

THE DETERMINANTS OF VALUE ADDITION:

A CRITICAL ANALYSIS OF GLOBAL SOFTWARE ENGINEERING INDUSTRY IN SRI LANKA

BY

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DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used the extent and nature of the correction is clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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Abstract

It was evident through the literature that the perceived value delivery of the global software engineering industry is low due to various facts. Therefore, this research concerns global software product companies in Sri Lanka to explore the software engineering methods and practices in increasing the value addition. The overall aim of the study is to identify the key determinants for value addition in the global software engineering industry and critically evaluate the impact of them for the software product companies to help maximise the value addition to ultimately assure the sustainability of the industry.

An exploratory research approach was used initially since findings would emerge while the study unfolds. Mixed method was employed as the literature itself was inadequate to investigate the problem effectively to formulate the research framework. Twenty-three face-to-face online interviews were conducted with the subject matter experts covering all the disciplines from the targeted organisations which was combined with the literature findings as well as the outcomes of the market research outcomes conducted by both government and non-government institutes. Data from the interviews were analysed using NVivo 12. The findings of the existing literature were verified through the exploratory study and the outcomes were used to formulate the questionnaire for the public survey. 371 responses were considered after cleansing the total responses received for the data analysis through SPSS 21 with alpha level 0.05. Internal consistency test was done before the descriptive analysis. After assuring the reliability of the dataset, the correlation test, multiple regression test and analysis of variance (ANOVA) test were carried out to fulfil the requirements of meeting the research objectives.

Five determinants for value addition were identified along with the key themes for each area. They are staffing, delivery process, use of tools, governance, and technology infrastructure. The cross-functional and self-organised teams built around the value streams, employing a properly interconnected software delivery process with the right governance in the delivery pipelines, selection of tools and providing the right infrastructure increases the value delivery. Moreover, the constraints for value addition are poor interconnection in the internal processes, rigid functional hierarchies, inaccurate selections and uses of tools, inflexible team arrangements and inadequate focus for the technology infrastructure. The findings add to the existing body of knowledge on increasing the value addition by employing effective processes, practices and tools and the impacts of inaccurate applications the same in the global software engineering industry.

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List of Abbreviations

AC	Acceptance Criteria
AHP	Analytical Hierarchical Process
APAC	Asia Pacific
BOI	Board of Investments
CASE	Computer Aided Software Engineering
CEO	Chief Executive Officer
DCS	Department of Census and Statistics
EDB	Export Development Board
FDI	Foreign Direct Investment
FP	Function Points
GB	Global Business
GDP	Gross Domestic Product
GM	General Manager
GSD	Global Software Development
GSE	Global Software Engineering
HRD	Human Resource Development
ICTA	Information and Communication Technology Agency
LSD	Lean Software Development
MD	Managing Director
NASSCOM	National Association of Software and Service Companies
РМО	Project Management Organisation
QE	Quality Engineering
SDLC	Software Development Life Cycle
SE	Software Engineering
SLASSCOM	Sri Lanka Association for Software Services Companies
SME	Subject Matter Expert
TechOps	Technical Operations

Chapter 01. Introduction

1.1. Introduction

The software industry in Sri Lanka does not have a long history compared to the other foreign revenue generators, but the government stats show that it has expanded by 300% to reach \$1.2 Billion in export revenue as of year 2019 compared to the previous year. The sector has therefore provided employment to more than 80,000 professionals and thereby contributing to 12% of Sri Lankan services exports (Government Census Report, 2019). This includes the domestic industry, start-ups and IT services and this workforce is expected to be developed up to 200,000 by end of 2022 (SLASSCOM 2016). Further, the trend of establishing the technology development centres in Sri Lanka of the large organisation has been increasing during the last five years. Currently, Sri Lanka is exporting ICT services to many countries around the world. The leading five countries are United States, Netherlands, Germany, France and Switzerland (IT-BPM Strategy Report, 2019). According to the government census report, the reasons behind Sri Lanka been asserted for the competitiveness stem from reasonable costs, high quality services and having an educated workforce with exceptional skills. Further, the same report argues that the value generation of the industry in inadequate compared to the other industries in Sri Lanka. Additionally, the inadequate policy and regulatory frameworks impedes the growth of the market which put the industry into the risk (IT-BPM Strategy Report, 2019). Therefore, sustainability of the software development industry depends on assuring the value addition is increased substantially within the next couple of years. However, the attention to identify the key issues, challenges and hurdles to increase the value addition in the global software engineering is low and it impede the successful industry development (Cavusgil et al., 2017).

This research aims to critically analyse the global software engineering practices in software product organisations in Sri Lanka. The first chapter introduces the industry in general and importance of carrying out this research that covers the current landscape, position and practices by contextualising to the scope of the research. Additionally, highlights of the literature contributions, research problem, aim of the research, objectives, research questions

and scope is clearly discussed which is followed by the anticipated contributions and the details explanation on the structure of the thesis.

1.2. Background of the Study

This section provides the context to the study that is carried out with the relevant refences along with important definitions, contextual information and a brief overview of the industry to give a high-level understanding.

1.2.1. Conceptual Perspectives

The value creation is one of the topmost topics among the business leaders when they are forming the business strategy (Carnahan, Agarwal and Campbell, 2010). According to Johnson (2015), the term value needs a clear definition for businesses along with how value is divided among the different players in the chain. Because the total value delivered is the sum of the value added throughout the vertical chain.

As Porter (1980) says, value is created through a chain of players that spans from suppliers of resources to firms, to buyers of products and services from firms.

In simple terms as Udawatta *et al.* (2019) say value can be outlined as the trade-off among the benefits and sacrifices in marketing exchange. According to Smith and Colgate (2007), the ultimate goal of the marketing is to achieve organisational, societal and personal objectives by creating superior customer value for selected market segments with a sustainable strategy. As Johnson (2015) says, there are different ingredients in the formula when trying to quantify the value. However, in simple terms it is the willingness of the customers to pay for a product or service.

According to Sanjari et al. (2018), the multidisciplinary nature of the management has introduced various definitions for value creation, but simply, value is the promise that will be delivered, communicated and acknowledged by the respective stakeholders such that customer are happy to pay for.

Value creation is a central concept in the management and organization literature for both microlevel and macrolevel which are heavily discussed in organization theory and strategic management research (Lepak, Smith and Taylor, 2007). As Sanjari *et al.* (2018) have further argued, the business success comes from value creation for all the stakeholders including the employees which could be built or destroyed throughout the business. The most broader definition for the value creation that covers both cost and benefit is "giving something valuable"

to receive something else that is more valuable to the business" (Haile and Altmann, 2016). As the owners or leaders of the business, it is their responsibility to assure that the intended value is created throughout the business process in their linier processes. Somehow, the sustainability of the business heavily depends on the value delivery.

In general, software industry consists of two primary categories: software product development and software service delivery. In addition to that, certain companies do both. Irrespective of nature of the business, any business has standard processes when delivering their product or service. The overall process is a series of actions taken to achieve a particular goal that may include people, tools, guidelines, equipment, data, software applications, measurements, milestones and documentation depending on the nature of the process (Little, 2004). As Udawatta *et al.* (2019) have stated, the typical software development process consist of parallel or sequential set of steps that divide the software development work to smaller and doable subprocesses that is used to develop a software application from the scratch or to enhance an existing software by adding features. This process may have predefined deliverables and artifacts that are agreed by the respective development teams to deliver and maintain.

According to Johnson (2015) in software engineering, the value is delivered through the predefined set of iterative or sequential set of steps with measurable outcomes at pre-agreed milestones by software engineering teams.

However, Johnson (2015) further says that the software engineering practices are still value neutral. A proper integration of value-based software engineering practices is necessary to assure the value delivery throughout the software engineering processes. As Williams (2017) has argued, the value chain for the software development should be emerged with the recent development in the industry. As he further says, the introduction of the distributed teams and global software engineering practices have changed the software development practices immensely. A similar view is upheld by Martin and Robert (2018) and they have further argued that studying the theoretical, methodical and applied aspects of value addition for the global teams has become a timely need. The application of the practices may vary from the software service industry to the product development organisations, therefore, a focused studies are necessary for the respective areas with an attention to the economic conditions (Whittle, 2019).

This study focuses on identifying the determinants for value addition in the software product companies in Sri Lanka that has global partnerships. In other words, global software product companies. The importance of this industry for Sri Lankan economy is clearly explained in section 1.1.3. However, as Haile and Altmann (2016) have highlighted, the value addition in the global software engineering is relatively low in both global and APAC regions compared to the other product development and manufacturing industries. According to Schwaber and Beedle (2016) due to the lack of focus for the value-based software engineering practices, the overall value delivery of the software product organisations is low which requires to be changed to increase the value addition. A similar view is upheld by Morin, Harrand and Fleurey (2017) and they have further argued that the value-neutral nature in the software development activities have led to controversial situations that cannot be reversed later as the opportunity for correction is low and any change requires additional efforts. According to Whittle (2019) non-existence of value-based approaches in software engineering cause to building software applications that would not generate the outcomes expected at the preliminary stages. Hence, inclusion of the value and human-values as well. Therefore, the global software engineering industry needs some attention to understand the specific values that Sri Lanka can deliver to assure the sustainability of the industry.

In summary, value is an overloaded term, but in general value is what the customers are paying for at the end of the day. The responsibility of the management is to assure a superior value is created throughout their business processes. However, the current focus for value creation in the software product companies is low compared to other businesses. Given that the global software engineering has already contributed to the foreign revenue in Sri Lanka immensely as well as there is a massive potential, this study focusses on identifying the determinants for value addition in the global software engineering in Sri Lanka to help the local businesses to assure business sustainability.

1.2.2. Contextualisation of the Concepts

The concepts mentioned above are heavily inherited from the other industries to the software development industry. Specially, the distributed team concept for the software development team has been derived from the product manufacturing industry (Bent and Dient, 2017). Given that the global software engineering industry is required to have value integrated into their development methodologies and none of the previous studies have focused on the local context to study the concepts thoroughly, the generic concepts were taken from the western literature and some of the Indian publications. Additionally, the value-based software engineering concepts were taken from the studies those were carried out for the collocated teams in the western literature. As Schwaber and Mike (2016) have argued, the software development

methodologies and practices do not change due to the geographical reasons, but socio cultural and local policies can impact to them. But, Whittle (2019) has argued that the nature of the global software engineering varies from the collocated teams. Therefore, this study is carried out based on the common definitions, but the applications are highly contextualise based on the applicability for them in the local context. Additionally, all the findings are validated through a complete exploratory study before starting the public survey. Therefore, this research is expected to be the best-suited study to understand the determinants for value addition in the global software engineering industry in Sri Lanka.

1.2.3. Brief Overview of Global Software Engineering and Sri Lankan software development Industry

The global economic landscape has changed significantly since the mid-1980s (Kose, Otrok and Prasad, 2008). Most of the top organisations in the world have expanded their business to the other parts of the world in the recent past to increase their sales. The rapid increase in the business linkages for trade and financial purposes, emerging markets, seeking for new knowledge, cost saving by reducing the operational expenses and potential future investments have been the leading factors to drive the global moves (Fred, Meredith and Forest, 2019). According to Wang (2016) majority of the businesses are focusing on the Asia Pacific (APAC) region due to the foreseen potential of the business expansions. According to Mazareanu (2020), APAC is the home for most of the largest organisations providing most of the sophisticated digital platforms along with the skilled resources being the technology driver for majority of the leading companies. Based on the categorisation of Cazurra (2018), countries in the APAC region would fall under platform countries, emerging countries, growth countries, maturing countries and established countries based on the distinct market attributes. Based on this categorisation, Sri Lanka comes under growth countries and a similar categorisation done by Wang (2016) and Inkpen and Ramaswamy (2012) also confirms that Sri Lanka has been in this category for almost last decade with respect to the contribution for the software development industry. However, Certain advancements in the global business are industry specific due to the nature of those businesses. Many researchers have critically analysed the industry specific trends. Global software engineering (GSE) is one of the rapidly developed industries among them.

According to NASSOCOM reports, 40% of the fortune 500 companies use this model and upwards to 50 nations are actively participating in the global software engineering industry. Further, Holmstrom *et al.* (2016) have stated that 41% of the software requirements are fulfilled

through the global teams based on the references Gartner's industrial research results. Additionally, they have highlighted that organisations now have started thinking of focusing more on the business value of IT whereas trends and predications have already showcased the global setup drives the next generation software industry. While highlighting the benefits of global software engineering, it is vital to understand the risks as well. Any industry trend has advantages and disadvantages says Grundy, van der Hoek and Whitehead (2010). They say global software engineering has limitations that limits the use of its positives. i.e. coordination, collaboration and control. The risks of global setup have been identified and acknowledged by number of studies. Threat of opportunisms, security, trust concerns, training issues, unexpected costs, loss of control, geopolitical risks, coordination problems, legal problems and cultural issues are among them (Boehm 2003; Edward 2010; Grundy et al. 2010; Lanubile et al. 2010; Nfuka and Rusu 2011; Holmstrom et al. 2016). Further, based on Hofstede (2002), culture has a significant impact on the global business where he has highlighted power distance, collectivism vs individualism, feminity vs masculinity, uncertainty avoidance, long-term vs short-term orientation as key factors when deciding the global business relationships. However, technology advances have helped the organisations to overcome most of the issues and businesses going global without much considering socio cultural distances said Espinosa and Carmel (2013) based on the outcomes of their empirical study.

The Sri Lankan market has an immense potential to leverage this industry and to be the driver of foreign revenue generation within the next couple of years. According to "AT Kearney Analysis 2012 and its drafted version 2016" Sri Lanka has been ranked as the 14th in the global service location index (GSL) with respect the five criteria given in Figure 1 (AT Kearny 2016) and it is evident how GSE is an emerging and potential industry in the next five years.

Financial Attractiveness		Educated Skilled Workforce		Infrastructure		Low Risk Emerging Market		Information Security	
Office rent of class A space in major business hubs		Secondary enrollment rate		Overall infrastructure quality score		Business operational risk		Rigor of IP Protection	
				UAE	6.3	UK Mauritius Malaysia	26 30 32	UK	5.7
		UAE	98%	Malaysia	5.7	UAE	30	UAE	5.0
Mauritius	192	UK	96%	UK	5.6	China	47	Malaysia	4.9
Sri Lanka	227	Sri Lanka	90%	Sri Lanka	4.7	Sri Lanka	47	Sri Lanka	4.1
Bangladesh	252	Mauritius	89%	Mauritius	4.6	Egypt	49	China	4.0
Philippines	262	Philippines	82%	China	4.2	Philippines	52	Indonesia	3.6
Malaysia	316	Egypt	81%	Egypt	3.9	Pakistan	52	India	3.5
UK	26	China	76%	India	3.8	India	52	Egypt	3.3
Egypt	368	Malaysia	70%	Pakistan	3.5	Bangladesh	55	Pakistan	3.1
Vietnam	440	Vietnam	70%	Philippines	3.4	Vietnam	56	Philippines	2.8
Pakistan	455	India	59%	Vietnam	3.1			Vietnam	2.5
China	472	Bangladesh	44%	Bangladesh	2.8			Bangladesh	2.4
India	918	Pakistan	33%						
UAE	918								

Figure 1 - Competitive advantages of SL outsourcing industry

Source: AT Kearny 2016, SLASSCOM

Therefore, Sri Lanka, as a developing country, has an immense potential in becoming competitive in the APAC market and earn more foreign revenues by further increasing the value delivery as an industry. Additionally, the software industry can easily become the topmost revenue generator in the national export strategy assuring the sustainability as well. To carry out this study effectively, the conceptual perspectives should be studied. The following section describes the relevant concepts for value addition in general as well as global software engineering industry.

1.3. Literature Contributions

Erdogmus, Favaro and Strigel (2014) discussed the benefits of value-based software engineering. According to them the software community has always struggled with concerning the value of an investment in both software application development and hardware. They have stressed the importance of having the value integrated to make the trade-off decisions between the investment themes. As Chen and Dodd (2016) argued, any decision related to the software development should be evaluated against the economic feasibility and differing value perspectives. But (Haile and Altmann, 2016)current development methodologies and practices does not cover the value aspects to help the managers, developers or respective stakeholders

the differentiate the outcomes of a software product or service. According to Haile and Altmann (2016) all stakeholders in the both development and platform ecosystems should be able to contribute to generate the sufficient value to the end users. But evolution of values of the software products and intended value deliveries of the respective services are currently not integrated into the development or delivery practices.

Schwaber and Mike (2016) have discussed that emerging software engineering principles and practices have contributed to evaluate the efficiency of the macro and micro level activities carried out by the respective team members, but value considerations are minimal. Additionally, the scope of work and necessity of the steps in the development processes should be evaluated against the ultimate value delivery. According to Haile and Altmann (2016), global software engineering practices have introduced custom versions of development frameworks to hold the accountability and authority that has killed the autonomy and freedom for the development teams to collaboratively do the fast deliveries. They have pointed out the negligence of introducing the software quality gates without spending time to improve the automated quality checks as one example. Another important area is highlighted by Whittle (2019). He argued that the software governance policies are for increasing the quality of the work, but not for assuring the authority of the managers. Additionally, conceptually disconnected activities in the operations due organisational policies or governance erode the value immensely (Martin and Robert, 2018). Other than that, Eling and Lehmann (2018) have argued that the value chain of the software application development should be based on the respective business cases, but the attention to the value addition in the software development to help to increase the value through business cases is comparatively low.

Chen and Dodd (2016) argued that earned value system has nothing to with the stakeholder value except controlling the cost, schedule and progress of a complex project. But companies are using these measures to evaluate the value delivery which is inaccurate. According to Williams (2017), application of economic value added (EVA) and Bohem's value based strategy have been studies thoroughly in the literature. Additionally, the lean software development and using resource advantage theory have been discussed as well. However, as Williams (2017) and Chen and Dodd (2016) have proved, these theories have good practices as well as limitations that subject matter experts should evaluate and apply based on the needs of the respective business domains. Hence, a detailed analysis against the application of these theories is needed before implementing them in the software development industry. Additionally, a countable number of studies have been carried out to apply Kano model,

Analytical Hierarchical Process (AHP) and Opportunity Scoring for specific focus areas in software development practices. As Singh (2016) has discussed AHP's theoretical guidelines can be integrated into a common model to aid in increasing the value, but the model itself does not fit totally into all the aspects of the software engineering. However, the Kano model concepts have been evolved with the software engineering practices and as Yunita *et al.* (2019) have stated the modified version of Kano model is heavily used to prioritise the software requirements nowadays. Additionally, Lin (2019) has described an practical application of Kano model for product design which has helped the stakeholders to decide the right priorities. However, as he has further argued, setting the priority is one important step in assuring the value-based thinking to all aspects of the processes. Similarly, the application of opportunity scoring is practical and making sense to identify the highly value adding features from a list of features which is not popular among the software community due to the complexities within the model (Pavel, 2019).

In summary, a limited number of studies have been carried out in the western literature also to identify the specific determinants for the value addition in the software development teams. Though the individual studies have been carried out to address the specific challenges in the collocated teams, the interest to the value aspects are minimal. As Whittle (2019) has clearly highlighted, global software engineering has introduced many challenges due to the socio cultural, time zone and communication barriers when working with multi-cultural and geographically distributed teams. Hence, applicability of the generic practices into the global software engineering itself is challenging and more importantly integrating the value into the practices needs a thorough analysis (Morin, Harrand and Fleurey, 2017). Additionally, there is no evidence to find out any study carried out in Sri Lanka with respect any of these aspects. Hence, arguably this is the first research that is carried out to set the yardsticks of the global software engineering industry, identify the key challenges with respect the value addition and finally to determine the influential factors that impact the value addition in the global software engineering industry in Sri Lanka. Following section describes the exact research problem.

1.4. Research Problem

Value addition in the global software engineering industry has not been increasing steadily over the past years in contrast to other global businesses (Franco, Hirama and Carvalho, 2018). According to Valverde *et al.* (2018) and Udawatta *et al.* (2019) there have been some effective

attempts to find the potential value erosion activities in the current practices, but an overall picture has not been considered when proposing the solutions. Therefore, individual outcomes of these researches have contributed to address targeted root causes which means that the traditional working models need further research to identify the key concerns with respect to the perceived value delivery to assure the sustainability of the industry.

When the current body of knowledge is considered, two primary reasons can be highlighted that impacts value delivery in the global software engineering. They are value neutral nature of software engineering activities and absence of value-oriented software development methodologies which has more areas to uncover (Jiménez, Piattini and Vizcaíno, 2016). When first aspect is considered, much of current software engineering practices and research is done in a value-neutral setting, in which every activity in the process is considered as equally adding values said Boehm (2013). Further he argues that the decisions that are made in global software engineering are much decoupled from the value propositions that establish the project. He has further said that a progress has been made during the last couple of years to consider integrating some value-oriented perspectives into the software engineering practices but insignificant. According to Kaur and Sharma (2014) the value perceptions related to the software development has not been popular among the practitioners until they realised the grip of the value proposition is losing and holding on to the competitive advantages has become challenging. As Chen and Dodd (2016) have argued, the integration of value into the software development practices is crucial to ensure the sustainability of the industry in a competitive environment.

Global software engineering has inherited challenges due to the nature of having globally distributed teams to work towards one goal. But leading organisations are moving to the remote locations by considering the cost benefits, availability of skilled labour, new market opportunities and the ability provide around the clock service to the customers. Sri Lanka has been identified as a key destination for the large organisations to build their development centres or to sign up with the local entities as their technology provider. A highly skilled talent pool combined with the cost-effective operational ability makes Sri Lanka's global software engineering Industry one of the most profitable industries to date (IT-BPM Strategy Report, 2019). But, as Morin, Harrand and Fleurey (2017) have restated, the value addition in the global software engineering is comparatively low with other global industries. According to Schwaber and Mike (2016), on top of the productivity, usability, and quality, the global software engineering industry needs to focus on the sustainability of the overall industry by ensuring the

integration of value into the global software engineering practices. Therefore, Sri Lanka being recognised as a key designation as well as the industry has been generating a significant foreign revenue, integration of the value asserts the competitiveness among the other countries in the region. Hence, the attraction of the world leading businesses could be increased by generating more values to their stakeholders through the current competitive advantages Sri Lanka has.

However, previous studies have not contributed much for the body of knowledge on the value addition in the global software engineering industry as a whole. Additionally, none has focused on the Sri Lankan global software engineering industry. Therefore, this research solely focuses on software product companies in Sri Lanka that has any form of global engagements as they contribute by 41% to the total export revenue of the overall IT-BMP revenue. As the literature has proven the inadequate attention to the value considerations of the industry and importance of the same, identifying the yardsticks of the industry and the practices in order to carry out a comprehensive research is a must to assure the sustainability of the global software engineering industry in Sri Lanka.

This research aims to identify the determinants for value addition in the global software engineering industry in Sri Lanka and critically evaluate the impact of them for the software product companies to help maximise the value addition to ultimately assure the sustainability of the industry. Additionally, findings of this research can contribute to the body of knowledge of the global software engineering with respect to the common topics such as global teams, software development methodologies, and governance structures. Moreover, the outcomes of this research enhance the application of the theoretical issues by clearing out the practical consequences as well.

1.5. Objectives of the Research

To facilitate the research aim, following research objectives were defined.

- 1. To identify and explore the contextual specific factors that affect on value addition.
- 2. To identify the value creation determinants through a comprehensive literature review.
- 3. To synthesise the contextual specific factors and literature findings to formulate definitive value creation determinants.
- 4. To examine the impact of the identified determinants for value addition in global software engineering industry in Sri Lanka.

1.6. Research Questions

In alignment with the research objective, following research questions were formed.

- What are the contextual factors that affect on value addition?
- What are the key determinants of value addition?
- How do the identified determinants impact the software product companies in Sri Lanka in increasing the value addition?
- How successfully Sri Lankan software product companies have integrated value addition aspects to their strategies?

1.7. Research Strategy

This research was carried out as an exploratory research until the initial yardsticks are identified through the previous studies and the exploratory study to formulate the conceptual framework. Thereafter, it was a descriptive research to achieve the aforementioned research objectives through a comprehensive questionnaire that focused on the large audience in the global software engineering industry in Sri Lanka. Mixed method was employed for this research by combining both qualitative and quantitative research components to expand and strengthen the conclusions of the study by answering to the research questions more effectively as the previous studies related to the selected domain is insignificant. Additionally, all the statistics through the government census department and the relevant reports through both government and non-government bodies were collected to facilitate the study further with the reliable sources. Finally, all the findings were put together by expanding the current body of knowledge in the global software engineering industry referring to the already established facts.

1.8. Scope and Demarcation of the Study

The overall IT-BPM industry in Sri Lanka has many aspects covering the whole spectrum of the businesses including the service industry. But scope of this study is limited to the software product companies that has the global engagements through either vendor contracts or their own technology development centres as augmented teams. There are four main categories of the companies based on the revenue they generate. i.e. large organisations, medium organisations, small organisations and start-ups. Given that there is any form of global engagement, all these four categories were considered in this study. Additionally, the target customer segments could be both local and/or global as there was no difference with respect

the software delivery process based on the location of the customer (Sanjari *et al.*, 2018). In a typical software development organisation, representatives from various functional segments work in a single change. Therefore, discipline wise, all possible individuals were considered in both qualitative and quantitative analyses to understand the all the potential actions, activities and perceptions on value addition. However, this research does not cover the support departments such as human resources, talent acquisition, administration, finance and R & D specific contributions with respect to the value creation topic in the global software engineering industry in Sri Lanka.

1.9. Anticipated Contributions

This research primarily aiming to contribute both practice and theory based on the findings in three ways at a high level. i.e. Enhancing the current body of knowledge in the global software engineering practices with respect to the value addition and integrating value-based software engineering based on already established facts and theories. Then, providing the minimum required guidelines for the global software engineering industry in Sri Lanka to take proactive measures on optimising the value delivery. Subsequently, to the other emerging countries to employ the best practices in their software development and delivery pipelines to increase the value addition. Finally, to contribute to the national export strategy in Sri Lanka by means of providing the foundation framework to be competitive among the region to attract more foreign investments through global software engineering industry.

1.10. Structure of the Thesis

The introduction chapter provided a brief introduction by briefly discussing the conceptual perspectives, the literature contributions, research problem, aim of the research, objectives of the research, research questions, research strategy, scope, anticipated contributions by effectively articulating the context.

Chapter 02 explore the current literature by carefully synthesising the already established facts, theories and models based on the scope of this research. This chapter is divided into four main sections: Contemporary interpretations of value creation which sets the background to the value addition along with importance of it. It covers the strategic positioning, value capturing method and use of value chains in businesses. This section is followed by theoretical perspectives of value creation and delivery which consists of application of lean management and resource advantage theory as theoretical contributions along with Kano model, analytical hierarchical process and opportunity scoring as models for increasing the value addition. Subsequently,

determinants of value addition are discussed based on the generic literature findings that reveals the five main dependent variables identified through the comprehensive study. This section is followed by establishing the hypothesis that uncovers the foundation stones for setting the hypothesis for this study. Next, a comprehensive conclusion is provided followed by a summary for the chapter.

Chapter 03 focuses on giving an overview to the global software engineering industry. This chapter consists of three main areas: global software engineering industry which provides a comprehensive introduction to the overall industry along with the evolution and growth aspects. The next section is the global software engineering industry in South Asia and Sri Lanka which sets the background to the research by providing the industry perspectives with the opportunities for Sri Lanka to be competitive in the global market based on the literature findings. Finally, value addition in the global software engineering industry which covers the theories, definitions, current state of the value addition and motivation for increasing the value addition. This chapter is concluded with a summary.

Chapter 04 discusses the research methodology in detail which covers the theoretical justification for all the selections through the study. Mainly this chapter is divided into nine important sections. Initially the research paradigm is discussed which is followed by the research design for both qualitative and quantitative studies. Then, the conceptual framework is presented with the research hypothesis. Thereafter, the research setting, data collection method for both qualitative and quantitative studies and sample selection is discussed with justifications. Next, the data analysis methods for this study are clearly discussed which is followed by the validity, reliability and trustworthiness section. Finally, the limitations and delimitations are discussed before concluding the chapter with a comprehensive summary.

Chapter 05 presents both qualitative and quantitative findings in detail. This chapter has two main sections: qualitative data presentation and quantitative data presentation. All the interview results, outcomes of the thematic analysis and specific limitations can be seen in the first section. The rest of the chapter is devoted to present the detailed findings of the quantitative analysis which shows all the results along with the outcomes of the hypothesis test. Finally, the chapter is concluded with a comprehensive summary.

Chapter 06 is devoted to present the findings of the study in comparison to the reviewed literature and already established factor in the current body of knowledge relevant to the value addition. This chapter presents the overview of the results which covers a comprehensive

review of the findings against the prevalence studies, application of theories and determinants for value addition. The second section of this chapter provides the factors leading to decrease the value addition in the global software engineering industry based on the findings which is followed by a comprehensive summary.

Chapter 07 is the conclusion chapter which presents the overall findings pertaining to the research objective which is divided into three subsections based on the research objectives. Then, the overall implication for both theory and practice are carefully discussed which is followed by the limitations and future work section. Finally, a comprehensive summary is provided at the end.

Finally, the additional materials are presented in the respective appendices.

Chapter 02. Industry Overview

2.1. Introduction

Global business (GB) or in other words the international business (IB) is a key trend in nowadays businesses that focus on trading across the world. It refers to the exchange of goods or series over a great distance. According to Kose, Otrok and Prasad (2008) global business is defined as corporate or economic activity that takes place across different countries. Global business has many forms says Fernandes and Machado (2015). i.e. Exporting: selling abroad either directly to the customer or a distributor, licencing: granting the reseller rights to a foreign partner for a given period of time, franchising: the parent company grants the permission to another company to do the same business with their specific guidelines and last type is foreign direct investments (FDI): building new facilities in a new country through a joint venture or wholly-owned subsidiaries.

However, the global economic landscape has shifted dramatically since the mid-1980s said Kose, Otrok and Prasad (2008). Most of the leading organisations in the world have expanded their business to the other parts of the world in the recent past to increase their sales. Two key trends could be found with respect the global businesses. i.e. the rapid increase in business linkages for trade and financial purposes and emerging markets. These two take the major share of the international growth. According to Wang (2006) majority of the businesses are focusing on the Asia Pacific (APAC) region due to the foreseen potential of the business expansions. Further, APAC region's countries have been categorised into platform countries, emerging countries, growth countries, maturing countries and established countries based on the distinct market attributes. According to Cuervo-Cazurra (2011), companies started looking into the global expansions primarily based on the resource-view: acquisition of resources that are unavailable in the home country. In addition to that, global presence, sales territory expansions and cost effective production are the key factors in making the decision. Fred, Meredith and Forest (2011) accept the views of Cuervo-Cazurra (2011) that the businesses are going global to fulfil the resource gaps while taking the other business specific advantages but further claim that distribution of the responsibilities and providing around the clock business services are crucial factors for business leaders to make that decision. These views are upheld by Inkpen and Ramaswamy (2012) in their book called Global Strategy: Creating and Sustaining Advantage across Borders which highlights the fact that global strategies are based on the matrix of facts and the leaders consider the global presence in nowadays business as a primary requirement. The business benefits of global presence are well acknowledged through the application of their continent categorisation. Further they suggest that global strategy should be based on a single prioritised need that is covered by the added advantages. With demand for the distribution of the product development and services, most of the leading business were not hesitant to sign agreement with third party vendors for getting their software requirements fulfilled through the distributed teams. As a result of that concepts related to the global software engineering were started to bloom. The researchers have put a significant effort to evaluate the different models that works for software industry in various ways.

Software can shape the digital environment that can ultimately shape how information is made available, how to conduct commerce, how to share and socialise or even how do we work (James D, 2007). The software industry has been gaining an increasing attention during the last few decades in both academic and business discussions as it is both technology as well as knowledge intensive. As businesses, the primary focus has been to build a knowledge-based economy by promoting knowledge-intensive businesses while the focus of the academia has been to understand the specialisations and perspectives on the knowledge resources to create and deliver competitive value propositions (Rajala et al., 2008). The demand for the software development industry has been dramatically increased with the rise of the demand for software applications and businesses moving towards e-businesses: businesses conducted over the internet. While the use of software applications in the businesses have been increased by 56 percent, 93 percent of the U.S. firms have some fraction of their businesses trade conducted over the internet which shows the potential for future markets as e-business has been promising to create new ventures due to dynamic and rapidly growing natures (Ge, 2011). As Kose, Otrok and Prasad (2008) have highlighted, the industry has been grown in both trade and financial linkages with the introduction of the internet. As they further say, the capabilities of the internet have emerged rapidly and created new ways of working and doing businesses. This has changed the dynamics of the international businesses by forcing the business leaders to come out from the traditional and conventional business models. Hence, having certain knowledgeintensive workforce attached to main business within the home country is no longer a requirement for the businesses to perform.

As Mazareanu (2020) says, with technology advancements business leaders started fulfilling their requirements by decoupling the front facing employees and back office employees easily. The demand for the global teams became popular due to the well-known advantages such as

availability of the skilled resources at a low cost, around the clock service, economic advantages. In addition to that as Young (2013) has highlighted, the international businesses were shaped based on the demands and availability of the resources after year 2000 that helps the businesses to make more profits by saving a costs. According to Cuervo-Cazurra (2011), the biggest change happened in the software engineering industry where most of the large organisations were influenced with the distributed team concepts that enables the businesses to heavily look for the possibilities beyond the home country. Later, it has been built as a separate industry that is considered as the global software engineering industry. This section discusses about the global software engineering industry and its evolution.

2.2. The Global Software Engineering Industry

Global software engineering is not a new concept, the origin of it runs back to 1970. The initial concept was built on top of contract programming where a component of a software or the whole product is outsourced to a third party where a particular supplier guarantees the delivery of the stated requirements at the right level of quality during the specified and agreed period(Cazurra, 2011). According to Jones (2001), this was believed to be the most effective mode of getting software applications done at a cheaper cost which was confirmed by Wang (2006). However, contract programming itself is challenging as both parties are bound in mutual agreements and the primary business does not hold any responsibility on the vendor's work processes and deliveries said Jones (2001). A similar view has been upheld by many other researchers in the field, but Inkpen and Ramaswamy (2012) say that contact programming was challenging when the things are more agile. However, due to the lack of interest from majority of the business firms in Europe and USA, this method has not been popular after 1990s (Mann and Götz, 2006). Therefore, as an alternative the first version of global software development called mainstream GSD was introduced in 1990s. According to the literature, virtuality and the virtualisation concepts were highly popular among the software development crowed. As Crowston, Sieber and Wynn (2007) have explained in their book, the mainstream GSD was popular due to many reasons. i.e. agility of developers, high frequency of communication, availability of the tools and more importantly the ability to frequently engage with the developers by the main organisation. Global Software Development (GSD) teams have been constituted by globally distributed engineers, managers and testers who are providing a specific service to deliver the promised work. One of the key features in the mainstream GSD is the composition of the teams where multicultural individuals those who represent several subcultures used to work in the same team to deliver the project outcomes. Mutual learning and understanding of the cultural habits and beliefs have undoubtedly challenges in this format. However, the virtualization of the software development through global distribution has been dominating for few decades even with the challenges in the socio-cultural differences. The literature in the mainstream is comprehensive and Mann and Götz (2006) have acknowledged the fact that researchers have focused more on identifying the challenges in the mainstream GSD and proposing solutions to them. However, there are, nonetheless, challenges related to the generalisability of the solutions proposed for specific subcultures. Crowston, Sieber and Wynn (2007) further have explained the impact of the uncertainty in the global software development along with the theoretical and practical implications based on the characteristics of the mainstream GSD. According their findings, subunits should be formed based on their specific purposes of the main organisation and the software organisations should be built based on the delivery objectives.

At the beginning of the twenty first century with the demanding trends towards the globalisation, further the multinational companies tried the global software development as their primary software delivery method. Instead of the traditional software practices, they started focusing mostly on the outcomes while minimising the cost of the development immensely(Cho, 2007). Due to the availability of the skilful resources in Asia at a lower cost, outsourcing and offshoring were significantly getting popular in most of the Asian countries and India is leading in the software development outsourcing business(Fernandes and Machado, 2015). According to Grundy, van der Hoek and Whitehead (2010) software development industry has been through several changes due to globalisation requirements. Further, they emphasise the value of the distributed software development team and the influences of it to get the software requirements fulfilled at lower costs by hiring well-trained and highly educated engineers around the globe. The businesses started to initially investigate the global trend towards business process outsourcing with different business models. The blow section discusses about them.

2.2.1. The Evolution of Global Software Engineering Industry

At the beginning of the twenty first century with the demanding trends towards the globalisation, further the multinational companies tried the Global Software Engineering (GSE) or in other words Global Software Development (GSD) as their primary software delivery method. Instead of the traditional software practices, they started focusing mostly on the outcomes while minimising the cost of the development immensely(Cho, 2007). Due to the availability of the skilful resources in Asia at a lower cost, outsourcing and offshoring were

significantly getting popular in most of the Asian countries and India is leading in the software development outsourcing business(Fernandes and Machado, 2015). According to Grundy, van der Hoek and Whitehead (2010) software development industry has been through several changes due to globalisation requirements. Further, they emphasise the value of the distributed software development team and the influences of it to get the software requirements fulfilled at a lower cost by hiring well-trained and highly educated engineers around the globe.

Herbsleb (2007) says that globally distributed projects have already become the norm for large projects and the large organisations are trying to establish their businesses often on multiple continents. Ambler and Lines (2016) have resonated Herbsleb's argument saying the trend for co-located teams has reduced from 77% to 31% from 2000 to 2015 and same building and within the same time-zone has only 17% demand compared to how it was in year 2003 which is 81% based on Boehm (2003) findings. A very recent study on collaborative software development which was conducted by Kearney (2018) has talked about three key areas for companies to go global. i.e. cost saving, innovation, and talent. Compared to their 2017's report, innovation has been identified as a key for the organisations to expand their businesses across the boundaries. A research that was more focused on application mobility which was done by Ge (2011) had discussed about the importance of innovation and cost saving with respect to the global teams which now has been upheld by Kearney (2018) and the same has been identified by Capra, Francalanci and Merlo (2014) where they have highlighted the importance of development quality, effort and governance have also become better compared to the collocated teams. Espinosa and Carmel (2013) have categorised the answers for "why global" into three categories; solving local IT skills shortage, cost saving and remain focused on core competencies. They have further highlighted that the software work undertaken at geographically separated location across the national boundaries have given more opportunities for the businesses compared to the collocated teams. According to NASSOCOM reports, 40% of the fortune 500 companies use this model and upwards to 50 nations are actively participating in the global software engineering. Further, Herbsleb (2007) says by 2006 80% of the output of software industry is exported and fulfilled by the global teams. Holmstrom et al. (2016) have upheld Herbsleb's argument where they say 41% of the software requirements are fulfilled through the global teams based on the references Garner's industrial research results. Further, they have highlighted that organisations now started thinking of focusing more on the business value of IT whereas trends and predications have already showcased the global setup drives the next generation software industry.

The trend towards global software engineering has been clearly highlighted by Herbsleb (2007) saying it has a substantial growth during the last decade and fundamentally it is different to collocated development. Grundy, van der Hoek and Whitehead (2010) have upheld the same view accepting that globally distributed projects are rapidly becoming the norm for the large software applications. A recent study that has been conducted in India has further elaborated the above stated trend with the census that 1/3 of the European fortune companies have already signed with Indian outsourcing firms either on contract basis or permeant basis by 2016 (Noll, Beecham and Richardson, 2016).

While highlighting the benefits of global software engineering, it is vital to compare against the risks as well. Any industry trend has advantages and disadvantages says Grundy, van der Hoek and Whitehead (2010). They say global software engineering has limitations that limits the use of its positives. i.e. coordination, collaboration, and control. The risks of global setup have been identified and acknowledged by number of studies. Threat of opportunisms, security, trust concerns, training issues, unexpected costs, loss of control, geopolitical risks, coordination problems, legal problems and cultural issues are among them (Boehm 2003; Edward 2010; Grundy et al. 2010; Lanubile et al. 2010; Nfuka and Rusu 2011; Holmstrom et al. 2016). Further, according to Hofstede (2002), culture has a significant impact on the global business where he has highlighted power distance, collectivism vs individualism, feminity vs masculinity, uncertainty avoidance, long-term vs short-term orientation as key factors when deciding the global business relationships. However, technology advances have helped the organisations to overcome most of the issues and businesses going global without much considering socio cultural distances said Espinosa and Carmel (2013) based on the outcomes of their empirical study.

While the key issues have been addressed by the organisations and researchers, the trend of setting up distributed teams has been continuing due to the key advantages. The South Asian countries have been moving into this industry rapidly as the demand came from the developed countries. As Khan, Niazi and Ahmad (2011) have highlighted, the South Asian countries are well ahead in the global software engineering industry due to the rapid growth of the infrastructure, technology and skilled labours. The industry has been using different business engagements to get their software requirements fulfilled through these low-cost development centres. But, As Young (2013) says, business process outsourcing (BPO) is more prominent in the global software engineering industry. The below section discusses how the global software engineering industry have been evolved with the BPO concepts.

2.2.2. Growth of the Industry through Business Process Outsourcing

Business process outsourcing (BPO) is not a novel concept said Cuervo-Cazurra (2011). He says that the history of the BPO runs to pre-internet era where the manufacturing industry started outsourcing the functions of their primary businesses. This often had included supply chain where either the raw material or partially built products of full product was built in a geographically separated place and imported to the respective markets where the primary businesses are in operations. Cavusgil et al. (2014) state that though the BPO was practiced in 1920s, the businesses started to move fast towards BPO in early 1990 and 2000. When internet was becoming popular, the businesses started looking for partners in the low cost market or where the raw materials are available to sign the agreements. Crowston, Sieber and Wynn (2007) say that the virtual businesses were initially kicked off in mid 1990s with the technology advancements. They have further highlighted that the business started looking into outsource their back-office functions initially, but with the time and high-tech infrastructure now it has opened the doors for different types of BPO contracts across multiple countries. However, business leaders nowadays are focusing on strategic partnerships with the foreign businesses with the increased global acceptance for the BPO (Wang, 2006). Further, this industry has been growing for the last few decades rapidly and a significant and visible growth can be seen in 1990s where most of the businesses have openly embraced the business relationships for both knowledge process outsourcing (KPO) and business process outsourcing (BPO). However, the modern BPO concepts have been groomed with the lessons learnt with the previous engagement models. Below section disclose the nature of the modern BPO.

2.2.2.1. Modern Business Process Outsourcing

The revenue of the BPO industry as a whole has been steady from 2000 to 2012 with a considerable growth, but afterwards it has been unsteadying. According Noll, Beecham and Richardson (2016) in 2013 and 2016 the market size dropped significantly due to the instability of the US market. However, recent studies show that the market size is getting bigger and steady gradually again afterwards. Figure 2 depicts the growth from 2000 up to date.




The combined contemporary work of Jones (2001), Cavusgil et al. (2014) and Mazareanu (2020) have discussed the important facts in the outsourcing business from year 2000 till 2019. According to them, one third of the global enterprises now consider global business or outsourcing as a mission critical activity. Further, Jones (2001) has specified that the future organisations would focus on the efficiency improvements while achieving the operational results. The same view have been upheld by Mann and Götz (2006) and further elaborated it. Their view is the mid-level organisations and enterprises will focus on the solutions while highend organisations are heavily focusing on the cost. Further, they say with technology advancements mid-market looks at collaborative and innovative business partnerships with the growing market segments as well. According to Mazareanu (2020) 90% if the outsourcing contracts are highly effective and they have met the targets while large enterprises have gained more attention due to the success rates at mid and lower level segments. As Cavusgil et al. (2014) have stated, the outsourced partners' goal is to leave the cost factor while maximising the value. The same view has been accepted and further elaborated by Mazareanu (2020) where he has stimulated the fact of value delivery is a key strategic direction in majority of the enterprises after 2005. But, assurance of the value delivery is a responsibility of the outsourced partner. According to him, energy, retail, travel, education, healthcare and pharmaceuticals, telco, digital marketing, hotel and restaurants, media and enabling services have outsourced their businesses already to the low cost centres in Asian region. With the emerging trends in multiple sectors, the global outsourcing market has been drastically changing. The below section uncovers the trend in the outsource market and how it has been evolved during the last few years.

2.2.2.2. The Global Outsourcing Market

When we consider the country wise contribution, Americas contributes to at large while in 2019 North America has contributed more than the total of Europe, Middle East and Africa (EMEA). According to Mazareanu (2020), North American organisations now have established the outsourcing contracts with Asian countries, Ireland and some parts of the Australian markets as well. According to his findings, 67% of the investments of North America now comes to Asian countries. Figure 3 shows the country wise investments for the last 10 year in the outsourcing market.



Figure 3 - Global outsourcing industry revenue from 2010 to 2019, by region (in billion U.S. dollars)

Source: Global outsourcing market size 2019 by Mazareanu (2020)

When both academia and industry are considered, there are many aspects in global software engineering that have already been studied by many researchers. They are better multisite collaboration, results being intangible, clear agreements for both service and product suppliers and transparency of the work (Ebert, Kuhrmann and Prikladnicki, 2016). Further, they have categorised the reasons for going global as below(Figure 4).



Figure 4 - Reasons for outsourcing and offshoring

Source: Global software engineering: Evolution and trends by Ebert, Kuhrmann and Prikladnicki (2016)

According to the findings of Ebert, Kuhrmann and Prikladnicki (2016), companies are going global based on three major facts. i.e. Cost reduction, availability of the talents and skills and quality cycle. Cost reduction acts as the major trigger around the globe for the business to evaluate the possibility of moving to the other cost-effective centres. However, Ambler and Lines (2016) argue that the relevance of cost reduction has been decreasing over time. The same argument has been accepted by Ebert, Kuhrmann and Prikladnicki (2016) as well. Further, they have highlighted the fact of paying different labour costs for the same task and output around the globe. If the same skill set required to produce the same output can be found in a remote location at a cheaper cost, the businesses want to utilise that opportunity to save the cost said Lorin M. Hitt and Eric Brynjoifsson (2014). However, as Ebert, Kuhrmann and

Prikladnicki (2016) have highlighted, educated software engineer who is available in Asian countries that can do the same task can save minimum of 40% than that of a USA or western European software engineer. Salary difference of two similar engineers from the two countries is 40% to 60%. The same view is accepted by James D Herbsleb (2007), but his opinion on taking the advantage of cost reduction is different. He says that the few facts reduce the potential of cost saving: hidden costs, missing and insufficient competencies and extra overhead costs. Ebert, Kuhrmann and Prikladnicki (2016) have the same view on the challenges in the reducing the cost. According to them, management and operational cost, cost of tools, process overhead cost, cost of travelling, resource acquisition cost and employee and infrastructure overhead cost dilute the cost reduction advantages. However, it is the duty of the strategists to find the best way to tackle the cost related issues while laying down most costeffective solution for the organisation. As Cavusgil et al. (2014) have explained, one of the key aspects in the global business is to look at all types of cost reduction possibilities and be more strategic about those types to improve the profitability as a whole. Further, they have upheld the views of Inkpen and Ramaswamy (2012) such that the business process outsourcing (BPO) should not only look at the maximum cost saving, meanwhile the business leaders should look at the competitive advantages and edges the organisation can gain by partnering or going global with the outsourced firms. In addition to that, processes, strategies and effective contracts can help the organisation to wider their business horizons while gaining more businesses by catering to more business needs of their customers.

On top of the academic researchers, there are industry researches that have been carried out in the same industry to identify the demand for the BPO. Majority of the organisations have focused on the cost cutting as the key focus, while there are other key factors which are equally important for the businesses. The below diagram (Figure 5) of Mazareanu (2020) shows the leading drivers for companies using these services. The results have been drawn from a survey that was conducted worldwide in 2018 from 280 respondents.



Figure 5 - Leading drivers for using outsourcing services worldwide in 2018

Source: Global software engineering: Evolution and trends by Mazareanu (2020)

Business process outsourcing, infrastructure and technology outsourcing and software outsourcing are considered as the three major categories of offshore outsourcing. But there are other forms of specific job function outsourcing mechanisms as well. Each form's primary focus is to increase the efficiency of their customer service while reducing the cost of those services(Mann and Götz, 2006). However, business leaders have chosen the strategy based on the purpose of outsourcing. There are many key advantages that people have identified in the BPO contracts. The below section discusses the specific reasons why organisations can be more productive and making more profits through BPO strategies.

2.2.2.3. Global Software Engineering Agreements and Potential Advantages

Mazareanu (2020) says that wage difference between the western developed countries and Asian developing countries varies from 40% to 60%. The same service can be obtained at a lower cost from same level experts from these developing countries at the same quality standards. Further, cost can be saved through multiple other factors. i.e. infrastructure, recruitment process, training cost, employee benefits and many more overhead costs. This argument is upheld by Cavusgil *et al.* (2014) and they have further highlighted the ways to reduce or control the operating costs by increasing the efficiency in the outsourcing contracts.

According to them, shop around the better rates for vendors, full and partial contracts, effortbased payments and pay for skills when and where needed are highly used in the outsourcing.

A similar research has been carried out by Young (2013) focusing on scope for the international businesses. His findings are summarised in Figure 6.



Figure 6 - Young's advantages of outsourcing in 2013

Source: International Entrepreneurship Research: What Scope for International Business Theories by Young (2013)

When comparing the research findings of the above, companies are gaining advantages of BPO in many aspects. Young (2013) suggests that businesses those who are in need to access to the right-fit skills to manage the difficult functions by gaining control over has been very successful in this business model. Further, he explains the use of outsourced services when providing around the clock service to the customers. As Mazareanu (2020) proposes, having the time to focus on the primary business is a critical factor for many businesses whereas products, services, distribution channels, geographic areas and more importantly the customer needs are identified and actioned at the right time by the core business while yielding a large portion of ROI through outsourcing. Similar argument was found in Crowston, Sieber and Wynn's (2007) work where they have argued that many businesses focus on non-core activities by the time they reach to the sustainability where the core activities get low attention and businesses are starting to lose the business objectives. They suggest that non-core and tasks

that need low attention from the business should be taken care through contracts. As both above diagrams depict, most of the giant businesses are going global with any form of outsourcing contracts to gain more advantages for their businesses.

Software engineering outsourcing or in other words global software development runs back to 1980s and even beyond when the initial idea of working remotely was kicked off(Rai, Patnayakuni and Patnayakuni, 1997). Initially the businesses tried outsourcing software requirements due to the lack of skills within the firms or it is not their core competency. i.e. the primary business focus is something else. With this, the IT firms started earning money through contracts and most of the leading businesses strictly signed only with the reputed IT firms(Hofstede, 2002). However, gradually different types of software outsourcing models have been introduced based on the different contexts. Initial contracts were only based only based on the projects and the location, cost relationship or even contract types have not been critical factors to consider. Instead, the business leaders have considered only the project scope and ability of the contractor to fulfil the requirements(Khan, Niazi and Ahmad, 2011). According to Dey, Fan and Zhang (2010) gradually companies started looking into other factors such as cost and flexibility when selecting an outsource party. Further, they have found that the type of the software development outsourcing could be based on three attributes. They are location: onsite, onshore, nearshore or offshore, relationship: project-based, managed team or staff augmentation and contracts: fixed price, dedicated development team or time and material model.

As Khan, Niazi and Ahmad (2011) have explained, distance is decisive factor for location based software development outsourcing. The selection of the mode is decided by the nature of the primary business, regulation of the country, nature of the software that is going to be built and other outsourcing challenges. When the onsite outsourcing is considered, the service providers agree to share the skilled employees with the signed business for the given period of time and they will be physically based in the location provided by the primary business. In this mode, the staff of the primary business party is augmented with the contractor's employees for a fixed time. As Dey, Fan and Zhang (2010) have explained, this mode is not particularly outsourcing, but some organisations refer it as staff augmentation as well. The second and third form of location-based outsourcing are the onshore and nearshore outsourcing. According to Khan, Niazi and Ahmad (2011), onshore outsourcing and nearshore outsourcing mean outsourcing a particular product or a serving within the country or nearby or neighbouring

country respectively. The most popular outsourcing mode nowadays is the offshore outsourcing said (Ebert, Kuhrmann and Prikladnicki, 2016).

Offshoring became very popular within the last few decades and now it has become a compulsory or must have branch of the IT industry. The demand has already been increased heavily and the demand for the jobs has been increased immensely. The primary demand comes from Western Europe, North America and some parts of the other Europe countries as well due to the shortages of the skilled workforce in their countries(Khan, Niazi and Ahmad, 2011). Immonen *et al.* (2016) argue that the demand for the offshore development centres (ODC) have been increased exponentially during the last decade and by 2025 it would be the only option for majority of the firms in Europe and USA. They have further discussed the three main factors to be considered in the outsourcing agreements with the partnered organisation. They are the budget, confidence and the commitment. There are plenty of researches that have been carried out in the literature by many prominent authors to highlight the benefits and challenges of the offshore outsourcing. The summary of the benefits of offshoring based on the contemporary work of Richmond and Seidmann (1993; Dey, Fan and Zhang, (2010); Khan, Niazi and Ahmad, (2011); Ambler and Lines, (2016); Immonen *et al.* (2016) is below. This is in comparison to the onshore and nearshore approaches.

- 1. Availability of computer-literate professionals who can speak in English
- 2. The large pool of information technology experts
- 3. Annually, a large number of graduates are graduating from universities and institutes
- 4. Cost factor
- 5. Around the clock service can be practically provided
- 6. Stable and advanced infrastructure can be found at a lower cost
- 7. Ability to select vendors from a pool of expert companies
- Initial expenses for setting up the companies are less compared to USA and Other EU countries
- 9. Availability of very advanced education systems
- 10. Education is cheaper

It was noticed that many researchers have highlighted the fact that offshoring to the Asian countries gives many cost benefits. i.e. vendor contracts are cheaper, hourly charge of the employees are less, advanced infrastructure can be found at a lower cost and even setting up a new venture is less expensive compared to USA and EU countries (Cho, 2007; Möller and Rajala, 2007). Due to that, many leading organisations have started looking into different forms of contracts and agreements with the companies in south Asian countries. However, when software organizations go global, there are both common and industry specific challenges which are discussed in the below section.

2.2.2.4. Challenges in Global Software Engineering Industry

When the software companies are going global, as Mann (2009) says, there are typical challenges they might face. The below table is a summary of the researches that have been carried out with respect the challenges in the global software engineering. According to Darja *et al.* (2012) South Asin countries are well ahead with addressing thes challenges compared to other countries. A similar view is upheld by Immonen *et al.* (2016) where they have highlighted the majority of the people specific issues are arising due to the lack of global processes and they have suggested to improve the common software delivery processes in order to overcome them.

Primary focus area	Challenge / Issues				
Communication	Communication impedance				
	Work in multiple time zones				
	Language				
People and process	People vs process oriented control				
	Formal vs information agreement				
	Project and process management				
	Increased maintenance effort				
	• Management overhead due to coordination issues				
	Dependency management				

Table 1	- Summary	of challenges	identified in	global	software	enginee	ering
	, , , , , , , , , , , , , , , , , , ,			0		0	. 0

	Long requirement engineering duration			
	Work prioritisation			
	• Waiting time in the process			
Product quality	Product quality measurements and assurance			
	Security compliance			
Global teaming	Different working hours			
	Culture			
	Work distribution			
	Lack of team cohesion			
Strategic alignment	Value stream mapping			
	Portfolio/product alignment			
	Tracking and evaluation			
	Leveraging available resource			
	Best practices are often deemed proprietary			

Source: Author's work based on research outcomes of Atkins et al. (2001); Herbsleb and Moitra (2001); Walter, Ritter and Gemuden (2001); Hofstede (2002); Rajala, Rossi and Tuunainen (2003); Cho (2007); James D. Herbsleb (2007) and Rajala and Westerlund (2007)

To address the above mentioned issues (in Table 1), researchers and some of the authors have suggested certain solutions as well. As Hofstede (2002) suggested human relationships are important for any kind of work. One of the key challenges he has highlighted is the lack of face-to-face interaction in the global software engineering which creates lots of problems. His solution is to use the communication and collaboration tools as much as possible in day today activities. Herbsleb and Moitra (2001) have suggested that the communication frequency in between the team members should be daily basis and they have suggested to use video conferencing facility for the meetings. However, identifying a common time for the discussions and meetings is hard when team members are working in different time zones. Hofstede (2002)

suggests using a rotation-based meetings or discussions and allow the team members to visit the onsite physically at regular intervals. According to Atkins et al. (2001) due to the distance, control and monitoring becomes a challenge and as a solution many organisations used to introduce processes and work agreements. This kills the collaboration and their suggestion is to focus only on a project management processes and limit the use of control and monitoring tools. However, as Rajala, Rossi and Tuunainen (2003) have highlighted the project management frameworks that are in use heavily focus on the work monitoring and it leads to lots of human conflicts. As a solution they have suggested to use a lightweight development lifecycles such as iterative waterfall models. But, Cho (2007) has said that both parties can get more benefits if they adopt agile concepts into their delivery process. As he has further found, 33% of the outsourced companies are using an agile framework as the primary process to deliver the software products. James D. Herbsleb (2007) has done a critical analysis on this topic and has found that agile frameworks help the organisations to focus more on a collaborative delivery approach then limiting the team members to the monitoring and control tools. When other problems and challenges are considered, the product quality issues can be sorted by introducing quality guidelines and a proper testing process said Herbsleb and Moitra (2001). However, according to their findings a common guideline are very rare in the industry, but CMMI or ISO guidelines can be used as the baseline practices to customise and come up with the company specific guidelines. Global teaming is a new term coined after year 2005 that was later identified as a challenge in the global software development setup (Cho, 2007). As Rajala and Westerlund (2007) have discussed, the nature of global software development is having global teams, but it has its own challenges as well. However, both these authors have suggested to address the global teaming related issues by improving collaboration within the teams. Finally, when strategic alignment issues are considered, as Cho (2007) has highlighted, the leaders in the business should focus on fixing the misalignments by having common communication grounds and having clear top to bottom KPIs and proper evaluation criteria. However, a recent study that was focusing on business models has found that strategic misalignments are considered as the key challenge in the global software development now. The same study which was conducted by Fernandes and Machado (2015) suggests to abort the projects at the earliest possible time if there is little or no chance in making it successful or strategic misalignments are seen upfront. They have further discussed the issue of portfolio and product misalignments, fragmented teams and unclear goals. The short-term solution they have provided is to focus on the mapping between project outcomes against the strategic focuses.

When it comes to global software development, many authors have only focused on the software teams and delivery frameworks. However, there are other strategic partners and support functions that are really important to do a succussful delivery. They are human resources, talent acquicision, administration, general management function, technical operations, training and development, branding, finance and leadership at each department. Though some of the researchers such as Richmond and Seidmann (1993); Ambler and Lines (2016) and Holmstrom et al. (2016) have touched based on the leadership and T & D aspects, there are no clear evidence in the literature to find out the very focused researches that have been carried out to discuss about the support functions' and strategic partners' contribution for the global software development. According to Ambler and Lines (2016) there is a vacume in the global software development literature in these areas where a significant impact can be made to the business by addressing certain issues by making certain improvements to their practices as well. As Holmstrom et al. (2016) and Gartner (2019) said the misalignment within the firms can be due to the neglegance of the critical job functions from top to bottom. Therefore, a considerable effort should be made to identify the contribution, imporatance and changes required by these services to improve the overall business processes.

Meanwhile the issues and challenges are identified and gradually sorted, global software engineering industry has been rapidly growing in Asian region. As Immonen *et al.* (2016) have highlited, this industry has been recognised by the respective governments and started building their vision on top of it. The below section uncovers the journey of global software engineering industry in South Asia in a nutshell.

2.3. Global Software Engineering Industry in South Asia

South Asian Global software engineering industry has a very short history compared to the other parts of the world said Richmond and Seidmann (2008). Even though the history of software development runs back to 1960s, it has evolved rapidly and practices within this discipline has been changed to cater to the business requirements. According to Atkins *et al.* (2001) the primary focus of the businesses was to go for nearshoring or having distributed teams within the same geographical region. But, with the advancements of the global software engineering, they have looked into other low-cost centres as well. However, global software engineering is a phenomenon of increasing importance to remain competitive while being profitable in the global landscape.

With the rapid growth of the global software engineering, Asian countries as well as certain countries in Europe region started to cater to this requirement by building the required infrastructure and resources. However, distributed development itself had certain challenges as stated in the above section. (Jiménez, Piattini and Vizcaíno, 2016). Further, the overall distributed software development was lacking a proper management process and there were no major project delivery frameworks those were developed to cater to the distributed format specially in the south Asian countries (Jalali and Wohlin, 2012). However, short term solutions were proposed by many institutes, authors and researchers to overcome the given challenges. They are, use of traditional waterfall software development lifecycle as the distributed framework, using video conferencing for communication, language training, performance based payment structures, process management and establishing people management hierarchies in the local contexts (Ebert, Kuhrmann and Prikladnicki, 2016). However, contradicting objectives of the source company and offshore individuals or companies made the process more complex due to the cultural differences. However, most of these challenges have been getting a low priority as the businesses wanted to establish their development centres or initiate their development contracts with outsourcing parties to either expand their business or to get their software requirements fulfilled at a lower cost but at the same quality (Jiménez, Piattini and Vizcaíno, 2016). Hence, it is vital to further deep dive and understand why businesses should choose global software engineering against the collocated teams to get their software requirements fulfilled. Specially, the benefits of moving into Asian countries that includes Sri Lanka as well. As this research is heavily focusing on global software engineering industry in Sri Lanka, below section gives a precise snapshot of the industry in Sri Lanka.

2.3.1. Global Software Engineering Industry in Sri Lanka

The global software engineering market in South Asia is young compared to the other global businesses as mentioned above. It has nearly 18 years of history as of now. India is the leading country that has the largest resource pool and solid infrastructure compared to the other Asian countries (Kearney, 2018). However as Sison *et al.* (2006) have mentioned, the focus for the research studies for the global software engineering in Asia was very low though South Asia was considered as IT outsourcing heaven. India has been producing many IT professionals compared to the other disciplines as the demand was rising. And according to Dumitriu, Oprea and Mesnita (2011) more than 40% of the fortune five hundred companies from Europe and USA have had either a partner company or outsourced entity in India. With the advancement of the technology, Sri Lankan government also has looked into possible agreements to initiate

exporting software products or to establish global engagements within Sri Lanka through business process outsourcing contracts. When the Sri Lankan market is considered, it runs back to year 2001 when the global businesses started to sign up with Sri Lankan small firms to get the software requirements fulfilled (SLASSCOM, 2019).

When the overall Sri Lankan ICT workforce is considered, it has a significant growth by 2018 compared to year 2014 where the numbers were increased from 82,854 to 124,873. It was expected to be increased up to 146,089 by 2019 and actually it went up to 157,046. It is a 56.7% growth compared to year 2014. Over the past few years, ICT companies have dominated the market by having the largest workforce where it holds 65.5% of the workforce. The traditional work in the government sector has been identified as improvements and the permanent staff has now been increased from 4.2% to 7.1%. Further the SLASSCOM annual report highlights that certain job categories have been identified as highly demanding among the others. i.e. Software quality assurance has gained the demand by 46%, software engineering by 21% and software shared services by 16% compared to year 2014. The female participation in year 2013 has been documented as 34%, but in year 2019 it has grown up to 48% (Kearney, 2018; SLASSCOM, 2019).

The quality of the workforce depends on the primary and secondary education of the country. In addition to that the tertiary education and professional educational institutes add more value to the overall education system (John and Letto-Gillies, 1996). In Sri Lanka the share of employees with bachelor's or similar capacity is considered, it has increased from 63% in 2013 to 85% in 2018. Having a bachelor's degree has become a norm and the entry level qualification in the ICT sector in Sri Lanka. Further, this has been grown over 90% in the ICT companies (SLASSCOM, 2019).

Software outsourcing readiness is measure based on many indexes according to the global standards. The leading organisation across the world use these measures when selecting an outsource partner or a country to build their secondary workforces in a secondary location (Barney, Aurum and Wohlin, 2008). A key measure is the talent pool and education. When Sri Lankan context is considered, ICT sector holds the highly skilled and educated workforce as mentioned above. Further, Sri Lanka is producing just above 10,000 software engineering or related graduates from various universities and institutes (SLASSCOM, 2019). The government of Sri Lanka has clearly set the target of moving to a knowledge economy as the primary ambition. The ICT sector in Sri Lanka has shown increasingly a positive productivity

in attracting investments directly and indirectly that adds a significant contribution to the foreign exchange. According to the central bank of Sri Lanka ICT related sectors have generated USD 995 million in 2018 that shows a steady growth on YoY basis which is 7-8% (Central Bank of Sri Lanka, 2018).

One of the other evaluation criterion is the English language proficiency score that is used by the business leaders when making the outsource contract decision to rank the countries (Nfuka and Rusu, 2011). When the English proficiency index is considered, Sri Lanka is among the top 100 and currently it is 78th based on the 2019 report. Further, it is 18th in Asia having 47.10 as the proficiency score (Insofint, 2019). This score is based on the country as a whole. However, there is no evidence to consider the software development sector in specific. According to Central Bank of Sri Lanka (2018) the talent pool and education of Sri Lanka has shown a positive growth during the last year and it has significantly contributed to the outsource market to support the economy. Other few evaluation criteria that Nfuka and Rusu (2011) have highlighted are economic outlook, political stability and condition, technical readiness rank, time zone and travel time. Out of them, economy of a country and political stability can vary based on many factors, but time zone and travel time are considered as constants in the evaluation. According to the global indexes which are indicated in the SLASSCOM report, Sri Lanka has many advantages compared to most of the other countries in the list. Given the increasing demand, the ICT industry is expected a significant growth by 2020 aiming a USD 5 billion revenue while creating 200,000 direct jobs. Further, minimum of 1000 start-up companies are expected to be facilitated given the skills, opportunities and minimum required facilities are in place. In addition to that the government of Sri Lanka wants to make the ICT as the number one foreign exchange earner by 2022 (SLASSCOM, 2019).

2.3.2. Opportunities for Global Software Engineering in Sri Lanka

To accomplish this target, the software industry in Sri Lanka should be highly dynamic, driven by passionate enthusiasts and simply lucrative. Further, the industry should be running at a large-scale to acquire more businesses and partnerships with the global leaders. Innovation is a key factor when it comes to become competitive among the Asian countries. It should be combined with cost-effective solutions. Further, the local industry should be ready to invest on the new businesses with the support of the Sri Lankan government. At the same time, the government should also be willing to actively facilitate the business sector by creating the required policies, providing the required investments, and creating more opportunities in the software related sectors. Further, education plays a key role as it should support the vision by identifying the skill gaps and providing the solutions through the higher education programs and professional training programs. To become the most financial attractive offshoring destination within the Asia, the local authorities and business leaders should focus on increasing the value creation and delivery in the global software engineering industry in Sri Lanka. The seminal work of Berling and Höst (2003) together with the combined and contemporary work of Boehm (2003); and Zanoni *et al.* (2014) have focused on value creation specific research areas for business growth. However, there is no contribution from the local authors or from the global authors about the dependence upon value creation, value delivery and value capture in the ambition of sustainability of the global software engineering industry in Sri Lanka. This is the research gap which prevails.

As Boehm (2003) has said, the impact of the intangibles on value creation and delivery is crucial aspect. However, the studies related to the value creation in the global software engineering is very limited and contribution from the firms' process and practices are rarely studied by the respective organisations. The same view is upheld by Haile and Altmann (2016) and further said that use of software has become a part of the business nowadays and using either an internal development team, maintain an outsource software firm in a cost effective market or long-term contract are used by the businesses to fulfil the software related requirements. Further they have said that studies related to the software delivery cycles, project staffs, uncertainty concerns, human resources, finances and infrastructure are key areas to evaluate the business performance with respect to the value creation and delivery. However, as they have confirmed there are very minimal research studies related to this area.

In addition to that, when the local context is considered, no specific value-based literature could be found for either local software development or global software development businesses. However, there are few prominent authors those who have contributed to the literature by making significant efforts to evaluate the value-based software engineering in different contexts. They are Boehm (2003); Boehm and L. G. Huang (2003); Boehm and L. Huang (2003); Little (2004) and Boehm and Ii, (2007). Further, there are few authors those who have focused on the software delivery frameworks with respect to the value delivery. They are Grünbacher, Egyed and Medvidovic (2012); Erdogmus, Favaro and Strigel (2014); Zanoni *et al.* (2014); Haile and Altmann (2016); and Schwaber and Mike Beedle (2016). When South Asian context is considered, majority of the global software engineering related researches have been carried out to identify the challenges and solutions. As Jiménez, Piattini and Vizcaíno (2016) have highlighted, 73% of the literature constributed to the distance and

seperation related issues while 11% has the focus for Agile software engineering in the recent literature within the south Asian context. However, this study should focus on the global software development related value-based aspects while assuring that the local demands are met. Hence, contextualising the existing literature and finding the releative and authoritative research findings and assuring a proper and accurate alignment is crucial to make this research success.

2.4. Value Addition in the Software Engineering Industry

There are four different aspects of value that should be considered in software development. They are project cost, schedule, business value and stakeholder value (Little, 2004). As Boehm (2003) has categorised, the value-based software engineering would be either a part of the business process management or enterprise/applied computing aspect or the other primary category is based on the social and professional topics, system based approaches or project and people management based approach. However, the gaps exist in the global software engineering with respect to the value addition. According to the studies, it was identified that several models have been proposed and used to enhance the value addition. Below section discusses 3 such models that are popular in the industry with their gaps.

2.4.1. Methods Used for Value Delivery in the Current Context

As Boehm and Liguo Huang (2003) have stated, the biggest issue in the software engineering is the value-neutrality. As they have further explained, integrating the value considerations into the software engineering practices is crucial to overcome the current value related challenges. With the recent demands in the industry, there are several methods that have been tried out by respective task owners to understand how well the value can be delivered to the stakeholders. Earned Value (EV), Economic Value Added (EVA) and Cost Benefit Analysis Method (CBAM) are such concepts that have been suggested in the value-based software engineering literature. Below section discusses each model and their gaps.

2.4.1.1. Earned Value in Global Software Engineering

Several studies have found that software development companies use earned value approach to measure and monitor the value. It uses the project plan, actual work completed and specific parameters for the value to see the projects meet the given deadlines. The primary focus is for the budget and time. In that method the business value of the particular requirement or the activity is not considered and stakeholder value has been omitted as well (Racheva, Daneva and Sikkel, 2009). In the typical project management processes, many techniques are used to evaluate the rate of success. Earned value is a commonly used method to measure the amount of work carried out against the amount of work planned. Oftentimes, in earned value analysis "budgeted cost of worked performed (BCWP)" is the term that is used. This is used to measure the ongoing progress as well as to forecast how the project would do in the future as well. In addition to that, it counts the performance indices or burn rates against the cost and schedule. One of the key assumption is in the earned value is burn rates are not fluctuating against the time (Christensen, 1998). Unlike in traditional project management, in earned value analysis three data sources are considered. i.e. the planned or budget value of work schedule (PV): gives the estimation for the project on how far the project work is supposed to be at any given time, the actual cost of work completed (AC): the actual expenditure or cost incurred due to the project activities and earned value of work completed (EV): the measure of project completion (Lipke *et al.*, 2009).

According to Christensen (1998) earned value analysis is accurate if the project plan is solid and scope is well defined. Further, the external parameters are constants during the project execution time. However, cost performance analysis is not simple always. If the efficiencies are being realised, the complexity of the planned work is less than anticipated, limited rework, market fluctuations are in favour of the project planned with respect the cost of labour and materials and overhead rates are decreasing the earned value analysis gives the great results. But, as Lipke et al. (2009) have found that 71% or more projects have experienced either a change or rework and 65% of the teams or individuals have done more work than what is mentioned in the work breakdown structure. Further, they argue that the EV only checks if the promised work is delivered within the specified time and budget. It does not assure the quality of the work. Another limitation that EV has is the probable rift that might be created between the teams and the project management team due to the constant monitoring. And more importantly the EV is not suitable for all kinds of software application development. According to Christensen (1998) EV works only for the projects that WBS is accurate and when the market parameters are not rapidly changing. Further, if the quality of the delivery is not a primary measure of the success of the project completion. And EVM is accurate only for a given context and if any metrics do not look good, it is not easy to explain why it has happed with the limited data that EV captures. One of the key areas that EVM has not considered is the economic value of the delivered work (Lipke et al., 2009). As Boehm and Ii (2007) say the uncertainty of the software is what is agreed in the industry where the requirements, technology, teams or budget can change during the lifetime of the project execution. Hence, the agreed work schedules and

plans should be flexible enough to accommodate the ongoing changes. Therefore, Lipke *et al.* (2009) categorise EVM as a good measure for the projects that the uncertainty is considerably low and the project scope is limited to what is agreed upfront. To fulfil that demand, Economic value added (EVA) has been suggested. The below section explains about EVA.

2.4.1.2. Economic Value Added (EVA) in Global Software Engineering

Economic value added (EVA) is another criterion of the measurement that is used in the project evaluations. It assesses the overall performance of the project while indicating the success of the project. Initially, EVA is used to establish the idea of the profitability of a given project to assess if it would create wealth for the organisation. And project managers are forced to make the decisions of both tangible and intangible resources by considering the value of the assets and respective expenses. In addition to that EVA is a good measure for the project managers to go on the selection of the projects where there are many. This can be used throughout the project as a measurement criteria to assess the ongoing project outcomes as well (Sharma and Kumar, 2010; Chen and Dodd, 2016). The calculation of the EVA is an estimation of the economic value added to the organisation as an economic profit. By definition, EVA is an indicator of profitability and a measure of financial performance based on the residual income (Sharma and Kumar, 2010). It is calculated by deducting the capital invested in the project from net operating profit after tax. Below is the equation.

Equation 1 - EVA calculation

EVA = (ROIC - WACC) * (TA - CL)

Source: Economic Value Added ($EVA \ ^{TM}$): An Empirical Examination Of A New Corporate Performance Measure by Chen and Dodd (2016)

As both Sharma and Kumar (2010) and Chen and Dodd (2016) research findings highlight, there are many advantages as well as a couple of disadvantages. The application of EVA in the software development companies was not popular said Haile and Altmann (2016). Further they argue that to get the benefit from the software development and operational services, the measurements and evaluations should be in three forms. i.e. pre assessments (pre-game), while the project is in progress (game) and post project completion (post game). They suggested it due to the volatile nature of the software application development. However, as Sharma and

Kumar (2010) have argued calculation of the EVA is completely based on the cash investment on the project, other investments are omitted. And EVA works for large organisations where they have the rich assets and businesses are stable in the nature. More importantly EVA does not suite for organisations that do not have tangible assets or organisations that work on intangible assets as the primary business such as software development firms. The same view is upheld by Chen and Dodd (2016) and further elaborated on the application of EVA into the software development. They argue that EVA focuses more on the short-term results than the long-term gains and software development would come in both formats. Further, value additions of a software feature of capability might not be quantifiable to consider in the EVA calculation. It requires a conversion of the intangible value to a tangible measure which is not described in the EVA calculation (Haile and Altmann, 2016c). According to Erdogmus, Favaro and Strigel (2014) EVA gives lenses to the senior management to assess the business and projects in a more powerful way, but nature of the business or the projects would make the measurements more volatiles and it is difficult for the middle layer management to pull the EVA levers to measure the ongoing activities. That is one of the key reasons that they highlighted the mismatches of use of EVA against the software development related project requirements to measure the value. Further, they argue on the probable value creation of the software products or features cannot be considered in the EVA calculation since the sales and revenue is a preliminary prediction at the beginning of the project lifecycles. However, the seminal work of Christensen (1998); Lipke et al. (2009); Sharma and Kumar (2010); and Chen and Dodd (2016) show that different measure have been considered in the field of software development to measure the value delivery through a software pipeline. However, as argued above, these measures have not been in favour of coming up with a solid answer for the value creation and delivery in the software development processes. Hence, majority of the businesses choose a value natural criterion to evaluate the project outcomes which are more subjective. Therefore, it is hard to make financially responsible decisions based on the value neutral methods.

2.4.1.3. Cost Benefit Analysis Method in Global Software Engineering

In typical project delivery cost, scope and time are considered as the three constraints in the project management triangle. These three parameters ultimately decide the quality of the work. The goal of the project manager is to trade between these three and make the delivery happen. But, in that traditional method, value was not considered to make the decision of the project delivery. In addition to that, mostly the time was a constant hence project managers used to

play around the scope that reduces the quality of the work(Boehm, 2007). To assure that design, architecture and development work is in accordance with the benefit that is intended, Murtazaev *et al.* (2010) have suggested to Cost Benefit Analysis Method(CBAM).

Cost Benefit Analysis Method(CBAM) incorporates the cost of a certain activity along with its benefit which help the respective stakeholders to choose the right work to be carried out (Murtazaev et al., 2010). As Sharma and Kumar (2010) have argued, the CBAM works well for the standard software delivery practices where the requirement specification is mostly complete and the market demand assessments are nearly 100 percent accurate. According to them creating material or non-material value depends on the life cycle and how well the process is being executed. As the current software development practices ignore the value aspects, applying the CBAM makes the process further inefficient says Murtazaev et al. (2010). To minimise the impact of the inefficiencies in the process, Baiden and Price (2011) have suggested to include measuring criteria for the effectiveness of the teams by including feedback cycles. However, their findings show that the integrating different disciplines into one goal and assuring the value through CBAM becomes complicated as there is no common agreement for the value delivery. A similar view is upheld by Murtazaev et al. (2010) and further highlighted the issues in identifying the benefits of a given requirement. However, as a proactive measure, they have suggested to use the presales feedback loop to align the development work against the sales and marketing plans, but this view is heavily criticised by both Baiden and Price (2011) and Grünbacher, Egyed and Medvidovic (2012) as the software applications value realisation does not work in a sequential approach. A recent research that has been conducted by Haile and Altmann (2016) shows that dynamics of the software applications vary based on the time and value creation should be an ongoing activity. Hence, it is clear that the efforts that have been taken to measure the project success rate do have certain limitations or gaps based on the discussion above. However, the global software engineering industry in the local context possesses many other challenges with respect to the value delivery which are discussed below.

2.4.2. Motivations for Increasing Value Addition in the Global Software Engineering Industry

Many prominent researchers have discussed critical areas that need the attention to increase the value addition in the global software engineering industry as a whole. As Boehm and Huang (2003) has stated, most of the activities in the current software delivery models take place in a value-neutral way. As they further explained, value should be created through the strategy and business model by considering the organisation's purpose. This view is upheld and elaborated

further by Haile and Altmann (2016). According to them, enabling a value creating business model is crucial for measuring, tracking and creating the value of a specific product or service. Based on their findings, this can be done by defining, creating, delivering and sustaining the value.

According to Racheva, Daneva and Sikkel (2009), software delivery methodologies have been evolved during the last few decades without considering the value delivery through the internal processes. Mostly, establishing and prioritizing the stakeholders and aligning the business strategy to enhance the value delivery by focusing on how the identified stakeholders are relevant to the business is important to balance the needs and expectations of the respective stakeholders. However, due to disconnect between the overall strategy of the organisation and software delivery frameworks and practices the intended value is not properly delivered to its stakeholders. The engagement of the stakeholders should be meaningful and frequent says Erdogmus, Favaro and Strigel (2014). According to them, the organisations should be able to define how well the stakeholders can be involved in the value delivery process which has not been considered in the current context of software delivery. And more importantly, satisfying the stakeholders by assuring what they want is delivered quickly and with the right quality is important for the sustainability of the business. As Schwaber and Beedle (2016) have explained, business people and developers should work together daily basis throughout the project to assure that the intended value is not eroded within the process itself. However, due to the lack of engagement, lack of focus for technical excellence and simplicity and inefficient communication have led the firms to reduce the value delivery in the software development industry. According to Haile and Altmann (2016), the value creation processes should be an integrated work that should connect the business strategy with the overall software delivery process and aftersales practices as well. Frequent retrospective of the work being carried out and continuous focus to improve the development processes are crucial for any organisation to assure that the delivery processes are assuring the value delivery. However, due to the lack of focus for continuous improvement and misalignment with the strategy and resource alignment for the value delivery have led to erode value within the development centres of the global software engineering teams. As Udawatta et al. (2019) have argued, alignment of the human resources in the distributed working environment plays a critical role as the decision should be made instantly in certain situations to assure that the work is not distracted due to an unavailability of the decision maker from a different geographical location. As they have found, additional governance and the process elements in controlling the work have impacted the

intended value delivery immensely. Further, they have argued that performance indicators do not reflect these areas to evaluate and act on them in the current delivery models.

Compared to most of the other industries, software development industry has issues that are specific and unique due to the nature of it said Khan, Niazi and Ahmad (2011). According to them selection of the team and delivery cycles or methods is heavily dependent on the overall organisational practices. Mostly in the global team setup, authority is kept with the primary organisation and only the work is distributed among the development teams across multiple geographical locations. But, the intended value is not properly communicated to the development teams. Based on their findings, due to the lack of communication the right value is always reduced or even heavily impacted. They further have mentioned that involvement of the people managers, technical leaders and functional leaders in the value related decision making has a positive impact to the overall value delivery. As Lorin, Hitt and Brynjoifsson (2014) have highlighted that involvement of the engineering leadership and project management leadership is lacking in the decision making process that has led distributed teams to waste time in between activities. As they have argued, implementing unnecessary governance reduce the ability to quickly adapt to the situation and continue to work on the promised deliveries. And over the wall responsibility transfers due to the functional hierarchies impact to the value delivery based on their findings. Hence, recognising the current issues an limitations within the global software engineering industry and addressing them help the businesses to assure their sustainability by defining, creating and delivering the right value to their respective stakeholders.

2.5. Summary

This primary focus of this chapter was to present the findings related to the global software engineering industry in general and more importantly the importance of this industry for Sri Lankan economy. As the findings have uncovered, this industry has been through substantial amount of changes to cater to the specific demands such high quality, cost reduction, 24/7 uninterrupted service, product innovation, and fast delivery. The demand for the global software engineering has been increased due to all these factors. As this chapter presented, the global software engineering market is young compared to the other countries in the APAC region. But it has shown a significant growth during the last two decades and the potential for further development is high. However, focus for sustainability by delivering more value through the industry is very minimal. Therefore, a comprehensive study that covers all the

important areas of the global software engineering industry in Sri Lanka can assure the sustainability of the industry by helping to achieve the V2025 goals of Sri Lankan government.

Chapter 03. Literature Review

3.1. Introduction

This chapter is devoted to review the theoretical and empirical literature related to the value addition in businesses in general and the global software engineering industry. The value addition literature consists of value addition & erosion, value, cost, margin & profit, application of financial value added, shareholder value creation and resource combinations for new value creations as well. Further, the value networks, value chains, value proposition for business leadership, and involvement of the culture in value addition have also been found. When the specific domain for this research is considered, it is evident that a significant effort has been put by many prominent researchers in this field to carry out researches related to global businesses, distributed software development processes, global teams, project management in the global setup, global software engineering and its challenges, the integration of the value based approaches to the software delivery process and application of the theories related to economics to the project management in the global setup which provides a range of new ideas. Out of the vast amount of literature, the focus of this chapter is limited to the global business in general and application of the concepts of value addition into the global software engineering industry.

When the literature is thoroughly evaluated, the concept of global business is not new, and it has been used in various forms in the businesses even before the internet became popular. As John and Letto-Gillies (1996) say, the international trading history runs back to the 17th century but a rapid growth has been noticed after the internet was born. According to Fred R, Meredith E and Forest R (2011) business needs have been changing every year and relocation of the production or service activities has been a common practice. They further say that the academics have paid an increased attention to elaborate the characteristics of the new business setups to help the businesses to go global. International trading has been helpful not only for the businesses but also for the governments to discover cost effective mechanisms by exploring the different instruments available in the global setup. As Cuervo-Cazurra (2011) says, one of the key initiatives in the global businesses. This view is upheld by both Young (2013) and Cavusgil *et al.* (2014). According to Zhu (2014), the demand for the global teams became popular among the business leaders when the resources became easy to access and

infrastructure was becoming cheaper compared to the previous decades. Further, he has argued that the global businesses were changing their business models to cater to the new demands with respect to the shared services such as garments, certain agriculture products, vehicle assembling and more importantly software development, delivery and maintenance. As Cuervo-Cazurra (2011) says the global software development setup has become a part of the organizational strategy after the year 2000 and now it is commonly called as business process outsourcing in nowadays businesses.

It is evident that many businesses have taken a cost saving initiatives to get the software applications developed from the countries around the world where the wages are considered to be low compared to the home country. As Atkins et al. (2001) highlight, the organizations have started searching for the global talents for many reasons. But the prominent reasons have been categorized into the know-how and cost of the labour. Hence, the majority of the researchers have focused on these areas. However, once the global software development has become a part of the organizational strategy, the focus of the researchers have been changed to the macros and micros that varies from the business integration strategies to implementing their own development centres across the cost effective geographical locations. As Fernandes and Machado (2015) argues, the business process outsourcing concepts have been evaluated by the researchers to identify the opportunities as well as challenges for the global business agreements. With the recent trends and latest technological infrastructure, it is evident that many organizations from North America and Europe have been moving their development centres to Asia Pacific Regions for many reasons. According to Kearney (2018), the global ranking of the cities have been changing every year because of the demand for the global agreements in the global software engineering industry. However, it was noticed that the focus for the value-based software engineering is very lacking in the literature. As Jiménez, Piattini and Vizcaíno (2016) say, initially value-based researches have been carried out focusing on the collocated teams which have become obsolete due to the nature of the global teams. The same view is upheld by Sanderson-wall (2017) and he further says that the value based approaches should be considered based on the locality. Hence, this literature study was carried out in multiple phases to identify key concepts, theories, challenges, and solutions given to address those challenges in the global software engineering industry. Later, a systematic map was drawn from that body of knowledge to formulate value-based software engineering for the global teams.

This chapter focuses on setting the proper literature background for the research. It starts with the setting the background to the research context which discusses the important concepts related to the value addition followed by the theoretical foundation for value-based business models that discusses the existing models along with their gaps. Thereafter, the determinant of the value addition is thoroughly discussed which cover both independent and dependent variables of this research. Then, the hypotheses around the generic global businesses with respect the value addition are discussed. Finally, the chapter is concluded with a comprehensive conclusion and a summary.

3.2. Contemporary Interpretations of Value Creation

Porter (1985) defines value as the maximum amount an individual is willing to pay to procure a good or avoid something undesirable from a provider. Pour (2004) says that value can be dependent on the expectation of the business, it can lead to tangible outcomes or intangible or financial outcomes. Pitelis (2009) describes value as the "perceived worthiness of a subject matter to a socio-economic agent that is exposed to and/or can make use of the subject matter in question. Hansen and Birkinshaw have proposed a different definition for the same term. They have said that the value is subjective and it depends on the sector which can drive the organisation's strategy (Hansen and Birkinshaw, 2007). Another definition is that the value is the characteristic of a performance, facility, and attribute, and all other aspects of goods and services to which consumers are willing to give their resources(Ramaswamy, 2004). Johnson, Christensen and Kagermann (2008) have proposed that strategy is empty if it is not focusing on the value. Hence, the definition of the value comes in various ways. Any business that has the intention of assuring all the stakeholder needs are met should focus on their business strategy to make sure that it has defined, purposeful and articulated objectives to invent, create, deliver, capture and modify the business values. After understanding the definition of value, the use of value related concepts in the context of business is discussed under the next topic.

3.2.1. Value Addition for Organisations' Strategic Positioning and Future Business Sustainability

According to Smith and Colgate (2007) strategic vision, strategic objectives and strategic initiatives are considered to be the foundations that drives the organisation towards the shareholder values. They further say these key pillars are unique to the business and intended values would remain in the papers unless and otherwise they are commercialised through a proper business model. As Carnahan, Agarwal and Campbell (2010) highlight, to assure the

value outcomes are accurately commercialised, the strategy should be mapped with both value proposition and the value perception that are clearly aligned with each business objective. Hence, as Biggemann and Buttle (2012) say every industry or business should focus on their strengths and internal capabilities to understand the value propositions as they are heavily dependent on their own capabilities and respective environments. Misalignment within the organisation can lead to erode the value in the business process itself.

Value creation is a fundamental concept in the management and organisation literature for both microlevel and macrolevel research (Lepak, Smith and Taylor, 2007). A significant effort has been put by many prominent authors to define the value in the businesses and to come up with various ways to improve the value creation for all the stakeholders. As Porter and Kramer (2011) have discussed, in recent years the businesses have been through significant changes with respect to social, economic problems and environmental aspects. Many businesses are still trapped in the outdated approaches value creation that has significantly emerged during the last decade. According to Barnes (2001), in the global economy the competition among the enterprises would be intensified and business leaders are required to manage their respective areas of the overall business strategy while making sure that business uncertainties are addressed within the value chain. As Williams (2017) highlights, the competitive advantage is created through the value that is created in the end to end value chain. Further, an integrative and structural approach to identify the value within the system and assuring the value delivery make the businesses more prominent within the competitive industry. It helps to solve various issues within the value chain he further said. As Porter and Kramer (2011) say, there are three ways that companies can create the value opportunities. i.e. reconceiving product and markets, redefining productivity in the value chain and enabling local cluster development. As Eling and Lehmann (2018) argue, the term value has an improved meaning in the digitized businesses which distinguishes between the primary activities and supporting activities. According to them, value is what creates the profits for the organisation in the process of changing the business inputs to the business outputs. In simple terms as Porter (1985) has defined, value is what is delivered to the customers that makes the customers to buy the product and value creation is about adding more value which leads to the competitive advantage. An extended definition has been provided by Eling and Lehmann (2018). According to them, creating and sustaining superior performance depends on a series of activities that are carried out within the business process of converting the strategic initiative to an actual customer requirement. Hence, the idea of value creation in the business is a collection of activities that takes place in an order

to add value at each level to assure the final product consists of the intended value for the customers.

As Lepak, Smith and Taylor (2007) say, value creation is considered to be a central concept in both organisation and management literature at both macro and micro level which are underestimated in many businesses and industries. Based on their research they have broaden the definition of the value creation. According to them, it refers to the specific quality of a new task, job, product or a service as perceived by its intended users in relation to their demands or needs. Based on this interpretation, the quality of the work that is being carried out, speed of the work, and overall work performance have significant impacts to the value creation and delivery. As Smith and Colgate (2007) say achieving personal, organisational and societal objectives by creating superior customer value in an effective and efficient way should be considered as the reason for the existence of the business if they want to assure the intended value is created and delivered through their business strategy. According to Sanjari Shahrezaei, Goharpey and Khademzadeh Yeganeh (2018) the perceived value could be changed in the journey of converting idea to the product or service but assurance of the value proposition is not killed during the journey is important for any business to be recognised by their respective customers. Hence, any business who wants to assure their long-term existence in the industry should make sure that their value proposition is carefully found, measured and monitored throughout their business processes. Hence, understanding how value can be created and delivered is important for any business to succeed. Value chain is such a method that is used in the industry to assure the right value is created, captured and delivered throughout the process. The following topic covers the concept of the value chain in detail.

3.2.2. Capturing Value Added Results Through Value Chain Based Solutions

Value creation is an everlasting journey for any business that focuses on keeping their competitive advantage to make profits (Smith and Colgate, 2007). Any organisation is trying to generate more value than the original cost of converting the input into the output. This decides why a company should exist in the market at first place. However, as Porter and Kramer (2011) say there is a chain of activities that take place in the process of creating the value. As he had suggested in his book "*Competitive Advantage (1985)*" this chain of activities helps the firms to create added value for the respective product or service which leads to the competitive advantage. Below topic covers the use of Porter's and McKencey's value chains in general.

3.2.2.1. Analysis of Value Chains

In a typical production process the companies acquire resources such as capital, raw materials and labour from one or more suppliers and transform those resources into a valuable output which can be sold to the buyers. This output can be a product or a service (Lepak, Smith and Taylor, 2007). As Biggemann and Buttle (2012) argue the simplest form of the value chain is when there is one supplier, one firm and one buyer. In fact, the real situation of a firm is much more complex than that. According to Smith and Colgate (2007), any firm that has a good distribution network will undoubtedly provide a the competitive edge to it and the value is created and maintained in between firms to assure the results. They further say that having a comprehensive integrative and structural approach within the supply chains is beneficial to maintain the value creation as the technology advancements can lead to obsolete the current processes rapidly. Hence, an uninterrupted connectivity between the primary and support activities is important for the firms as they have suggested. Figure 7 shows Porter's value chain.



Figure 7 - Porter's value chain model

Source: The investors book by Rayan (2016)

This model has been further discussed and criticised by many other prominent authors in the literature to address the gaps within the generic guideline. As Massingham (2016) explains,

Adding the relationships in between the activities is crucial in the overall business process as shown in Figure 8.



Figure 8 - Modified Porter's value chain by Massingham

Source: Massingham (2016)

Originally Porter suggests that his value chain analysis as a tool for any firm to use as an strategic instrument to analyse the relationship in between the activities that are being carried out to understand where customer value increases or decreases cost in order to better understand the competitive advantage while addressing the gaps in the relationship of suppliers, customers and other companies in the same industry (Smith and Colgate, 2007). As Lepak, Smith and Taylor (2007) have said the value chain analysis technique is heavily used in the manufacturing industry to identify the product flows in order to assure the intended value is created, but it's heavily dependent on the industry. Alternatively, Biggemann and Buttle (2012) defines it as a tool that can be used by the management to realize how the company could be more competitive in the industry by assuring the interconnection between the steps in the production process. But, Johnson's (2015) argument is that Porter's value chain works only with the tangible products, not with intangibles. However, the original model is a blueprint where it can be customised into the industry specific requirements as and when necessary.

The other mainstream value chain is the McKinsey value chain which consist of the six main activities which are shown in Figure 9.



Figure 9 - McKinsey Value Chain representation

Source: Value chain in strategy and marketing by (Martin and Robert, 2018)

As Williams (2017) highlights, McKinsey's approach for the value chain analysis is simple and easy to develop. Further, he argues that the framework seems dynamic and in case there are new activities, this model can easily be modified and used. However, Massingham (2016) has argued that the simplification within the model is two sided where the business strategies can be scaled as the business wishes or it can go wrong due to the negligence of the important activities within the model. Zhang (2017) has built a counter argument on the same topic and he confront the views of Massingham (2016) saying that the simple and precise value chain is more suitable for nowadays business to understand their respective company value chain while defining the supplier value chain, employee value chain, customer value chain and competitor value chain as well. However, Martin and Robert (2018) have highlighted the reality of certain organisations cannot be straight away mapped to unidirectional or liner approaches as the internal processes might be either happening simultaneously or in the non-critical business paths in parallel. However, considering the different views of these authors, blueprints of the value chains should be customised based on the nature of the business, locality or the internal company policies. The application of these value chains to evaluate the software practices should be evaluated against the nature of the product or the specific service that each company provides as Rayan (2016) argued. Next, the evaluation of the applicability of these value chains specifically for the software industry is discussed.

3.2.2.2. Application of Value Chains

Software industry heavily deals with intangibles where development of the software does not depend on the inbound logistics as a typical manufacturing company would depend on the raw materials (Williams, 2017). A similar argument has been coined by Eling and Lehmann (2018) where they highlight the relevance of the support activities for any kind of firm, but irrelevance of mapping of certain primary activities for the specific service industries. As Eling and Lehmann (2018) argue, each step in the overall value chain has been considered as separate events, but the inter-relationships between these activities have been purposefully ignored

which has led the firms to be uncertain those who are in the service industries. A similar argument has been proposed by Zhang (2017), where he suggest that the product interrelationships and market inter-relationships within the primary activities should be considered separately for industries such as software development or service industry to map it easily by reducing the complexities.

Based on the literature findings, application of the value chain analysis for each industry should be done based on the needs and nature of the respective industries. Further, a global value chain may be helpful to understand the end to end relationships of the inter dependent activities that are carried out within the business process. Strategic differences with competitors, sources of competitive advantages, assurance of the sustainability, intelligent benchmarking and disruption anticipation are key areas of focus to improve the current value chain analysis process. When the global software engineering industry is considered, the challenges within it is much complex than the collocated software development process. Hence, a significant effort should be put in order to clearly identify the relationships in between the processes in the global software engineering industry to come up with a proper value-based approach.

3.3. Theoretical Perspectives of Value Creation and Delivery

The term value yields frequently in discussions of business strategy said Johnson (2015). Hence, understanding the meaning of value in the context of business is helpful to formulate a proper business strategy. As Porter (1980) says, value is created through a chain of players that spans from suppliers of resources to firms, to buyers of products and services from firms. In simple terms as Udawatta et al. (2019) say value can be outlined as the trade-off among the benefits and sacrifices in marketing exchange. According to Smith and Colgate (2007), the ultimate goal of the marketing is to achieve organisational, societal and personal objectives by creating superior customer value for selected market segments with a sustainable strategy. As they have further explained, when developing a new product or a service, identification of the customer's perspectives and purpose of the organisation is key to create value through differential positioning. In the emerging customer value paradigm, value is considered as the most emerged theme for the business success where anticipating and responding to the relevant value of areas as to maximize economic value (Johnson, 2015). Hence, Johnson (2015) further says that firms exist to create value its intended customer segments where is neither efficient nor effective for buyers to attempt to satisfy their own needs. As many of the authors have argued, assuring the value delivery makes sure the sustainability of the business. This chapter is devoted to discussing about the theories related to the value addition. Primarily, lean management, resource advantage theory and three different models are discussed in the below sections.

3.3.1. Creating Value Through Lean Management

Over the last few decades, industries across the globe have embraced many of management practices that they hope will enhance the competitiveness (Arnheiter and Maleyeff, 2011). Further, they say that lean management is one of the key initiatives that is among them which is agreed and upheld by Apurba L. Koner (2010). As Ruiz-De-Arbulo-Lopez, Fortuny-Santos and Cuatrecasas-Arbós (2013) say, identifying the shortcomings of the traditional methods and increasing the value by reducing the waste has been more prominent among the business leaders because of the guaranteed competitiveness through right value stream mapping assured by the lean concepts. Hence, the concept of lean management has become popular within a shorter span of a time. The below section discusses the conceptual background of lean management.

3.3.1.1. Lean Management: An Overview

According to Womack and Jones (2005), lean management encourages shared responsibility and shared leadership to ensure the value delivery by eliminating waste in the process through continuous improvement. As Seth and Gupta (2005) have discussed, lean management focuses on working on a systematic approach to achieve small but incremental series of changes in the process to increase the value by improving efficiency and quality in a long time. Further, they have mentioned that resource optimisation and steady workflow that focus on actual customer need are considered as the primary purposes of lean management. As Arnheiter and Maleyeff (2011) have highlighted, the application of lean management in specific industries should be part of their lean methodology which incorporates the guiding principles. They have further argued that identifying the value, value stream mapping, creating continuous workflow, developing a pull system and facilitating continuous improvement could be considered as universal management tool given that evaluation and application are carefully done specific to the selected industry. The same view is upheld by Lopez, Santos and Arbós (2013) and they have further argued that an intelligent business process, proper use of resources, improved focus and enhanced productivity can easily be achieved if the processes are properly mapped with the lean principles which create a solid business process to enhance the total performance of the company.

As Nayak (2006) says identifying the value is a key concept in the lean management. Distinguishing the value from the waste activities and identifying what actually customer is paying for is how the value is identified. However, there can be teams or individuals those who are not directly involved in the direct value adding process, but they are needed in the overall process. Hence, clear definition of the waste is needed. As Abdulmalek and Rajgopal (2007) have explained, a major impediment to creating a smooth flow are the bottlenecks in the process that is followed. Cycle time and throughput are taken as the measurements to evaluate these things within the process, but clear identification of the value-adding and non-value-adding tasks is compulsory to establish a lean process said Seth and Gupta (2005). As they have further argued, once the mechanisms of shortening the cycle time and increasing the throughput are identified, it is necessary to focus on continuing the focus to improve every process by focusing on enhancing the activities that generate the most value for the customer while removing as many waste activities as possible. The same view is upheld by Womack and Jones (2005) and they have further pointed out the importance of holding the individuals accountable for their respective work.

Application of lean management differs from industry to industry (Gericke and Blessing, 2011). The below section describes how it has been applied in few key industries.

3.3.1.2. Application of Lean Management

Lean manufacturing and lean management are two separate and standalone tools that have been developed during the last few decades to address the key concerns related to cost reduction and waste elimination. Application of the lean value management in the manufacturing industry can enhance the value to the customers, eliminate the non-value added functions or activities in order to improve the bottom line profits (Nayak, 2006). As McManus and Millard (2002) have explained, the value stream analysis and mapping is a key concept that was coined in the manufacturing industry with the lean management which has helped to improve the business processes. As Nayak (2006) has described, value stream mapping is a technique to establish a common language within the firm to identify the process and to provide a blueprint for improvements by identifying the wastes and non-value added activities. This would cross numerous functions which involve many processes. According to McManus and Millard (2002), value stream map identifies the customer needs, waste in the process, areas generating poor quality, processes lacking inter-organizational coordination, labour cost, material cost, inventory cost and maintenance cost. However, as they have further explained certain areas are industry specific where value management methodology could be vary based on the applicability. However, a deep understanding about its application in different industries is important to realise its generic usages as well as challenges. The below two sections describe its generic applicability and for the software development industry.

As Gries and Gericke (2009) have described application of lean in the service industry is much clearer than application of it in the product development industry as measuring the value added by the development process is difficult to quantify. Hence, establishing a common method to identify the waste within the product development process comparing to their relative value by providing a proper mechanism to quantify the outcomes is not easy in all the industries. However, as Ruiz-De, Patxi and Jordi (2013) have argued, traditional methods of analysing the value stream costing to understand the impact of applying lean management methods to any business is challenging and their suggestion is to create the value streams based on the value realisation mechanisms in the product life cycle. But, Siyam *et al.* (2015) have a different perception on the same topic where they have highlighted that the conventional interpretation of becoming lean does not equate to an effective value orientation in product development. They have argued that instead of focusing only on the value realisation within the product
development process, it is necessary to understand the potential wastes in different contexts. The application of the value-oriented concepts at different operational levels may vary and the result of it could depend on how well the value stream mapping has been taken place in the respective industries. As Gries and Gericke (2009) argue, application of the lean in the product development through proper models is relatively young as the research focus for value related concepts in the same industry is still new. Though there are models proposed by Chase (2001) and Browings (2003) were prominent, the examples of the application cannot be seen. Hence, the application of the lean management can vary from industry to industry and different models of the lean management process have been used to gain the advantages of it.

According to Koner and Nau (2010), learnings from the manufacturing field has been applied to other industries in order to improve their processes to increase the value considering the benefits of learn transformation. A similar view is upheld by Nayak (2006) and he has further argued that any industry can focus on reducing their lead times, improving the product quality and eliminating or reducing the waste. As Gries and Gericke (2009) say, manufactures have already experienced the increases in profitability and customer satisfaction through lean management and same could be applied in many other industries to gain the same. According to Resetarits (2012), lean has already been applied successfully in healthcare, information technology, software development, construction, government and apparel, farming, insurance and even in education. This clearly shows how lean has been evolved across multiple industries within the last few decades to help the respective industries to grow. In addition to that, lean concepts have been practiced in software development as well. Below section elaborates more on the specific usage and application of the lean practices in software development along with the identified limitations as well.

One of the key applications of the lean other than the manufacturing is the software development industry. As Womack and Jones (2005) explains, the field of software engineering has plenty of opportunities for improvement that can lead to add more value to the stakeholders in various ways if they capitalise on their opportunities properly. The original concept of lean software development has been coined in year 2003 which is considered as a translation of the lean manufacturing principles. It has a strong relationship to agile principles as well. According to Poppendieck, Poppendieck and Wesley (2003) lean software development focuses on seven principles. i.e. Eliminate waste, amplify learning, decide as late as possible, deliver as fast as possible, empower the team, build integrity in, and see the whole. As Kupiainen, Mäntylä and Itkonen (2015) have discussed, identification of the waste in the

software development has differences compared to the typical manufacturing industry. Primarily the waste in software development could be due to partial work done, extra features, relearning, task switching, waiting, handoffs, defects and even from management activities. As Petersen (2015) argues, the software development teams should focus on identifying the sources of waste and eliminate them first to assure that the non-value adding activities are not taken place within the delivery process.

However, lean software development practices have been a debatable concept in the software industry due to various reasons (Poppendieck, 2010). As he further says, there are strengths and weaknesses of using this concept. Though it helps organisations to identify the waste and act on them, in the real world software development processes certain direct non-value adding activities are needed to assure the product livelihood said Siyam et al. (2015). The same view is upheld by Petersen (2015) and he has further discussed about the key issues with application of lean concepts in the software development. One such area is the limitation with the scalability of the framework because it depends heavily on the team involved in the development process. Another weakness of lean software development is, everything within the process depends on the documentation, failure to do it correctly can result in many development mistakes. As Kupiainen, Mäntylä and Itkonen (2015) have discussed, lean software development heavily depends on the qualification of the development team members. In the traditional team structure, there were many roles to assure the developed components are properly reviewed and tested, but in the lean setup having the reviews are considered as a waste. Another key area that they have explained is the lack of disciplines in the teams can fail the whole project. Hence, they summarise saying both individuals and teams can together lead the software development to collapse the whole software delivery process. As Kupiainen, Mäntylä and Itkonen (2015) have argued, use of lean software development is heavily dependent on the nature of the product and company. They further argue that formation of the team and how teams are organised to complete a particular development activity are key factors when using a light-weight method like lean software development. The current challenges within the global teams are getting further challenging if the process itself has weaknesses mentioned above. According to Petersen (2015) any development process that includes the remote workers should have a mechanism to measure the flow of development work. Absence of such would create more problems for the organisations. A similar view is upheld by Poppendieck (2010) who is one of the core authors of the very first lean software development book and she says that the customers do always have unrealistic requirements when it comes

to the software development. Hence, heavily depending on the individuals and omitting the best practices in the traditional processes can badly impact to the overall business. Therefore, she suggests identifying the application of the lean software development practices based on the nature of the business, customers and development teams. In addition to that, there are shortcomings of the lean management in general as well. The next section describes them.

3.3.1.3. Challenges and Shortcomings of Lean Management

Despite the various examples of successful implementation of the lean management, it faces a great deal of criticism across multiple industries which is proven to be true given the census within the last two decades (Siyam *et al.*, 2015). A similar argument has been brought by Ruiz-De, Patxi and Jordi (2013) and according to them around 70% of the organisations those who have attempted to adopt lean have failed to achieve the intended results. The same view is upheld by Petersen (2015) and he has further argued that though certain organisations get benefits as initial gains, those are short-lived where the companies regresses to pre-lean performance sooner or later.

The biggest challenge with application of the lean is the absence of the right tools and infrastructure says Abdulmalek and Rajgopal (2007). According to them, ³/₄ of the organisations have failed to identify the real problem with application of lean, instead they have tried to solve the problem by finding workarounds. As they have further highlighted, applying lean at the team level does not make sense failing to do it leadership level. A similar view is upheld by Koner and Nau (2010) and they have further argued that a steady phase and starting with management are key facts for the success. According to them, lean does not have a governing body who defines what lean is and how it can be applied in multiple contexts. Due to that, the information available in the public space is both fragmented and potentially incorrect. Ruiz-De, Patxi and Jordi (2013) explain that due to the absence of proper guidelines for multisector application of lean, people make assumptions and fail at the end. Another aspect that they have highlighted is the wrong intention of applying lean. That is, majority of the companies focuses on cost reduction instead of process flow improvements. This has led them fail in the middle of the journey. As both these group of researchers have explained, it happens due to the absence of the governance body.

As Resetarits (2012) says, the real challenges with lean are not how it is applied, but the challenges with the lean principles. He has provided a counter argument to the above challenges saying that a proper application method should be decided by the respective organisations after

investing enough time on the education process. However, absence of margin for error, not having an evaluation criterion to evaluate the effectiveness within the process itself, lack of number driven approaches and finally considerably high up-front work are the key challenges in the lean management. As Siyam et al. (2015) have highlighted, lean has certain impacts to the people, process and culture which can be considered as side effects. Limiting the creativity of the team, having undue inspection on people, impact on the jobs, turning people into robots and paying less attention to people skills are considered under that category. A similar view is upheld by Petersen (2015) and he has pointed out that the lack of focus for the individual knowledge and reducing the collaboration by specifying internal regulations have a long-term business impact. As Siyam et al. (2015) have highlighted, lean does not work for all the industries and it does not work for all types of work environments and it would fail to show the positive outcomes in all types of projects. Trying to apply it in any given industry for any type of project may increase the stress of the workers and ultimately it leads to many other issues. As they have further mentioned, the is no standard production model that fits for any industry. Hence, understanding the drawbacks and evaluate the applicability of the lean management to the respective industry is highly important. As Nayak (2006) says each individual in the team should master the selected tool to get the maximum output to avoid collapsing the entire management system. Further he says that proper planning and application of a suitable change management process can reduce the risk given that leadership and the management understand their roles in the implementation phase. However, the rule of thumb is the upfront evaluation of suitability is crucial as many authors have highlighted.

After exploring the literature about both positives and negatives with respect to the application of lean management in multiple sectors, it was identified that, not all segments can try applying lean straightaway. Instead, of that a proper customisation and leveraging the current strengths through their own plan are compulsory for a successful implementation. However, industry specific challenges and limitations should be carefully considered in order to live with lean principles. Certainly, the self-organisation and self-discipline are crucial from top to bottom when applying a concept like lean management as it converts the whole process into a simplified version. Metrics, evaluations or countermeasures are not clearly specified by the lean principles, hence understanding about the process clearly and avoid the use of tools that require numbers is important for the organisation. Finally, as lean encourages continuous improvements, it requires a blend of commitment and patience in order to achieve a great success.

It is believed that resource advantage theory helps the organisations to carve their competitive advantages by improving the value addition. Hence, the below section describes about it.

3.3.2. Creating Value Through Resource Advantage Theory

Recent value addition related literature has been developing vastly and academia has included conceptual knowledge with respect to the value addition to their respective course work as well (Peranginangin, 2015). Development of theories related to the value addition shows a robust subject matter in which various concepts, theories, topics and models are developed and examined. Certain theories are integrated with other disciplines such as psychology, engineering and even science. Resource advantage is such a theory which talks about winning the competition game by identifying the key value propositions (Hunt and Davis, 2008). This section is devoted to discussing the resource advantage theory.

3.3.2.1. Resource Advantage Theory: An Overview

When the strategy literature is considered, the competition related concepts and theories have been evolving. That includes addressing the marketing orientation, company's superior performance with proper marketing strategy and alignment, competitive advantage, strategic issues in marketing and many more. As Hunt and Davis (2008) emphasise, one of the key research interest is the comparative advantage theory of competition. The original concept has been coined in early 90's where resource-based theories got the initial attention. As Ban and Coroianu (2011) have discussed, in marketing and economics, the competitive advantage in the industry performance plays a crucial role. They further highlight the importance of competitive rationality and differential advantage as well. However, as many authors have discussed, in both macro and micro level, the competitive advantage is consistently assuring the sustainability of any firm. As Wooliscroft and Hunt (2012) argue, the historical perspective of the use of resources for marketing has been changed with the introduction of the resource advantage theory.

Two primary theories that are considered as the foundation for the resource advantage theory are competitiveness theory for differential advantage theory by Alderson (1957) and Corner (1991)'s theory of the ability of the organisations to explain their constraints and reasons for their existence. Corner's theory is based on resource-based view. As Hunt and Davis (2008) argue, resource advantage theory is capable of explaining all important aspects of strategies in the organisation which covers the whole spectrum. That includes resource-based strategy, relational marketing strategy, competency-based strategy, market-oriented strategy, brandy

equity strategy, industrial-based strategy and market segmentation strategy. The value which is created in any organisation can come from either tangible or intangible resources which are already covered in this theory said Wooliscroft and Hunt (2012). Hence, the application of this concept is not limited to any industry instead it can be used any firm that focusses on distinct product and service development strategy that enables the businesses to deliver more value to the end users.

As Hunt and Morgan (1995) ; Hunt (1997) and Peranginangin (2015) have described, the resource advantage theory heavily focuses on heterogeneous characteristics of the products that leads to optimise the heterogeneous resources as well. Based on their findings, improving the value given to the customers through adding value on resource quality and quantity is a key factor. As Figure 10 shows, competitive position can be determined by considering the relative resource produced value and relative resource cost.

		Lower	Parity	Superior
	Lower	?	² Competitive Advantage	3 Competitive Advantage
Relative Resource Costs	Parity	4 Competitive Disadvantage	⁵ Parity Position	6 Competitive Advantage
	Higher	7 Competitive Disadvantage	8 Competitive Disadvantage	?

Relative Resource-Produced Value

Figure 10 - Competitive Position Matrix

Source : The comparative advantage theory of competition by Hunt and Morgan (1995)

As Hunt and Morgan (1995) have described, any organisation would like to be categorised them as cell 3 where they produce superior value at a lower cost. Cell 2 and cell 6 are bringing superior financial returns while keeping the competitive advantages. According to them, cell 5 is considered as the parity position and cell 1 and 9 could be either value or costs which may or may not have superior returns. However, any firm that would fall into cell 4, 7 or 8 should seriously consider their competitive position and reconsider their strategies to move to a

competitive advantage position as soon as possible. According to Hunt and Davis (2008), resources in any firm can be categorised into seven categories. i.e. financial, physical, legal, human, organisational, informational and relational. The same concept had been presented by Hunt and Morgan (1995) in their paper as well. Based on this categorisation, if any organisation has a resource that could be rare among the competitors, it has the potential of producing comparative advantage. In addition to that, if these resources are cost effective, that firm can produce superior value to their customers. However, as Hunt and Morgan (1995) highlights, mostly these types of resources are not cheap, but organisations could keep them at a considerable pay scale given their skills and knowledge help the firm to keep their competitive position.

3.3.2.2. Application of Resource Advantage Theory

The use of resource advantage theory is not industry specific. It can be applied to any firm that focuses on producing superior value to their respective stakeholders (Hunt and Morgan, 1995). As Ban and Coroianu (2011) have highlighted, depending on the firm level, the theory can be applied to either to get superior financial performance or superior quality, efficiency and innovation. The same concept has been presented in Hunt and Morgan's (1995) conceptual paper as well. According to them, resources can be utilised to maximise the competitive advantage for both macro and micro levels. However, Wooliscroft and Hunt (2012) have provided a counter argument on the same theory where they have highlighted the fact of the firms being heterogeneous and the dynamic nature. In addition to that, this theory is considered as an evolutionary and interdisciplinary. Hence, they suggest applying the theory based on the respective premises. The same view upheld by McWilliams and Siegel (2011) where they highlight the value creation of a firm depends on the sustainable competitive advantage that the firm defines as their strategy. Therefore, as many authors have suggested, the application of the resource advantage theory to maximise the value creation should come from the strategic direction itself where the respective processes within the firm can capitalise on each area with the set objectives to assure the superior value creation for the betterment of the firm.

As McWilliams and Siegel (2011) have further explained, any firm can categorise their tangible resources into financial, physical and legal whereas intangible resources include human, organisational, informational and relational resources. As Hunt (2000) says, the theories explain the process of leading the heterogeneous and imperfectly mobile resources towards differentiation and customer value delivery which will enhance the company performance. As he further highlights, the role of the strategic leaders is to identify the different types of

resources available within the firm and utilise them in order to deliver the promised value to the end users. However, Tyalor (2005) says that understanding the different levels of the firm and establishing competitive positions at each level as resource foundations are must to get the maximum advantage of the resource advantage theory. Converting the resources into the competitive positions requires a thorough understanding about both tangible and intangible resources of the firm said Griffith and Yalcinkaya (2010). They have further argued that employing resource advantage theory without understanding how well each resource can be placed at the competitive position could lead to inefficiencies as foundations are must to get the maximum outcomes. Same view is upheld by McWilliams and Siegel (2011) and they have highlighted the understanding both internal as well as external influences is contributing to the journey of generating more value very well.

However, as Hunt and Morgan (1995) have discussed in their conceptual paper, the nature of the firm has a strong influence over applying the resource advantage theory as suppliers, consumers, societal resources, societal institutions and public policies are contextually different from firm to firm and environment to environment. A similar view is upheld by Wooliscroft and Hunt (2012) and highlighted the importance of the market place position, segmentation and current organisational performance when occupying the basic theory of resource advantage theory. In addition to that as the theory heavily focuses on both proactive and reactive innovation, the readiness of the human resources for accepting it and space for it in the strategy are clearly the building blocks of the successful implementations.

As the theory has evolved after it has been established, the primary concepts have also been changed. As O'Keeffe, Mavondo and Schroder (1998) have described, due to the industry specific nature, in appropriate application of the resource advantage theory can lead to cease the innovation and productive gain and even the economic growth would stop. As they have argued, the challenge is to identify the actual application of the theory to the respective industry. However, being relevant and holding the competitive position is the firm's need while assuring what they do is right for their customers said Hunt and Davis (2008). Understanding both financial and customer perspectives while focusing on the internal process to optimise it are crucial. Further, learning and innovation are considered to be playing a vital role in applying the resource advantage theory (Peranginangin, 2015). As the focus of this research is to increase the value addition in the global software engineering industry, application of the resource advantage was considered with respect the selected industry as well. The following

section describes the challenges and shortcomings of the selected theory with respect to its applications.

3.3.2.3. Challenges and Shortcoming of Resource Advantage Theory

As Griffith and Yalcinkaya (2010) have discussed, the service delivery industries are facing challenges with productivity, economic growth and sustainability where resource advantage theory shows the answers. As they further discussed, optimising the production strategy and internal processes that align with the marketing strategy leads to a sustainable value delivery. The same view is upheld by Hunt and Madhavaram (2012) where they have highlighted the fact that theory of competition and competitive rationality help the service delivery organisations to map their strategic goals to improve the productivity. Both these concepts are part of the resource advantage theory where they cover under the productivity improvements. However, a contradicting view has been presented by Peranginangin (2015) where they have applied the resource advantage theory into healthcare industry in order to understand the value addition mechanism for the customers. According to him, identifying the outputs obtained and mapping it with the financial figures have not been clearly defined by the theory, and resource quality as well as quantity provided in the service industry are highly qualitative measures that limits the possibilities of quantitative evaluations. The same view is upheld by Griffith and Yalcinkaya (2010) and they have discussed the inability of mapping the semantics of the resource advantage theory with the anticipated financial performances. Similar approach has been tried in the agriculture industry to optimise the value delivery where the marketplace is considered to be very dynamic by O'Keeffe, Mavondo and Schroder (1998). The conclusion drawn by the authors have shown that product delivery side of the selected industry shows very positive alignments where the agri-services were not capturing and delivering the intended outcomes with the resource advantage theory. However, as many authors have highlighted, a proper customisation can help the respective firms to adopt the resource advantage theory in order to improve the competitive position in the given market.

As Conner, K. (2011) have described, within the industrial organisation economies, the theory can be applied to gain the competitive edge by optimising the internal processes as well as the strategic drives. However, as he further argues, their intention to improve the value delivery in the school education system by applying the resource advantage had been challenging as the intangible aspect of the resources have not gained a lot of attention. A similar view is upheld by Day G. S. & Wensley, R. (2003) where they have argued that the determinants of the marketing performance and the relationship to the service delivery measurements are highly

subjective. As Johnathan (2003) has described, the generic strategies and firm specific strategies should be firmly categorised by the respective strategic owners, and value delivery initiatives should be taken based on the respective areas of focus to improve the utilisation of the resources. Otherwise, the evaluation and continuous improvement based on the evolving resource advantage theory becomes a bottleneck for the firms to optimise their value delivery.

Another research that was carried out by Griffith and Yalcinkaya (2010) that was focusing on global advertising has shown that there are new underlying focuses for the resource advantage theory that should be included to provide more insights on building the competitive advantages. As they have found, firm/inter-firm understanding, coordinating and delivering the intangible product or services is challenging due to the nature of those industries. However, comparatively the service delivery industry is more challenging than even the intangible products as they have recognised. A similar view is upheld by Peranginangin (2015) based on her research outcome where she has highlighted that competitive theory in the emerging market context needs certain revision specially with respect to the global scopes.

Given that the theories are more generic concepts, application of them into the industry specific requirements should be done based on the short-term and long-term outcomes as John and Manin (2007) have highlighted. According to Cavusgil *et al.* (2014), competitive dynamics and organisational learning are important to realise the value of a resource for a given organisation. As the resource-advantage theory argues that the value of a resource to a firm is seen in terms of its potential to yield competitive differentiation and/or customer value delivery that enhances performance outcomes, intangible resources as well as elements embedded within the firm must not be left out when advancing the value addition Hunt (2016). However, as Jenie and Hesfede (2015) have argued, underlying focus on resources, managing relationships, and optimising and differentiation of customer value delivery can enhance the performance outcome which are not directly addressed within the resource-advantage theory. In addition to that, Griffith and Yalcinkya 2014) have pointed out that the firms are seeking for superior financial performance. But achieving them only through a non-consummatory theory such as resource advantage theory is challenging if it is not evolutionary.

Finally, though the resource-advantage theory has identified challenges and gaps, it has helped the organisations to increase the resource specific value to a greater extent. When competitive dynamics, organisational contexts and processes are concerned, value mapping has to be done considering and associating the overall landscape of the business process. Therefore, application of the resource-advantage theory could be retested in the given context only up a certain extent, but this study needs more than that as it heavily focuses on software engineering practices and processes in the global software engineering landscape to increase the overall value addition.

The following chapter elaborates the different models that are used to increase the value addition.

3.4. Models for Value Creation

As Boehm and L. G. Huang (2003) have said, in software development industry, activities are carried out in a value neutral way. Every need, new requirement, function, use cases, issues and improvements are considered equally important. Every step in the lifecycle is treated as equally important. The link between the tasks and other operational activities are irrelevant. Further, as Racheva, Daneva and Sikkel (2009) have said largely the activities involved in the software business have not properly been measured and agreed by the stakeholders. They have further discussed the concept of business value in the field of software engineering and exceptions as well. However, they have upheld the views of Boehm and L. G. Huang (2003) and studied further the impact of value parameters in the software delivery models. According to them, cost-benefit is the only mechanism that has been considered in the evaluation of the software requirements. The use of HR departments, support functions and administration and authoritative management hierarchies, effective structures and software process are should also be considered according to the researchers carried out by Boehm and L. G. Huang (2003); Little (2004); Racheva, Daneva and Sikkel (2009); Zanoni *et al.* (2014) and Schwaber and Mike Beedle (2016).

To identify the value adding activities, capabilities or features in the software, evaluating them against a proven technique important. For that, many researches have been carried out to select the best approach that particular team or organisation should choose. In software development, majority of the product owners struggle with identifying the most value adding initiatives or features due to the lack of knowledge. According to Boehm and L. G. Huang (2003) more than 60% of the business leaders and product owners vote for initiatives and features based on the likelihood of engagement against the project cost. As Racheva, Daneva and Sikkel (2009) have discussed, many companies struggle with this method due to three reasons. i.e. decisions are not tied to strategic goals, likelihood is a hypothesis and priorities are driven by the latest records available and accepted by the loudest executives in the team. Further, they argue that

companies that make the decision only based on the internal opinions are wasting the opportunities and there is a high risk of them being beaten by the competition. Identifying the value created by each activity in the software delivery is not certainly an easy task said Boehm and L. Huang (2003). As they have identified, this requires a lot of intervention of the respective stakeholders and their expertise on narrowing down the probable value creation.

There are few popular multicriteria selection models which are currently in use in the multiple industries. They are Kano model, Analytical hierarchical process (AHP) and opportunity scoring. In addition to that, another software specific model is used by many software companies now which uses reach, impact, confidence and effort as the inputs to evaluate the capabilities of a specific software. However, there is not enough evidence in the literature to prove the accuracy or usage of this model.

In this section the focus is to discuss about the available methods for identifying the values and the application of them in the global software development.

3.4.1. Kano Model

Kano model focuses on the level of the customer satisfaction in three categories: must-haves or basics, performance and delighters or excitements. Figure 11 depicts the model.



Figure 11 : Kano Model

Source: Kano Model Analysis in Product Design by Lin (2019)

This model is used to measure the customer satisfaction which was developed by Noriaki Kano in 1980s. As Singh (2016) says, Kano model is heavily used in the software design phase to identify the respective categories of the proposed features. Those categories vary from basic or threshold features to excitement features. According to Rice (2014) this model is useful for the product teams with limited resources and time that need to make the prioritisation decisions within a limited time frame. However, as Rice (2014) says it is not a numerical methodology, instead an expert judgement is used to figure out the minimum-threshold features. According to Yunita et al. (2019) this method is a very well proven systematic method for feature prioritisation. As both Rice (2014) and Yunita et al. (2019) have discussed, this helps to identify the features that market or audience would accept and Kano questionnaire basically limits overestimating the excitement features while stopping the must-haves. However, Xu et al. (2009)'s case study has shown that the relative significance of the requirement helps only to the maintain or expand the strategic advantages but, it leads to hide the importance of the actions attached to the completion of the particular requirement. Further, customer satisfaction is a subjective measure of the product feature. And the overall process is time consuming as well. According to Tontini (2007) 54% of the participants of his research had not a good understanding about the product features hence, the answers for the questionnaire was selections based on the assumptions. And further he says that multiple rounds were carried out in order to reach to a conclusion. Hence, process itself is eroding value as both researchers have highlighted. In addition to that Kano model is one-dimensional where it focuses only on the value added to the end user based on the attractiveness. But, strategic implications are emerging daily and the competition would lead to implement the non-value adding features as it focuses only on the external inputs. Further, it is a subjective measure of the value that might satisfy the end users. As Matzler et al. (1996) have discussed, Kano model provides a rough sketch to the end user for their evaluation in relation to the product performance. In that sense, it only considers the qualitative assessment which leads the resulting Kano categories qualitative as well. The classification criteria are not explicitly defined in the Kano model though they are used to evaluate the requirements. And the subjective nature of the evaluation would lead to wrong predications as the classification criteria are not logical. The biggest missing compartment of Kano model is producers' concerns as it is inherently customer-driven. In practice, producer capacity and their assessment is critical to do a proper cost-estimations while considering the demand for the given needs (Tontini, 2007). A similar view is upheld by Xu et al. (2009) and they have suggested to include two dimensional non-linear approach to categorise the end users' requirements into the right category. Further, the necessity for a

numerical approach has been discussed by them which should be incorporated to the basic model. However, this evaluation still focuses on the requirement categorisation. It does not still cater to the need of evaluating the overall value it could be adding while considering the process and people.

3.4.2. Analytical Hierarchical Process (AHP)

AHP is a structured technique used in complex decision making on the selection of the human reactions based on a ranking by comparing between two clusters (Rice, 2014). As Singh (2016) has described, one of the biggest challenges in today's business world is to choose the right project to execute while maintaining the right strategic alignments. These decisions lead to constitute the critical factors, hence making the right choice with the right level or adequate information is crucial for the businesses. As he has further explained, the use of the benefitcost relationship for each project is basically an ordering of scheme to satisfy the requirement of prioritisation. It does not mean to use the exclusive financial ratios or cost of overall execution. Based on Nord, Ozkaya and Kruchten (2014)'s argument, possible definitions for higher benefits and low costs can guide the businesses to choose the right project. Whereas, cheaper and less resource needs are more profitable while assuring a higher ROI, less complex and less internal resistance would give the competitive edge, finally the less risk projects make the stakeholders happier. However, as they have further discussed, these evaluations are more complex when it comes to the practical applications. The AHP process uses a practical approach to decompose the problem into multiple levels through different criteria as Figure 12 depicts.



Figure 12 - Example for AHP hierarchy

Source:- Singh (2016)

This model uses a numerical approach where the weight of each factor is considered as the input to the final assessment for the comparison. Once the primary evaluation is established, the numerical probability of each selected alternative is calculated which helps to decide the likelihood of the fulfilment of each alternative against the given goals. As Singh (2016) says the model may seem simple, but it is a complex approach. According to Rice (2014) AHP considers multiple inputs when constructing the hierarchy and those inputs can be consolidated to get the people to agree on the outcomes as it gives a technical and mathematical approach. The tendency to agree on the outcomes is higher in AHP since it uses a mathematical approach. However, pair-wise comparison in AHP is artificial and it requires to redo the same process if the consistency index is above 10%. Further, as Singh (2016) further explains, simplified version of AHP is required for the simple projects as this systematic approach takes a considerable time to evaluate it upfront. In addition to that interconnections between the project, people and processes should be considered in the evaluation of identifying the value of each project. Based on the current situation, application of AHP to the software industry make the individuals to learn the AHP's factors, definitions and exact meaning to give a proper estimation. Further, as AHP is based on the pairwise comparison and it uses the inconsistency rate to validate the outcome, the previous judgements can mislead the outcome of the project evaluation even by a precision. According to Xu et al. (2009) AHP works best for complex projects which takes a considerable time to complete, hence using it to evaluate and compare the shorter cycled projects becomes an additional overhead. Further, Tontini (2007) and Yunita et al. (2019) have highlighted the fact that application of AHP in the software which is volatile by its nature can make lead to make the incorrect decisions as no comparison matrix in AHP can cater to the volatile nature for the selection of the preferences.

3.4.3. Opportunity Scoring

The opportunity scoring or opportunity analysis is a process to evaluate the product requirements based on the customer feedback which has been built on top of Anthony Ulwick's outcome driven innovation theory. According to Ulwick (2002) asking the customer what they want in their products or services is a norm in many organisations, but they go about it all wrong. Companies invest a lot of money on innovation to come up with new products or services, but after all customers refuse to buy them. The reason for that is customers should not be asked for solutions, instead they should be asked for outcomes. He suggests a five-step process to identify the opportunity with the given produce or service. The steps are planning the outcome-based customer interviews, capture the desired outcomes, organise the outcomes,

rate outcomes for importance and satisfaction and finally use the outcomes to jumpstart innovation. Figure 13 depicts the opportunity scoring method.



Opportunity Prioritization

Figure 13 - Opportunity scoring method

Source : Pavel (2019)

This simple technique serves effectively for the product or service prioritisation said (Ulwick, 2002). However, can the same be used to understand the overall value creation and delivery is still a doubt as process overheads and people have not been considered within the concept itself (Pavel, 2019). As the companies, the right selection of the frameworks or methodology leads to the successful outcomes and it can maximise the value to all the stakeholders (Bettencourt and Ulwick, 2008). As Ulwick (2002) has pointed out determining the most interesting and attractive ideas is the top priority of the organisations, but they can fail if they do not focus on the internal strengths and delivery practices which are crucial in the business. In value-neutral software engineering all the activities are considered as equally important. Though the top value adding features are selected, if the delivery framework or internal process do not support to deliver the product on time with the right quality the opportunity score along cannot guarantee the outcome (Bettencourt and Ulwick, 2008). Further, Pavel (2019) says that product managers in the company should be focusing on the right selection of the product requirement while delivery leaderships should understand value of the activities carried out within their boundaries to make sure that it is customer centric and predicted value is delivered to the end users.

According to Bettencourt and Ulwick (2008) and Pavel (2019) opportunity scoring is a very simple but powerful method to identify the most innovating solutions to a identified common problem and the visualisation of the same is clear and precise. However, this method uses a feedback loop to get the customer view through a questionnaire. If the customers underestimate or overestimate, the result becomes unrealistic. Therefore, it is vital to focus on selection of the right audience to get the intended outcome. Further, as Pavel (2019) says, the model itself does not assure the overall value creation or delivery, it focuses only on the concept evaluation.

	Focus	Simple	Data driven	Value vs Tech balance	For complex projects	Overall value creation is considered
Kano model	Requirements	No	Yes	No	Yes	No
Analytical Hierarchical Process	Goals	No	Yes	No	Yes	No
Opportunity Scoring	Innovation	Yes	Yes	Yes	No	No

Table 2 - Comparison of the existing evaluation methods

Source: Author's work based on Matzler et al. (1996); *Ulwick* (2002); *Tontini* (2007); *Bettencourt and Ulwick* (2008); *Xu et al.* (2009); *Rice* (2014); *Singh* (2016); *Lin* (2019); *Pavel* (2019) and Yunita et al. (2019)

To understand the value created through the given product or service, it is necessary to identify the overall business process from concept to the customer said Zanoni *et al.* (2014). As the Table 2 shows, the effort of most of the researchers have been put to identify the impact that can make within the ideation phase, but from design to delivery activities have not been significantly considered. Relative worth, utility, monetary worth of something, marketable price and importance are considered as the key factors in the evaluation of the any given activity (Little, 2004). As Haile and Altmann (2016) defined, value-based software engineering is the explicit concern with value concerns in the application of science and mathematics by which the properties of the computer software are made useful to people. But, when the existing methods are carefully evaluated, it is evident that the focus is less to the overall value creation, instead the primary focus relies within the requirement prioritisation process. Therefore, evaluating the overall software process with respect to the concerns in the global software engineering is still a vacuum to be filled in the literature.

3.5. Determinants of Value Addition

The objective of a firm is to create superior customer value with a strategy that they cannot satisfy by themselves or through a competitor if they want to make more profits (Smith and Colgate, 2007). The primary role of the marketers is to identify what value to create and when, why and how well the product concept from a value perspective. Developing marketing strategies as well as the measures are considered as important in order to come up with a sustainable strategy (Little, 2004). According to Woodall (2003), the customer value has two components: customer received value and customer lifetime value. These two are for customer and firm respectively. As Carnahan, Agarwal and Campbell (2010) have explained, identifying customer's perceived preferences and catering to assure those attributes are properly defined based on a context is considered as the value delivery. A similar argument is upheld by Mutambi (2008) and he has further said that conceptualising and incorporating the perceived value requires multiple assessments that can help to operationalise an effective value creation process. However, as Jawarsaki and Park (2009) argue, there is no commonly accepted definition for the customer value, hence, there are multiple arguments on the same. Therefore, any method that addresses customer's functional, essential and experiential needs can be accepted as a proper framework for enhancing the stakeholder expectations (Biggemann and Buttle, 2012).

According to Ulaga (2003), there are eight categories of value in business. They are product quality, product delivery, time to market, the price (cost), cost of the process, personal interaction, supplier know-how and service support. Based on these eight areas, he has further identified few sub focus areas based on the benefits of each to analyse the value delivery process. This is considered to be a comprehensive mechanism based on the arguments of Haile and Altmann (2016). A simplified framework has been proposed by Heard (1993) where he argues that only three main areas are important in the value creation. They are product characteristics, delivered orders and transaction experiences. But, this model has been heavily criticised by Smith and Colgate (2007), Carnahan, Agarwal and Campbell (2010) and Johnson (2015). The gist of their argument is that Heard's model does not consider many sources that contributes to the value creation process. A specific argument has been provided by Johnson

(2015) where is clearly says that the ability of understanding the benefits, features, functions and the use of the product or service are crucial when it comes to the value delivery, but it is not clearly captured by Heard's model. And he further argued that the customer, employee and organisation are the key three pillars of the overall value delivery system which should be considered together in any value creation related assessments. However, understanding the customer value perspectives in different contexts, creation of the value addition strategies based on the customer needs, proper conceptualisation and accurate operationalisation are key to be successful in the competitive market for any business.

As this research focuses on the value addition aspects in the global software engineering industry, the below sections are devoted to specifically discuss how the identified determinants of the generic value addition can be integrated into the given contexts in order to come up with a generic research framework for the selected industry.

Software engineering processes cannot be taken in an isolation to evaluate it separately to measure the value creation and delivery. The whole process includes many steps where different professionals intervene at different levels to do the final delivery. The process begins with the ideation phase which goes through many steps in between and finally ends up at the customers feedback and acceptance. This nature is applicable for both collocated teams as well as distributed teams with global software engineering (Lanubile *et al.*, 2010). As Cho (2007) explains the typical software development process starts at the portfolio level to respond to a need in the market. The evaluation of the market changes to identify the emerging opportunities available and find the best solution to capture those opportunities take place at the higher level of the organisation. To make it a productive output, it requires the involvement of the business leaders, technology leaders, legal team, marketing team, software development team, technical support team, infrastructure, administration, finance, security, project management organisation, human resources and IT team. As he argues to deliver a high-quality product, everyone who involves in the overall process must be contributing effectively while assuring every single sub goal is met.

As discussed throughout the literature review, value addition in the businesses have been discussed in various angles in both western and Asian literature. However, characteristics of those variables are considered, those can be grouped into the five high-level and prominent variables with respect the perceived value addition in the global businesses. Table 3 shows the summary of the findings along with the respective sources.

Table 3 - Selection of the Variables for Conceptual Framework

Variable	Key Characteristics	Source	Grouping
Team composition	Size of the team	Estler <i>et al.</i> , (2014)	Staffing
	Distribution of the skills	Nord, Ozkaya and Kruchten (2014)	
	Hierarchy	Adom, Hussain and Agymen (2018)	
Key skills	Individual skillset	Sanderson (2017)	Staffing
	Contribution to the goals	Kearney (2018)	
Team collaboration	Ability to collaborate	Ebert, Kuhrmann and Prikladnicki	Staffing
	Rigid constraints	(2016)	
		Jiménez, Piattini and Vizcaíno (2016)	
Organisational structure	Size of the team	Ambler and Lines (2016)	Staffing
	Management style	Koner and Nau (2010)	
	Authority	Kupiainen, Mäntylä and Itkonen	
		(2015)	
Software development life cycle	Mode of delivery	Estler <i>et al.</i> , (2014)	Internal Process
		Sanderson (2017)	
		Jiménez, Piattini and Vizcaíno (2016)	
Internal processes	Mode of delivery	Eling and Lehmann (2018)	Internal Process
	Internal guidelines and policies	Martin and Robert (2018)	
		Paredes-Valverde et al. (2018) Pavel	
		(2019)	

Organisational culture	Expectations	Ambler and Lines (2016)	Internal Process
	Practices	Pavel (2019)	Governance
	Guidelines	Haile and Altmann (2016)	Staffing
		Noll <i>et al.</i> (2016)	
		Franco, Hirama and Carvalho (2018)	
		Whittle (2019)	
Power	Influence	Jiménez, Piattini and Vizcaíno (2016)	Governance
	Behavior	Haile and Altmann (2016)	
	Rights to execute	Noll, Beecham and Richardson (2016)	
Governance	Policies	Franco, Hirama and Carvalho (2018)	Governance
	Internal guidelines	Vlietland and Vliet (2015)	
	Structure	Bass (2016)	
		Noll <i>et al.</i> (2016)	
Overarching process	Policies	Jiménez, Piattini and Vizcaíno (2016)	Internal Process
	Internal processes	Franco, Hirama and Carvalho (2018)	
Automation	Ability to run automation for	Pavel (2019)	Use of Tools
	testing	Haile and Altmann (2016)	
	Pipeline automation		
	Use of tools		

Computer Aided Software	Use of tools for software	Estler <i>et al.</i> , (2014)	Use of Tools
Engineering tools	engineering	Faily and Lyle (2013) Krishnamurthy	
		(2016)	
Effective project management	Lower the manual intervention	Sanderson (2017)	Internal Process
	Ability to monitor the progress	Lanubile et al. (2010) Krishnamurthy	Use of Tools
	Use of tools	(2016)	
IT infrastructure	Stable infrastructure	Haile and Altmann (2016)	Technology Infrastructure
	Cost	Daoud (2018)	
		Eling and Lehmann (2018)	
		Martin and Robert (2018)	
		Yunita et al.(2019)	
Hardware	Minimum required hardware	Williams (2017)	Technology Infrastructure
	Availability	Daoud (2018)	
	Network	Eling and Lehmann (2018)	
Software	Trustworthiness	Sanderson (2017)	Technology Infrastructure
	Functionalities	Bass (2016)	Use of Tools
	Ability to customize	Haile and Altmann (2016b)	
	Effective management	Krishnamurthy (2016)	
		Sanderson (2017)	

IT support	Availability	Daoud (2018)	Technology Infrastructure
	Active support	Eling and Lehmann (2018)	
		Jabbouri et al. (2016)	
Environment and tooling	Ability to spin up easily	Ambler and Lines (2016)	Technology Infrastructure
	Use of tools for automation	Siyam <i>et al.</i> (2015)	
	Stable environment	Jeffrey and James (2013)	
		Islam, Jasimuddin and Hasan (2015)	

Source: Author's work based on the literature review findings

The literature has the findings related to each of the areas focusing on certain characteristics. Use of the worlds in different contexts are different but they carry the same characteristics. Therefore, all the findings through the literature was relooked and re-evaluated based on the similarities and differences with respect the internal characteristics before coming up with the independent variables. Table 3 shows the summary of that exercise meanwhile below five sections clearly articulate the rationale behind the selection of the five variables for this research.

3.5.1. Impact of Internal Processes for Value Addition

According to Boehm (2003) both execution and strategy team should understand the importance of the value delivery throughout the process. He says that much of the current practices in the software development pipeline are done in a value-neutral way in which the task carried out at each level is considered as equally value adding activities. Majority of the researchers focus on identifying the challenges and issues in global software engineering, but there is a lack of focus to identify the key issues in the process with respect to the value creation and delivery (Möller and Rajala, 2007). However, as James D. Herbsleb (2007) says the decisions that are made in the global software engineering are much decoupled from the value proposition that establish the project. When the literature related to the value addition in global software engineering is considered, there are conflicting views about it. According to Cho (2007) the lifecycles does not change depending on the demography, but James D. Herbsleb (2007)'s argument is that lifecycle should not be the same when moving to the distributed teams. Cho (2007)'s view is accepted by Rajala and Westerlund (2007) and they have suggested to evaluate the delivery framework in a demographic intensive way to understand the changes required to accommodate them on the go. But as Barney, Aurum and Wohlin (2008) say, business leaders worry about the return on investment while technology leaders' responsibility is to assure the maximising of the value creation throughout the delivery process for a given investment. A similar view is discussed by Jonsson, Westergren and Holmström (2008) and they have further highlighted the importance of the integrating valueoriented perspectives into the software engineering practices. However, number of researchers have highlighted the fact that going global strategy has increased the complexity of converting value-neutral software engineering into value-based software engineering (Boehm 2003; Dumitriu et al. 2011; Kaur and Sharma 2014; Ebert et al. 2016).

The responsibility of the product management leadership is to understand the product requirements in the industry to solve any problems that their customers face. Once the requirement is properly identified, it should be validated against the desirability, feasibility, viability and sustainability says Rajala and Westerlund (2007). Enterprises should align their whole development efforts around the end to end value flow said Grundy, van der Hoek and Whitehead (2010). Taking the overall economic view into consideration and building the rest of the processes around it is crucial for the businesses to deliver the value to the end users. In order to keep the customers happy and active, the primary goal of the businesses is to focus on identifying the ways to generate sufficient value to them. Understanding the variability, preserving the options, building software applications incrementally with fast, defining clear milestones and managing the unnecessary working in progress are considered key for success in today's business world (Jalali, 2010). Not only the software delivery, software service platforms have also become an important segment in today's digital economy as many organisations moved from their own data centres into the platform as a service and software as a service (Edward, 2010). As Edward (2010) further explains, platform ecosystems generate considerably different values to the businesses, the value creations are interrelated while creating a complex value delivery requirements are different compared to the traditional setup. It has happened due to various market conditions and changes in the business environment as well. In order to determine the competitive advantages, the value should be created through the development as well as the platform to assure that the value is generated for all market participants. Figure 14 depicts the service-related value creation parameters.



Figure 14- Effects of service value parameters on the values obtained by stakeholders

Source: Value creation in software service platforms by Haile and Altmann (2016)

As Haile and Altmann (2016) have identified, both functional and non-functional capabilities with respect to the service represent the quality of service value parameter which satisfy the end users' expectation on the performance, interoperability and functionality to meet the intended services. The other factor is the installed base which represents the number of active users that indicates the

source of revenue to the business. Another factor that they have identified is the service variety which is an indication of the number of services available throughout the platform as a service to the end users. Finally, they have discussed the impact of the cost to assure the value delivery to the stakeholders. In this simple framework, they have identified the variances of these artefacts can impact to the overall value delivery and the relationship among these parameters do matter to maximise the value. In this service value model, the outcome is that the frameworks used in the software companies do make an impact to the value creation and delivery.

As Little (2004) says understanding the dynamics of the software is important for any organisation to realise the value of the activities which are being carried out. Considering only the cost equations to make the decisions on software delivery without the market sensitivity and economic analysis ultimately useless as it gives a wrong impression. Further, he argues that time-to-market sensitivity should be considered when understanding the cost factors. Some organisations use net present value to consider both cost and value together, but uncertainty is not considered in that model as well. Hence, in software development, considering cost factor in an isolation does not make sense for the organisation to make the decisions. He has used five parameters to decide the effective productivity. They are staff effectiveness, value created, rework time, value capture and resources. In this analysis, team sizes against the cost factor and effective team productivity versus the team size have been considered. He further argues that software development is heavily dependent on the individuals and the team. Hence, effective team productivity has a direct relationship to the value delivery at the end of the day. He has measured the effective team productivity using the below equation.

Equation 2 - Effective team productivity

 $\frac{Effective \ team}{productivity} = \frac{Team \ size \times Average}{Productivity}$ $\frac{team \ productivity}{team \ size = 1}$

Source: Value creation and capture : A model of the software development process by Little (2004)

In this equation effective team productivity is considered as dimensionless while the calculation of the team productivity is done based on the number of lines of codes they have written within the give time frame or function points can also be used to measure the same. According to Samual Conte's argument the average productivity of the team declines exponentially with team size. As Massaro (2005) says based on the Abdel-Hamid's study that the project performance has a significant impact on the project staffing. And he further says that cost versus schedule trade-off choices are heavily impacted with the selection of the team formation which is ultimately linked to the staffing strategy. Little (2004) has used the same concept to prove the relationship between the team productivity and formation of the team. Figure 15 depicts the concept of the relationship between the team size against the team performance.



Figure 15 - Effective productivity using different models

Source: Value creation and capture : A model of the software development process by Little (2004)

This argument is upheld by Lipke *et al.* (2009) and they have introduced use of earned value management (EVM) in the software development industry to make the project manager capable of making the informed decisions on committing on the deliveries with a proper forecasting. They have used cost performance index (CPI) which is the earned value to actual cost ratio and schedule performance index (SPI) which is the earned value to planned value ratio to decide the independent estimate at the completion. As Figure 16 depicts, the accrued EV against the time and cost is used

as the primary measure to do an accurate prediction on the software delivery. The variance is considered as the predicted uncertainty when deciding the final value delivery.



Figure 16 - Earned value schedule concept

Source: Prediction of project outcome. The application of statistical methods to earned value management and earned schedule performance indexes by Lipke et al. (2009).

They have further studied the reasons for the variances in this model. One key factor is the actual time taken by the teams to deliver the promised workload. According to them the confidence limit and team performance cause the schedule variance in the project delivery. Therefore, they conclude their study saying that the confidence level affects the reliability of the delivery and overall value delivery can be a measure of the performance of the team comparatively to the other uncertainty factors.

3.5.2. Interventions of the Staff for Value Addition

As Boehm and LiGuo Huang (2003) says in general software development, a set of tasks are carried out by an assigned individual or a team in order to satisfy a goal set by the organisations. This work is associated with budgets and schedules directly. The tasks assigned has an earned value (EV) for its completion and the measures are taken to validate it against its budget. They are

using the earned value system to explain the impact of the team formation and individual contribution for the overall value delivery. Real earned value cannot be measured against the time and task completion and the feedback should be a part of the evaluation as they say. Therefore, a method of benefit realisation is proposed by them as depicted in Figure 17.



Figure 17 - Benefits Realization Approach Results Chain

Source : Value-Based Software Engineering: Reinventing "Earned Value" Monitoring and Control by Boehm and LiGuo Huang (2003)

As they have highlighted in this flow, the contribution in between tasks plays a crucial role when delivering the value to the customers. They further suggest that the benefit realisation analysis should be quantitative, and contribution of the teams can be measured using the function points or against the quality measures such as number of bugs introduced by a new code or a change. In addition to that their findings have shown the importance of a value-based feedback control that directly has a relationship to the team performance. They argue that the traditional project feedback mechanisms are useful only to control the development pipeline, but efficiency and value delivery cannot be attained through them. Therefore, they have insisted the importance of a value-based monitoring and controlling capability to assure the proper evaluation of the individuals and teams to maximise the value delivery.

These researchers have highlighted the importance of the performance of the team to the value delivery. Developing a set of tasks in an isolation without knowing the value of the work ultimately is a waste as those tasks may not be adding any value to the product they deliver. Therefore, knowing the benefit to the end user and understanding the impact that particular task can make are important as individuals or team those are involved in the process. As Butler (2012) says, teams

get involved in the software development journey at different levels to cater to the demands by adding their skills and knowledge. However, in many organisations the software task force is not yet value centric yet instead they are cost centric. Little (2004) says that communication, coordination, balance of member contribution, mutual support, individual effort and cohesion lead to the effectiveness and efficiency of the team. Further, Hoegl and Gemunden (2001) have proposed this model earlier where they have argued that the trust, value sharing, and coordination play the key role in making an efficient team setup. Therefore, it is need not to say the staffing or team formation is a crucial factor in the value creation and delivery irrespective whether it is collocated or distributed teams. As Schwaber and Mike Beedle (2016) emphasise, the right selection of the formation of the people leads to the right value delivery at the end of the day. Hence, one of the key factors in this research is to identify the impact of staffing in the value creation in the global software engineering industry in Sri Lanka.

The next focus of this research is to identify the shared system methodology and impact of the development practices against the value creation. According to Ryssel, Ritter and Gemünden (2004) there are many different types of software systems that organisations use. Figure 18 depicts the classification of them.



Figure 18 - Types of information systems and their classification

Source: The impact of information technology deployment on trust, commitment and value by Ryssel, Ritter and Gemünden (2004).

According to their categorisation, many of these internal and external needs are now being outsourced to the distributed teams across the world. They have further studied the reduction of the transaction cost, increased the communication and eliminate the non-value adding activities in both internal and shared software projects. As Massaro (2005) argues, having a proper interorganisational systems and intra-organisational processes lead to maximise the customer attraction through value delivery. The organisations should be focusing on the reduction of the corporate costs, operational costs, and processing time to assure that the products or services are reaching the customers on time. As Boehm and Ii (2007) emphasises, the key aspects of the greater team work is to empower the individuals in the teams while assuring that the unstructured

processes do not limit their collaboration and effectiveness towards delivering what they are asked to do.

To strengthen the human relationship in order to understand the customer needs, organisational needs and business focuses, a common understanding should be built around the motivated individuals through a proper methodology (Succi, Wells and Williams, 2002). Numerous researches, studies and theoretical development have been conducted to understand the produce lifecycles challenges and their impact to the overall delivery. In addition to that the development models, practices, frameworks and methodologies have also been studied to measure the success of application of them in the software development. As Sutherland et al. (2007) say the focus to understand the right delivery framework to increase the energy and focus by maximising the clarity and transparency is very low by the researchers in both collocated and distributed setup. Further, with the rapid evolution allowing the teams to operate at different scales by enforcing non-value adding rules and regulations makes the overall process chaotic. According to Soundararajan and Arthur (2009) 41% of the organisations have moved to Agile practices to reduce the complexities in the hard structured processes. In addition to that 62% of their respondents have said they are moving to Agile to maximize the return on investment by gearing the software development practices to keep the customer happy with shorter development cycles. The impact of the structured versus unstructured delivery processes have been evaluated by Maranzato, Neubert and Herculano (2012). They have found many impediments due to the process limitations. One key area is the problems related to the coordination due to the unstructured processes. As they have discussed, difficulty in finding relevant expertise, large communication network, lack of understanding about the processes, delay in communication, misinterpretation of tasks due to the communication barriers and extra coordination requirements due to the management policy lead to the failure of the project deliveries. As they have found application of the hectic software processes have impacts on building trust within the team, building their own identity and organising the teams around the value. As Baiden and Price (2011) say not having a proper framework means no standardisation. When there are no standards, it is hard to navigate around the maximising the value and teams' effort becomes obsolete due to the lack of practices in the organisation. A good delivery framework should be simple, focus on the optimisation of the time, money and resources, increasing the efficiency and visibility, facilitating more informed decisions, leading to higher profits and creating more value to the end users (Haile and Altmann, 2016c).

When the global software engineering scope is considered, challenges due to the improper software delivery methods are enormous compared to collocated teams (Edward, 2010). The primary challenges in the global software engineering has been categorised into three areas: communication, coordination and control. All these threes challenges lead to a lot of uncertainty of the final value delivery. As Rajala, Westerlund and Möller (2012) have pointed out, every organisation wants to deliver a quality product to the end users to keep their interaction with the business in a positive manner. However, various challenges in the global software engineering has caused the business to face additional issues. There are many researchers those who have spent a considerable time and energy on finding out solutions for lack of communication, coordination issues, trust issues, project visibility and control related issues, productivity issues and knowledge sharing issues. But, building the processes around the value has not received a significant interest (Ebert, Kuhrmann and Prikladnicki, 2016). According to Rajala, Westerlund and Möller (2012) any framework that focuses on the value creation should be guiding the teams through proper adoption of the communication tools, tolerance of the ambiguity and uncertainty, effective time management and ability assure that the over process does not kill the value delivery to the end user. Figure 19 shows the direct relationship between the value versus the supplier-perceived value which was done by Ryssel, Ritter and Georg Gemünden (2004).



Figure 19 - Value creating function of a direct and indirect activities

Source: The impact of information technology deployment on trust, commitment and value by Ryssel, Ritter and Gemünden (2004).

As they have pointed out a proper link between these functions is necessary to assure the value is properly delivered to the end users. Having a hectic hierarchies and internal processes kill the value in between and limit the value functions in many ways. According to Racheva, Daneva and Sikkel (2009) business value is the key for any organisation and finding the wastes in the processes and providing solutions to assure the end users get what they want at the right time is the responsibility of the management of the organisations. As they have highlighted, 64% of their survey respondents from the software development teams say accumulation of many non-value adding activities limit them delivering software products incrementally and iteratively. One of the other findings of their research is that the hectic software processes leads to combine many features in one delivery which increases the risk of failure. The survey results have shown that 41% of the schedule risks, 37% of the budget risks, 86% of the technical risks and 17% of the external risks have not been considered in the software development processes they have been using.

To fulfil the end users' demand while maximising the value creation, it is necessary to understand the right level of the demand and supply integration (Esper *et al.*, 2010). Any processes that is used to bridge these gaps should address the gaps in the demand market knowledge, supply market knowledge and demand and supply management domains. The overall outcome depends on each step in the delivery process. The below detailed diagram of customer value creation (Figure 20) through demand supply integration shows the importance of a software delivery framework that focuses on the maximising the value.



Figure 20 : Customer value creation through demand and supply integration

Source: Demand and supply integration: A conceptual framework of value creation through knowledge management by Esper et al. (2010)

A recent research that was focusing on the adopting Agile for global software engineering which was done by Nord, Ozkaya and Kruchten (2014) has emphasised that the benefits for both parties should be considered and facilitated in any form of software delivery framework. According to their findings, 73.5% of their survey participants have said that their respective organisations adopted Agile driven techniques without a proper internal study. Out of that, 81% says that previous delivery channels and processes used for simple and less complicated projects are now being developed and delivered through the agile frameworks which has caused the delays in between. Another study on the application of agile in global software engineering which was done by Estler *et al.* (2014) has upheld the same argument and further argued that application of the agile to solve the coordination, communication and control issues has led to introduce many other challenges such as low team performance, lack of trust, irritated and frustrated individuals and over the wall responsibility negligence due to the global nature. As Kaur and Sharma (2014) say

fast pace development can only be done through quick iterations by assuring the technical excellence through a proper software development framework.

Based on the literature findings, the software development framework and application of the software processes, gates and approval paths do have a strong relationship to the value creation through software delivery. Therefore, understanding the direct and indirect impacts of them and identifying the value erosion activities without the processes in order to maximise the value creation and delivery in the global software engineering industry in Sri Lanka has become a crucial activity in this research.

3.5.3. Impact of the Use of Tools for Value Addition

Another important area to focus in the global software engineering is the use of proper tools to maximise the performance by making the processes more effective (Jongeling, Datta and Serebrenik, 2015). The use of computer aided software engineering tools is to reduce the time and cost of software development process and to increase the quality of both product and service by making the software engineers', quality engineers', project managers' and functional managers' jobs easy and enjoyable from requirements elicitation till maintenance (Singer et al., 2010). This was originally coined by Nestec Corporation and the primary focus was to come up with tools to facilitate their graphics and cross reference documentation tools. However, it has been through a long journey by now and there are many tools that are used in the software organisations nowadays to support the software engineering tasks in their day-to-day activities (Lanubile et al., 2010). A research which was conducted by University of Missouri-St. Louis, has found that 73.5% of the software companies in Mussori are not using CASE tools. They had focussed this study with 39 organisations and certain organisation have banned using software tools due to the cost and maintenance difficulties. Further, 23.4% had confirmed that they have not been using any tools because of the unrealistic and unmeasurable returns. They have conducted the same research with same companies after 4 years and found out that out of the 73.5% respondents, only 24% is no longer using any kind of tool (Krishnamurthy, 2016). As Topalidou-Kyniazopoulou (2012) say CASE tools can vary from simple task management software to complex behaviour analysis software. According to him, these tools should not be limiting to draw diagrams, document requirements or visualise the graphs, instead they must be used as the knowledge representation and processing tools throughout the cycle and way to standardise the practices within the
organisation. Many organisations have not realised the value of using such tools he further has said. According to Zanoni et al. (2014) tools were categorised into three types. i.e. Upper CASE tools: used in planning and design stages, lower CASE tools: used in implementation, testing and maintenance and integrated CASE tools: used in all stages of SDLC. These tools are coming as diagramming tools: to represent components of a system, data or control flow in a graphical form, process modelling tools: to represent the process model, project management tools: to plan the cost, effort and time along with the resources and manage the execution, documentation tools: to document and manage all required information from top to bottom, analysis tools: to check for inaccuracy and incomplete requirements, design tools: to design the block structures, configuration management tools: To manage the different software versions and respective configurations, change control tools: to track the changes to the software, programming tools: to do the real programming, prototyping tools: to simulate the project requirements, software development tools: to assist the software engineers to develop and build software applications, quality assurance tools: to help the quality assurance engineers to manage the testing process or maintenance tools: to manage and monitor the live environment (Krishnamurthy, 2016). But, as Chen and Dodd (2016) argue the software industry itself has been through a lot of changes during the last decade. Introduction of agile made a lot of changes to the way of software delivery, use of artificial intelligence (AI) made a considerable impact to the traditional practices, and robotic process automation has changed the whole process. Therefore, sticking into the old list of CASE tools does not make sense for the organisations. According to Gartner (2019) technology trends in year 2017 and 2018 have led the business leaders to think from a different point of view to improve the efficiency of their working patterns without limiting to the traditional way of working.

The value creation and delivery cannot be assured, if the value is eroded throughout the journey of making the software (Sanderson, 2017). The businesses started to move to global teams due to many advantages as mentioned in the literature above. But, with the changes in the working patterns in distributed setup, the organisations should work on identifying the impact of choosing the right tools to make the global teams to work effectively. The journey starts from the concept at the business level and it is ended at the customers with the end product. Throughout this journey, there are many people involved, many decisions are taken and many activities are taken place (Bent and Dient, 2017). Therefore, the selection of the tools in the global software engineering

cannot be limited to the traditional SDLC, instead it should be done after considering the scope of the global software engineering as well.

Both local as well as the global software engineering community has evolved enormously during the last two decades said Jongeling, Datta and Serebrenik (2015). Introduction of the process automation, improved software development tactics, rapid changes in the customer needs and changing the industry dynamics are some of the recent changes. They further have said that the diversified needs of both software development and business teams should be carefully addressed through the right tools. As Ganesh Krishnamurthy (2016) argues, there is a significant involvement of the tools for seamless team communication, workflow management, files and documentation management, timesheets and reporting. A similar view is upheld by Faily and Lyle (2013) and they argue that team management, collaborative reviews and task management should be done through an effective tool otherwise, the inefficient use of the tools can reduce the effectiveness of both business and development teams. Schwaber and Mike Beedle (2016) have highlighted the importance of choosing the right tools at each level. i.e. managing the portfolio needs, mapping of the value streams, setting goals, management of the teams, training and development, financial tracking, work records, implementation of governance, tracking software development pipeline, work order management, communication and collaboration, and employee performance management. According to Erdogmus, Favaro and Strigel (2014), there are software crisis indicators that are related to the typical software development process. One of them is the use of old and existing tools which kills the overall value generation in the software delivery process. Another important area has been highlighted by Zanoni et al. (2014) where the data driven decision making can only take place if the right tools are in place. Further, they have highlighted the importance of tracking and maintaining the lifecycle of a customer needs throughout its journey. In addition to that, another key area has been discussed by Haile and Altmann (2016). They have found that typical project managers make decisions on the software delivery in a value neutral way. Based on the census, 71% of their survey respondents has not been aware of why certain tools are in place. As they further highlighted, this uninformed decisions lead to erode the value of the overall software delivery.

Value creation through software development actually starts with the strategic decision that is made upfront to help selling products and services by creating values to the customers (Boehm, 2007). In broader term, as Erdogmus, Favaro and Strigel (2014) say the value creation is no longer the financial perspective, instead it has a part to play with the business recognition as well. Hence, the investments should be made to the right product or service. To make the that decision, the leadership should be supported with the facts that they need. Therefore, in software engineering the use of tools in nowadays businesses starts even the concepts are final (Schwaber and Mike, 2016). According to Haile and Altmann (2016) the intangible factors that drive the value creation differ by industry and skills, systems and processes should be properly utilised to maximise them. The intangible factors include technology and innovation, alliances, employee reaction, customer relationships, community relationships, management capabilities and even brand value. Therefore, as Gartner (2019) confirms, use of tools play a vital role in the value creation journey of any organisation.

3.5.4. Impact of the Governance Process for the Value Addition

In addition to the staffing, delivery process and tools, another important area that needs to focus the software development pipeline is the governance. According to Cavusgil et al. (2014) 67% of their survey respondents from the software development teams are unsatisfied due to the governance overhead. Further, they argue that in the global setup, it is natural to enforce the additional governance by the management to assure the products are up to the level they expect. However, mixing up with unnecessary gates and traditional gate keepers can kill the overall value generated throughout the software development process if that decision has not been taken intelligently. As Dubinsky et al. (2011) say the governance has emerged as a critical success factor to the software development that is focusing on the team work. The general activities that includes in the governance are defining and executing decisions right, introducing the mechanisms to empower the development process, and enforce the required rules and gates to assure the process is properly controlled. As they further say any organisation in the software development field use four governance mechanisms. i.e. governance definition, governance enactment, business awareness and goal achievement. According to Vlietland and Van Vliet (2015) the implementation of a proper governance helps to reduce the team conflicts and improve the efficiency as well. However, they say that according to their findings 65% of their survey respondents feel negative about the process limitations when reaching the software delivery goals. Another interesting area that they have focused on their research is the implementation of the regulations to control and reduce the operational cost. Their findings show that implementing improper regulations to control

and monitor lead to additional cost in both people and tools. In addition to that these regulations make the software development teams unhappy which reduces the team performance. Hence, analysis of the required controlling measures and identifying the minimum required regulations to assure the quality of the delivery while assuring the value creation is maximised is important from any type of software organisation.

With the global teaming model, the requirement of having governance differs. In most of the cases the software requirements are outsourced to a third party through the vendor contracts. Therefore, as Vlietland and Van Vliet (2015) highlight, it is vital to define a global project management policy and define policies for management in between locations. They have identified three key issues related to the governance in the global setup. They are motivation: separation of the global teams through governance make the individuals to lose the motivation, external schedule pressure: the pressure created due to the conflicting priorities between teams and errors introduced by other teams: the issues caused due to the limitations in the processes which are introduced by the governance. According to Bass (2016) managing large scale offshore teams either through the plan-based or agile software development method need a pragmatic tailoring of governance to accommodate the organisational constraints without making any additional burden to the software development teams. As he has found, program governance: risk assessment, architecture standards, test plan and contracts, product artefacts: product backlogs, product architecture implementation, user acceptance test and product release process, release artefacts: release processes, release plans and testing, project management process: scope, time, estimates, work breakdown, work status board and development pipelines and finally feature artefacts: requirements, designs, source codes, test criteria and feature code binaries are crucial to be defined in the global governance process to make them clear to everyone involved in the software delivery process.

According to Haile and Altmann (2016), implementation of the governance could take place at different levels of the software development journey. At the business process identification stage, it is necessary to identify the roadmap, timeline and resource constraints. If the source of problem statement is not real, the value is eroded upfront. In a value neutral setup, this evaluation is taken into consideration with the value delivery in mind. As they have further highlighted, unnecessary governance in place can delay the overall process, demotivate the individuals in the team, increase the lead time which will ultimately be the reason for a failure. As Vlietland and Van Vliet (2015)

have argued, most software related governance practices have ignored the fact of value addition, instead the steps in the development pipeline is governed through hectic governance practices. They have further discussed the impact of enforcing the unnecessary governance in place where their case study shows that software delivery pipelines have been delayed by 45% due to the wrong selection of the governance practices. Further, a similar view is upheld by Noll *et al.* (2016) and according to them, traditional hierarchical organisations have implemented the governance without a proper restructure which has led to misalignment of the overall processes within the organisation. When the global teams are considered, the regulations are varying. Hence, implementation of a common governance is impractical as well. However, as Bass (2016) have argued, the implications of the implementation of wrong governance does not depend on the size of the organisation. Therefore, a proper evaluation and a clear selection criterion is necessary for the software organisations to assure that the value is not eroded due to the implementation of the governance.

The challenge in introducing the governance in the global software engineering is to make it a norm without killing the value creation in the end to end process said Noll et al. (2016). They have identified four issues with respect the improper enforcement of the governance into the global teams. i.e. conflicting priorities due to the improper authorities, use of the existing workforce to implement the governance, increased management overhead when managing multiple teams and increase the time to market due to the unhealthy approval engagements. They are suggesting identifying the nature of the global setup, team distribution, skills of the teams, internal processes, respective artefacts and local governance requirements in order to find the optimal governance structure for the global teams. As Bent and Dient (2017) suggest strategy which determines the direction, structure which determines the decision making power (location based), processes which guide the flow of the work, rewards which provides the motivation to the team and people which is the right selection of the team are crucial when implementing the governance in the global software engineering. Therefore, with respect to the global software engineering industry in Sri Lanka, these factors are considered to the increase the value creation by making sure that the right governance is in place for the both management to assure that the minimum required governance in place and the development teams to feel they are protected by the respective governance not controlled by them.

According to the literature findings, the value creation in the global software engineering industry heavily depends on the four key factors. They are staffing, delivery process, use of tools and governance. Hence, this study focused on identifying the impact of these parameters with respect the global teams in Sri Lankan software development industry in order to come up with a proper process that maximise the value creation for all the stakeholders. Currently there is a little understanding on these factors among the local industry and the literature related to this is very limited. However, the mappings will be found based on the analysis through the case studies which were done by the government and respective authorities to identify the key areas and the data collection helps to do a comprehensive analysis against these key factors to identify the impact of them to the local industry which helps to propose a good process. However, in addition to the direct impacts through these parameters, a supportive fact to make these relationships positive was found in the literature. It is the technology infrastructure.

3.5.5. Impact of the Use of Technology Infrastructure for Value Addition

Information technology has become a basic need for any kind of business nowadays (Jabbouri *et al.*, 2016). It has now been considered as a part of the strategy in many businesses. The impact that it can make it massive when it comes to business productivity and performance. It is useful in augmenting the overall business processes. It includes development and management of internal software application, hardware infrastructure, networking and the databases. In today's knowledge-driven economy, tracking and retrieving the knowledge has also become a part of the IT business now. Further, it has become a positive driver for managing the overall business workflows (Islam, Jasimuddin and Hasan, 2015). As Krishnamurthy (2016) said in today's business world the opportunities are emerging constantly and they might hit the companies quickly. It will not last long if the companies do not act on them. To quickly act, a proper connection between all the entities in the business is vital. Bellow diagram (Figure 21) of Immonen *et al.* (2016) shows the links between each process activity and importance of the same in a typical software business.



Figure 21 - The elements and phases of services in a digital service ecosystem

Source: A service requirements engineering method for a digital service ecosystem by Immonen et al. (2016).

As Immonen *et al.* (2016) describe, the technology infrastructure should be capable, affordable and available at any time. Especially, in the field of global software engineering, it is vital to identify the business needs in one geo location and communicate the same knowledge to a different geo location in an effective way for them to start building the software applications. According to Jabbouri *et al.* (2016) every single component of the business is mission critical now. Unavailability of such a component may lead to many service shortfalls or even failure of business. As Immonen *et al.* (2016) further elaborate, organisations should recognise the importance of a proper IT infrastructure for them to run their businesses smoothly. As the above picture describes, each component of the whole eco system is connected via the technology infrastructure. High availability, enhanced efficiency and performance of each component can decide the future of the business. According to Jeffrey and James (2013), the infrastructure has made possible a significant impact to the growth of the business and to improve the productivity in many ways. As they further elaborate, proper use of the IT infrastructure can help the organisations to redefine their business models while using the real-time data and interpretation of the same.

For a software development organisation, IT infrastructure is a must. They cannot run their business without it. However, as Kearney (2018) says organisations can get an edge if they properly understand the importance of the IT infrastructure for the business. Further, automated workflows, information transformation and native support for software delivery are key to the software development business. With the introduction of the internet of technology (IoT), the hardware and communication has become complex. Having smart monitoring and recovery tools, automated customer support agents, low cost communication tools, effective collaboration tools and proper software delivery pipelines and dashboards of the same are helpful for software organisations (Jeffrey and James, 2013). Gartner (2019) has spoken about the importance of having a business continuity plans (BCP) for any kind of businesses nowadays. It can help the organisation to recover from any potential threat. These plans ensure that the business can function even during a disaster period. In today's world, facilitating the BCP effectively and efficiently has a significant contribution from the IT infrastructure. Proper tools and facilities should be in place for any organisation to run their businesses smoothly.

In the global software engineering industry irrespective whether it is a disaster situation or not, the teams used to work in geographically distributed locations. Having proper infrastructure and facilitating the IT infrastructure as a organisational initiative is important as Jeffrey and James (2013) have highlighted. In a typical software development life cycle, teams and the management focus on delivering the promised features of components at the right time with the right quality. However, how effectively they can do that depends on the company's infrastructure as Jabbouri *et al.* (2016) argue. According to Sanderson-wall (2017), team may carry out an important activity in the SDLC more effectively in the global software engineering, but if the infrastructure cannot continue to deliver it to the end user at the same pace, the overall value creation is lowering even it was supposed to create more values to the organisations. A similar view is upheld by Noll, Beecham and Richardson (2016) and they further argue that the organisations should recognise the importance of facilitating the teams with the right infrastructure to deliver what they have promised. Another key aspect that they have highlighted is the having continuous integration of the tools at the right milestones in the delivery framework such as application automation, testing

automation and platform automation. The time to market needs can easily be achieved by using right infrastructure to facilitate the pipeline requirements in between. One of the key areas that Bass (2016) discusses is the complexity of the global software engineering and risk associated with that. He argues that the implementation of the governance practices does not make sense to the organisations if they do not have the right processes to implement it and proper infrastructure to facilitate it. A similar view is upheld by Noll *et al.* (2016) and they have further discussed the use of proper information security infrastructure, communication tools and automated threat detection mechanisms in the implementation of the governance in the global software engineering. Therefore, there is a significant impact from the IT infrastructure for implementing a proper governance model as well.

As many authors have argued and proven, the overall value creation in the global software engineering does not only depend on the products or services they do. In addition to that the internal infrastructure plays a key role in facilitating the overall software development process starting from the concept to the customer. When the value creation is considered, it is important to identify the direct impacts of the team, delivery process, use of tools and governance, but it is necessary to realise the improve the impact of having a proper infrastructure to facilitate the other important areas.

After a comprehensive study, it was identified that the value creation in global software engineering has many areas to consider. Many prominent authors have studied the key components of the global software engineering and their impact to the overall business goals. The businesses want to identify the value that a particular idea might create for all the stakeholders at the concept level and to assure that it is delivered throughout the development and delivery process. Therefore, as any software requirement goes through a journey, at each point it is necessary to assure the anticipated value is not eroded by any means. The identified parameters that have a direct impact to the value creation are staffing, software delivery process that teams and management follow, use of the CASE tools and governance practices that companies used. These four areas are important for any business as the literature proves. In addition to that information technology infrastructure was identified as another key area to consider in the value creation in global software engineering. However, as many authors argue there is no direct impact to the value creation with that but identified parameters do have a relationship to the infrastructure as discussed above. It has

a moderating effect in between the four key parameters and the value creation in the global software engineering. Hence, these five key areas were considered in this research to propose a framework for the global software engineering in Sri Lanka to maximise the value creation.

In order to further analyse the relationship between the technology infrastructure and the four independent variables, a deeper analysis was required. Number of authors have tried various statistical approaches to understand the relationship between these variables. Jeffrey and James (2013) have used a regression analysis instead of structural equation modelling where they have proved the moderating behaviour of the technology infrastructure for skilled labour and software delivery process. They have further highlighted the fact that having the essential skills has shown a direct impact, but due to the lack of technology infrastructure the added value has a negative trend. Further, based on their analysis the use case of having an optimal delivery pipeline has a strong relationship to the underline infrastructure that the company uses. According to them, interconnected pipelines should have a streamlined infrastructure to optimise the value delivery. Further, they have shown that inefficient or lack of infrastructure limits the value addition for both collocated as well as the distributed teams. A similar study has been carried out by Jabbouri et al. (2016) that has focused on the impact of the technology infrastructure for the innovation where they have found the impact of the infrastructure does not show a strong dependency, but it has shown a moderating impact. They have further prov(Johnson, 2015)ided a conclusion saying that the internal processes can be considered as complete and efficient when the required infrastructure is in place to maximise the value delivery. Another research that has been carried out by Islam, Jasimuddin and Hasan (2015) that focuses on the culture, teams and structures have found the indirect relationship to the technology infrastructure where they have concluded with a detailed regression analysis to figure out the same. According to them, having a skilled teams and the optimal team structures alone cannot add value, instead the infrastructure should support to deliver the same to the respective stakeholders. Another key area of focus of this research is the impact of use of tools for the value delivery. Jonathan (2014) argues that tools are considered to be part of the infrastructure where David (2015) and Lelis and Othamani (2016) deny the same argument saying that tools are supported by the infrastructure, but not directly part of it. A similar view is upheld by Johnson (2015) and he has further argued that the technology infrastructure should be part of the strategy to support the internal and external tools. Based on the previous work carried out by many authors and the facts available in the literature, it is proven that the technology

infrastructure contributes to the value delivery with a causal effect than direct. Hence, if the technology infrastructure is manipulated, the value delivery can have either a positive or negative impact based on how effective it is being used. Therefore, the evaluation of the overall impact of the four dependent variables and the moderating variable for the value addition in the business is clear and proven. Thereafter, the dependent variable of the research is discussed in the below section.

3.5.6. Value Addition in Business - Enhancing Stakeholder Expectations

Any organisation that focuses on making more profit wants to create superior customer value with a solid business strategy that their competitors cannot replicate (Smith and Colgate, 2007). There are multiple responsible people that get involved in the process. Primarily marketers should identify value creation with respect to what, when, why and how well from a value perspective. As Mutambi (2008) has explained there are two components. i.e. customer lifetime value and customer received value. These two are important to create a sustainable strategy as they represent the customer as well as the organisation. According to Haile and Altmann (2016), value delivery means understanding the customer's perceived preferences and assuring they are defined properly within the given context. As the focus of this research is to identify the value addition in the global software engineering industry, the below section is devoted to understanding why businesses go global from the angle of value addition and the available literature related to the value addition in the selected industry.

Due to the increasing demand, the large organisations has considered moving their software development units to low cost centres and their operating models have been significantly changed due to that (Dey, Fan and Zhang, 2010). Many outsourcing models have been popular among these organisations such as dedicated development teams or resources, time and material model, fixed-price contracts or offshore development centre out of which majority of the organisations are focusing on having an offshore development centre in a low cost centre. According to Lorin M. Hitt and Eric Brynjoifsson (2014), productivity, business profitability and consumer surplus have shown a very positive impact with the recent moves of these organisations. Herbsleb (2007) says that globally distributed projects have already become the norm for large projects and the large organisations are trying to establish their businesses often on multiple continents. Ambler and Lines (2016) have resonated Herbsleb's argument saying the trend for co-located teams has

reduced from 77% to 31% from 2000 to 2015 and same building and within the same time-zone has only 17% demand compared to how it was in year 2003 which is 81% based on Boehm (2003) findings. A very recent study on collaborative software development which was conducted by Kearney (2018) has talked about three key areas for companies to go global. i.e. cost saving, innovation and talent. Compared to their 2017's report, innovation has been identified as a key for the organisations to expand their businesses across the boundaries. A research that was more focused on application mobility which was done by Ge (2011) had discussed about the importance of innovation and cost saving with respect to the global teams which now has been upheld by Kearney (2018) and the same has been identified by Capra, Francalanci and Merlo (2014) where they have highlighted the importance of development quality, effort and governance have also become better compared to the collocated teams. Espinosa and Carmel (2013) have categorised the answers for "why global" into three categories; solving local IT skills shortage, cost saving and remain focused on core competencies. They have further highlighted that the software work undertaken at geographically separated location across the national boundaries have given more opportunities for the businesses compared to the collocated teams. According to NASSOCOM reports, 40% of the fortune 500 companies use this model and upwards to 50 nations are actively participating in the GSE. Further, Herbsleb (2007) says by 2006 80% of the output of software industry is exported and fulfilled by the global teams. Holmstrom et al. (2016) have upheld Herbsleb's argument where they say 41% of the software requirements are fulfilled through the global teams based on the references Garner's industrial research results. Further, they have highlighted the organisations now have started thinking of focusing more on the business value of IT whereas trends and predications have already showcased the global setup drives the next generation software industry. Hence, the industry has already taken steps to move to the global software engineering setup due to its benefits.

However, the value addition in the global software engineering industry has not yet been a key topic among the researchers, academia or industry (Ebert, Kuhrmann and Prikladnicki, 2016). According to Espinosa and Carmel (2013), addressing both conceptual issues and practical issues within the global software engineering industry is crucial for the businesses to assure the intended value is created and delivered. As Jalali and Wohlin (2012) found the global software engineering has been characterised by organisational cultures, diversified stakeholders from multiple nations, different geographical locations and potentially different time zones. Any business in todays

competitive setup wants to strive to gain market share and improve profits. However, in order to do that value addition is vital. When business making decision to move to the global teams, it is primary based on the cost reduction. However, creating value for money is essential to be more successful (Viswanath and Betz, 2015). As Sanderson-wall (2017) says, measuring the outcome of the software engineering projects in the global setup has been challenging and it is difficult to find a common method that can be used to measure it as well. He further argued that there is lack of existing measurements for value for money that takes the holistic approach. Though there are primary measures such as function points, defects, requirement complexity, technical debts or even cost of change, the value has not been considered in the measuring criteria (Viswanath and Betz, 2015). Hence, the value in the global software engineering industry is a combination of various quantitative and qualitative measures.

During the literature review, it was found that the global software engineering industry practices depend on multiple parameters. However, inclusion of the value-based software engineering into the global software engineering has been quite challenging. Capturing the loopholes within the current system and coming up with a proper measuring criterion is challenging without understanding the context properly. Hence, four different parameters were identified in this literature which are described above as the independent variables and one moderating variable that has a direct relationship to the value addition in the global software engineering industry. As Adom, Hussain and Agymen (2018) have said, given that the parameters are clear, the next important step is to establish the hypotheses to validate and prove the arguments scientifically.

3.6. Summary

This chapter covered the outcome of the comprehensive literature review that was carried out to understand the value addition in businesses in general and specifically in the global software engineering industry. Both theoretical and practical aspects were considered in the literature and the outcomes were organised into multiple sections to examine them carefully. Initially the conceptual background related to the value addition theories were clearly discussed which was followed by the theoretical background related to the value-based software engineering which covered three important value measuring criteria. The outcomes of these led to the research framework where the four dependent variables and one moderating variable were discussed in detail along with the dependent variable. Finally, an attention was paid to identify a series of hypotheses that have been built around the global businesses which could be later used to build specific hypotheses for this study after the exploratory study. These key findings were carefully studied and documented in this chapter with enough evidence from the literature.

Next chapter gives a comprehensive overview about the chosen industry.

Chapter 04. Methodology

4.1. Introduction

As the literature finding have uncovered that there is a significant gap in the value addition in the global software engineering industry that needs to be addressed. This research was carried out to bridge that gap in the industry to carefully address the value addition related issue to increase the value addition in the global software engineering industry in Sri Lanka. This chapter provides the detailed rationale for the overall research process along with the selections of the respective research tools and instruments. It is organised into multiple topics that covers the research paradigm, research design, conceptual framework, method of sample selection, method of data gathering, measurements of variables, and analytical techniques that were employed for the analysis which are logically group into qualitative and quantitative sections separately.

4.2. Research Setting

This section describes and justifies selection of the research setting, thereby providing the background, history, and issues germane to the problem.

4.2.1. Information and Communication Technology Industry in Sri Lanka

The term information and communication technology (ICT) in Sri Lanka primarily refers to telecommunication, computer and information services that includes BPO: business process outsourcing, KPO: knowledge process outsourcing, software development, ICT services and computer science and information technology education. According to Kearney (2018), Sri Lanka has been ranked among the top fifty outsourcing destination while the commercial city of Sri Lanka: Colombo has been recognised as an emerging city which is ranked among the top twenty by the global surveys conducted up to year 2019. The export revenue has been growing rapidly and according to the central bank reports, total earnings by 2019 is recorded as US dollars 1089 million which was US dollar 213 million in year 2007. During the last five years, the exports have been tripled while workforce has been doubled. In overall, this sector has shown a 120 percent growth by making it the fourth largest export segment in Sri Lanka by contributing to the economy significantly. The government of Sri Lanka envision a US dollar 5 billion in revenue and 200,000

direct jobs in the ICT sector by year 2022. Meanwhile they are anticipating at least 1000 start-ups to be established in the country that helps to achieve the above target. The state-owned Information and Communication Technology Agency (ICTA) is at the forefront of driving all the initiatives that includes building information technology cities and villages, building information technology infrastructure and enabling environment, developing and promoting skilled labour, leveraging ICT for economic and social development by facilitating the modernisation of the government services and by promoting Sri Lanka as an ICT hub.

According to the export development board's records, current workforce is more than 85,000 professionals are currently employed in the sector with a continuous growth of 20 percent year on year. This workforce is highly innovative, adaptable and more importantly conversant in English. The healthy business environment which prevails in the country has created more success for the interested investors to come and build their businesses in Sri Lanka. While the country is settling after a thirty-year civil war, the blooming industries such as ICT can shape the future of the country by assuring the more export revenue are brought through services and product development and more foreign direct investments are facilitated as well. However, still the focus for the value addition in the industry is low due to various reasons which are described in the below section.

4.2.2. Value Addition in the ICT Industry in Sri Lanka

Current workforce is serving to many industries such as communication, banking financial services and insurance, apparel and textile, manufacturing, healthcare, education, transportation, media, retailing, hospitality, food and beverages, and travel and leisure. In addition to that there are many more other segments that Sri Lankan firms are providing their ICT services. However, as the industry is still young, the focus for the value addition in the overall industry has been still low and the number of researches conducted to evaluate the same is insignificant. According to the literature findings, a single paper cannot be found in any of the leading journals. The knowledge gap is clearly prevailing in the selected industry not only in the local context but also in the global context as confirmed by many authors. According to Sharma and Kumar (2010), India has been facing a similar issue though they are leading in providing the ICT services in the region as the focus of the businesses, educational institutes or even individual researchers has not been significant on the value addition aspects. A recent study that has been conducted by Chen and Dodd (2016) which focuses on employing the economic value added (EVA) concepts as a

corporate measure shows that the global software outsourcing market focuses on delivering the work at lower cost, but attention to the value delivery is insignificant. Given that the global industry is still awaiting for more researchers to focus on the value addition in the global software engineering industry, that demands prevails in the local context without a doubt.

As the industry is maturing and the government is focusing on generating more export revenue through the global software engagements, the importance of the studies to improve the value addition is clear as the growth of the industry depends on how much value that is delivered by employing the best practices by the local firms. This enables the Sri Lankan firms to be competitive with the regional firms. As Haile and Altmann (2016) argue, without a value delivery, there is no existence of a business. Being a service industry, it is important to assure that the internal workforce is ready to generate more value as it is the bedrock of the business. According to Sanjari *et al.* (2018), many service based organisations tend to overlook the importance of the value addition that they are supposed to make because of the lack of focus. They further explain that any industry that focuses on the long-term growth, should pay attention to the value addition as it can assure the sustainability of the industry. As a country and a growing industry, this demand should be recognised, and this study can help to shape the future of the ICT industry in Sri Lanka.

Next, the selection of the research paradigm is explained in detail.

4.3. Research Paradigm

A research paradigm is a set of commonly held beliefs and assumptions within a research community about ontological, epistemological, and methodological concerns (Perjons and Johannesson, 2014). As Mackenzie and Knipe (2006) says, paradigm means a way of looking at something that represents an established standard that could be considered as a set of related ideas. To select and apply the proper paradigm effectively, analysis of four major paradigms: positivism, postpositivism, critical theory and constructivism is important. Each paradigm has an ontology, an epistemology, a purpose and a methodological approach to follow (Creswell, 2013). Believing the tangible social realities, investigator and investigated being independent of each other, identifying proper variables for the research that uses for prediction, explanation and general laws are the ontology, epistemology and purpose of positivism. Respectively, believe in social realities, investigator and investigated are note being independent, emphasis on the context while accommodating both qualitative and quantitative methods, and focusing more on explanations

while generalising are considered the nature of post positivism. For critical theory, believing in multiple realities, having an integration of the subject and investigator, focusing on qualitative measures to transfer the findings are the respective philosophies. Finally, for constructivism, people focus on building their own understanding and knowledge of a given research context by reflecting the findings, experiences and learnings to create their own knowledge (Perjons and Johannesson, 2014). According to Stewart (2017), each research paradigm supports some research methods and selection of the respective method becomes easy when the paradigm is decided. Therefore, understanding the research problem and research objectives are important for the researcher to decide the paradigm. As Perjons and Johannesson (2014) have explained, ontological elements of the paradigm set the foundation for the researcher to choose the best fit for the respective studies. In Addition to that, Kaushik and Walsh (2019) have provided a comprehensive explanation about application of pragmatism in research. Table 4 provides the clear explanation of the respective paradigms.

Paradigm / Elements	Ontology	Epistemology	Methodology
Positivism	Naïve realism – "real" reality which is apprehendable	Dualist / objectivist: findings true	Experimental / manipulative; verification of hypothesis; chiefly quantitative methods
Post-positivism	Critical realism – reality is 'real' but only imperfectly and probabilistically apprehendable	Modified dualist / objectivist; critical tradition / community; findings are probably true	Modified experimental / manipulative; critical multiplism; may include qualitative methods
Critical theory	Historical realism – 'virtual reality' shaped by social, economic, ethnic, political, cultural, and gender values, crystallised over time.	Transactional / subjectivist; value mediated findings	Dialogic / dialectical
Constructivism	Relativism – local and 'specific' constructed realities	Transactional / subjectivist / created findings	Hermeneutical / dialectical
Pragmatism	Objective or subjective focuses on "what works"	knowledge is always based on experience. ideology or proposition	Experimental / manipulative Qualitative and/or quantitative

Table 4 - Basic beliefs and elements of five alternative research paradigms

Source : Research dilemmas by Holm (2008) and As Pragmatism as a Research Paradigm Kaushik and Walsh (2019)

As Kaushik and Walsh (2019) have further highlighted, pragmatism does not promote contentious metaphysical concepts by believing the truth and reality, instead it accepts there can be single or multiple realities that are open to empirical inquiry. The same concept has been previously presented by Crewell and Clark, (2011) where they have highlighted that the reality is grounded in the environment with the human experience. More importantly, as Pansiri (2005) has stated, pragmatism doubts that the reality can ever be determined once and for all which is upheld by Moragan (2014). However, pushing philosophical arguments aside and only focusing on the

human experience do not mean to be the approach of pragmatism. Instead, it must be proven with facts, because the outcomes are dependent up on the context and inseparable from the human experience Kaushik and Walsh (2019). Additionally, instead of only believing that the objectivity and subjectivity, pragmatism promotes the continuum process to realise the realities without limiting to examining empirical evidence and/or hypothesis testing opposing to what is preached in positivism and constructivism respectively. In addition to that, pragmatism is typically associated with abductive reasoning that moves back and forth between deduction and induction (Morgan 2007; Kaushik and Walsh, 2019). Hence, considering the nature of the study, pragmatism best suits for this research.

Hereafter, the rest of the topics are organised into two sections to describe the qualitative and quantitative approach of the study.

4.4. Overall Research Design

According to Glable (1994), research design is described as a blueprint demonstrating the preparation of conditions for collecting, measuring and analysing the data by combining relevance to the research objectives with a proper procedure. As Goddard and Melville (2004) have described, it is the framework of research methods and techniques chosen by the researcher to carry out the research in planned manner to meet the research objectives. The below sections discuss that overall plan which include the research approach, strategy, conceptual framework which ware formed during the research process and the method that were used for this research with a proper rationale for the suitability of the same to fulfil the requirements of addressing the research problem. As the mixed method: an emergent methodology of research that advances the systematic integration, or "mixing," of quantitative and qualitative data within a single investigation or sustained program of inquiry (Wisdom and Creswell, 2013) was employed, both qualitative and quantitative approaches, strategies and instruments can be found in the relevant sections. This methodology permits a complete and more synergistic utilisation of data, then do separate quantitative and qualitative data collection and analysis.

Additionally, there are plenty of approaches to take for different types of researches depending on the research objectives. As Stewart (2017) has mentioned, mixed method also could be either concurrent or sequential which could be employed based on the context. Another perspective is that, though qualitative and quantitative methods do have their own purposes, the combined assessments help the researchers to uncover valuable features. But, selection of the right approach should depend on the respective purposes and objectives (Perjons and Johannesson, 2014). As Feilzer (2010) has explained, fundamentally pragmatism paradigm has more advantages when mixed method is chosen. Integration of both qualitative and quantitative research strategies together helps the researcher to accommodate diversified data in the study as well as it increases the accuracy of the outcomes. Therefore, sequential mixed method was chosen since the selected research topic in the given context has substantive findings to uncover. Figure 22 depicts both qualitative research design and quantitative research design that were used for this research which is followed by two separate sections that explain both qualitative and quantitative approaches.



Figure 22 - Mixed method research design

Source: Author's work based on the researches carried out by Creswell (1999); Perjons and Johannesson (2014); Khaldi (2017) and Stewart (2017).

The qualitative analysis and the quantitative analysis were done in two phases where the qualitative data was collected and analysed in the first phase which is followed by the quantitative analysis in the second phase. Below section describes the research approach, strategy and instruments there were employed for each phase in detail.

4.5. Qualitative Study

This section is devoted to discussing the research design, approach, strategy, data collection methods, sample selection and data analysis methods that were employed in the qualitative study.

4.5.1. Research Design

As Khaldi (2017) has mentioned, the qualitative research involves collecting and analysing nonnumerical data which comes in various formats such as text, audio, image and video to understand the backgrounds, concepts, experiences and opinions as well. A well-executed qualitative analysis let the researcher to gather in-depth insights into a selected research topic. According to Feilzer (2010), the researcher should carefully chose the research approach, strategy and tools to achieve the research objectives. It was important to address both how and why research questions by understanding the experiences and phenomena deeply in the context of global software engineering in Sri Lanka. The qualitative approach allowed to verify the research framework through first-hand experience while adding a more weight to the sub parameters of the variables with truthful reporting. Below sections describes the respective areas with the rationale for each selection in detail.

4.5.1.1. Research Approach

To address the research problem effectively, logically as well as unambiguously, it is necessary to use a good research approach. As Mackenzie and Knipe (2006) have explained, there are two main research approaches: inductive that focuses primarily on developing a theory and deductive that aims to test an existing theory. Further, inductive approach moves from specifics to the general observation while deductive approach initially focuses on generic and move to specific with one or more specific hypotheses. According to Goddard and Melville (2004), when a research needs to be moving from a specific level of observations to broader generalisation, the researcher should follow a bottom-up approach whereby choosing an inductive approach. As Kothari (2004) has said, researchers can start to elaborate a topic through observations and do an analysis to evaluate the relevance and relationships clearly to conclude the research with general conclusions. Given that selected research topic has more to uncover, the inductive approach best suits and gives more benefits for the researcher. Therefore, inductive approach was chosen for this study.

Further, as Pawlowski, Suzanne D, Okoli (2004) have described, when a particular problem has not been studied thoroughly and clearly or proper priorities have not been uncovered yet, the type of the research should be exploratory to find out the exact problems and to uncover the necessary priorities and definitions. A similar view is upheld by Mackenzie and Knipe (2006) and they have further mentioned that considering the nature of the problem, drawing definitive conclusions should be done consciously. John W. Creswell (1999) has further explained that the exploratory method has caught the attention of the researchers when there are more to uncover. As he further argues, research style in its own right and distinctive. But, selection of the method should be purely based on the availability of the primary and secondary data. Mackenzie and Knipe (2006) have further elaborated this and argued that the choice between the available research approaches should be done based on the context and available resources to draw meaningful conclusions.

However, as they further say, the exploratory research helps to investigate a problem clearly, but it does not help to provide conclusive results. According to Benbasat et al. (1987), if any research leads to a new theory or a model that solves a managerial problem, it should be conclusive approach that any researcher should take. As Mackenzie and Knipe (2006) describes, systematic investigations leads to proper conclusions if the collected data is analysed and interpreted in a way to understand, describe, predict and present the actual challenges within a particular industry that helps to solve them effectively. As Abowitz and Toole (2010) have explained, to understand the human social factors, it is necessary to choose the mixed method in order to construct meaningful conclusions since the individual human traits and behaviours may complicate the research outcomes. According to Malina, Nrreklit and Selto (2011), consequences of utilising or incorporating inadequate or inappropriate research methods can be severe as it may lead to waste time, produce unwanted or unexpected results and even the research outcomes would not be valid.

Hence, they suggest starting the research as exploratory and ending as conclusive to analyse the current context clearly and uncover the hidden or unfound definitions, practices or theories and to use those findings for conclusive results. A similar view is upheld by Creswell (2013) and according to him, when the existing literature does not add more value to the research due to the lack of availability of the facts, the researchers should avoid sticking into an industry or context initially, instead use an exploratory approach to find details about the generic literature related to the overall scope and focus on the specific industry with the findings through that. And as he

further explained, the most successful approach is to tackle the generic research findings and conduct the detailed research around the key findings to further study them to avoid diminishing the research outcomes. According to Malina, Nrreklit and Selto (2011), this method helps the researchers to identify the thought process of the people based on the minimal amount of the findings of the literature and drive to draw comprehensive research outcomes with enough statistical relationships among the parameters. According to Goddard and Melville (2004), though the conclusive researches primarily focus on testing specific hypotheses to make conclusions about specified methodologies, it can be used to provide recommendations to increase the accuracy of the managerial decision making process by building proper frameworks. However, As Kothari (2004) has argued, researchers can choose exploratory research design to investigate a problem, an issue or opportunity to provide insights and evidence about the selected research topic, but can conclude the same by providing facts to determine the outcomes of the managerial decisions as well. Therefore, as the purpose of this research is to evaluate the value addition in the current context of global software engineering industry in Sri Lanka to provide more meaningful insights for the companies to make useful decisions to increase the value addition, the research was carried out as an exploratory at the beginning and conclusive towards the end.

After selecting the research approach, it is vital to focus on the research strategy to conduct the research successfully. The below section describes the selected research strategies with their rationale.

4.5.1.2. Research Strategy

According to Creswell and Poth (2017), there are number of research options which can be applied independently or even be combined for a typical research. As Cassell and Symon (2018) have explained, the research strategy helps the researcher to right data collection and analysis procedure. To create reliable knowledge, it is vital to pick and choose the right strategies. Therefore, a careful attention was paid to the strategy as it is crucial to be specific on the overall strategy which is clearly explained below.

In a typical research, the strategy section introduces the main components of a research: the research topic, area of focus, research perspective and research methods (Goddard and Melville, 2004). According to Creswell (2013), if the research strategy is unclear and ambiguous, the outcomes of the research are invalid. Further he has said that research questions and objectives

help the researcher to select the appropriate research strategy effortlessly. As Kothari (2004) has explained, case study, qualitative interviews, quantitative surveys, action research or action oriented research could be considered as the options for a researcher to select depending on the nature of the research. According to Perjons and Johannesson (2014), experiment, survey, archival research, ethnography, grounded research, action research and case studies are considered as the possible strategies for a research. When each of them is studied thoroughly, each has their own characteristics and applications. As Johnson et al. (2013) have summarised, case studies are primarily focusing on in-depth analysis of a given company or a small number of cases and typical survey methods are heavily used to collect the significantly high number of opinions from a comparatively large populations whereas the interviews are used to study a focus group or an identified set of individuals to deep dive on a given topic. In addition to that, action researches are heavily used to address a given business problem while archival, ethnographic and grounded theory researches are used when the primary sources are held in archives, the researcher wants to observe or interact with the participants and when a new theory wants to be generated respectively. Given the nature of the research, research setting, availability of the resources, research purpose and objectives, the strategy should be carefully selected (Khaldi, 2017).

This research was conducted to identify the value addition related determinants in the global software engineering industry in Sri Lanka. However, as the selected industry is quite young in Sri Lanka, the focus of the researchers to identify these parameters has been lacking. As Haile and Altmann (2016) have said, identification of the value addition in the selected industry has not got enough attention as the challenges and gaps are still prevailing in the global scope as well. According to them, available resources are either irrelevant, mission creep, lack of transparency or traditional. In addition to that, as Gartner (2019) has shown, there is lack of awareness and appreciation of the value addition in the global software engineering industry as a whole. However, given that the global businesses have been through a long journey, general value addition related determinants could be found in the global business related literature.

Due to the identified limitations, a better understanding about the research problem was vital to avoid unwanted surprises towards the end of the research. As Creswell (1999) has said, following a multifaceted procedures of combining, linking and employing multi-methods helps the researchers to come to proper conclusions. According to Byrne and Humble (2007), the best way

to offset the inherent issues by using a single method is to mix both quantitative and qualitative research when there is more to unveil or the current literature does not assure the complete accuracy. Further, they say that examining the same phenomenon in multiple aspects adds more value to the research outcomes. More importantly, reflecting the participants views clearly, fostering multi-source information and collecting comprehensive data through many view points are important for the researcher to understand the research settings clearly (Kothari, 2004).

As the given topic is yet to be researched and unveil the key concepts, the mixed method was chosen for a better outcome as explained earlier. As the initial step, the qualitative analysis was carried out because the findings would emerge the research while the study unfolds and certain perceptions of the experienced individuals in the industry can be captured at the beginning to frame the research properly that are relevant to the given context. (Creswell, 2013). Further, when the researcher tends to become subjectively immersed in the subject matter while the research uncovers the hidden data, the qualitative approach gives the ideal start for the research as Creswell and Poth (2017) have highlighted. The primary purpose was to collect the experts' ideas on the elicited framework to assure that the generic determinants do apply to the selected specific industry as well. This analysis was carried out as a face-to-face series of interviews with 23 participants which covered from start-ups to tier one companies in the Sri Lanka. This survey consisted of two sections. i.e. section 01 to collect the important demographic information and section 02 to deep dive into the value addition related concepts which consisted of 20 open ended questions. The inclusion criteria for the survey were below (Refer Table 5).

Criterion	Justification		
Involvement in the global	The primary research focus is only for the global software		
software engineering	engineering companies. Hence, the non-global companies		
	were not considered.		
Product development	As Kaur and Sharma (2014) have said, the delivery		
companies that follow	process contributes to the value addition in any industry.		
structured / standard process	And the same has been identified as an independent		
and/or unstructured/non-	variable in the research framework as well. Hence, both		
standard processes			

Table 5 - Inclusion Criteria for Qualitative Analysis

	structured and non-structured companies were included			
	for a better comparison.			
Distribution of the teams /	Having global teams / distributed teams is a key			
having global teams /	component of global software engineering industry based			
functional and non-functional	on the literature findings. The structure of the hierarchies			
hierarchies	depends on the distribution of the teams and the			
	governance structure varies on the team formation.			
	Therefore, this was selected as a criterion.			
Use of value streams / value	Use of value streams and/or value maps is more prominent			
maps	in the value-based business models based on the literature			
	findings. Any organisation that is lacking in proper			
	portfolio mapping (top to bottom) shows negative			
	influence due to the negligence of the interconnection in			
	between the value addition/delivery process. Hence, those			
	who use value streams effectively and those who do not			
	use it effectively would help to understand the impact of			
	it.			
Criteria for measuring the	According to the literature, software industry is still			
value addition	operating in a value-neutral way due to lack of attention to			
	the value measures. Therefore, understanding the value			
	measurements used by various types of software			
	companies is important.			

Source: Author's work

A semi-structured interview template was used for these interviews which can be found in the Appendix. The quantitative analysis was followed by the qualitative analysis to further collect the data from a larger audience to carry out the analysis further. More details about that analysis can be found in the below section.

4.5.2. Data Collection Methods

The primary purpose of the qualitative study was to understand the exploratory reasons with respect to the value addition in the global software engineering in Sri Lanka and assay how and

why development process, arrangements of the teams, use of tools, governance and technology infrastructure in the respective company setup. There are numerous data collection methods that a researcher can use. i.e. observations, textual or visual analysis, interviews and focus groups (Creswell, 2013). Each of these methods have their own practical usages as well as limitations. All these methods are more focused on understanding the underlying reasons and gaining insights. Each method helps to dig deeper, but according to Kothari (2004), interviews and focus groups are very common in most in all the types of researches because they are more trusted and most familiar to the researchers. However, the observations help the researcher to come to conclusions in the practical research setups by combining the findings or other research methods because researchers can use their senses to examine in the natural settings (Goddard and Melville, 2004). Hence, some researchers combine multiple methods to collect the required data.

4.5.2.1. Planning the Interviews

Having explored multiple qualitative data collection methods and purpose of this research, interviews are used as the primary source of information which ended up having twenty three interviews with the industry experts those who represent the respective disciplines, organisation clusters and experience groups. Fundamentally there are three types of research interviews: structure, semi-structured and unstructured (Khaldi, 2017). Structured interviews are the ones that use predetermined set of questions which are verbally administered through a questionnaire with no or little variation or no scope for follow-up questions to let the responder to elaborate more on his or her responses. This helps researcher to administer the interviews easily and effectively. The unstructured interviews, conversely, let the responder to explore more on his or her own answers where the researcher does not go by any predefined agenda, instead open-ended questions are used so that the responder can take his or her own time to elaborate the ideas. Usually, this category is time consuming, and it is not easy to manage since there is no or little guidance. Generally, this method is only employed when there is nothing known about the a given research area (Johnson *et al.*, 2013).

Semi-structured interviews are heavily used in many disciplines as it provides a guideline to the participant while letting the participant to talk more about his or her responses to elaborate more and justify the answers with more details. In this format, the interviewer comes up with several key questions which set the yardsticks and define the areas to be focused and explored while

keeping the space for the participant to diverge to pursue an idea and if needed to provide more details about a responses that he or she has provided (Johnson *et al.*, 2013). According to Wisdom and Creswell (2013), compared to the structured interviews, this method gives more flexibility to the researcher to discover more information which may not have been previously known or thought.

Given that, the focus has been set to explore the views and experiences of the participants with respect to the value addition related practices, interview was the best method as it helped the researcher to understand the process, practices and tools that are used by respective organisations, and more importantly the perceptions each discipline on the value-based software engineering practices deeply. A semi-structured interview template was used throughout all the interviews to capture the data required for the analysis. A detailed explanation of the questionnaire development can be found in the below section.

4.5.2.2. Development of Interview Template

According to Goddard and Melville (2004), the objective of the researcher should be to ask questions that are likely to yield as much as information related to the study that helps to address the aims and objectives of the research. When designing the interview templates and making the questions, having open ended questions helps the researcher to gain more information by going deeper in the respective area. The questions should be contextual, natural, understandable and sensitive (Cassell and Symon, 2018). As Creswell and Poth (2017) have described, the flow of the questionnaire should be from easy to difficult which will allow the participants to build the confidence and rapport that will ultimately generate rich data. According to Johnson *et al.* (2013), it is best to start with an introduction to explain the research aims and objectives while setting the expectation to the participants on the outcomes. Therefore, having a keyword map or a proper introduction helps the researcher to explain if needed and the participant to understand the context easily.

The length of the interview may vary depending on the participants, but managing the participants time and assuring the given time is effectively used is important to assure the collected data is in the expected quality (Shenton, 2004). In order to build the confidence and the rapport, demographic questions are ideal to place as the first few questions if research wants to collect them. If not, asking an open-ended question about the topic helps both researcher and the

participant to scope the rest of the interview easily (Goddard and Melville, 2004). According to Mackenzie and Knipe (2006), it is always advisable for the researcher to pilot the interview before collecting actual data which allows the researcher to understand if the questions are clear and understandable. More importantly, the flow of the questions suits the expected outcomes of the interviews.

After carefully considering all these best practices, the interview template was prepared for this research. It consisted of two major sections: demographic information and processes, practices and perception on the value addition in the global software engineering industry in Sri Lanka. The role and overall industrial experience were captured because the experience of the individual matters on his/her perception on the second half of the interview. Other than that, the size of the current company and nature of the development team: collocated or distributed was considered as it is one of the criteria considered in the inclusion matrix. The second half heavily focused on staffing, development process, use of tools, governance and technology infrastructure as they were the independent variables found in the literature study. The initial interview template was piloted with potential three participants via online meetings and assured the template is ready to rollout with the actual participants. Once it is done and reviewed, the interviews were scheduled with the industry experts from the selected strata.

4.5.2.3. Conducting the Interviews

According to Abowitz and Toole (2010), fundamentally, selection of the participants should be done based on the research aims and objectives because the quality of the responses decides the outcomes. Therefore, it was thoroughly considered when choosing the participants for the interviews. In addition to that, setting the right expectations, assuring the ethical principles: anonymity and confidentiality, and a good research setup helps both parties to have a productive discussion (Mackenzie and Knipe, 2006). According to Creswell and Poth (2017), when the participants feel the trustworthiness, it increases the likelihood of openly discussing and sharing his or her thoughts on the given topic. Therefore, it should be assured by the researcher by sharing the respective consents. As Johnson *et al.* (2013) have said, building the rapport prior to the actual interview, can assure an effective discussion. Hence, it is important. When conducting the actual interview, the participant should be educated on the interview schedule clearly so that the process

is more natural. It is important that the researcher learns about the techniques to increase the productivity of the interviews beforehand (Creswell and Poth, 2017).

After carefully understanding the best practices, guidelines and effective interview techniques, the participants were selected based on the research aims and objectives which is described in the research sample and data collection section. The initial request email consisted of the basic information that was required for the participant to understand the research aims and objectives, expected duration, the scope of the interview and ethical practices as well. Initially, only three interviews were scheduled irrespective of the ten emails sent out asking for appointments. Thereafter, rest of the interview requests were sent out through the known contacts to get the required participants for the interviews. Another technique that was used to get more participants is to encourage the those who participated to nominate at least one or two more potential candidates those who would add more value to the interview process. It helped the researcher a lot to get confirmed interviews within a short period as the participants were not reluctant to participate since this was already recommended by someone they know. All twenty three interviews were carried out online via Google Hangout, Microsoft Teams and Zoom based on the preference of the participants and responses were recorded real-time during the interview. Once the interview was over, the interviewer summarised the interview and repeated to get the final consent from the interviewee to assure the actual answers are captured. This validation process helped to cleanse the data during the interview itself. The outcomes of this study were later analysed which is described in the data analysis section and it was used to formulate an effective questionnaire for the quantitative analysis which is described in the quantitative study section.

4.5.3. Sample Selection

According to Cassell and Symon (2018), there are two heavily used sampling techniques for qualitative analysis. i.e. Purposeful sampling: participants can provide an in-depth and detailed information about the phenomenon under the investigation. Convenience Sampling: participants are easily accessible and convenient to the researcher. The use of these two techniques depends on the specific research questions as the selection criteria may change based on the objectives of each research question. This research was focusing on the value addition at each level of the software delivery life cycle. Hence, the participants should be able to provide an in-depth information about a specific area. However, as Creswell and Poth (2017) have said, researches can choose to select

techniques in conjunction with one another depending on the purpose. Hence, a hybrid of purposeful sampling and convenience sampling techniques was used. When selecting the participants, organisations were divided into five strata based on the respective revenues and samples were selected based on those categories. The priority was given to the subject matter experts in each discipline mentioned below. The rest of the participants were selected based on the availability and ability provide a significant input the research outcome. Since 23 face-to-face interviews were planned, during the first round, the invitations were sent to 10 participants, but only 3 accepted. While the discussions are scheduled with them, recommendations were taken from the first-round participants to select the individuals for the second round. This method was convenient and easy to carry out the interviews effectively. All 23 transcripts were converted to datasheets and uploaded to NVivo 12 for the analysis which are discussed in the data analysis section. The disciplines considered for this analysis are Software Engineering, Quality engineering, Project Management, Architecture, Product management, Solution management, Value stream, Sales and marketing, Business strategy, IT Business management, Technology Services, Technology Operations, and Product strategy management. Error! Reference source not found. contains the targeted strata along with the expected sample sizes.

Strata	Total	Percentage	Sample	Percentage
Very large and large	3	4.11%	1	33%
companies				
Medium companies	14	19.18%	4	36%
Small companies	29	39.73%	8	28%
Start-ups	27	36.99%	10	37%
Total	73	100%	23	33%

 Table 6 - Strata Selection

Source: Author's work based on the government's agency report

While the interviews are carried out it was important to pay attention to the research ethics to assure each participant is comfortable to participate and share their data with the researcher as explained in the "Conducting the Interviews" section. Before starting the interview, interviewer explained about the research, purpose of the interview, format of the interview and how the privacy is assured. In addition to that, every participant was given the right to optout at any time without

reasoning if they feel uncomfortable. No company information is tracked or recorded in either paper or electronic format. All the datasheets were filled anonymously. As the interviewer, it was assured that the confidentiality of the data by saving them securely in the cloud with the preliminary security measures. In addition to that, being neutral without being non-judgemental during the interview was considered as mandatory to avoid the biasness.

Next, the data analysis methods for qualitative analysis are discussed in the below section.

4.5.4. Data Analysis Methods

Qualitative analysis is the determination of the non-numerical information about any given research topic that could include the data collected from focus groups, open-ended questionnaires or interviews (Khaldi, 2017). According to Cassell and Symon (2018), fundamentally qualitative analysis focuses on the quality than the quantity by exploring how something is described in a meaningful way. A properly designed qualitative analysis helps to understand the motivations and behaviours in a given research context to come to meaningful conclusions by understanding feelings, thoughts and perceptions (Kaushik and Walsh, 2019).

Due to the lack of availability of the literature and data in the given research context, a complete qualitative analysis was carried out with twenty three industry experts to understand the industry dynamics against value addition in the global software engineering in Sri Lanka. Thereafter, a thematic analysis was carried out to identify common themes, topics and ideas along with specific patterns which is described below.

4.5.4.1. Thematic Analysis

Thematic analysis is used to analyse the qualitative data by identifying, analysing and interpreting the patters of given themes (Hardy and Bryman, 2009). In addition to that, the thematic analysis can be used to describe the theoretically informed frameworks and validate the research questions as well (Byrne and Humble, 2007). As this research took a mixed method approach, the initial analysis was started with the qualitative analysis. Although, there are various approaches to carry out a typical thematic analysis, the common six steps method was employed for this research as it is simple, straightforward and the best fit for the given research. The six steps are, familiarisation: understanding and data with a thorough overview, coding: highlighting the sections, phrases or sentences and labelling them, generating themes: identifying the patterns among them and proposing themes, reviewing themes: assuring the themes are accurate, useful and meaningful,

naming themes: formulating the exact meaning of each and every theme by figuring out how the given theme helps to understand the data and finally the write up: writing the findings in a methodical way with a proper structure.

NVivo 12 was used as the tool for the qualitative analysis and all the datasheets were fed into the tool for further analysis. A comprehensive thematic framework was formed after completing the five steps in the six-step process described above and write up can be found in the findings chapter. The thematic analysis was one of the key pillars for the quantitative analysis which was carried out later. The results of the qualitative analysis were used to validate the research framework as well as to improve the questionnaire which is described in the quantitative study section. Below section describes the validity, reliability and trustworthiness considerations for this study.

4.5.5. Validity, Reliability and Trustworthiness

It is common practice that validity and reliability are used in the quantitative research, but now it is heavily considered in the qualitative research paradigm as well (Johnson et al., 2013). Johnson (1997) argues that the validity should be considered in terms of descriptive, interpretive, theoretical, internal and external. As defined by Goddard and Melville (2004), the reliability refers to the data collection techniques and procedures used for analysis of the collected data can reproduce the same results if they were repeated by another researcher in a different context. To assure the reliability, there are four threats that the researcher should avoid. i.e. participant error, participant bias, researcher error and researcher bias (Vogl-lukasser and Puri, 2004). According to Goddard and Melville (2004), the selection of the interview setup and time has a direct impact to the output which causes for the participant error in one aspect. Hence, they suggest utilising the most productive timeslots of participants day and at the most convenient location which was considered and accommodated during the research. As all the interviews were carried out online and one-on-one basis, errors could be avoided significantly. When the participant bias is considered, Shenton (2004) suggests that assurance of the confidentiality, presenting the information in a judgement free manner, and organising the questionnaire and answers in a way that participants are forced to give biased answers can help to avoid this biasness.

The concept of validity in the qualitative study has been argued by many authors on the subject of the applicability in different research settings. However, as Creswell and Poth (2017) have highlighted, qualitative studies also need a certain qualifying check or measure to assure the

validity of the study. Additionally, as they further argue, quality of the research could be measured in terms of the ability of generalising the results which ultimately increases the validity of the trustworthiness of the research. In contrast, Maxwell (2009) argues that use of the triangulation techniques is considered as a good test to get the sense of validity while generalisability addresses one important aspect of the research. According to Patton (2008), mixed method research itself is a good assessment where the combination of data collection techniques is used to assure validity of the outcome of the research. Given this study has considered multiple methods of searching and gathering data in various views assures the validity.

Although the reliability is arguably applicable for testing quantitative research, nowadays in qualitative studies this is employed to test as a way of information elicitation to test for the quality (Khaldi, 2017). According to Stenbacka (2001) the concept of reliability is even misleading in qualitative research. On the other hand, Patton (2008) argues that validity and reliability are two key factors that researchers should consider while designing the study, analysing the results and judging the quality of the research. According to Creswell and Poth (2017), the best way of ensuring the reliability of the qualitative study is by increasing the trustworthiness. Although there are counter arguments of the applicability of the validity and reliability for this study, the researcher assures that all the qualitative data collected through the interviews are trustworthy and can be generalised in terms of the spectrum of conceptualisation and application. In order to do that, all the best practices were followed during the study to increase the credibility and defensibility of the results. According to Shenton (2004), the researchers' responsibility is to avoid overloading the interviews, avoid making assumption, stop rushing and avoid believing everything you see or hear during the interviews and surveys. To avoid the researcher errors, no two interviews were scheduled on the same day and other instructions were carefully followed during the discussions. Last threat is to avoid research bias. To avoid this threat, the participants were asked to review the results and asked for alternative explanations when needed. In addition to that, during the interviews, acting neutral was practiced when asking questions and answers are given by the participants. Given that all the best practices were followed to avoid the threats, reliability of the study is assured. As Kothari (2004) has explained, if high reliability is assured, the validity of the research is assured as well. In Addition to that, as explained in the reliability of the questionnaire section, test-retest technique was used as well to prove the research outcomes are reliable as best
practices were followed during the research process. Therefore, credibility and the dependability of the study is considered seriously and assured at the end.

The findings of the qualitative study helped to formulate both the conceptual framework as well as the questionnaire for the public survey as well. The below section explains the process of quantitative study followed by the conceptual framework.

4.6. Quantitative Study

This section is devoted to discussing the research design, approach, strategy, data collection methods, sample selection and data analysis methods that were employed in the quantitative study.

4.6.1. Research Design

In the typical exploratory sequential design, the research is carried out in two phases: qualitative data collection phase and quantitative instruments phase in which the results of the qualitative analysis can be directly used in the quantitative analysis or vice versa if the given literature is sufficient to find the answers for the primary research problem (Wisdom and Creswell, 2013). According to Stewart (2017), findings from the qualitative study can be directly verified and further explored through a thorough quantitative study. As the mixed method was employed for this research, the quantitative analysis was carried out to collect more data from the larger audience to further analyse the value addition related determinants in the global software engineering in Sri Lanka. This section describes the approach and strategy that were used in detail.

4.6.1.1. Research Approach

As described in above sections, the existing literature is insufficient to build a strong research framework around the global software engineering industry in Sri Lanka. Given that the much is not known about the research topic, the descriptive research approach was used as suggested by Goddard and Melville (2004). According to Wisdom and Creswell (2013), the descriptive approach is appropriate to identify the trends, characteristics, frequencies or even categories. As Stewart (2017) has argued the descriptive research approach helps the researcher to describe a population, situation, or a phenomenon by focusing on answering the specific questions except "why". As he has further explained, it is necessary to understand the specific characteristics of a given research problem to find the solutions accurately. According to Khaldi (2017), descriptive study can be classified into varies types based on the approach taken. i.e. descriptive survey,

descriptive normative survey, descriptive status, descriptive analysis, descriptive classification, descriptive comparative and corelative survey. Each type has their own purpose, advantage and disadvantage which should be considered by the research when choosing the right technique. According to Johnson *et al.* (2013), quantitative researches lead to establish certain unidentified relationships among the variables. As they have further explained, descriptive approach best suits when the researcher wants to answer the research questions by establishing proper arguments around the corelation between the variables in order to generalise through the findings.

One of the key requirements of this research is to identify the key phenomenon related to the value addition in the global software engineering industry by determining the relationship between the dependent and independent variables in the given context that later helps to generalise the outcomes. As the descriptive approach was chosen for this study, the subject was measured once through the outcomes by establishing the association between the variables. According to Goddard and Melville (2004), in a typical descriptive analysis, the quantitative analysis helps the researcher to clearly identify the cause and effect of given variables which can be used to predict the outcomes later as well. As Kothari (2004) has explained, if the purpose is to build a strong argument around a given research topic through precise measurements, the researcher should chose the descriptive approach by employing a well-built quantitative research to study the specific variables through the proven statistical techniques. According to him, this method assures the unbiases outcomes of the study as it is not known to the participants and deliberately hidden. A similar view is upheld by Malina, Nrreklit and Selto (2011) and they have further argued that, when the mixed method is used for a given research, quantitative analysis helps to generalise the findings that can be applied to any other population. Therefore, given the nature of this research and the applicability, descriptive research approach was chosen to study the research problem effectively.

4.6.1.2. Research Strategy

Creswell (2013) says that taking the quantitative approach towards the end of the research gives more efficient data and it gives precise measurement & analysis of the target concept. Quantitative research approaches emphasise the process of analysing the data collected through questionnaires, surveys or polls through objective measurements, statistical, numerical or mathematical means through proven statistical data analysis techniques, algorithms and tools (Khaldi, 2017). Survey method is widely employed in all kinds of researches to collect the data from the respondents to

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core questions what, why, how, how often and how many when conducting the deep analyses (Goddard and Melville, 2004). This method is scientific and effective when collecting data through both open ended and closed ended questions. As Crump (2007) has said to collect the opinions, perceptions and observations from a large group, survey researches are efficient and effective. According to Abowitz and Toole (2010), when the emphasis is upon collecting authentic quantitative data to come to valid conclusions in the absence of second party or third party data or when the literature does not support enough to prove a concept, the ideal research strategy is to choose the survey. Given the applicability and practicality for collecting data to determine the value addition parameters in the global software engineering industry in Sri Lanka, survey method was chosen.

a public survey was shared with more than thousand professionals from the selected segments via emails, social media and through direct contacts that consisted of six different sections focusing on six areas. i.e. demographic information, project management and delivery process, change management and governance, general team formation and delivery frameworks, Tools that are used within the processes and technology infrastructure. This survey consisted of eighteen questions primarily focusing on the aforementioned areas. To capture the opinion of the respondents, likert scale was used which is recommended by many authors in the literature. This scale is an orderly scale to measure someone's attitude by measuring the extent to which they agree or disagree with a particular question or a statement (Vogl-lukasser and Puri, 2004). As Byrne and Humble (2007) argue, it is the most widely user psychometric approach to collect the opinion or feeling in a survey research. As they have further explained, the best scale is to choose an unevenpoint scale when there is an option to rate from negative to positive while keeping an option for neutral or middle option. The same view is upheld by Abowitz and Toole (2010) and Malina, Nrreklit and Selto (2011) as well. Therefore, a 5-point unbiased scale was chosen for this questionnaire. A detailed explanation about the questionnaire can be found in the questionnaire development section under the data collection methods topic.

Below section discusses about the research framework that was formed after the literature review which was again tested through the qualitative analysis.

4.6.2. Data collection methods

An ideal data collection procedure should be clear, unbiased, reliable and valid said Vogl-lukasser and Puri (2004). According to Kothari (2004), there is not a one right fit for all kinds of researches as the selection of the methods should be done based on the nature of the research, availability of the data, anticipated research outcomes, timeline and budget as well. This section describes the selection of the data gathering methods and instruments for the quantitative analysis.

4.6.2.1. Planning the Survey

As Mackenzie and Knipe (2006) have argued, selection of the data type, source and suitable instruments are considered as the key decisions in a typical research. As they have further explained, the decision is purely based on the ability of answering the research questions adequately. A similar view is presented by Crump (2007) and according to him, methodological procedures to obtain the required data from the selected sample should be decided by considering the research scope and research approach as the methods and strategies would be vary based on the nature of the research. In addition to that, there a huge influence from the research setting as the availability of the required data is heavily dependent on it. Therefore, the selection of the methods was further studied to understand their applicability and suitability for the selected research topic.

Creswell (2013) says it is necessary to understand the situation by studying it more clearly, establishing the clear priorities and developing a proper operational definition to improve the quality of the research. Further, Mackenzie and Knipe (2006) have mentioned that a properly designed quantitative analysis can be used to measure the attitudes, behaviours, opinions and other variables to either support or reject a promise. Kothari (2004) has stated, a properly articulated survey can be used to gather the data from a selected group or a population. A similar view is upheld by Johnson *et al.* (2013) and they have further mentioned that quantitative research should focus on collecting numeric and unchanging data and convergent reasoning than divergent reasoning. To draw definitive conclusions through quantifiable data, the best approach is to choose a structured questionnaire with carefully selected set of closed ended questions (Khaldi, 2017). Primarily, opinion surveys are used for this research as the responses can be analysed with quantitative methods by putting them into scales through numerical values(Creswell, 2013). As many authors have pointed out, surveys are cost effective as well as easy to get the participants

opinion. Given that this research required many inputs from the industry experts to come to meaningful conclusions, a survey was shared with more than thousand software and information technology professionals to get the opinions collected. To assure the correctness of the instructions and directions are clear to the respondents, a pilot survey was conducted with 15 professionals from different software discipline which assured the effectiveness of the survey as well.

4.6.2.2. Operational Definition and Measurements of Variables

According to Perjons and Johannesson (2014), operational definition refers to how the specific variables are defined and measured which are used in the study. This study heavily focused on identifying the key parameters that impacts to the value addition in the global software engineering industry in Sri Lanka. This comprehensive study was built around the five important variables identified through the literature which were later assured and proven through the exploratory study. Table 7 - Operational definitions and measurements of variables provides more details on the selected variables.

Variable	Definition of Variable	Indicator	Category of	Measurement	Source
			Data		
Delivery	Software development	1. Delivery responsibility	Ordinal	Likert Scale	(Ovaskainen et al.,
Process	organisations uses various	2. Transparency			2017; Adom,
	techniques to deliver the	3. Customer satisfaction			Hussain and
	software components they	4. Meeting goals			Agymen, 2018)
	develop. Delivery process	5. Process awareness			
	covers the step-by-step				
	approach taken to complete				
	the software delivery.				
Governance	Software governance	1. Managing requirement	Ordinal	Likert Scale	(Dubinsky et al.,
	includes the structure for	changes			2011; Vlietland and
	aligning the development	2. Conflict resolution			Vliet, 2015; Bass,
	strategy and delivery	3. Environment			2016; Noll et al.,
	guidelines to track the	ownership			2016)

 Table 7 - Operational definitions and measurements of variables

	progress and to measure the	4. Change approval	
	performance.	5. Cross Team	
		collaboration	
		6. Continuous	
		improvement	
Staffing	Staffing refers to the	1. Effective team Ordinal Likert Scale	(Valverde et al.,
	managerial function of	formation	2018; Shen et al.,
	hiring, selecting and	2. Level of	2018; Eeckhout,
	arranging the software	communication	Maenhout and
	professionals into the	3. Team collaboration	Vanhoucke, 2019)
	respective teams.	4. Projects and resource	
		mapping	
		5. Effective budget	
		allocation	
		6. Portfolio alignment	
		7. Internal framework	
		efficiency	
Use of tools	Use of tools defines the	1. Use of development Ordinal Likert Scale	(Jongeling, Datta
	selection and use of effective	tools	and Serebrenik,
	tools to ease the day-to-day	2. Reliability of tools	2015;
	repetitive activities which	3. Tools selection	Krishnamurthy,
		4. Automation	2016)

	are carried out by the	5.	Monitoring and			
	software professionals.		controlling			
Technology	Technology infrastructure	1.	Attention for	Ordinal	Likert Scale	(Jeffrey and James,
infrastructure	consists of the software		infrastructure			2013; Islam,
	development, testing,	2.	Infrastructure			Jasimuddin and
	deployment and		reliability			Hasan, 2015;
	maintenance related	3.	Effective management			Jabbouri et al.,
	facilities and support.		and control			2016)
Value	Value addition refers to the	1.	Assuring timely	Ordinal	Likert Scale	(Haile and
addition	amount of value which is		delivery			Altmann, 2016a;
	delivered to the respective	2.	Stakeholder			Sanjari <i>et al.</i> , 2018;
	stakeholders to enhance the		satisfaction			Udawatta et al.,
	stakeholder value.	3.	Efficient change			2019)
			management process			
		4.	Effective tool use			
		5.	Efficient technology			
			infrastructure			

Source: Compiled by author's based on the intext citations provided in the table

The following section clearly discusses about the overall questionnaire development process based on the above variables and other specific guidelines found in the literature.

4.6.2.3. Development of Questionnaire

During the literature review, it was identified that multiple generic value addition related surveys have been conducted by many authors such as Lepak, Smith and Taylor (2007), Mutambi (2008) and Carnahan, Agarwal and Campbell (2010). And there were software development and software operations specific questionnaires that had been carried out by Haile and Altmann (2016) and Udawatta *et al.* (2019). Learning of these studies were the basement of preparing the questionnaire.

The online survey consisted of six major sections: demographic information, project management and delivery process, change management and governance, general team formation and delivery frameworks, tools that are used within the processes and technology infrastructure as stated earlier. Demographic information covered the discipline, target customer base, size of the organization, and participants designation or role. This section was followed by the project management and delivery process which consisted of two subheadings called process and workings styles and project management best practices. Those two sections had seven and eight questions respectively that each participant was asked to rate their degree of satisfaction on a five ordinal scale that varies from strongly disagree/neve to strongly agree/always. The same scale was used for all the questions as the referenced questionnaire had used the same. After the project management section, the next focus was to analyse the change management and internal governance process. In that, participants were asked fourteen questions under three different subheadings called requirement and change management process, service delivery and team collaboration. This section was followed by the generic team formation and delivery frameworks section which was focusing on understanding how teams are formed how well the teams comply with the guidelines given by the selected delivery framework. In this section, participants could share the size of the respective teams, delivery framework that they are using and specific software development practice they have adopted. This generic information section is followed by again two subsections to understand their perception on the selected framework and the value addition of each step in the current framework. These two sections consisted of five questions each that the participants got an opportunity to rank how they feel on the same ordinal scale mentioned above. The next section was focusing on the use of tools within the respective software delivery process which consisted of ten questions covering various tools used in typical software development pipeline. Finally, the participants were asked to share their opinion on the impact of technology infrastructure for value addition. Five different questions were asked to rate from one to five scaled mentioned above on the attention to the topic by the management, understanding of the teams, reliability and suitability of the given technology infrastructure to assure the value addition. Additionally, participants were given an opportunity to share their thoughts towards the end of the survey as an open-ended question. This section consisted of 4 questions that were included for exploratory purpose under the delivery method and team formation section to determine if there is any relationship between the selected framework and the value addition with respect the accurate formation of the teams. In addition to that, each section had at least one question to collect the participants opinion on the value addition which were used in the data analysis process later when identifying the corelations between the independent and dependent variables. However, to assure that the questionnaire is not bias, a complete reliability analysis was done which is described in the below section.

4.6.2.4. Reliability of the Questionnaire

As mentioned above, it is recommended to use a pilot survey to assess the reliability and the validity of the survey. Hence, the initial survey was shared with 20 individuals from all five company categories described in the sampling section those who come from different disciplines. During the pilot study, they were encouraged to ask questions or make comments about any question in questionnaire if they were unclear or ambiguous. Test–Retest Reliability test was performed with a time span of two weeks and the Test-Retest reliability coefficient of all the respondents were above 0.72, thus the reliability of the questionnaire was confirmed. But, for more clarity some minor wording changes were made based on the feedback to the questionnaire. Therefore, this survey was shared with a larger audience through emails and social media which is described in detail in the below section.

4.6.2.5. Conducting the Survey

According to Cassell and Symon (2018), a self-administered questionnaire is easier to standardise due to the nature of systematic differences between the interviews and questionnaires and the simplicity that a well-defined questionnaire can provide. A similar view is upheld by Kaushik and Walsh (2019) and have further mentioned that, even a complex topic can be simplified using a clear and proper language. As explained above, the questionnaire was developed in such a way that it is very well structured, language was simple, questions were short and easy to understand, the flow of the sections was meaningful and last, it was unambiguous. Therefore, this self-explanatory questionnaire was ready be shared with the potential participants as an online survey.

After analysing the existing questionnaire tools, the questionnaire was built using Google forms as it is easy to use, has the ability apply the required validations, can add various types of questions, and more importantly the end users are much familiar with the Google tech stack. A precise description was added to both survey body as well as the message which was shared through an email that consisted of the research aims and objectives to make the participants clear about the importance of having their opinion for this research. Confidentiality and informed consent are considered as the two important ethical issues that the researcher should be adhering when conducting a research (Khaldi, 2017). Therefore, all the participants were fully informed how well the confidentiality is assured and the consent was taken before proceeding to answer the questions. And more importantly, the participants were given the right to opt-out at any given time if they feel uncomfortable. Initially, the survey was shared with those who participated for the interviews with a separate note to share the same with their respective teams as it could cover the majority of the targeted population. However, without relying only on them, the same survey was shared through social media and professional media to get more responses within the targeted timeframe. After a couple of reminders and reshares, the expected number of responses was received within the planned timeframe.

All responses were recorded within the Google form which was later converted to a spreadsheet for the analytical purpose. Below sections describes more on the sample selection process for both interviews and survey.

4.6.3. Sample Selection

More succinctly, the quantitative research with a properly designed and administered questionnaire helps to better understand the characteristics and behaviours of an identified population (Creswell, 2013). As Abowitz and Toole (2010) have said, the researchers are focusing on inferring the population through the selected sample when collecting data through a survey. To draw proper conclusion from the survey results, the sample is should be a valid, consistent, diversified and transparent (Johnson *et al.*, 2013). If the population is very large, geographically dispersed and demographically mixed, it is difficult to gain access to a representative sample. Therefore, narrowing down the population to suit the research objectives is crucial to select a proper sample (Khaldi, 2017). Once the population is clear to the researcher, the sample can be chosen easily that the results of the survey can ben seen with the right perspectives (Perjons and Johannesson, 2014).

Sampling frame for this research is the database available at the national chamber for the computer professionals. Based on the available data, population for this research is quite large and it is difficult to identify the characteristics of every member of the population. Therefore, the best technique that works for this research is probability random sampling. Hence, the survey was shared with the selected sample as an electronic questionnaire. According to Khaldi (2017), to truly reflect the opinion of the population, the sample size should be accurately large. The accuracy depends on the percentage of selecting the responses, hence avoiding the potential extreme categories is essential (Goddard and Melville, 2004). As mentioned above, the population for this research is less than 5000. According to the findings of Israel (1992), the ideal sample size is 370 with 5% error rate at 95 confidence level. Therefore, to obtain at least 370 quality responses, that represents all the disciplines of software engineering, the survey was shared with more than thousand potential respondents.

In summary, the aim was to conduct at least 23 interviews with industry experts and the survey with 370 participants of those who engage in global software engineering. As explained in the interviews section, the face-to-face interviews were carried out successfully and the result of the interviews were used to improve the questionnaire which was prepared to be shared with the larger population. It was planned to be carried out in two phases: pilot survey and actual public survey. The initial pilot study was carried out for 7 days from 8th January 2021 with 20 selected individuals from the population and the same survey was publicly shared on 14th January 2021. The survey was left open for 45 days and 383 responses had been received by the intended deadline. Except twelve surveys, others were complete. However, out of the those twelve there was only 1 which does not belong to global software engineering and rest had some dummy data. Therefore, to improve the accuracy, all twelve surveys were rejected. Hence, 371 survey results were included in the analysis. That process of analysing the data is described in the below section.

4.6.4. Data Analysis Methods

Quantitative analysis is a key technique in research that uses mathematical and statistical modelling, measurement, and research to understand behaviour in a given research setting (Johnson *et al.*, 2013). Quantitative results represent a given reality in terms of a numerical value that can be used to interpret important and meaningful information through a carefully analysed data. According to Khaldi (2017), a properly designed quantitative analysis can provide the analyst with tools to analyse and examine the past, present and predictable future as well. Therefore, as part of the overall research process, a comprehensive quantitative

analysis was carried out based on the responses collected through a properly formed questionnaire which was shared with the intended sample.

To examine the relationship between the identified variables, correlation analysis was applied, and the multiple linear regression analysis was used to determine the significant factors that influence the value addition in the global software engineering industry in Sri Lanka. In addition to that, to check the validity of the results and satisfy the regression assumptions, heteroscedasticity test, independence of residual, normality of residual and multicollinearity of the data is checked. Finally, as this analysis consisted of multiple groups, an Analysis of Variance (ANOVA) was used to determine if there is any impact of demographic characteristics for the value addition. Below three sections explain the techniques that were employed to do the analysis of the data.

4.6.4.1. Multiple Linear Regression Analysis

According to Hardy and Bryman (2009), multiple linear regression analysis is used to explain the relationship between one dependent variable and two or more independent variables. By doing this analysis, the intention was to identify the relationship between delivery process, staffing, governance, use of tools and technology infrastructure with the value addition in the global software engineering in Sri Lanka. Hence, the model was applied to clearly understand the relationship of the specified dependent variable with the identified dependent variables mentioned above. In addition to that as Yan (2009) has explained, the multiple liner regression analysis helps to determine the overall fit as well. Therefore, to understand the relative contribution of the respective variables, the same helped to identify the variance explained as well.

4.6.4.2. The One-way Analysis of Variance (ANOVA)

The one-way analysis of variance (ANOVA) is a technique to determine if there is any statistically significant difference between the means of two or more independent groups (Roediger III *et al.*, 2001). In addition to that as Hardy and Bryman (2009) have highlighted, the ANOVA helps to understand if the survey results are significant. Further, this test gives the confidence of moving along with the generic outcomes by giving only the indication of the significant difference in variance, but it does not say in which group the variance was. Therefore, additional statistical method was needed to understand in which group the differences were. As this method was used to understand the relationship between the demographic data with the value addition in the global software engineering in Sri Lanka, after

the initial ANOVA, the Turky post hoc test was employed to identify the exact group that had the significant difference. The outcomes of these studies are clearly explained in the findings chapter which is followed by this chapter. The below section discusses the validity, reliability and the trustworthiness of the collected data.

4.6.5. Validity, Reliability and Trustworthiness

Validity and Reliability are essential in a research that increases the credibility of the study (Feilzer, 2010). Validity is defined as the degree to which a concept is precisely measured in a quantitative study and reliability or the accuracy of the instrument assures the consistency of the results (Johnson *et al.*, 2013). Considering the homogeneity, convergence and theory of evidence through various aspects for the questionnaire construct validity was demonstrated which is further described in the data analysis and presentation chapter. To assure the criterion validity, Pearson Product Moment Correlation was conducted in SPSS to test for the validity which can be found in 5.3.1 section. In this assessment, convergent validity, divergent validity and predictive validity measurement criteria were taken into consideration. Hence, the research instruments were assured for the validity.

In order to assess the reliability, internal consistency (homogeneity) through Cronbach's α ., stability using test–retest and equivalence using inter-rater reliability were used which is described in detailed in 5.3.2 section. The outcomes of these assessments ensured the reliability, or the consistency of the measures used for the quantitative analysis.

Finally, As Pilot and Beck (2014) has defined, the trustworthiness of a study refers to the degree of confidence in data, its interpretation and methods used to ensure the quality of the study. To assure the trustworthiness, it is important to pay attention to credibility, dependability, confirmability and transferability (Guba, 1985). Later authenticity was added by Guba and Lincon (1994). As they further say, not all procedures are used in each study, hence assurance of the trustworthiness depends on the respective procedures and measure used for the given research. As suggested by many prominent authors, credibility can be established through triangulation where the data is collected through different sources and different methods whereas the dependability can be assured through groper justifications for the process of inclusion of each data to the assessment which is described in the data analysis chapter in detail. As suggested by Malina, Nrreklit and Selto (2011), the transferability is not applicable for this study as it heavily focuses on non-probability sampling techniques. Therefore, the research has been

carried out in such a way that the credibility, dependability and confirmability are assured in both internal and external contexts which ultimately increases the trustworthiness of the study. The pilot surveys, data audits and chosen data analysis techniques helped to assure the trustworthiness without any doubt.

The thorough literature review and the outcome of the qualitative study helped to formulate solid conceptual framework which later laid the foundation for the quantitative study. Below section describes the conceptual framework in detail.

4.7. Conceptual Framework and Research Hypotheses

This section describes the process of formulating both conceptual framework and hypotheses in detail with the rationale.

4.7.1. Conceptual Framework

Conceptual framework explains the path of a research that helps the researcher to get a comprehensive understanding of a phenomenon (Leshem and Trafford, 2007). According to Ovaskainen *et al.* (2017), a well-defined conceptual framework gives both researchers and its readers a precise visual representation of the key concepts or variables and more importantly the scope of the study along with the relationship in between the identified variables. The objective of having conceptual framework in a research is to make the findings more meaningful, acceptable to the theoretical constructs in the research field and ensures generalizability (Adom, Hussain and Agymen, 2018). As Ovaskainen *et al.* (2017) have further explained, the conceptual framework assists the research in stimulating research while the knowledge gap is properly formulated and impetus to ensure that extension of the knowledge is meaningful and generalizable. Therefore, a well-formulated conceptual framework was developed for this research after a comprehensive literature review.

During the literature review, it was identified that the studies focusing on the value-based software engineering is insignificant though the researchers have paid more attention to address the challenges and issues in the global software engineering with the distributed teams in general. Hence, findings, learnings, critical reflections, and critiques of value addition in the global software engineering industry are limited. To shape the research, in particular, to identify the required basic information on the value addition related parameters, the generic literature was adequate and sufficient as there were comprehensive researches on value addition in businesses in general in the literature. When the local context is considered, there is no single research papers in the archives that has been done focusing on the value addition

in the global software engineering industry in Sri Lanka. Hence, this problem has not yet been thoroughly studied by the researchers. Given that the exploratory approach was adopted to study the problem, a generic study was conducted to identify the variables that are important for value addition in a typical product-based business irrespective of the nature of industry. And then, it was narrowed down to the global businesses to further validate those identified variables and to understand if there are any other important variables specific to the global businesses. Therefore, as the literature uncovered, the key variables that impact the value addition are staffing, delivery process, use of tools, governance and technology infrastructure. The initial findings in the generic context showed that organisation of the teams, use of proper delivery process, effective use and selection of the required tools and governance within the company and specific processes have a direct impact to the value addition whereas the technology infrastructure has a moderate impact that can affect to the strength of the above four variables. Hence, the initial framework was built around these findings and the study was carried out based on it.

Once the initial findings were uncovered through the available research findings, a thorough study was carried out to further investigate the problem and validate it. As Vogl-lukasser and Puri (2004) say, the best method is to ground the research model in empirical literature to validate it followed by a cross validation through an exploratory study through expert judgements. A similar view is upheld by Cassell and Symon (2018) where they have argued that the effective use of a qualitative analysis can be the best approach to validate the research framework when the empirical literature is lacking in a given context. As they further say, the use of a generic framework which is found through the literature for a specific objective should be done in a methodical approach by identifying the key areas of focus with a proper qualitative analysis. According to Kothari (2004), explanation of the development of the research framework is not necessary given that it was formed through a comprehensive literature study. However, a statistical validation through a qualitative analysis is sufficient for validating a research framework. As Creswell (2013) has suggested, a meta-analysis and a statistical validity measures are used to evaluate the conceptual frameworks after grounding the same on an empirical literature. A similar view is upheld by Malina, Nrreklit and Selto (2011) and Cassell and Symon (2018) as well. Therefore, the framework which was formed based on the thorough empirical literature was afterward verified via a qualitative analysis which was conducted based on the data collected through 23 interviews which is discussed further in the data analysis section. Given that the initial framework was formed in the generic global business setup and there are not sufficient findings in the local context on the value addition related parameters, the qualitative analysis was carried out to validate all five parameters with the industry experts. All the collected data was carefully analysed to understand the relationship in between them which is described in the data analysis section in detail. The findings assured that the initial discoveries through western literature are accurate. But one significant and important finding is the impact of the technology infrastructure for value addition which is described in the below section.

4.7.2. Impact of Technology Infrastructure

Technology infrastructure generally refers to all forms of underlying technological platforms, applications, software and support. As part of the qualitative analysis, the impact of the technology infrastructure for value addition was carefully analysed along with the other variables. As the literature findings uncovered, the technology infrastructure moderates the relationship between the staffing, delivery process, governance, use of tools and value addition by strengthening in various ways. The facts indicated in the literature chapter had focused mostly on the generic concerns such as increasing the overall value delivery by optimising the infrastructure. Hence, the initial conceptual framework was formed based on those findings which is believed be accurate in the generic literature.

But the findings of the qualitative analysis uncovered that the technology infrastructure can no longer be considered as moderating in the today's business world, instead it is an independent variable for the value addition. The arguments provided by the interview participants proven to be valid through the analytical results as the technology infrastructure plays a crucial role in the modern-day businesses. Given that it is no longer considered as a moderator variable, but an independent variable the research framework was modified as follows (**Error! Reference source not found.**).



Figure 23 - Research Framework

Source: Author's work

4.7.3. Research Hypotheses

The research was initiated as an exploratory study as the current literature around the value addition in the global software engineering in Sri Lanka was not found as mentioned above. However, as the global business-related literature uncovered the current landscape of the generic global business with respect to the value addition related concepts and variables. Therefore, the above research framework could be built to formulate the rest of the research activities efficiently and effectively around the five variables those were identified. According to Mutambi (2008) and Racheva, Daneva and Sikkel (2009), once the conceptual framework is built after an exploratory research, a researcher should establish sufficient number of hypotheses to prove the accuracy of the findings relating to the given context. A similar view is upheld by Abowitz and Toole (2010) and they have further argued that the study should now be converted into a descriptive analysis. When the empirical studies related to the determinants of value addition in the global business are considered, various techniques and variables have been used to build the hypotheses. Below table (Table 8) summarises the findings.

Table 8 - Empirical studies of determinants of value addition in global businesses

Hypothesis	Va	ariables	Empirical Strategy	Authors		
	Dependent	Independent	-			
The stakeholder value in businesses is	Stakeholder value	Human resources	Logit model	Šmite <i>et al.</i> (2010)		
heavily dependent on human resources in	in global business	mapping for projects				
global businesses than local businesses						
The stakeholder value in businesses is	-	Fully loaded cost per	-			
increasing in global businesses than local		employee				
businesses when skilled resources are						
employed at lower costs						
The value of the share of stakeholder	Share of services	Share price if the	Probit and random	Rajala and		
increases with staff augmentations in global	provision by	company does not	effects	Westerlund (2007)		
businesses	individual share	involve in long-term		Barney, Aurum and		
	holder	debts		Wohlin (2008)		
	Share limits per s		-			
		holder				
		Cost of staff per				
		projected hours				
Value addition of global businesses	Value addition in	Use of Standard	Not mentioned	James D. Herbsleb		
increases against the processes employed	global business	processes		(2007)		

Cost per head increases when internal		Fully loaded per head		Cho (2007)
processes increase the number of quality		cost		
gates				
Value addition in global businesses has a	-	Quality gates in		
positive impact to the number of tests in the		employed process		
internal process				
Value addition in businesses has an impact	Value addition in	ITIL service standards	Logit model	Boehm and LiGuo
against the service delivery frameworks	business			Huang (2003)
Value delivery increases when service	-	Internal service quality		
quality increases		matrices		
When more people work, the more likely is	Value addition in	Number of members	Discrete time	Butler (2012)
it increases the value addition	global business	in a unit	hazard	Hoegl and
More difficult processes, the more likely is	-	Production heavy		Gemunden (2001)
it decreases the value addition		processes		
Larger the team, increases the governance	Impact of	Size of the team	Probit-ML	Barney, Aurum and
which decreases the value addition	governance for			Wohlin (2008)
Openness will promote less governance	shareholder value	Use of the standard		
		governance practices		
Per head cost of employee increases with	Impact of	Cost of employee with	Not mentioned	Boehm and LiGuo
governance	governance for	/ without governance		Huang (2003)
Distributed teams need additional	value delivery	ITIL for distributed		Butler (2012)
governance		teams		

Value addition increases with right		External factors for		Hoegl and
governance		rightsizing the		Gemunden (2001)
		governance		
Value delivery increases against the tools	Value delivery of	Cost of tools per	Discrete time	Jongeling, Datta and
	global production	single delivery	hazard and logit	Serebrenik (2015)
Value delivery decreases due to the	teams	Time in production	model	Singer et al. (2010)
absences of right tools		line with / without		
		prescribed tools		
Overstaffing tends to increase the use of	-	Per head cost per tool	-	
tools		in production pipeline		
Technology Infrastructure increases the	Value delivery in	Shareholder value per	Logit model	Cavusgil et al.
value delivery	the global	unit		(2014)
Value delivery increases with the	business	Cost of product units	-	Dubinsky et al.
technology infrastructure in production /		per development units		(2011)
development units				
Value addition tends to increase with	Value addition in	Cost of technology	Random effects	Vlietland and Van
cutting edge technology	private sector	infrastructure	models	Vliet (2015)
Staff efficiency increases with the rightbusinessNPS for value		NPS for value stream	1	
technology infrastructure				
Risk of failure tends to decrease due to the	Value delivery in	Risk probability factor	Not mentioned	Jabbouri et al.
right infrastructure	tech companies	of failure		(2016)

Source: Compiled by Author based on the incite references

According to the above hypotheses on the determinants of value addition in the global businesses, few generalised hypotheses can be developed to assess the impact of the identified variables to understand and prove the dependencies in between the dependent and independent variables. They are staffing alignment hypothesis, internal process constraint hypothesis, governance implications hypothesis, tools' ideology hypothesis and institutional technology infrastructure hypothesis. Hence, after discussing various arguments and the propositions in the literature and proven through qualitative analysis, this research sets out five hypotheses based on the conceptual framework to explain the value addition in the global software engineering industry in Sri Lanka.

4.7.3.1. Impact of Staffing for Value Addition

It was evident that the alignment of the teams those who get involved in the software delivery pipeline has an impact to the intended value delivery. As Sanderson-wall (2017) has argued, the concept of a product, capability or a feature starts at the portfolio level where the senior leadership team of the company gets involved to make the choice of accepting or rejecting the proposed concept based on the strategic themes. As he has further said, the intended value is considered by the respective stakeholder when they make the decision. According to Laudicina (2021), the agreed scope and the roadmap is communicated to the rest of the teams in the delivery pipeline to assure that the intended value is delivered by completing the anticipated work. However, as both authors have highlighted, getting the right quorum involved in the value related decisions and communicating the same to the rest of the teams are important to assure the value delivery. Further, they have argued that the inclusion of enablers of the value addition is important than blindly adding the resources to the team. According to Immonen et al. (2016), number of resources in a software development team does not assure the value delivery, but right sizing and including the right resources do. Given that the literature has sufficient proofs to understand there is a relationship between the staffing and value addition, the exploratory study was used to assess the same. As described in the data analysis section and clearly explained in the data representation section, the impact of the staffing to the value delivery was proven through the exploratory study. Therefore, given that there is a positive relationship between the arrangement of the teams with the value addition in the global software engineering industry in Sri Lanka, the first hypothesis was formed to test it scientifically through the public survey results which helps to achieve the intended research objectives.

Hypothesis 1 (H1): Staffing has a positive impact on value addition.

4.7.3.2. Impact of Delivery Process for Value Addition

In a typical software delivery process, the primary objective is to take the software product to the market within the given time and budget. As Larman and Vodde (2013) have explained, the primary goals of software delivery teams to assure that the project requirements are covered, and the delivery is on time and the quality is assured. But, Nord, Ozkaya and Kruchten (2014) have argued that any software delivery process should be able to assure the interconnection between the steps in the process to assure that the value is not eroded while carrying out the assigned tasks. As Johnson (2015) has highlighted, the value delivery should be assured throughout the process. However, various delivery processes are employed by the software companies that help them to deliver agreed scope of the product or feature, but as Udawatta et al. (2019) have pointed out, the attention to the value-based software delivery is low though a continuous evolution of software development practices are presented. The literature has evidence to prove the relationship between the software delivery framework or method with the value addition, but nothing specific to the global software engineering industry in Sri Lanka. Therefore, the exploratory study was used to analyse the various software delivery methods used by the respective organisational units and the intention of using them. Further, the same analysis was used to validate the claim of the literature on the relationship between the value addition and the delivery process. Given that the results of the study assured there is a relationship between these variables, the second hypothesis was built around the software delivery process which can be tested through the public survey results.

Hypothesis 2 (H2): Delivery process has a positive impact on value addition.

4.7.3.3. Impact of Governance for Value Addition

In a typical software delivery, business and product owners create the requirements after analysing the current market needs and predicting the future demands based on the predefined assumptions which is developed and tested by the software development teams. However, governance is playing a crucial role from the concept to the customer journey to assure the respective teams are doing the right thing by defining a set of structures, processes and policies (Dubinsky *et al.*, 2011). According to Vlietland and Vliet (2015) mismatches between the structure of the business organisation and software development organisation can cause to introduce unwanted governance which can deliberately kill the value addition within the software delivery process. The same view

is upheld by Noll *et al.* (2016) and they have further argued that complex systems are at a high risk when the ownership, accountability and alignments are unclear which can lead to fail towards the end because of the erroneous implementation of governance. As Bass (2016) has clearly highlighted, the organisations should implement the right level of governance to yield the anticipated business goals are achieved. It must be aligned with the framework, sufficient and transparent. But, the shared notion of the business value is sunk within the process due to the unwanted governance when trying to enforce without the right alignment (Noll et al., 2016). Outsourcing and external party engagements would require customised set of governance guidelines which can cater to the boundaries of enterprise level relationships (Vlietland and Vliet, 2015). Given that the adherence to the prescribed development processes are mandatory to the development teams, there is no valid reason to enforce additional managerial control mechanisms the erode the value addition (Vlietland and Vliet, 2015). Hence, the determination of the right level of governance to assure the strategic alignment, value delivery, risk management and resource management are necessary for the global businesses (Schwaber and Mike, 2016). As the literature has proved that governance has an impact to the value delivery in the global businesses, it was considered during the exploratory study to assess the importance of the same for the global software engineering industry in Sri Lanka. Since the framework was tested and proven through the exploratory study, the below hypothesis was built around the governance to consider and test it though the public survey results to ensure the research objectives are achieved.

Hypothesis 3 (H3): Governance has a positive impact on value addition.

4.7.3.4. Impact of Use of Tools for Value Addition

In general, the use of tools in the software development lifecycle helps to investigate and accomplish the business processes, document them and optimise when necessary. The proper selection and use of the tools assure the outcome of the projects are productive (Jongeling, Datta and Serebrenik, 2015). According to Krishnamurthy (2016), managing the complexities in the software development requires the best tools that fits for the purpose. As he has further said, distributed teams require additional tools for communication, collaboration and control. As Haile and Altmann (2016) have highlighted, the overall software development lifecycles can be benefited from the software tools at different stages to increase the value addition. A similar view is upheld by Morin, Harrand and Fleurey (2017) where they have further argued that the right tools

can alleviate the problems of development, delivery, documentation, maintenance and operational activities as well. As they have suggested, the management control and efficient communication are crucial throughout the software delivery process to assure the value addition. Given that the software development teams are distributed and working in multiple time zones, companies should invest in buying or implementing the right tools to facilitate the teams to assure the deliveries within the timeline and budget (Chen and Dodd, 2016). Since the literature has provided sufficient evidence to prove the overall relationship between the use of tools and value addition, the same was tested through the exploratory study as well. As a result, the relationship was clear between those variables and below hypothesis was built to test it through the public survey results to confirm the relationship between the use of tools and the value addition in the global software engineering industry in Sri Lanka.

Hypothesis 4 (H4): The use of tools has a positive impact on value addition.

4.7.3.5. Impact of Technology Infrastructure for Value Addition

Technology infrastructure is a crucial component in the nowadays global businesses that helps to achieve the business goals (Bent and Dient, 2017). As the Gartner report highlighted, majority of the global businesses rely on the cutting edge technology to grow their businesses around the world to maximise their profits. According to Jeffrey and James (2013), a typical infrastructure includes hardware devices, software and network resources. However, as Islam, Jasimuddin and Hasan (2015) have argued, the technology infrastructure is no longer limited to the three basic requirements, but also important to focus on computing power, respective IT and business services, facilities, energy and power management and business continuity as well. According to Jabbouri et al. (2016), for global businesses, it is vital to have a steady and sophisticated technology infrastructure to assure the value delivery of the overall business as it plays a crucial role. As Morin, Harrand and Fleurey (2017) have argued, critical infrastructure for today's global businesses help going global as well as sustaining the business at large. Given that the technology infrastructure was a proven parameter when assuring the value addition in the global businesses, the exploratory study was used to test the same for global software engineering industry in Sri Lanka. As the results uncovered, it has a significant impact throughout the software delivery at different stages. i.e. Requirement elicitation, documentation, prioritisation, accurate presentation, development, testing, communication, deployments, maintenance, help and support, alerting, and

overall service delivery and management. Therefore, the last hypothesis was built around the technology infrastructure to be tested though the public survey results.

Hypothesis 5 (**H5**): The technology infrastructure has a positive impact on value addition. As the literature focused primarily on the generic global businesses as the focused studies about the value addition in the global software engineering in Sri Lanka was not found, the exploratory study was important. As stated in the introduction, the outcomes of a series of face-to-face interviews were utilised to conduct a comprehensive thematic analysis to validate the research framework and to formulate the hypotheses which are based upon the findings of both literature and outcomes of the exploratory study. These hypotheses were tested through the data collected from the public survey which is explained in the data analysis section and the outcomes are explained in the data representation chapter.

The next section describes the applicability of the ethics, confidentiality and identified few limitations for this study.

4.8. Ethics, Confidentiality and Limitations

As this research collects individual's perceptions and certain company related process information, it is subjected to some ethical concerns. Hence, all the data collection processes started with an acceptance from the participants where they have the option to optout at any given time if they feel uncomfortable to answer any question. Further, the participants were explained how the data is going to be used in the research process in detail. The data that was collected was used to analyse, interpret and synthesise the research problems identified to formulate a solution.

As the researcher, all the ethical considerations were captured and addressed during the research as well as after the research. It includes originality of work, honesty, integrity, carefulness, respect to the intellectual properties, confidentiality of the collected data, respect for colleagues, legal concerns, non-discrimination and privacy protection. This research does not include any person below age 18 as well as any differently abled people.

All the data that was collected during the research processes was stored in Google cloud with the right level of the security and all the documents are stored anonymously. No personal identifiable

data was collected or stored during the research process. Finally, once the research is over, all the collected data will be cleaned and discarded.

One of the key challenges was the lack of participation for the public survey. Though, it was shared with more than 1000 individuals directly via emails and social media, the rate of return was very low. But through multiple boosts and encouragements through the known parties, expected number of responses were collected.

In addition to that, access to certain reports and human resources were limited due to the restrictions imposed on COVID-19. Therefore, an additional effort was put to collect the data in the digital format which required certain approvals from hither authorities. Some precautionary measures were taken to avoid the delays in the data collection process. Such as limiting the face-to-face interviews for 40 minutes as they were conducted online, avoiding physical group discussions and having them online to test the pilot survey and finally, lifting the budget restrictions to spend some money on social media to boost the online survey to expedite the response collection process.

4.9. Summary

This chapter covered the overall research process that was used to answer the identified research questions along with the rationale for the selection of the specific procedures and techniques used to analyse the context and data, and finally to interpret them in a more meaningful way. The research approach was chosen as an exploratory at the beginning and conclusive towards the end as the research required to uncover most of the facts related to the local industry. The research setting was limited to the software product development companies that have any kind of global engagements as the research was only focusing on the global software engineering practices. The mixed method was the right fit for the given research based on the recommendations given by many authors. Therefore, rest of the research activities were decided around it. The flow of the chapter was formulated based on the exact research process used in the study where the qualitative study is discussed first then the formation of the research framework which is followed by the qualitative study. Given that the mixed method was employed, a comprehensive qualitative analysis and a quantitative analysis were carried out on the data collected through interviews and a survey, respectively. The data gathering process was clearly discussed along with the focus and intentions for questionnaire development process in detail. Initially twenty-three face to face

interviews were carried out to validate the literature findings and then the public survey was shared after conducting a pilot test. For the data analysis, only 371 responses were considered as the rest of the responses were incomplete. The analysis of the data was carried out in two phases. i.e. the qualitative analysis was initially carried out using NVivo 12 as a thematic analysis and then the survey results were analysed using SPSS 21. Primarily, regression and ANOVA were employed for this research as they were more suitable to come to the conclusions. In addition to that, all identified limitations and the mitigations approaches were discussed as well.

Chapter 05. Data Analysis and Presentation

5.1. Introduction

Once the researcher collects all the data required through the selected methods, he is ready to answer the research questions through a presentation of relevant data (Kothari, 2004). As he further has said, it includes variety of different techniques to visually present the findings through the data analysis to make the reader understand about the research aspects clearly. According to Creswell (2013), data presentation forms and integral part of an academic study and it is necessary to use the collected data effectively and interpret the same using a reliable tool to answer the research questions correctly. Therefore, presenting the data accurately and selection of the right tools for the analysis were done carefully to assure that the research questions are answered properly and unambiguously. Given the nature of this research, the mixed method was chosen as explained in the methodology chapter. Hence, this chapter provides both qualitative analysis and quantitative analysis in detail.

After forming the initial research framework, a series of face-to-face interviews were scheduled with the leaders, managers, engineers and analysts from large organisations, small and medium scale organisations and start-ups to understand their perceptions on the value addition in the global software engineering industry in Sri Lanka with respect to the variables in the framework. Convenience sampling was used to select the participants for this work and twenty-three interviews were conducted with the selected participants. A standard interview template was initially formed and the same was used with all the participants which were ultimately converted into datasheets that were required for the processing of the same. The collected data was analysed using NVivo 12 software and the findings are discussed in this chapter under the thematic analysis topic. In addition to the qualitative analysis, a quantitative analysis was carried out as well to answer the research questions through a public survey. This survey was distributed among the potential participants through the social media and directly via emails. Out of the 381 responses received within the specified time frame, 371 responses were complete, and the same dataset was considered for the analysis. SPSS version 21 was used for this analysis with alpha level of 0.05. To test the

normality of the data and internal consistency of variables Shapiro-Wilk test and Cronbatch's alpha tests were used, respectively.

This chapter discusses the complete data analysis process along with the respective results of each test. This covers both qualitative analysis and quantitative analysis along with the details of the tests that are conducted to test the reliability and validity as well. After that, it discusses the outcomes pertaining to the research objectives in detail. Finally, this provides the overall synthesis of the data analysis phase that shows how well the research objectives are met by clearly answering to the specific research questions formed.

5.2. Qualitative Data Presentation

Qualitative data consists of information about specific qualities, characteristics, information or some facts that cannot be measured. They can be texts, images, videos or any kind of visuals (Yan, 2009). According to Benesty *et al.* (2009), a qualitative analysis is very important in a research to address the how and why questions that enables a deeper understanding about the experiences and phenomena in a given context. As discussed in the methodology chapter, a qualitative analysis was mandatory for this research to collect data about the value addition specific information with respect to the identified independent variables through the literature to gain more knowledge and to verify the conceptual framework. Therefore, from the selected strata, twenty-three face-to-face interviews were carried out to collect the required data. The findings and the different methods and techniques used for the analysis are explained in this section.

5.2.1. Interview Results

All qualitative datasets were analysed using NVivo 12. A thematic analysis was conducted based on the six main themes: value addition in the global software engineering industry in Sri Lanka, effect of staffing, impact of the chosen delivery framework, impact of the governance, impact of the use of tools and impact of technology infrastructure. In addition to that, the participants were asked to share their thoughts on the overall perception about the global software engineering with respect to the benefits and different types of engagements that their organisations have used. The participants represented the people who get involved in the whole spectrum of the software development lifecycle and the leaders those who are engaged at the strategic level in both local as well as global scope. Table 9 shows the demographic characteristics of the participants.

Variable	Label	Ν	%
	Software Engineering	7	29.17%
	Product Management	3	12.50%
Discipline	Architecture	2	8.33%
	Project Management	9	37.50%
	Quality Engineering	2	8.33%
	Technical Operations	1	4.17%
	СХО	7	29.17%
Employee Category	Manager	14	58.33%
	Lead	3	12.50%
Experience	5-10	3	12.50%
	30-40	1	4.17%
	10-20	16	66.67%
	20-30	4	16.67%
	Director	5	20.83%
	CEO	2	8.33%
	MD	3	12.50%
Occupation	Architect	1	4.17%
	Manager	9	37.50%
	GM	1	4.17%
	Lead	3	12.50%
Gender	Male	19	79.17%
Gender	Female	5	20.83%
	Start-Ups	10	41.67%
Org Cluster	Small	7	29.17%
	Large	1	4.17%
	Medium	6	25.00%

 Table 9 - Demographic characteristics of the participants of the qualitative analysis

Source: Author's work based on analytical results

Few key points to note in the demographic characteristics is as follows. There were 23 participants representing more than 40% from the start-ups, nearly 30% from small scale, 25% from medium and 4% from large scale organisations. 79.17% of the participants were male and 20.83% were female participants. When their disciplines are considered, project management and software engineering disciplines were represented by the majority by contributing little more than 67% whereby all other disciplines were represented by the rest. Another key factor is that, more than 66% of the participants represented the 10-20 years' experience category which sums up to is two-third of the total sample. Table 10 shows the snapshot of the all 23 cases.

Person	Discipline	Emp Category	Exp (Yrs)	Occupation	Org Cluster	Sex
Cases\\CS - A	Software Engineering	CXO	5-10	Director	Start-Ups	Male
Cases\\CS - B	Software Engineering	CXO	30-40	CEO	Small	Male
Cases\\CS - C	Product Management	Manager	10-20	Director	Large	Male
Cases\\CS - D	Software Engineering	CXO	20-30	GM	Medium	Male
Cases\\CS - E	Architecture	Manager	10-20	Architect	Medium	Male
Cases\\CS - F	Project Management	Manager	10-20	Manager	Medium	Female
Cases\\CS - G	Architecture	Architect	10-20	Architect	Small	Male
Cases\\CS - H	Project Management	Manager	10-20	Manager	Start-Ups	Male
Cases\\CS - I	Project Management	Manager	10-20	Manager	Small	Female
Cases\\CS - J	Project Management	CXO	20-30	GM	Medium	Male
Cases\\CS - K	Project Management	Manager	10-20	Manager	Start-Ups	Female
Cases\\CS - L	Product Management	Manager	5-10	Director	Start-Ups	Male
Cases\\CS - M	Project Management	Manager	10-20	Manager	Small	Male
Cases\\CS - N	Software Engineering	CXO	20-30	MD	Medium	Male
Cases\\CS - O	Project Management	Manager	10-20	Director	Small	Male
Cases\\CS - P	Quality Engineering	Manager	10-20	Manager	Start-Ups	Male
Cases\\CS - Q	Product Management	Lead	10-20	Lead	Start-Ups	Male
Cases\\CS - R	Technical Operations	Manager	10-20	Director	Medium	Male
Cases\\CS - S	Software Engineering	Lead	5-10	Lead	Start-Ups	Female
Cases\\CS - T	Software Engineering	CXO	20-30	CEO	Small	Male
Cases\\CS - U	Software Engineering	Lead	10-20	Lead	Start-Ups	Male
Cases\\CS - V	Project Management	Manager	10-20	Manager	Start-Ups	Female
Cases\\CS - W	Quality Engineering	Manager	10-20	Manager	Small	Male
Cases\\CS - X	Project Management	Manager	10-20	Manager	Start-Ups	Male

Table 10 - Summary of the cases

Source: Author's work based on analytical results

All 23 datasheets were initially cleansed and coded into the respective themes using the auto code functionality in NVivo. The created codes were separately analysed through cross tabs and matrix queries to form the thematic framework which is shown in Figure 24.



Figure 24- Thematic framework for the interview responses

Source: Author's work

Additionally, when analysing the themes, the focus was predominantly the whole group (Vogllukasser and Puri, 2004). When analysing, a particular attention was paid to whether the different demographic groups establish any common grounds and how individuals contribute to each of these common grounds (Crump, 2007). Hence, this analysis focused heavily on the content of each interview and the dynamics of the interactions within the selected demographic groups. Below section describes the thematic analysis in detail.

5.2.2. Thematic Analysis

Once the thematic framework was established, the collected datasheets were thoroughly analysed against the selected themes. This section describes the findings of each assessment with respect to the given theme in detail.

5.2.2.1. Global Teams

Organisations have used global teams for many reasons. As the literature uncovered, primarily they are looking for the cost advantages, availability of the skilled resources, infrastructure and certainly as a strategic initiative to look for new markets as well. One of the key areas that was covered in the interview was the reason for global software engineering or having global teams. The participants highlighted few other reasons that their respective management teams have considered when selecting Sri Lanka as a development centre or their company as a vendor:

"...The management can focus on expanding their business or simply to support their customer around the clock. And sometimes they can even think of the cost factor where they can save cost by moving to countries where the human resource and infrastructure cost is low..." (General Manager, CS - D)

"...Cost is not only the factor, but also quality of work, work ethics, cost and willingness to work are key factors that people might consider when moving to other countries.." (Managing Director, CS - N)

Primarily, eight keywords were found during the interview which were highlighted by the participants. They are,

A : As a business strategy	B : Communication	C : Infrastructure
D : Low Cost	E : New Market	F : Quality of Work
G : Skilled Resources	H : Time Zone Over	lap

Table 11 shows how these specific reasons have been considered as a key factor for each organisation cluster.

	A	В	С	D	Е	F	G	Η
Org Cluster = Large	0	0	0	0	1	0	1	0
Org Cluster = Start-Ups	1	0	0	9	5	2	8	1
Org Cluster = Small	2	0	0	4	3	1	4	2
Org Cluster = Medium	0	1	1	5	1	0	4	2

Table 11- Reasons for having global teams based on the organisation cluster.

Source: Author's work based on analytical results

Primarily the cost has been the leading factor for all the organisations to consider Sri Lanka when they are building the global teams. 31 percent out of the total mentions says it is the key factor for their management to select Sri Lanka. Then, 29 percent says having skilled resources has been another important factor which is followed by having a development centre to look for new markets which counts to 17 percent. However, one of the key findings is, those who mentioned that their respective companies have signed agreements with Sri Lanka to look for new markets, no one had any local sales entity that focuses on local sales, instead their primary market was the region. As Kearney's (2018) report clearly shows, the Asia Pacific region has been a key strength for the global market that has been contributing immensely for the last decade. Hence, that can be a key factor for the organisations to consider Sri Lanka as a hub for them to implement their development centres. Other than the main three key factors, there were few mentions about the time zone overlap, and quality of work that can be taken into consideration as two other contributing factors. According to Holmstrom et al. (2016), temporal and socio-cultural related factors should be given the priority when building global teams. As this research has uncovered, organisations have focused on the opportunities than challenges when taking the initiatives to go for global teams.

To further understand the perceptions of the participants on the reasons for going global, another analysis was done based on their occupation. The result of that analysis is shown in Table 12.

	Α	В	С	D	E	F	G	Η
Occupation = CEO	1	0	0	1	1	0	1	2
Occupation = Director	1	0	0	2	1	1	3	2
Occupation = GM	0	0	1	1	0	0	1	0
Occupation = Architect	0	0	0	1	0	0	1	0
Occupation = Manager	0	0	0	8	4	1	7	0
Occupation = Lead	1	0	0	2	2	0	3	0
Occupation = MD	0	1	0	3	2	1	1	1

Table 12 - Reasons for having global teams based on the occupation.

Source: Author's work based on analytical results

According to this aspect, top level management people from the local entities takes this from a different angle by focusing on the long-term factors such as quality of work, time zone overlap, as a business strategy (Viswanath and Betz, 2015) or new market (Kearney, 2018) where the

managers, architects and leads focuses only the generic factors such as cost and availability of the skilled resources that were highlighted by the senior level managers as well. According to the report published by Laudicina (2021) based on the AtKerny findings shows that the primary reasons for the business leaders for going global relies on the holistic advantages which are aligned with the vision than the operational factors. However, availability of the resource, fully loaded cost per resource and having new markets still top the list while enough attention is paid to the strategic concerns such as quality of work, infrastructure, time zone overlaps and communication as well. Both these aspects clearly show the key factors which are specified above that are leading to consider Sri Lanka as a key centre for the businesses to consider when implementing their technology development centres as their own or through vendor contracts. Comments included,

"...Resource availability, infrastructure and quality of the work would be the first 3 priorities in my list..." (Director, CS - A)

"...Cost is the primary thing. Other than that quality of the work, delivery timelines, availability of the resources, academic background, and infrastructure as well..." (Managing director, CS - D)

The next focus is to analyse the key factors for eroding the value in the current setup and variables that have direct impact to the value addition in the global software engineering in Sri Lanka. The below sections describe each variable.

5.2.2.2. Influencing Factors for Value Erosion in the Current Practices

During the interviews, the participants were asked to name at least three key facts that they consider as key factors for eroding the value in the current practices or processes. The findings were analysed against their respective organisation clusters. Comments included,

"...We always look for improvements. Obviously, there are things that can be considered as wastes. Specially the unwanted and non-value added activities in the current process.." (Director, CS - D)

"..local management and certain service delivery related people are making unwanted paths for release approvals which wastes a lot of time. These are process overheads. We need to improve them.." (Manager, CS - F)
Table 13 shows the mentions of the respective keywords.

Keyword	Mentions	Percentage
A : Additional Governance	5	9.80%
B : Lack of Knowledge	5	9.80%
C : None	3	5.88%
D: Non-Value Based Activities	11	21.57%
E : Process Alignment Issues	2	3.92%
F : Process Overhead	18	35.29%
G : Redundant work	2	3.92%
H : Software Wastes	4	7.84%
I : Technical Incapabilities	1	1.96%

Table 13 - Value erosion factors in the current practices and processes.

Source: Author's work based on analytical results

According to the summary provided in Table 12, there are two prominent factors that have impacted all the types of the organisations to erode the value. Table 13 shows the detailed breakdown of the specific mentions in the selected organisation clusters.

Table 14 -	Value	erosion	activities	based	on the	organisation	cluster.
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	А	В	С	D	Е	F	G	Н	Ι
Org Cluster = Large	0	0	0	0	0	1	0	0	0
Org Cluster = Start-Ups	3	1	2	5	1	8	0	2	0
Org Cluster = Small	0	3	0	4	1	4	1	1	0
Org Cluster = Medium	2	1	1	2	0	5	1	1	1

Source: Author's work based on analytical results

Out of the 23 participants from all four clusters, 18 have mentioned about the process overhead which is 78.2 percent whereas 11 have mentioned about the non-value-based activities which is 47.8 percent. Other than that, additional governance and lack of knowledge on the value addition has been mentioned by 5 each which is 15.6%. The common factor across all the organisation clusters is the process overhead that has caused to erode the value. When analysing it further, start-up category has a significant issue with the process overhead and the non-value added activities in

the software delivery process. As Massaro (2015) has mentioned, frequent examination of the project management practices and fixing the internal lagging points have helped the organisations to increase their turnover by 17 percent in an average. A similar view is upheld by Haile and Altmann (2016) where they have highlighted the fact that every step in the process should have an intended purpose that contributes to the overall value delivery. Further, they argue that the software delivery processes become hectic when it consists of many non-value adding activities which has been highlighted by the interview participants as well.

"...In my opinion, overall development process has many unnecessary and non-value adding steps that we can take out..." (Manager, CS - M)

Therefore, these two key factors found in this study go hand in hand where the companies can get the real benefits by identifying the real value delivered by each activity in the process. To further analyse the delivery methods used by each organisation, the participants were asked to specifically share their thoughts on the value addition in the current delivery method they are using. The findings of that study are discussed the below section.

5.2.2.3. Impact of Delivery Frameworks for Value Addition

One common question was asked from all the participants of the interview to share their knowledge on the value delivery of the current process they are using. Except one person, all other participants have confirmed that the current process delivers some value. 65.2 percent says their process needs improvements while 47.8 percent says value is delivered at certain level, but not at all the levels:

"...I think it is not always 100% correct to say we are delivering the value, there may be areas to improve..." (Managing director, CS - N)

"...I think we deliver the maximum value, but we haven't thought of such measure to evaluate and see it..." (General manager, CS - D)

The five areas of the keywords mentioned by the participants are,

A : Lack of focus	B : Needs improvements	C : Not at all
D : Not at all levels	E : Perfectly fine	

Table 15 shows the summary of the analysis.

Table 15 - Value delivery in the current process

Keyword	Mentions	Percentage
A : Lack of focus	2	8.70%
B : Needs improvements	15	65.22%
C : Not at all	1	4.35%
D : Not at all levels	11	47.83%
E : Perfectly fine	5	21.74%

Source: Author's work based on analytical results

In addition to the two key findings which are mentioned above, 21% of the participants believe that the current framework is delivering the value they are intended. Hence, a cluster based and disciplined based analysis was also conducted to further analyse it which is shown in below two tables (Table 16 and *Source: Author's work based on analytical results*

Table 17).

Table 16 - Value delivery in the current framework based on the discipline.

Discipline	А	B	С	D	Е
Software Engineering	2	4	0	3	1
Quality Engineering	0	1	0	1	1
Project Management	0	6	0	5	1
Technical Operations	0	0	0	0	1
Architecture	0	1	1	0	1
Product Management	0	3	0	2	0

Source: Author's work based on analytical results

Table 17 - Value delivery in the current framework based on the cluster.

Organisation Cluster	Α	B	С	D	Ε
Large	0	1	0	0	0
Start-Ups	1	8	0	7	0
Small	0	5	1	3	2
Medium	1	1	0	1	3

Source: Author's work based on analytical results

Based on the analysis of both aspects, all the clusters and all the disciplines believe that respective areas need improvements to increase the value addition whatever the process they are currently practicing:

"...It is the responsibility of the respective managers to assure they do not do any non-value adding activities in their pipelines. But, in the mandated process there can be certain value draining activities which we have not evaluated much. It requires improvements..." (Manager, CS - X)

As Racheva, Daneva and Sikkel (2009) have argued, any given process has some form of value erosion activity due to three reasons: misalignment of the lifecycle steps, lack of attention, and unclear interconnection between the lifecycle steps. Therefore, to clearly understand what the root causes for above arguments are, the responses were further analysed based on two aspects: assurance of the value delivery and proactive measures taken by the respective stakeholders to assure that value is not eroded within the process as suggested by Racheva, Daneva and Sikkel (2009) and Esper *et al.* (2010). Boehm (2007) has suggested two easiest ways to evaluate the value delivery in a given framework: assess goal achievements or evaluate the customer feedback. Esper *et al.* (2010) have upheld the same argument and suggested to use the number of incidents of a given product that would help to understand if the right value is delivered to the end users. According to Lipke *et al.* (2009), projection of an outcome of a given project can depend on the meeting of the goals or deadlines and number of issues faced by the end users after a delivery. By considering all these recommendations and the responses given by the participants, below five groups were formed to do the thematic analysis. Other than that, pilot programs have been used by certain organisations to validate their value delivery as well.

A : Customer Feedback	B : Goals Achievements	C : Incidents
D : None	E : Pilot Program	

All the responses were tagged into the above themes and the initial analysis was done based on the respective organisation cluster.

Table 18 shows the outcome of it.

Cluster	Α	В	C	D	Ε
Large	0	1	0	0	0
Start-Ups	5	8	2	0	1
Small	3	3	1	0	2
Medium	2	2	0	1	1
Total	10	14	3	1	4
Percentage	43.48%	60.87%	13.04%	4.35%	17.39%

Table 18 - Validation methods for value delivery in the current framework by organisation cluster

Source: Author's work based on analytical results

It was found that all the organisations in all four cluster heavily depend on the delivery goals set for the given software delivery. In addition to that, for software deliveries, several organisations have defined their own goals to be evaluated quarterly, bi-annually and annually. As Lipke *et al.*(2009) have argued, three primary goals are set for software development teams: deliver on time, keep the quality high and meet the stated project requirements. A similar view is upheld by Baiden and Price (2011) where they have proposed a results based evaluation approach for both strategic ad tactic level goals that can assure the value delivery at each level. However, based on the findings of this study, 60.87% depends on the goals whereas 43.48% depends on the customer feedback and altogether, 89.01% depends on either feedback or goals. Hence, all the participants except one from all the clusters have confirmed that they are currently using some form of a technique to evaluate their current processes. To analyse this further and understand the below exercise was done with respect to the proactive measures.

As Baiden and Price (2011) have pointed out, there is a 27% of a chance that value delivery is assured when teams are using proactive measures to assure the value delivery. As they have further explained, the method used by the respective companies depends on the delivery framework they have chosen and discipline. Murtazaev *et al.* (2010) have upheld the same view and highlighted the importance of setting guidelines for the delivery teams to follow to avoid the post issues. Based on the literature findings as well as the keywords found in the interview results, responses were categorised into the following themes and Table 19 shows the summary of it.

- A : Depends on Feedback B : Depends on retrospectives C : None
- D : Not proactive, but reactive E : Process Mapping
- F: Value Stream Mapping

Table 19 - Validation Method for value delivery by discipline

Discipline	Α	В	С	D	E	F
Software Engineering	2	2	3	1	1	0
Quality Engineering	1	1	1	1	1	1
Project Management	2	2	3	2	1	1
Technical Operations	0	0	1	0	0	0
Architecture	0	1	0	1	0	0
Product Management	0	1	2	0	0	0
Total	5	7	10	5	3	2
Percentage	21.74%	30.43%	43.48%	21.74%	13.04%	8.70%

Source: Author's work based on analytical results

43.48 percent have said that they are not using any proactive measures to validate their software delivery framework, instead primarily depends on either retrospective or delivery goals. 30.43 percent have confirmed that they are using retrospective to evaluate the value delivery:

"...We do two things: proactive measures and reactive measures. We do process accounting by giving some points and convert it to the monetary values. So, we can easily understand what elements can contribute positively and negatively as well.." (Manager, CS - W)

"... Teams depend on the retrospective to understand if the intended value is delivered..." (Lead, CS - S)

In summary, the right selection of the delivery framework, use of both proactive and reactive measure to evaluate the value delivery, continuous focus to improve the value delivery through proper evaluations, mapping software delivery to the respective value streams and finally, assuring the interconnection between the steps in the delivery framework have been identified as key drivers for the value addition with respect to the software delivery framework in the context of global software engineering. The next focus was to identify the governance practices used by the respective organisation in Sri Lanka and to understand the impact of the different practices for the overall value addition. Following section describes the findings of the analysis.

5.2.2.4. Impact of Governance for Value Addition

As Dubinsky et al. (2011) have pointed out, organisations cannot avoid adapting to the new techniques, improving the current practices of the system deliveries and implementing improved control frameworks in a typical software delivery lifecycle. But, as they have further argued, majority of the organisation fail to do them because of the structural issues and in particular mismatches at the interface between business organisations and the software development entities as the value delivery component is not clearly visible across the board. As Vlietland and Vliet (2015) have argued, to yield the business value and to mitigate the risk any organisation should set the right structures, processes and policies by which the software development teams is intended to follow. But, the concept of using the governance in the context of software development has been often erroneously understood and used by implementing regulatory compliance guidelines which erode the value addition within the development process itself as well as deployment and maintenance phases as they have further argued. Hence, Dubinsky et al. (2011) have suggested to align the interest and practices to the intended business unit's objectives to achieve the overall business goals. Therefore, the participants of the interviews were asked to share the respective governance practices that they have implemented within their organisations as well as to share their experiences about implementing the same with respect to the value addition in their respective businesses:

"...Governance board is very common now in many businesses because it is important to have it. But, I do not say all the processes and governance will help..." (Director, CS - R)

The perception about the governance was the first question and below keywords found in the outcomes of the interview.

A : Any Level Eroding Value	B : Killing Autonomy	C : Neutral
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D : Right Level Adding Value E : Subjective

It was visible that the perception about implementing governance varies based on the size of the organisation as well as the discipline. Table 20 shows the cluster wise findings.

Table 20 - Perception about implementing governance - cluster wise

Organisation Cluster	Α	B	С	D	E
Large	0	0	0	1	0

Start-Ups	3	1	1	6	3
Small	1	1	0	5	1
Medium	2	0	1	4	0
Total	6	2	2	16	4
Percentage	26.09%	8.70%	8.70%	69.57%	17.39%

Source: Author's work based on analytical results

In general, 69.75 percent believes that right level of the governance can add value to the overall software delivery. 26.09 percent believes that any form of governance can erode the value. However, a deviation was seen within the clusters as well. 57.14 percent and 62.5 percent of those who are from the medium and small organisations believe that governance is needed while 58% of the start-up representatives believe that governance erodes the value addition. Among them, 37.4 percent believes that the governance can kill the autonomy of the teams. As Dubinsky *et al.* (2011) have said, the organisations are looking for implementing policies with their growth and that argument is clearly proven with the results of this study. However, implementing governance with global teams and collocated teams require a proper analysis of the respective workstyles, culture, internal policies and formation of the teams as Bass (2016) has stated. Hence, a follow up question was asked from the participants to share their opinion on implementing governance for the global teams. The responses were evaluated based on the respective disciplines that they are representing.

First, they were asked to answer the question "Do you think any additional governance is needed to manage the global teams?" and responses are below (Table 21).

	No	Yes	May be
Discipline = Software Engineering	2	3	1
Discipline = Quality Engineering	0	2	0
Discipline = Project Management	1	7	1
Discipline = Technical Operations	0	1	0
Discipline = Architecture	1	0	0
Discipline = Product Management	2	1	1
Total	6	14	3
Percentage	26.09%	60.87%	13.04%

Table 21 - Additional governance for global teams

Source: Author's work based on analytical results

According to the findings, 60.87 percent says that additional governing protocols are needed to manage the global teams due to various reasons which are mentioned in the below table.

"...Some additional elements are needed. One thing could be defining the SLAs for communications when you have teams in multiple time zones. Otherwise, we cannot do our work productively.." (Manager, CS - W)

"...When you have multi-cultural people those who work for the same organisation in different countries, you might need additional processes..." (Director, CS - O)

However, out of the 6 people who have said no, 4 people are from software engineering and product management disciplines. 50 percent of the yeses have come from project management discipline. Noll *et al.* (2016) have highlighted a similar concept where they argue that project management and leadership want additional processes while the engineers and architects did not show any interest towards introducing any additional gates to the standard processes for global teams. A similar result was found in this analysis as well. The follow up question was to understand why they believe their argument on the governance is accurate. When categorising the answers, below key themes were found.

- A : Additional Elements Needed B : Authoritative Protocols
- C : Communication Protocols D : Culture Specific Protocols
- E : Guidelines to Follow

Primarily, participants have highlighted the importance of having certain guidelines which are specific to the respective cultures and that can be added as an additional element to the current process they are following. However, leaders and project management groups see the importance of having a common communication protocol to assure responsiveness as they have seen a huge gap. 39.13 percent has said that a guideline is enough than implementing additional protocols. However, 82.6 percent of the project managers believe that without a proper governance protocol, it is hard to manage the global teams. As Bass (2016) has argued, all the artefacts in the general governance protocols do not help the organisations to implement successful structures, instead tailor made solutions should be implemented keeping the cultural specific issues, communication gaps, authoritative structures and time zone gaps. Table 22 shows the summary of the findings

about implementation of governance for the global teams based on the five key areas mentioned above.

	Α	B	С	D	Ε
Discipline = Software Engineering	4	1	2	4	2
Discipline = Quality Engineering	2	0	0	1	0
Discipline = Project Management	4	2	2	6	5
Discipline = Technical Operations	1	0	0	0	1
Discipline = Architecture	0	0	0	0	1
Discipline = Product Management	1	0	0	0	0
Total	12	3	4	11	9
Percentage	52.17	13.04	17.39	47.83	39.13

Table 22 - Implementing governance for global teams - discipline wise

Source: Author's work based on analytical results

When this is deeply analysed, it was identified that start-ups and small organisations do not heavily focus on implementing additional elements, instead 83.4 percent in that category says that communication protocols and a guideline is sufficient to operate effectively. Another key aspect of the governance is the release approval process. As the statistics shown, start-up and small organisations do not use any specific approval paths, instead the teams are empowered to make their own decisions when releasing a product or feature to the production whereas medium and large organisations insist the importance of a governing body for the release approvals. However as Jabbouri *et al.* (2016) have said, selection of the governing body and definition of the rights of them should be company specific. Given that, 8 out of the 11 medium and large organisations are using the standards practices, the value delivery could be limited due to the limitations within those practices. However, encouraging the team collaboration and limiting the number of gatekeepers in the delivery process can save a significant amount of time and increase the value delivery (Noll *et al.*, 2016).

In summary, right amount of the governance is needed for any kind of organisation when they are working with distributed teams to assure the right value is delivered to the stakeholders. But tailormade solutions are needed that addresses the culture specific challenges to ensure that additional guidelines or protocols do not erode the value. The other important area that was taken into consideration is the use of tools. Below section describes the focus areas along with the findings from the interviews.

5.2.2.5. Impact of Use of Tools for Value Addition

Participants were given an option to share their opinion on the use of tools for value addition in the software development lifecycle in general and responses were tagged into two themes below.

A : Adding Value B : Eroding Value

Table 23 shows the outcome of the analysis based on their organisation cluster.

Table 23 - Impact of use of tools for value addition - cluster wise

	Α	B
Org Cluster = Large	1	0
Cluster = Start-Ups	9	1
Org Cluster = Small	6	0
Org Cluster = Medium	6	0
Total	22	1
Percentage	95.65%	4.35%

Source: Author's work based on analytical results

Out of the 23 participants, 22 have confirmed that use of tools for software development has a direct impact to the value addition:

"... Tool selection is very important for distributed teams as it is directly contributing to the value addition.." (Managing director, CS - N)

As Singer *et al.* (2010) have shown in their study, several tools are used by software development companies based on the nature of the software they develop, cost of the applications, skills of the employees and availability of alternative solutions. According to Krishnamurthy (2016), computer aided software development tools are selected based on the relevance, but his study shows that more than 57 percent of the small and medium level companies have failed to choose right tool due to the cost considerations.

Comments included,

"...The basic tools are in place, but we need to further evaluate it and select better tools across the development pipeline..." (Director, CS - O)

"...In our case we are using many drawing tools, prototyping tools and project management tools as well..." (Lead, CS - Q)

Further, his study results show that organisations have paid more attention to the communication, infrastructure and project management tool by forgetting all other important aspects of the whole spectrum of software development. Considering the mismatches between the ideas, the participants were asked to share their opinion on what kinds of tools would add value to the overall software development practices. The responses were categorised into the below themes and analysed against their respective organisation cluster.

A : Automation Tools	B : CASE Tools	C : Communication Tools
D : CRM	E : Infrastructure	F : Monitoring Tools

G: Project Management Tools

The findings were tagged into the above themes and the analysis was carried out. Table 24 shows the outcome.

1 able 24 - Use of tools for value addition - organisation cluster wi	Table 24 -	Use of tool	s for value	addition -	organisation	cluster w	ise
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	A	В	С	D	Е	F	G
Org Cluster = Large	2	1	1	0	0	1	1
Cluster = Start-Ups	0	4	3	1	0	3	4
Org Cluster = Small	0	3	4	0	1	2	4
Org Cluster = Medium	1	1	3	0	1	0	3
Total	3	9	11	1	2	6	12
Percentage	13.04%	39.13%	47.83%	4.35%	8.70%	26.09%	52.17%

Source: Author's work based on analytical results

Based on the data in the above table, 52.17 percent believes that project management tools directly add value whereas 47.83 percent believes that communication tools can add value. As Krishnamurthy (2016) has suggested, more than 87 percent of the companies that he had picked for his study in India has spent money on project management tools. Similar pattern could be found here as well where majority believes in having project management tools can add value. Another factor is that people from all the clusters believe computer aided software engineering tools (CASE tools) can add value to the overall delivery. But, though Gartner's (2019) report shows that the automation gives the edge within the next decade, it was not highlighted in the interview findings. However, large and medium scale companies strongly believe in having automation helps to add more value. According to Jongeling, Datta and Serebrenik (2015), the focus of the start-ups and

the small scale organisations heavily focus on the quick deliveries and it was very rare that those organisations focused on acquiring tools for automation, monitoring and customer relationship management which was clearly seen in this study as well. However, to further analyse the perception on the use of tools for value addition, another analysis was carried out to check if all disciplines believe that they are using the right tools which is shown in the below table (Refer Table 25). They were given the options mentioned below.

A : Using right tools B: Wrong tools C: Need better tools

Table 25 - Using the right tools - discipline wise

	Α	В	С
Discipline = Software Engineering	6	1	4
Discipline = Quality Engineering	1	4	4
Discipline = Project Management	5	1	3
Discipline = Technical Operations	1	0	1
Discipline = Architecture	1	1	1
Discipline = Product Management	1	2	3
Total	15	9	16
Percentage	65.22%	39.13%	69.57%

Source: Author's work based on analytical results

One key finding of this analysis is the wrong use of the tools in the quality engineering aspects. Out of the 5 mentions, 4 of them have confirmed they are not using the right tools. As mentioned above, though the organisations do not pay more attention to the respective disciplines, specialised people in those areas believe in having the right tools can add more value to the stakeholders. Another important aspect is 69.57 percent in the selected audience believe that there are better tools though current tools meet their expectations. But software engineering and project management teams have confirmed that the current toolset help them to deliver the intended value. However, they have agreed that there are better tools that can be used as well.

One other key area that was highlighted by the participants was the reliability of the tools they are using. According to the people those who represented project management discipline, their companies select the tools based on the cost, but not how reliable they are. A similar view is upheld by the software engineering participants as well. However, as Krishnamurthy (2016) has said, a crucial factor for the evaluation of the tools is the reliability. In addition to that he has provided three more aspects which are related to the reliability. i.e. ability customise, after sales support and easy to use.

Comments included,

"... Our management has listed the tools that teams can use, therefore we have to choose one out of them.." (Lead, CS - Q)

"... We need a better mechanism to evaluate if we are using right tools, in my opinion we have many unreliable tools.." (Manager, CS - V)

"... Since we are a start-up company, we have the freedom to choose the tools, but we do not have a proper mechanism to evaluate them.." (Manager, CS - P)

In summary, the participants have agreed that use of tools have a direct impact to the overall value addition in the software development process. Key findings are, having right tools helps the people to add more value, selection of the tools should be based on the relevance than the cost and availability, start-ups and small-scale organisations do not focus much on having automation tools and last, all disciplines believe that there are better tools to increase the value addition. Hence, right focus for the selection tools can directly impact to the value addition in the global software engineering industry in Sri Lanka.

The below section focuses on identifying the key themes and specific keywords with respect the people aspect.

5.2.2.6. Impact of Staffing for Value Addition

People play a crucial role when delivering value to the stakeholders(Johnson, 2015). But, how they have been organised into the respective segments in the value map can either add value or erode value (Haile and Altmann, 2016). In a typical software development pipeline, there are billable and non-billable, development and service based or engineering and management categories based on the nature of the organisation (Haile and Altmann, 2016). According to Udawatta *et al.* (2019), a key challenge in integrating the software development teams with the business unit is the range of duties and how they vary from one department to the other. A common ground for the value addition has become a nightmare due to the typical and known challenges within the software development companies. However, as both Johnson (2015) and Udawatta *et al.* (2019) argued,

proper alignment of people to the value streams have made a significant impact to the value addition in the overall delivery. Therefore, the participants of the interviews were asked to share people specific challenges when delivering value:

"...We have development teams and quality teams separately. They are not aligned to the product or specific projects. They work on the priorities set by the project managers. But, I am sure it is based on the project needs, not value stream." (Lead, CS - Q)

"... We have both large and small teams and we frequently change them when deliveries get impacted. None of them are value stream based." (Manager, CS - V)

A comprehensive analysis was done to identify the key themes with respect the staffing and arrangement of the teams to maximise the value delivery. Initially, they were questioned on the formation of the teams. The keywords found in the interviews are,

A : Large Teams	B : Non-Value Stream Based	C : On Site
D : Product Based	E : Small Teams	F : Value Stream Based

To further understand how the formation of the teams vary with the size of the company, a detailed analysis was conducted based on the cluster which is shown in Table 26.

	Α	B	С	D	E	F
Org Cluster = Large	1	1	0	1	1	0
Org Cluster = Start-Ups	6	7	0	6	1	1
Org Cluster = Small	1	4	1	5	3	2
Org Cluster = Medium	1	3	0	5	6	3
Total	9	15	1	17	11	6
Percentage	39.13%	65.22%	4.35%	73.91%	47.83%	26.09%

Table 26 - Formation of the teams - cluster wise

Source: Author's work based on analytical results

In given context, 73.91 percent says that their teams are organised based on the product needs and 65.22 percent has confirmed that those are not value stream based. When the numbers are analysed further, primarily the start-up companies have built large teams while other clusters focus on building small teams. As Petersen (2015) has said, responsiveness to the customer is a key measure in the software development world, but 78 percent of the participants of his study has not even had the basic knowledge about their customer queries or problems due the team formation of those

respective organisations. He has further pointed out that, the size the team should depend on the outcomes or return on investment of the respective products, but not only the urgency of the delivery. According to Ruiz-De, Patxi and Jordi (2013), 16 out of the 22 companies that they had chosen for their study have been following the traditional cost accounting techniques to evaluate the project outcomes which is not appropriate based on their findings. Further, they have argued that the value stream costing (VSC) is more suitable for the software organisations as there are visible differences in the software development companies against a typical manufacturing company. However, this study shows that only 26.09 percent has only considered the value streambased teams where others have built their teams based on specific project requirements. When start-up companies are considered, as Siyam et al. (2015) have pointed out, they primarily have a single value stream though they do not map it to the resources. A similar view is upheld by Tyagi et al. (2015) and they have further argued that planning, designing, creating, implementing, and finally marketing of a product for the start up companies are considered as a single journey and they measure the outcomes towards the end of the project by assuring the product is breakeven within the specified time frame. However, they have argued that for established organisations quality of the outcome and system performance do matter and product delivery highly focuses on them. Therefore, identifying and exploring the wastes, inefficiencies and non-value-added activities in the current product development process and addressing them through a proper value stream mapping solves the key issues as development teams can be organised based on the needs of the respective value streams.

Based on this study, 47.83 percent says that they have small teams, but project based. According to a study carried out by Franco, Hirama and Carvalho (2018) on applying system dynamics approach in software and information systems project has shown that more than 67 percent of the small teams which are non-value-stream based have failed to produce the intended results. They have highlighted four reasons as the probable root causes: improper resource mapping, gaps in the requirement engineering, issues in the interconnection of the product development phases and finally, the lack of continuous control and monitoring. Based on Paredes-Valverde *et al.* (2018), mostly the companies failed due to the lack of attention to the details in the human resource selection for a given project. Therefore, a proper mapping of the resources with the respective value streams using a proper decision support system is what they have suggested for software companies. However, focusing on people, constraints, skill requirements and proper combination

of those resources are crucial to assure the value addition in the overall software delivery process (Eeckhout, Maenhout and Vanhoucke, 2019).

In summary, mainly the software development teams have been organised based on the project needs than the actual value delivery irrespective of the cluster or discipline. Priority has been given to the delivery timelines than the delivery goals. Primarily, the start-up companies have focused on building large teams focusing on the product outcomes with the least amount of focus for the actual return on investments. But small, medium and large-scale companies have built small teams which are cross-functional to achieve the delivery objectives. According to the outcome of the study, attention to the formation of the teams based on the actual value delivery is lacking in the global software engineering industry in Sri Lanka.

Another key area of focus of this study was to identify the impact of technology infrastructure for delivering value in the global software engineering industry in Sri Lanka. Following section describes the findings of the interviews with respect that topic.

5.2.2.7. Impact of Technology Infrastructure for Value Addition

As the literature findings uncovered, technology infrastructure plays a background role to facilitate any form of production companies to assure their value delivery. Therefore, the impact of the technology infrastructure for software specific needs was carefully considered in the interviews to understand the real need of it to increase the value addition. Primarily the participants were asked if they consider this as a key factor for value addition, if so, how well their organisations have provided the necessary infrastructure. In addition to that, participants were asked to wider the scope to the country level as well to understand if there are misalignments in the larger scope. This section provides the detailed outcome of the analysis related to the technology infrastructure.

The initially analysis was done based on the specific organisation cluster and responses were tagged and analysed based on the below themes which were taken from the keywords provided by the participants. Unanimously, everyone has agreed that technology infrastructure is a must for software development companies:

"...It is a key area that everyone understands that how important is it. If the right infrastructure is there, it definitely contributes to the value delivery..."(Director, CS-R)

"...Technology infrastructure has become a must have now. Even during the last few months we all experienced it. Without it we cannot deliver any value. It is the platform or the medium.." (Manager, CS - F)

20 out of 23 participants have confirmed that having the proper technology infrastructure increases the value addition. Table 27 shows the outcome based on the two key questions asked.

A : Highly value adding

B : Must have

	A	B
Org Cluster = Large	1	1
Org Cluster = Start-Ups	8	10
Org Cluster = Small	6	6
Org Cluster = Medium	5	6
Total	20	23
Percentage	86.96%	100.00%

Table 27 - Technology infrastructure for value addition - cluster wise

Source: Author's work based on analytical results

As Eeckhout, Maenhout and Vanhoucke (2019) argued, scheduling of the project activities and carrying out the tasks need a continuous attention to the constraints, assumptions and resources. The resources cover both human and non-human. According to them, key constraints related to the infrastructure are cost, availability and quality. According to Islam, Jasimuddin and Hasan (2015), knowledge sharing plays a crucial role in the software development process as the concepts could be born in one part of the world, but it could be used in the other part of the world. Therefore, having human resources to bridge the gaps in the knowledge is no longer practical. Another argument that Jabbouri *et al.* (2016) have provided is, software development process involves technology infrastructure at different stages in different gravities. i.e. hardware infrastructure, devices, testing environments, production environments, test beds, and even virtual infrastructure. According to them, infrastructure needs should be carefully identified based on the product needs where minimum required facilities are provided for the teams to carry out their respective activities without any blockers. When it comes global software engineering, teams are distributed and working in different time zones. Therefore, challenges in the global setup are greater and a considerable effort and money should be spent on the required infrastructure. Therefore, as Jeffrey

and James (2013) have highlighted, the attention to the technology infrastructure has been insignificant due to three reasons: lack of knowledge, cost and status quo.

As multiple disciplines get involved in the general software development process, the participants' responses were further analysed based on their respective disciplines. Table 28 shows the analysis findings based on the three themes below.

A : Expensive	B : Lack of focus	C : Needs to improve
---------------	-------------------	----------------------

	Α	B	С
Discipline = Software Engineering	3	6	6
Discipline = Quality Engineering	1	4	5
Discipline = Project Management	4	5	5
Discipline = Technical Operations	1	1	1
Discipline = Architecture	1	1	1
Discipline = Product Management	3	2	3
Total	13	19	21
Percentage	56.52%	82.61%	91.30%

Table 28 - Technology infrastructure for value addition - discipline wise

Source: Author's work based on analytical results

This analysis proves that the focus for building the required infrastructure is very low where 82.61 percent has confirmed in their responses. In addition to that, 21 out of 23 responses have mentioned that the infrastructure should be improved to deliver more value to the stakeholders. However, the organisation cluster wise analysis shows that 82 percent of the start-up category does not believe that the infrastructure is expensive and needs improvements, but overall 56.52 percent believes that the cost of technology infrastructure is expensive. Therefore, technology infrastructure requires more attention to increase the overall value addition as Jabbouri *et al.* (2016) have argued.

In summary, technology infrastructure was initially considered as a moderating variable based on the generic literature, but the software development specific survey shows that it is an independent variable which needs more attention from the software development organisations to increase the overall value addition in the global software engineering industry in Sri Lanka.

5.2.2.8. Value Addition in Global Software Engineering Industry in Sri Lanka

The value addition in the global software engineering industry depends on five variables: delivery framework, staffing, use of tools, governance and technology infrastructure. As the study has

uncovered, each variable is contributing in different scales to increase the value addition. As the below table shows, the participants have provided their responses about the value-based software engineering which are tagged into four main areas mentioned below.

A : At business level

B : Frequently at all levels

C : Lack of focus

D : Only at lower level

E : Not at all

The participants were asked if they use value-based software engineering concepts in their regular software development lifecycle. The outcome is as follows (Refer Table 29).

	Α	В	С	D	Ε
Org Cluster = Large	1	0	1	0	0
Org Cluster = Start-Ups	1	0	5	0	7
Org Cluster = Small	1	1	6	0	4
Org Cluster = Medium	1	0	4	1	3
Total	4	1	16	1	14
Percentage	17.39%	4.35%	69.57%	4.35%	60.87%

Table 29 - Usage of value-based software engineering - cluster wise

Source: Author's work based on analytical results

The organisations that have considered the value addition at any level sums up to 26.09 percent whereas 74.81 says they have not considered it. When the start-ups are considered, they have neither focused nor known how they should be moving from value-neutral software engineering to value-based software engineering. All four clusters' representatives agree that their respective organisation have not paid enough attention to apply value-based software engineering.

Comments included,

"...If any organisation wants to deliver the value to its stakeholders, the key is to assure that value is clearly communicated and assured throughout the process. Non-value based software engineering practices have impacted the overall value delivery immensely..." (CEO, CS - T)

"...Value neutrality in most of the aspects of the software delivery has a direct impact to the overall value delivery.." (General manager, CS - J)

As Jabbouri *et al.* (2016) say, business cases in the technology development companies does not consist of the fact of value with the stated requirements, instead the outcomes are bound around short-term goals. The risk of having a lack of focus for the value delivery at each level is the negative impact that makes for the long-term sustainability of the business (Chen and Dodd, 2016). Though business leaders have tried out several options to accommodate value addition somehow to the respective strategic business units of software development, those attempts have been failed due to the wrong implications of the value-neutral software engineering practices. To integrate value into the respective actions within the software delivery pipeline, all key areas should be practicing the value-based software engineering (Schwaber and Mike, 2016). This analysis has shown that the focus of the leaders in the global software engineering industry in Sri Lanka has been insignificant to accommodate the value-based industry practices to increase the overall value addition. However, as Morin, Harrand and Fleurey (2017) technology has advanced in various aspects, the processes in the current setup requires significant changes to accommodate the benefits without letting the policies to remain them with the traditional practices.

With the introduction of the smart devices, the daily controlling and monitoring abilities have gone up (Whittle, 2019). Assurance of the interconnection between each step in the pipeline and providing necessary quick actions to unblock the teams have become normal in today's world (Morin, Harrand and Fleurey, 2017). If any company does not focus on understanding the big picture, can fail in the long-run due to the lack of focus for the important aspects of the overall delivery. As Whittle (2019) has further argued, all the internal processes should be interlinked and every step in the process should have a meaning which should be understood by the respective stakeholder. However, this study showed that a major revamp is needed to support the global software engineering companies to maintain a proper interconnection between the steps and to remove unwanted activities within the processes. As mentioned above, 13 out of 23 participants agree that there are gaps exists in the current processes and 17 out of 23 have said they have not considered the importance of considering the interconnection between steps.

According to the responses, 56.52 percent says that the lack of involvement of the managers in the value related decisions have led the organisations to add unwanted steps into the pipelines:

"..If the respective managers do not understand the intended value, it is not easy to assure the value delivery. But, unfortunately our managers do not get the opportunity to contribute it effectively as they are involved at the last stages.." (Manager, CS - K)

As the below table shows, forming the teams and managing them effectively by letting the immediate supervisors to well aware about the respective activities along with value delivery, makes the processes more efficient that leads to add more value to the stakeholders. The responses for the question "when the immediate supervisor gets an opportunity involve in the value related decisions?" have given the following themes.

A : At business level B : Frequently	C : Lack of involvement
--------------------------------------	-------------------------

D : No involvement E : Only at lower level

The findings were analysed based on each discipline as managers represent each department or the discipline. The findings are as follows (Refer Table 30).

	Α	B	D	E	F
Discipline = Software Engineering	1	2	5	0	2
Discipline = Quality Engineering	0	1	1	0	2
Discipline = Project Management	0	5	3	1	9
Discipline = Technical Operations	0	0	1	0	1
Discipline = Architecture	1	0	2	0	0
Discipline = Product Management	1	0	1	1	0
Total	3	8	13	2	14
Percentage	13.04%	34.78%	56.52%	8.70%	60.87%

Table 30 - Involvement of the managers in value related decisions - discipline wise

Source: Author's work based on analytical results

These findings show that leaders who represent software engineering, architecture and product management get the opportunity to get involved at the business level, so that they are aware about the value of a given activity. However, that 56.52 percent says that the involvement of the managers is lacking, and 60.87 percent says they are only getting involved at the lower level. As Whittle (2019) says, the responsibility of the managers is to understand the value of each and every activity, requirement, change or product upfront and align the teams, infrastructure, tools and process to meet the intended results towards the end. However, given that the opportunity for the managers in the local context do not get a chance to get involved in the initial stages of the product

development activities, the assurance of the value delivery becomes a tedious task. According to the results, certain managers do not get involved at all in the decision making process. When analysing this further with the respective organisation cluster, large organisations and medium level organisation do not allow the local managers to participate in the business requirement grooming sessions. However, start-ups and small level organisations have that luxury to get the respective stakeholders from the beginning.

According to Morin, Harrand and Fleurey (2017), there is no any common model that works fits for all types of global teams. However, as they have argued, unnecessary governance has limited the people's engagement in the casual setup which kills the collaboration of the teams. However, any form of reductions in the blame game and over the wall responsibility transfers definitely adds value to the overall delivery as they have shown.

The other key area that requires attention is the selection, usage and maintenance of the right toolset that can be used from the concept to the customer flow:

"...Organisation can give a standard framework, but the teams should have the freedom to select the right tools to assure they are adding the right value.." (Lead, CS - Q)

As shown above in the tools section, companies are heavily focusing on the development and project management tools. As Faily and Lyle (2013) have argued, the tools covers the whole spectrum of the software development lifecycle and right selection of the tools helps the organisations to maximise the overall value delivery by removing the effort duplicates, unnecessary gatekeepers, process overheads and unnecessary manual work. Therefore, as this study has shown, the global software engineering industry needs to pay more attention to the right use of the tools than fearing it.

Finally, this study showed that local industries along with the global management have not paid enough attention to facilitate the development and operations team with the right technology infrastructure to expedite the software delivery process:

"... Given that our senior management understand the value of having right infrastructure, we can add more value in day to day basis..." (Manager, CS - M) Though the global teams need certain basic infrastructure in place, there are limitations at the country level as well as the company level. Cost of the infrastructure and unavailability of the infrastructure are two key issues highlighted by the participants. As Jabbouri *et al.* (2016) have highlighted, the productivity and innovation are killed due to the limitations in the technology infrastructure as the effort of the individuals are put to solve the problems in the infrastructure while leaving the critical software development activities aside. Therefore, right attention and focus for providing the technology infrastructure directly contributes to the value addition to the overall software development and delivery process.

In summary, this study clearly shows and proves that the value addition in the global software engineering industry in Sri Lanka depends on the selected software development framework, effective use of tools, right governance, proper arrangements in the human resources and the effective use of the technology infrastructure.

5.3. Quantitative Data Presentation

As defined by Hardy and Bryman (2009), quantitative analysis is a technique that uses statistical and mathematical measurements and modelling techniques in research to understand specific behaviours which is represented by numeric values. According to Darlington and Hayes (2016), it provides tools to examine and understand the past, current and anticipated future with respect to a given research domain in quantifiable and measurable ways. A properly analysed dataset helps the researcher to come to meaningful conclusions with solid arguments that can be used to predict and shape the future (Austin and Merlo, 2017).

As part of the data collection, a public survey was shared online through emails and social media with a larger audience to collect their perception on the value addition in the global software engineering industry in Sri Lanka. 383 responses were received within the given timeframe which was used for this analysis. Below sections describe the analyses, tools and techniques that are employed for this analysis along with the rationale for each of them in detail.

5.3.1. Descriptive Statistics

Descriptive statistics are primarily used to describe the basic features of the data in a particular study which provides a simple summary about the samples and the specific measures (Hardy and Bryman, 2009). According to Darlington and Hayes (2016), in research, there are lots of measure

or large number of people are measured on different kinds of measures, but descriptive statistics are used to present quantitative descriptions in a manageable form. Therefore, this section provides a high-level explanation about the collected data.

Out of the 383 responses received, 371 was considered for this analysis as twelve responses had to be discarded since they were incorrectly filled. The convenient sampling technique was used, and the collected data was analysed using SPSS version 21 with an alpha level 0.05. Internal consistency was tested using Cronbatch's alpha among the Likert scale items before creating the variables which is followed by a descriptive assessment. Then, Pearson correlation was used to analyse the correlation between the identified variables. To test normality of data, Shapiro-Wilk test was conducted. Simple descriptive statistics were used to analyse the demographical data. Multiple regression analysis was applied to predict the value addition based on the independent variables identified through the literature and tested through the qualitative analysis earlier. Finally, Analysis of Variance (ANOVA) was used identify the interaction between the value addition in the global software engineering industry in Sri Lanka with the individual variables in detail. The research objectives are addressed through a comprehensive regression analysis which was tested through multiple validation tests.

Table 31 shows the descriptive statistics of the respondents.

	Statistics								
		Business Nature	Target Customers	Size of the organisation	Discipline				
N	Valid	371	371	371	371				
	Missing	0	0	0	0				
Std. Dev	/iation	.984	.437	1.064	2.034				
Skewne	SS	375	-1.061	.457	153				
Std. Error of Skewness		.127	.127	.127	.127				

Statistics

Source: Analytical results

The survey was shared with potential respondents from various companies that represent multiple disciplines those who play different roles in the companies that has global engagements in Sri

Lanka. The summary of each category of the respondents against their characteristics are illustrated in Table 32. Detailed analysis results can be found in the Appendix.

Section	Category	Frequency	Percent	Cumulative
				Percent
Business Nature	Product-based company	142	38.3	38.3
	Service-based company	9	2.4	40.7
	Both product and service	215	58.0	98.7
	Operations	5	1.3	100
	Total	371	100.0	
Target customers	Local and global	89	24.0	24.0
	Global	282	76.0	100
	Total	371	100.0	
Size of the	1-25	36	9.7	9.7
organisation	26-100	141	38.0	47.7
	101 - 500	112	30.2	77.9
	501 - 1000	55	14.8	92.7
	1000+	27	7.3	100
	Total	371	100.0	
Discipline	Software Engineering	69	18.6	18.6
	Leader / Manager	26	7.0	25.6
	Quality Engineering	89	24.0	49.9
	Project Management	117	31.5	81.4
	Technical Operations	12	3.2	84.6
	Architecture	37	10.0	94.6
	PRDM / BA	20	5.4	100
	Total	371	100.0	

Table	32 -	Descri	ptive	statistics	of the	respondents
I GOIO		200011		Statistics	01 1110	respondences

Source: Compiled by the author based on the descriptive statistics results

Product companies and both product and service companies dominate with 96.3 percent whereas all the participants are having a global relationship. 68.2 percent are from medium level organisations and the rest are from small scale and large-scale companies. The questionnaire was shared with participants from various disciplines such as software engineering, quality engineering, project management, technical operations, architecture, business analysis or product management and service delivery. Out of the 371 responses, majority comes from the project management discipline which is 31.5 percent which is followed by quality engineering which is 24 percent. More than 50 percent of the responses are from project management and quality engineering those who have represented project managers, program manager, program directors, quality assurance engineers, leads and managers. Software engineering representation is 18.6 percent and architecture, leaders, product management/business analysis and Technical Operations (TechOps) are 10 percent, 7 percent, 5.4 percent and 3.2 percent, respectively. This has assured that the data collected through the survey has a proper distribution among the companies, disciplines and roles.

Once the initial cleansing was done, the dataset was assessed thoroughly using SPSS software which is described in below sections.

5.3.2. Assessment of the Dataset

The quality of the data refers to the suitability of the data to serve its intended purpose (Roediger III *et al.*, 2001). According to Yan (2009), there are multiple criteria to assure the quality of the data. The process may include ensuring the data is within the scope of collections, the content is relevant, data could be viably managed and potentially distributed and ready for the detailed assessments. As Uyanık and Güler (2013) have highlighted, the assessment of the dataset should be done by the researcher based on the expected outcomes of the research. Therefore, a complete assessment was carried out to assess the collected data which is described in this section.

Internal consistency was tested using Cronbatch's alpha among the Likert scale items before creating the variables. Five-point Likert scale was used with the scale "Strongly disagree" to "Strongly agree" for the opinion questions and "Never" to "Always" for the frequency related questions. The analysis was conducted based on the variables in the research framework. Below six sections describes the reliability statistics for each variable. Table 33 shows the summary of all six variable groups used for the assessment.

Table 33 - Reliability analysis results

	Cronbach's Alpha	N of Items
delivery_process	.808	13
governance	.833	13
staffing	.880	9
tool_use	.857	9
tech_infra	.803	4
value_addition	.758	6

Source: Analytical results

The distribution of the questions under each variable group and the assessment results of the subsections can be found in the Appendix.

5.3.2.1. Reliability Test for the Impact of Delivery Framework for Value Addition

There were thirteen questions in two different sections in the questionnaire those were focusing on the delivery framework and its impact to the value addition. As shown in Table 33, the alpha coefficient for the group was 0.808 which suggests that the items have relatively high internal consistency as the value above 0.7 is considered as acceptable (Hardy and Bryman, 2009). Though the coefficient could have been further improved by removing certain questions from the group, it was not considered as the alpha value with them showed a good level of internal consistency. Hence, it was concluded that items in the group are closely related.

5.3.2.2. Reliability Test for the Impact of Governance for Value Addition

This section consisted for three sub sections: change management, service delivery and team collaboration with thirteen questions altogether. Same technique was used to analyse the reliability of the section and the result showed as 0.833 (Refer Table 33) which could have been further improved to 0.858 by removing one question, but it was not considered as the overall result shows good internal consistency. Therefore, it was concluded as this section is acceptable and items in the group are closely.

The governance of the software development organisations varies from section to section and organisation to organisation. The survey consisted of two subsections with thirteen questions altogether on identifying the impact of governance for value addition which are independently represented in Appendix.

5.3.2.3. Reliability Test for the Impact of Staffing for Value Addition

This section consisted for two subsections: formation of the teams and product/project portfolio alignment with nine questions. As shown in Table 33, the alpha coefficient for the section was 0.880 which is the maximum value that could be taken. Hence, it was concluded that items in the group are closely related and acceptable.

Organisation of the software engineering team varies from the project orientation, framework specific arrangements, company hierarchy orientation or cross-functional matrix-based arrangements. In order to understand the impact of the arrangements of the teams for the value addition, nine questions were asked from the respondents which can be found in Appendix.

5.3.2.4. Reliability Test for the Impact of Use of Tools for Value Addition

This section consisted of nine questions which are focusing on the use of tools within the software delivery process where the respondents were asked to share their opinion on selection, usage and efficiency of those tools. The Cronbach's alpha value for the section shows as 0.857 (Refer Table 33). Though the value could be improved to either 0.867 or 0.877 by removing some questions, it was not considered as the original alpha coefficient showed value above 0.8 with those questions as well. Therefore, this section is considered as acceptable and items in the group are closely related.

Throughout the software development lifecycle, various tools are employed to increase the efficiency and accuracy. In order to analyse the impact of the use of tools for value addition nine areas were covered in the survey which can be found in Appendix.

5.3.2.5. Reliability Test for the Impact of Technology Infrastructure for Value Addition

Respondents were asked to share their opinion on the impact of the technology infrastructure for the value addition in the global software engineering industry with respect to the facilities, cost, reliability, attention and utilisation. As shown in Table 33, the alpha coefficient showed as 0.803 which could have been improved to 0.817 by removing a question, but it was not considered as the original value is above 0.8. Hence, it was concluded that items in the group are closely related.

Technology infrastructure was identified as a key contributing factor for value addition in the global software engineering industry in Sri Lanka through the literature as well as the exploratory

study. Therefore, four key areas were covered in the survey to analyse it further which can be found in Appendix.

5.3.2.6. Reliability Test for the Value Addition in The Global Software Engineering Industry in Sri Lanka

Respondents were given the opportunity to share their opinion on the overall value addition in the global software engineering industry in Sri Lanka with respect to the key variables: delivery framework, governance, staffing, use of tools and technology infrastructure. There were six specific questions in the questionnaire to collect their opinion. Cronbach's alpha was applied for those questions as well to evaluate the reliability. The overall sections showed a value of 0.758 alpha coefficient (Refer Table 33). Hence, it was concluded that items in the group are closely related. Therefore, the result of this section has been considered as acceptable and used for the analysis.

Given that the reliability test has proved that the items in each group can be considered as closely related, the rest of the analysis was carried out as planned. Below section describes the descriptive analysis of the result set.

5.3.2.7. Descriptive Statistics of Variables

As shown in the below table, the mean values of independent variables: delivery process, governance, staffing, use of tools and technology infrastructure are 2.31, 2.19, 2.42, 2.38 and 2.24 respectively which is close to 2 in the Likert scale. The dependent variable's: value addition in the global software engineering industry in Sri Lanka mean value is 2.35 which is close to Likert scale 2 as well. These values show clearly indicates that overall value addition in the global software engineering industry in Sri Lanka is relatively low and their current practices with respect to the value addition is low as well. Standard deviation varies from 0.45 to 0.68 whereas the minimum is the delivery process and highest is the technology infrastructure.

According to Hardy and Bryman (2009), if the coefficient of skewness is in between -0.5 and +0.5 is considered as the data is normally distributed and if that is in between -1 to +1 data is considered as approximately distributed. Given the skewness is in between -1 to +1, this dataset is considered as approximately distributed. Further, when the Kurtosis is considered, it is closer to 3. Hence, it assures further that the dataset is normally distributed (Hardy and Bryman, 2009).

Table 34 - Descriptive statistics

	Statistics								
		delivery_proc ess	governance	staffing	tool_use	tech_infra	value_additio n		
Ν	Valid	371	371	371	371	371	371		
	Missing	0	0	0	0	0	0		
Mean		2.3101	2.1996	2.4262	2.3807	2.2453	2.35		
Std. Devi	ation	.45533	.56138	.60514	.55202	.68759	.657		
Skewnes	s	.844	.798	.805	.949	.829	.840		
Std. Erro	r of Skewness	.127	.127	.127	.127	.127	.127		
Kurtosis		3.165	2.981	2.927	3.195	2.878	2.574		
Std. Erro	r of Kurtosis	.253	.253	.253	.253	.253	.253		

Source: Analytical results

The descriptive analysis results are shown in Table 34. After carefully analysing the dataset to assure that it is approximately distributed, a correlation analysis was conducted understand the relationships between the respective variables. Below section discusses the findings in detail.

5.3.2.8. Correlations Analysis

Pearson correlation (r) was applied to study the relationship between the variables. According to Hardy and Bryman (2009), the r: sample correlation coefficient produced by bivariate Pearson correlation is used to measure the strength and direction of linear relationships between pairs of continues variables. According to Evans (1996), correlation is an effect size, and we can verbally describe the strength of the correlation using the absolute value of r. According to Benesty *et al.* (2009), four out of the five identified independent variables have a strong correlation since the degree of correlation value is between the value addition and delivery process, value addition and governance, value addition and staffing, and value addition and use of tools are 0.587, 0.690,0.733, and 0.635 respectively. The coefficient correlation value of technology infrastructure and value addition is 0.463 which is considered as a moderate degree with a medium correlation (Refer Table 35).

		•••					
		delivery_proc ess	governance	staffing	tool_use	tech_infra	value_additio n
delivery_process	Pearson Correlation	1	.801**	.494**	.687**	.438**	.587**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001	<.001
	Ν	371	371	371	371	371	371
governance	Pearson Correlation	.801**	1	.689**	.739**	.600**	.690**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001	<.001
	Ν	371	371	371	371	371	371
staffing	Pearson Correlation	.494**	.689 ^{**}	1	.721**	.732**	.733**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001	<.001
	Ν	371	371	371	371	371	371
tool_use	Pearson Correlation	.687**	.739 ^{**}	.721**	1	.714**	.635**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001	<.001
	Ν	371	371	371	371	371	371
tech_infra	Pearson Correlation	.438**	.600**	.732**	.714**	1	.463**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001		<.001
	Ν	371	371	371	371	371	371
value_addition	Pearson Correlation	.587**	.690**	.733 ^{**}	.635**	.463**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	
	Ν	371	371	371	371	371	371

Correlations

Table 35 - Pearson's correlation coefficient of the variables

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Analytical results

Therefore, the strong correlation between the variables shows that the value addition in the global software engineering industry in Sri Lanka depends on the software delivery framework that the company uses, the governance enforced by the company, how effectively the teams are organised, how best tools are selected and used, and finally, the effective use of the technology infrastructure. However, the analysis was further carried out to understand how well it supports to the research objectives. Below section explains the analysis conducted to evaluate the outcomes against the research objectives.

5.3.3. Analysis Pertaining to Research Objectives

The objectives of the research are to analyse the nature of the global software engineering industry in Sri Lanka through already established facts, critically assess the current practices in the product development organisations to identify the current software engineering practices and the wastes, and finally, to analyse the impact of independent variables identified through the literature to facilitate avoiding the non-value adding activities in the respective software engineering practices. The entire analysis was carried out aiming to achieve these objectives which is described in this section in detail.

5.3.3.1. Hypothesis Test Using Regression Analysis

Regression analysis is a powerful statistical method that allows to examine and estimate the relationship between dependent variable and one or more independent variables of interest (Darlington and Hayes, 2016). According to Austin and Merlo (2017), regression test can be used to mathematically sort out impacts of specific variables to make date driven decision making easier. Further, they say that it can be used to not only assess the strength of the relationship between variables but also to model the future relationships as well. Typical regression analysis come is three forms. i.e. linear regression analysis: assesses the relationship between a dependent variable and an independent variable, multiple linear regression: assesses the relationship between a dependent variable and multiple independent variables and nonlinear regression analysis: helps to analyse the nonlinear relationships in more complicated datasets. As Daoud (2018) has said, typical linear models are based on fundamental set of assumptions such as dependent and independent variables show a linear relationship between the slope and intercept, independent variables are not random, residual error is constant across all observations and it is zero and finally, residual error values is in the normal distribution. However, this research dataset has already been analysed carefully before the regression analysis which are explained in above sections. Therefore, the researcher did not make any other additional assumption around the regression analysis.

The conceptual framework for this research was formed after an extensive literature review which concluded with five variables that could potentially impact to the value addition in the global software engineering industry in Sri Lanka. Given that the regression analysis should be done for multiple variables, the multiple regression was the suitable regression for this research. It was a multivariate analysis. It was run to predict the impact of the value addition determinants: staffing, delivery process, use of tools, governance and technology infrastructure. According to the outcomes (F(5,370)=233.541, p<0.00001 (0.05 sig. level) and R Square =0.762) of the analysis, it is statistically and significantly proven that the value addition in the global software engineering industry has a strong relationship to the identified variables. Below two tables (Table 36 and *Source: Analytical results*)

Table 37) show the model summary and ANOVA results.

Table 36 - Model Summary

	5		Adjusted R	Std. Error of the	
Model	R	R Square	Square	Estimate	Durbin-Watson
1	.873 ^a	.762	.759	.28569	2.044

Model Summary^b

a. Predictors: (Constant), tech_infra, delivery_process, staffing, tool_use, governance

b. Dependent Variable: value_addition_f

Source: Analytical results

Table 37 - ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	95.309	5	19.062	233.541	.000 ^b
	Residual	29.792	365	.082		
	Total	125.100	370			

ANOVA^a

a. Dependent Variable: value_addition_f

b. Predictors: (Constant), tech_infra, delivery_process, staffing, tool_use, governance

Source: Analytical results

As Austin and Merlo (2017) have explained, the coefficient of the determination is used to explain how much variability of one factor could be caused by the relationship of it to another related factor which is known as the goodness of fit. As shown in the model summary table, the coefficient of the determination of this analysis is 0.762. Thus, it is a highly reliable model future forecast which means that 76.2% satisfaction has been covered by the regression model. Therefore, it can be concluded that the model is nicely fitted. According to Yan (2009), if the ANOVA result is significant, the model can be used irrespective of the low R squared (0.762). The multiple correlation (R) is 0.873 which proves that the independent variables together are having a strong association to the value addition in the global software engineering industry. When all these facts are considered carefully, it can be concluded that the model is jointly significant and appropriate. According to Yan (2009), the sign of a regression coefficient is the ideal measure to understand if there is a negative or positive correlation between each independent and dependent variable. When the value is positive, it is a positive correlation where the mean of the dependent variable tends to increase when the value of the independent variable increases. The negative value coefficient indicates that the dependent variable tends to increase when the independent variable increases. A similar view is upheld by Uyanık and Güler (2013) where they have said that the unstandardised coefficient can indicate how much the dependent variable varies with an independent variable. Hence, analysis was carried out for each independent variable to assess the effect of each of them which is shown in Table 38.

Table 38 - Coefficients

			Coefficien	ts ^a				
Unstandardized		Standardized				Collinearity Statistics		
	Coefficients		efficients	Coefficients				
Model		В	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	046	.093		493	.623		
	delivery_process	.122	.059	.095	2.068	.039	.307	3.258
	governance	.374	.054	.361	6.876	.000	.237	4.219
	staffing	.537	.042	.559	12.710	.000	.337	2.967
	tool_use	.128	.051	.122	2.530	.012	.282	3.548
	tech_infra	.175	.035	.207	5.024	.000	.383	2.610

Source: Analytical results

Based on the coefficient values of analysis, delivery process, staffing, use of tools, governance and technology infrastructure are significant at 0.05 significance level. Thus, all these facts are likely to influence the value addition in the global software engineering in Sri Lanka. The p-values and individual beta values of governance, staffing and technology infrastructure show as 0.000 and 0.361, 0.559 and 0.207, respectively. Therefore, governance, staffing and technology infrastructure are the most significant factors to increase the value addition. Similarly, delivery process (p-value = 0.039 and β = 0.095) and use of tools (p-value = 0.012 and β = 0.122) have a high individual positive effect on the value addition in the global software engineering in Sri Lanka.

5.3.3.2. Validity of Regression Test

In order to assess the validity of the regression results, several diagnostic tests can be used. Given that the outcomes of these assessments are valid, the accuracy of the test is high and findings are more valid (Hardy and Bryman, 2009). Therefore, to validate the accuracy of the test and its results, following tests were carried out.

5.3.3.2.1. Multicollinearity Test

According to Darlington and Hayes (2016), the collinearity is defined as a correlation or an association between two independent or predictor variables and multicollinearity refers to the same meaning when there are two or more variables associated. The collinearity diagnostics is a powerful assessment to confirm if there are serious problems with the multicollinearity. According to the definition provided by Austin and Merlo (2017), if several "eiganvalues" are closer to zero indicate that the variables or predictors are highly intercorrelated such that a small change in the data values can lead to large changes in the estimates of the coefficients. Based on the analysis results, delivery process, governance, staffing, use of tools and technology infrastructure's Eigenvalues are 0.054, 0.022, 0.017, 0.012 and 0.005 which are closer to zero as shown in Table 39. It indicates that the predictors or variables are highly interconnected.

 Table 39 - Collinearity Diagnostics

				Variance Proportions					
			Condition		delivery_	governa	staffing	tool_use	tech_infra
Model	Dimension	Eigenvalue	Index	(Constant)	process	nce			
1	1	5.890	1.000	.00	.00	.00	.00	.00	.00
	2	.054	10.488	.14	.02	.00	.03	.00	.28
	3	.022	16.234	.52	.02	.11	.00	.06	.23
	4	.017	18.497	.01	.03	.00	.82	.04	.32
	5	.012	22.430	.01	.01	.25	.00	.79	.15
	6	.005	34.095	.31	.91	.64	.15	.11	.03

Collinearity Diagnostics^a

a. Dependent Variable: value_addition_f

Source: Analytical results

According to Daoud (2018), variance inflation factor (VIF) or tolerance help to identify if the multicollinearity problem persists. Given that the VIF value is less than 10 or tolerance is more
than 0.1, it assures that there is not any multicollinearity problem. If so, the test results are considered to be more valid. As shown in Table 41, the VIF values are less than 10 and tolerance values are more than 0.1. Therefore, it assures that this regression test is more valid since the multicollinearity problem does not persist.

To check if the analysis has any heteroscedastic issues, the following test was also carried out.

5.3.3.2.2. Heteroscedasticity Test

According to Hardy and Bryman (2009), heteroscedasticity means unequal scatter. In a typical regression analysis, it is assumed that all the residuals are drawn from a population that has a constant variance which means homoscedasticity: the variance of residual is a constant. Given that the residuals have a constant variance, the regression assumptions can be satisfied. As Darlington and Hayes (2016) have highlighted, the best and easiest way to test heteroskedasticity is the visual approach. Using standardised residuals and predicted values, a scatterplot was constructed which is shown in Figure 25.



Figure 25 - Scatterplot for hetersocedasticity



According to Austin and Merlo (2017), if there are patterns in the residuals, the model has a problem which leads to lower the trustworthiness of the results. Given that, it does not show any specific patterns, i.e. they are distributed randomly, the variance of residual is a constant which means the residuals are homoscedastic. Therefore, the results are trustworthy, and the regressions assumptions are satisfied.

To check for the serial corelation, below test was carried out.

5.3.3.2.3. Independence of Residual

As Daoud (2018) has defined, the serial corelation or auto correlation means the residuals are correlated which means the residuals are not independent. According to him, the validity of the results of a regression test increases when the residuals are independent. Austin and Merlo (2017) have mentioned that, violation of independence due to the serial correlation means that the model requires improvements. If it is an extreme serial correlation, it is mostly a badly mis-specified model. Therefore, detecting it is crucial to assure the regressions results are valid. According to them, the best way to detect it is to use the Durbin-Watson test which is used to measure the auto correlation in residuals from regression analysis. The outcome of the Durbin-Watson would be a value in between 1 and 4 where the independence of the residuals is assured when the value is closer to 2. According to Daoud (2018), if the value is in between 1.5 and 2.5, it is considered as the residuals are independent. According to Table 39, the Durbin-Watson value is 2.044 which means it is in between the specified range and more importantly it is very much closer to 2. Therefore, based on the definition of independence of residual the result of the regression is valid and regression assumptions are satisfied.

Finally, the normality of the residuals is tested to further test if the regression results can be accepted which is explained below.

5.3.3.2.4. Normality of Residuals

According to Hardy and Bryman (2009), normality means the assumption that the underlying residuals are normally distributed or approximately normally distributed. Normality of residuals could be either a positive value or a negative value. As Darlington and Hayes (2016) have said, this can be tested using either a mathematical test or using the graphical approach. Shapiro-wilk and Kolmongorov-Smirnov are heavily used to assess this. They have further said that null hypothesis and alternative hypothesis are normally distributed and not normally distributed,

respectively. Given that the p-value is less then predefined significance level, the null hypothesis can be rejected. If it is, otherwise, null hypothesis cannot be rejected.

The Q-Q plot is the graphical method that is mostly used to test the same. Given that the residuals are closer to the linear line, it is accepted that the residuals are normally distributed(Hardy and Bryman, 2009).

Table 40 - Test of Normality

	Kolm	nogorov-Smir	nov ^a	Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.044	371	.085	.994	371	.166

Tests of Normality

a. Lilliefors Significance Correction

Source: Analytical results

As shown in Table 40, the Lolmogorov-Smirno results showed the probability as 0.085 and Sharpiro-Wilk results showed the p-value as 0.166. Hence, all the p-values are insignificant. Therefore, residuals are normally distributed with 0 mean based on the definition provided above.

Figure 26 shows the normal Q-Q plot of standardised residual.



Figure 26 - Normal Q-Q plot of standardised residual

Source: Analytical results

When Q-Q plot is considered, the residuals are closer to the linear line which proves that the residuals are normally distributed. Therefore, both mathematical and graphical approaches have proven that the null hypothesis cannot be rejected which assures the results of the regression analysis are valid. Below section describes the evaluation of the results against the hypotheses pertaining to the research objectives.

5.3.3.3. Outcomes of the Hypothesis Test

Hypothesis testing is one of the key activities in statistics which is used to test an assumption regarding a population parameter through a carefully collected dataset by employing a suitable methodology based on the nature of the data and reason for the analysis (Newey and McFadden, 1994). Primarily this test is used to assess the plausibility of one or more hypotheses which was formed by a researcher after preliminary study. The typical assessment is carried out using the collected sample data form a given population. The result of this analysis provides evidence concerning the plausibility of the selected hypothesis (Snyder and Swann, 1998). According to Nearing *et al.* (2020), this assessment can be carried out in four steps. i.e. identify the two

hypotheses, formulate the analysis plan, analyse the data, and finally, accept or reject the respective hypotheses based on the results. Therefore, these four simple steps were carried out for this research to test and prove all the hypotheses formed during the analysis.

After a comprehensive literature review and the exploratory study, five hypotheses were formed based on the research objectives: To identify and explore the contextual specific factors that affect on value addition, to identify the value creation determinants through a comprehensive literature review, to synthesise the contextual specific factors and literature findings to formulate definitive value creation determinants, and to examine the impact of the identified determinants for value addition in global software engineering industry in Sri Lanka. The hypotheses test was carried out to test them based on the collected data to prove mathematically the relationship between the staffing, delivery process, use of tools, governance and technology infrastructure with respect to the value addition in the global software engineering industry in Sri Lanka. Below sections explain each hypothesis along with the test results. Table 41 shows the results of the multiple regression analysis.

Table 41 -	Multiple	Regression	Test Results
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		Unstandardized Coefficients		Standardized Coefficients		
Model		В	Std. Error	Beta	t	Sig.
1	(Constant)	046	.093		493	.623
	delivery_process	.122	.059	.095	2.068	.039
	governance	.374	.054	.361	6.876	.000
	staffing	.537	.042	.559	12.710	.000
	tool_use	.128	.051	.122	2.530	.012
	tech_infra	.175	.035	.207	5.024	.000

Coefficients^a

Source: Analytical Results

5.3.3.3.1. Hypothesis 1 (H1): Staffing Has a Positive Impact on Value Addition

In order to identify the determinants that impacts to the value addition in the global software engineering, a comprehensive literature review was carried out as mentioned above. During the study, staffing or in other words arrangements of the teams was identified as a key influential parameter that helps to determine that value addition. Therefore, nine unique subsections were included in the survey to get the opinion of the respondents on the set hypothesis on staffing. The collected data was analysed against the hypothesis and based on the results which are depicted in **Error! Reference source not found.**, staffing factor positively influences (p=0.000, β =0.042) the value addition in the global software engineering industry in Sri Lanka thereby supporting the Hypothesis 1 (H1). Hence, the Hypothesis 1 is accepted.

5.3.3.3.2. Hypothesis 2 (H2): Delivery Process Has a Positive Impact on Value Addition The second hypothesis was built around the software delivery process which was identified as a key influential parameter during the literature review which was later proven through the qualitative analysis. The delivery process covers the who spectrum of the activities carried out by many cross-functional individuals those who get involved at different stages of the process. Therefore, thirteen different areas were covered in the questionnaire to collect the opinion of the respondents on the impact of the delivery process for value addition. Based on the results show in **Error! Reference source not found.**, the delivery process used by the organisation is positively influencing (p=0.001, β =0.095) which supports the Hypothesis 2 (H2). Hence, the second hypothesis is accepted.

5.3.3.3.3. Hypothesis 3 (H3): Governance Has a Positive Impact on Value Addition

Governance practices which are employed by the respective product development companies could impact to the overall value addition due to various factors which were identified through the literature. Hence, this was further analysed using the qualitative study which turned out to be true. Therefore, thirteen areas were considered in the public survey to collect data in order to analyse against the Hypothesis 3. The regression results and the coefficients clearly show that the governance is positively influencing the value addition in the global software engineering industry with p=0.004 and β =0.361 as shown in Table 41. Hence, it is concluded that the Hypothesis 3 is accepted.

5.3.3.3.4. Hypothesis 4 (H4): The Use of Tools Has a Positive Impact on Value Addition The other key area that had been highlighted in the literature is the use of tools in the software development and delivery pipeline. This covered multiple areas which spans from requirement elicitation to the production support and maintenance. During the qualitative study, this was highlighted by the participants that tools play a critical role when delivering the value. Hence, participants of the survey were asked to share their opinion on the impact of the tools for value addition. Each one of these areas were carefully considered during the analysis which turned out to prove that the use of tools has a positive influence on the value addition with p=0.000 and β =0.122 as shown in Table 41 that support the Hypothesis 4 (H3). Therefore, hypothesis 4 is proven without a doubt.

5.3.3.5. Hypothesis 5 (H5): The Technology Infrastructure Has a Positive Impact on Value Addition

Finally, the impact of technology infrastructure for the value addition was identified as another key influential variable that decides the value addition. Additionally, identification of the importance of the infrastructure, reliability, cost effectiveness, utilisation, maintenance and support, monitoring and controlling, and overall facilitation were highlighted during the exploratory study as well. Therefore, participants of the survey were asked to share their opinion on these selected areas with respect to the impact of them for value addition. The results were assessed through the regression test which proved the positive impact of the technology infrastructure for value addition with p=0.001 and β =0.207 as shown in Table 41 thereby proving hypothesis 5 is true with the significance level 0.05.

Hence, the analysis of the sample data collected through the public survey has proven that the value addition in the global software engineering industry in Sri Lanka is dependent on staffing, delivery process, use of tools, governance and technology infrastructure.

5.4. Summary

This chapter covered both qualitative and quantitative analysis in detail. Once the data is collected through the twenty-three face-to-face interviews, the datasheets were prepared and uploaded to NVivo to initialise the qualitative analysis process. To carry out the qualitative assessment effectively, a well-formed thematic framework formulated. Thereafter, the thematic analysis was carried out based on the identified themes. Primarily, global teams, generic value erosion factors in the typical software development practices, impact of delivery process or framework, governance, use of tools, staffing and technology infrastructure are analysed in detail. All the findings were carefully tagged into the respective themes and a descriptive analysis was conducted to understand different team formations and delivery practices in the respective companies. This analysis assured that the findings of the literature along with the formed conceptual framework are accurate. These outcomes of the qualitative analysis were used to finetune the survey which was shared with the larger audience later followed by a pilot assessment. The survey results were then cleansed and uploaded to SPSS 21 to carry out the quantitative analysis. A reliability assessment was carried out to assure that the internal consistency which is followed by descriptive analysis of the data collected. Then, Pearson correlation (r) was applied to study the relationship between the variables. Thereafter, a comprehensive regression analysis was conducted to evaluate the outcomes of the findings against the research objectives. Given that the research framework is proven, validity of the regression test was tested using multicollinearity test and heteroscedasticity test. Further, the independence of the residual and normality of the residuals further assured that the regression results are valid. Thereafter, the five hypotheses were evaluated based on the outcomes of the analysis which are proven with positive results. Finally, the chapter is concluded with a comprehensive summary.

Chapter 06. Discussion

6.1. Introduction

After a comprehensive detailed data analysis provided in the previous chapter covering all aspects related to the analysis of the collected data and respective interpretations, this chapter is dedicated to focus the discussion on the interpretations of the results referring to the research questions and objectives, implications, limitations and recommendations for future research.

The discussion is organised into three primary areas based on the research questions. i.e. generic observations of the global software engineering industry in Sri Lanka through already established facts, outcomes of the research findings with respect to the software delivery methods, organisation of the teams, use of tools, application of governance and employing the technology infrastructure and finally, the factors leading to decrease the value addition in the global software engineering industry in Sri Lanka. Finally, the chapter is concluded with a comprehensive summary.

6.2. Overview of Results

In the review of the literature, it was identified that no research has been carried out in Sri Lanka to identify the value addition in the global software engineering that helps the businesses to assure the sustainability of the global software companies in Sri Lanka and the overall industry by increasing the value addition. Very little has been known in the global scope as well with respect to the same interest area. Majority of the researches have been carried out to identify the challenges in the view of global teams and value-based software engineering practices in general. This research is an attempt to fill this knowledge gap and identify the value addition determinants of global software engineering in Sri Lanka which are discussed considering the available literature and previous studies by and large that was validated through a comprehensive research process.

6.2.1. Systematic Review of Prevalence Studies for Value Addition in Global Businesses

Value addition is the perceived worthiness of a product or a service that the intended or potential customers would pay for. It can lead to tangible and intangible outcomes(Johnson, 2015). The overall value addition of a product or a service depends on performance, facility, attributes and sector specific characteristics(Haile and Altmann, 2016b). If any given business can cater to the

demands of its stakeholders while assuring the business strategic objectives are met, it can ensure the value delivery. In order to stay competitive in today's business world, it is necessary to have a set of purposeful and properly articulated objectives to invent, delivery, capture and modify the business's overall value delivery(Sanjari *et al.*, 2018). Understanding about the value addition in the global businesses is crucial for the business leaders to make efficient decisions. However, misalignment of strategic vision, objectives and initiatives have led the firms to unknowingly based upon value eroding actions to protect the value propositions through the hard approaches. This might have happened due to the gaps in identifying the value outcomes with respect to the given businesses.

Enhancing the stakeholder expectations is the ultimate goal of any business that aims to make profits. This can only be done by creating superior customer value through a solid business strategy(Eling and Lehmann, 2018). But it was noticed that attention to what, when, why and how well the product or service would fit into the customer lifetime value and customer received value are lacking in the global business scope. Understanding customer perceived preferences and assuring it is delivered is considered as the value delivery of a business. The purpose of going global is to increase the overall value addition of a business by reducing the cost, adding skilled resources, improving the quality of the service and establishing good business relationships with the customers. Productivity, business profitability and consumer surplus have shown a positive impact because of the concept of global businesses. It has been proved that in recent years, significant attention has been paid to move to global teams, manufacturing plants, offshore teams, or outsource agreements with the competition in the global market. The competition in the global economy requires the leaders to rethink about the competitive advantages(Rayan, 2016). Therefore, it is necessary to have an integrated value delivery mechanism that assures the sustainability of the business in the long run.

Several challenges and issues that are prevailing in the current global businesses were identified through the past research. These include the disconnected operations, time zone issues, culture specific issues, communication barriers and limited infrastructure(Dey, Fan and Zhang, 2010; Wareham, Lluís and Giner, 2013; Ambler and Lines, 2016). Additionally, environmental factors, political instability in certain locations and social issues have impacted the global business at large(Immonen *et al.*, 2016). However, majority of the problems are industry specific, and these

common problems can be solved by adopting a proper framework after a domain specific analysis. The common issues in the global businesses that have a direct impact to the value addition are lack of focus in strategic vision, employing immature processes, misalignment in business objectives, gaps in identifying the perceived value delivery, absence of proper alignments in the strategy for value outcomes and lack of alignment in value proposition and value perception(Khan, Niazi and Ahmad, 2011; Ambler and Lines, 2016; Sanderson, 2017). A proper attention to the specific issues can help the business leaders to find most suitable solutions for given challenge. But, given that the strategic issues are solved by the respective industries or businesses, additional value erosion activities take place within certain processes which should be addressed individually.

The global software engineering industry has been facing inherited set of challenges from these generic challenges. As the industry is getting mature, the basic challenges such as time zone gaps, communication issues, infrastructure issues, and challenges due to the lack of skilled resources have been addressed significantly. However, the focus for the value addition in the global software engineering is still inadequate compared to the other businesses. To address the value addition specific issues in the global software engineering industry, it was necessary to understand the industry specific dimensions. Concept building, business evaluation, solutioning, developing and implementing, testing and verifying, deploying and finally maintaining are considered as generic steps in the software development process. In the global setup, individuals from several geolocations contribute at each stage at different scales which were carried out by collocated team members earlier. Capturing the value-added results throughout this process has become hectic due to the inherent nature of the stages mentioned above. However, the critical factors that impact the overall value addition in the industry were found to be the delivery process, staffing, use of tools, governance and technology infrastructure that drive the value delivery of any software product development company in Sri Lanka. Findings related to these five parameters are discussed in detail in the respective sections in this chapter. Below section describes the value based software engineering practices in general to lay the foundation based on the findings of this research.

6.2.2. Value Based Software Engineering Perspectives

Typical software product companies in Sri Lanka consists of software engineering teams, quality engineering teams, project managers, architects, functional managers, technical operations and leadership teams. In general, offshore and outsource development teams can be seen in Sri Lanka.

Irrespective of the business type, all the organisations those who participated in the study practice generic software development methodologies such as waterfall model, Agile Scrum, Agile Kanban or even scaled versions of Agile to deliver the software products.

A key finding of the study is the value neutral software development practices that have reduced the ability of measuring the outcome based on value-based measures(Chen and Dodd, 2016). The global entities in Sri Lanka have not even considered adopting value-based software engineering practices yet. It was found that the key decision makers in the local team do not get an opportunity to take part in the conceptualisation and business plan level to provide their input, hence the expected value delivery is not known to the actual team who does the work. Additionally, the current body of knowledge does not include the structured guidance on how to plan and manage the software delivery upholding the value. A proper alignment and collaboration were not seen in between the local entities and global counterparts. As Kupiainen, Mäntylä and Itkonen (2015) have said organisations should promote the delivery across the teams with right alignment and collaboration which assures the value is not eroded within the delivery pipeline. But, as the qualitative study shown, the emphasis on the value-based software engineering is not promoted though the critical success factors of a software delivery is lying within the value domain.

According to Shen *et al.* (2018), allocating employees to tasks in a software project is challenging when the outcomes are unclear or value is not known to the actual development teams. The same view was upheld by both Whittle (2019) and Martin and Robert (2018). However, this study shows that alignment of the teams is around the project needs, hence they believe that intended value is delivered though it is not known to the teams. The members who represent the leadership team promote the concept of value-driven practices to assure that the software development teams are responding to the rapidly changing market conditions with the right software upgrades. However, they accept the problems with the disconnection between the business teams and development teams which does not help them to work on common objectives as discussed by Williams (2017). This perception was hardly seen in the start-up and small-scale organisations because of the nature of rapid software development and use of limited processes, but the term "value-based software engineering practices" was not known by them. Medium and large-scale organisations have promoted advocating the process of integrating the value into the software development practices, but most of them did not have proper measurements in place to assess if the perceived outcomes

are achieved. They rely on the software development framework and its guidelines on the value delivery.

Large organisations in Sri Lanka promote the cadence software delivery practices that helps to reduce the complexity, address the uncertainty concerns, enforce the quality and promoting the collaboration in general as stated by Haile and Altmann (2016) and Morin, Harrand and Fleurey (2017). They believe that cadence approach automatically addresses the concerns of valueneutrality. But, according to Eeckhout, Maenhout and Vanhoucke (2019), strategic misalignments and proper collaboration between the business and the development teams still persist with the cadence development practices as well which has not resolved the problem of integrating the value into the software development practices. Certain medium level organisations have similar characteristic, but small and start-up companies are primarily traditional software development practices where the decisions are made around time, cost and scope. Therefore, advocating the integration of value-based software engineering practices into the current and emerging software practices is crucial to assure that project outcomes are not degraded at the end (Schwaber and Mike, 2016). Once the generic value addition related concepts were evaluated, it was vital to understand the perceptions of the industry specialists on the application of the theories and models in the actual work environments. Therefore, a significant effort was put in the exploratory study on identifying it which are described in the below section.

6.2.3. Application of Theories and Models for Value Creation in Global Software Engineering Industry in Sri Lanka

Literature findings uncovered certain industries have used lean management and resource advantage theory to increase the value creation in numerous ways which assures the sustainability of the businesses(Singh, 2016; Pavel, 2019; Yunita *et al.*, 2019). When further evaluating, certain software delivery methods were found those were built on top of the lean management concept, but nothing related to the resource advantage theory in the given research setting. When models are considered, Kano model, analytical hierarchical process and opportunity scoring were found to be three popular model that are meant to help in increasing the value creation (Tontini, 2007; Bettencourt and Ulwick, 2008; Yunita *et al.*, 2019). In addition to that, capturing the value-added results through value chain-based solutions was part of the literature which was not found to be prominent among the global software engineering companies in Sri Lanka based on the exploratory

study. Therefore, application of only the theories and models mentioned above were included as part of the exploratory study which is explained in the below sections.

6.2.3.1. Use of Theories for Value Creation

Lean management focuses on working on a systematic approach to achieve small but incremental series of changes in the process to increase the value by improving efficiency and quality in a long time (Kupiainen, Mäntylä and Itkonen, 2015). As Arnheiter and Maleyeff (2011) have mentioned, lean management proposes few guiding principles. i.e. identifying the value, value stream mapping, creating continuous workflow, developing a pull system and facilitating continuous improvement. There are various industries that have benefited from the lean concepts such as manufacturing, government, healthcare, hospitality and food and beverages at large. As a result of this, a lean toolkit for software development practices has been introduced as well because software engineering has plenty of opportunities for improvement that can lead to add more value to the stakeholders in various ways if they capitalise on their opportunities properly (Womack and Jones, 2005). However, literature itself had many criticisms on the application of lean concepts in software engineering such as inability to identify direct and non-direct value adding activities, conflict of identified software wastes, lack of measurements for intangible products and limitations in scalability of the proposed frameworks (Kupiainen, Mäntylä and Itkonen, 2015; Petersen, 2015; Siyam *et al.*, 2015).

Resource advantage theory focuses on increasing the value by focusing on two foundation concepts: competitiveness theory and differential advantage theory(Griffith and Yalcinkaya, 2010). Resource advantage theory can explain all important aspects of strategies in the organisation which covers the whole spectrum. That includes resource-based strategy, relational marketing strategy, competency-based strategy, market-oriented strategy, brandy equity strategy, industrial-based strategy and market segmentation strategy (Hunt and Davis, 2008). But application of resource advantage theory in the software engineering has not been popular because software development is purely process driven.

However, as part of the exploratory study, use of theories in the global software engineering industry in Sri Lanka was studied. The outcomes of the research showed that application of lean management for software development is no longer in practice as the industry dynamics and requirements have been drastically changed. Based on the results of CS - B, CS - D and CS - N,

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their companies have at least tried once to implement lean software development practices, but they have given in up as the measurements of workflows in a remote working setup is absent and coming up with new measurements is costly compared to the lightweight processes such as Agilescrum. CS - D further highlights the challenge with application of the lean is the absence of the right tools and infrastructure. Rest of the participants were not aware of application of lean in software engineering. When resource advantage theory is considered, none of the participants had any sense about the theory, but CS - D and CS - I results showed that certain organisations have tried resource-based strategies to evaluate the value creation in their businesses back in 2012. But there was no evident in both literature and outcomes of this study to prove that resource advantage theory has been applied to increase the value addition in the global software engineering industry.

6.2.3.2. Use of models for value creation

One of the key challenges in the software development industry is to set the right priority for the features, capabilities, tasks and activities based on the anticipated value creation (Haile and Altmann, 2016). As the literature findings uncovered, Kano model, analytical hierarchical process (AHP) and opportunity scoring have been used in other industries to increase the value creation. All three models have tried to assure either the product development or service delivery activities are carefully attached to the strategic goals while ensuring that the activities within the process do add value to the outcome (Singh, 2016; Lin, 2019; Pavel, 2019).

As described in the literature, Kano model focuses on the level of the customer satisfaction in three categories: must-haves or basics, performance and delighters or excitements. As Singh (2016) says, Kano model is heavily used in the software design phase to identify the respective categories of the proposed features. Those categories vary from basic or threshold features to excitement features. However, this model has not been popular among the software development companies since it does not give numerical output. As Lin (2019) has explained, Kano questionnaire basically limits overestimating the excitement features while stopping the must-haves and it helps to identify certain audiences as well.

AHP is a structured technique used in complex decision making on the selection of the human reactions based on a ranking by comparing between two clusters (Rice, 2014). In addition to that, it helps in certain setups to evaluate the cost-benefit analysis of a project or a product. This model uses a numerical approach where the weight of each factor is considered as the input to the final

assessment for the comparison (Bettencourt and Ulwick, 2008; Singh, 2016). Though AHP was popular among in the literature as a scientific method for prioritising the features and activities, no evident was found to prove that it has been effectively used in the industry.

Opportunity scoring is the third model which was evaluated based on the literature findings. This analysis is a process to evaluate the product requirements based on the customer feedback which has been built on top of Anthony Ulwick's outcome driven innovation theory (Pavel, 2019). It is a step-by-step process that helps the organisations to identify the opportunity with the given produce or service. The steps are planning the outcome-based customer interviews, capture the desired outcomes, organise the outcomes, rate outcomes for importance and satisfaction and finally use the outcomes to jumpstart innovation (Xu *et al.*, 2009). But it was proven through the literature findings that opportunity scoring does not support for complex projects and does not consider the overall value creation of the product or service.

However, to further clarify the use of application of model to work prioritisation in the global software engineering industry in Sri Lanka was one of the key areas focused in the exploratory study. Participants were asked to explain the requirement elicitations and prioritisation process in their respective companies and follow up questions were asked to clarify the use of models as explained in the thematic analysis section. The outcomes showed that none of the companies uses any specific models stated above, instead they use company specific investments strategies when it comes to the work prioritisation.

In summary, lean software development and use of resource advantage theory in software development are the two primary theories considered as value addition related concepts based on the literature findings. And Kano model, analytical hierarchical process and opportunity scoring were considered as the models for value creation. But there is no clear evidence that companies are using any of these concepts to create more value to their stakeholders in the global software engineering industry in Sri Lanka.

6.2.4. Value Addition Determinants of the Global Software Engineering Industry in Sri Lanka

The objective of a firm is to create superior customer value with a strategy that they cannot satisfy by themselves or through a competitor if they want to make more profits (Smith and Colgate, 2007). In nowadays businesses, most of the companies rely on the software applications. But, in earlier times the influence of the software applications for the overall profits of a company was relatively minor. According to Laudicina (2021), the rate of adopting technology into the businesses has grown significantly and it has become a competitive advantage for the businesses to keep the momentum. According to the market researches, the spending on the enterprise software is currently at 489 Bn USD while they predict it to be increased by 285 Bn USD within the next five years. According to Kearney (2018), digital transformation, technology enabled enterprises, information security, work automation, and cloud are the industry trends and the spending on the enterprise with the latest industry dynamics and trends.

Organisations are rapidly moving to the global software engineering model due to the significant short-term benefits as well as the foreseen potential long-term benefits irrespective of the challenges in the system. When establishing the relationships with the other geographical locations, offshoring, outsourcing or vendor contracts are heavily used and the selection of the type of the business model is primarily dependent on the mode of the work delegation and how significant is the specific domain knowledge (Lin, 2019). Mostly, the large organisations tend to choose the distributed software development because it is efficient, cost-effective and swift (Ambler and Lines, 2016). The industry in Sri Lanka has been growing significantly during the last two decades by adding more and more foreign revenue that helped the overall economy of the country to be partially stable. However, the sustainability of the industry depends on the key value drivers as the competition from the other countries in the region is comparatively high irrespective of the geographical, temporal and socio-cultural challenges. Therefore, a significant focus for the value addition in the industry is crucial to sustain and grow (Immonen *et al.*, 2016). This study was carried out around the five parameters identified through the literature and verified through the exploratory study. All the findings are summarised in Figure 27.



Figure 27 - Value addition determinants in the global software engineering industry in Sri Lanka

Source: Author's work

The key findings from the exploratory study and the survey were grouped into five groups based on the conceptual framework which was built and proved in this study. All the findings related to each area are discussed below under each topic.

6.2.4.1. Increasing the value addition through delivery process

Software delivery process is one of the key factors that decides the value delivery of the work that is being carried out by the software engineering teams. The findings of both qualitative and quantitative analysis showed that the selection of the delivery process has been done through flawed techniques which has introduced inherent difficulties. However, there are certain strategies that are used the organisations to assure that the adaptation of the process is effective and aligned. i.e. focused on end users: should understand the how well the process should be aligned to deliver the outcomes to the end user, emphasis on the delivery time: should focus on the time taken to deliver the software pieces, increasing the transparency: stakeholders should be able to see where the project is heading and having extensive user involvement: users should be able to provide continuous feedback. When these factors are considered further, it was found that there is no single process that fits for all the types of the software deliveries. Primarily, the delivery process should be chosen based on the complexity of the software application. In addition to that, companies in the start-up and small category had faith on the traditional software delivery processes while, medium and large-scale organisations tend to adopt shorter and latest development methodologies. As Chen and Dodd (2016) have argued, the cross functional skills within the delivery team help the to satisfy the customer needs easily than having multiple functional departments that executes sub steps in a delivery process. According to Eeckhout, Maenhout and Vanhoucke (2019) the staffing strategy of the small and start up organisations are primarily focusing on the ability of having multi-skilled people within the delivery teams, but in large organisations skills are specialised and grouped to reduce the number of people that helps to reduce the staff cost. A similar view is upheld by both Larman and Vodde (2013) and Kaur and Sharma (2014). Therefore, based on the literature findings and proven through the findings of this study, it is necessary to employ a good strategy to choose the right software delivery method for the organisations to assure the value delivery is assured.

In addition to that, the organisations have not evaluated the process alignment with the value delivery. There were two primary gaps those were identified during the study. i.e., the gap between the business and software development teams and the gap between the operations team and software development teams. As Larman and Vodde (2013) have argued, bridging the gap between the business teams, development teams and operations team increases the ability of delivering the expected outcomes effectively. Therefore, choosing the best delivery process that addresses these gaps are important for the organisation. In addition to that, the interconnection between the steps in the delivery process is a crucial factor that helps to assure the value is not eroded. But, it was identified that the companies do not focus on paying attention to the gaps in the steps of whatever the chosen process. According to Nord, Ozkaya and Kruchten (2014), in absence of proper interconnection between the steps in any given process, the lead time increases. Further, Estler *et al.* (2014) have argued that the team work with a steady and connected protocols decreases the lead time. Therefore, the lack of focus for the interconnection between the steps in the delivery process plays a crucial role in value delivery within the software development companies as well.

In summary, choosing the right delivery framework, addressing the gaps by employing right methodologies, proper agreements with the respective parties on the delivery process and assuring the interconnection between the steps in the delivery process are crucial to increase the value addition in the global software engineering industry in Sri Lanka.

6.2.4.2. Right governance for increasing the value addition

According to the findings of the study, ownership and accountability of the work are considered as two important aspects when it comes to the software product delivery irrespective of the size of the organisation. Therefore, the leadership teams in respective organisations have used different strategies to assure that the work assigned to the teams are properly evaluated, any change is properly managed, all intermediary conflicts are addressed and finally the delivery process itself has required approvals to push a change to the product environments. It was identified that large organisations tend to employ the standard governing bodies and practices while small organisations do not encourage to mandate any additional governance. According to Dubinsky *et al.* (2011) both these are considered as corner edges of the same stick and the companies should employ what works best based on the nature of the work, teams and any other governing practices.

Software product companies in general have two functions. i.e. software development and software deployment. Both these teams follow the governance practices up to the level they are supposed to. Typically, the structure, processes and respective policies have been implemented as described in the data presentation section. But often this is misinterpreted as the regulatory compliance by the organisations. However, majority believes that the governance is needed to yield the business value and to mitigate the risk. This study uncovered three important factors which are impacting to the value addition in general. i.e. having an effective change management process, proper conflict resolutions and a simplified service delivery process.

Effective change management helps the software development teams to assure that the ongoing activities are not impacted due to the unwanted distractions in the middle of a planned work and the change requirements are properly evaluated against the intended business values. This shared notion of the business value is heavily considered by the respective organisations whenever the business teams want to either change the requirements, technology or team. Large organisations use a formal method that consists of proper approvals while medium and small organisations rely on the minimal and informal approvals when it comes to accommodating the change requirements.

However, in the traditional method, any change requirement has caused to sign new agreements while the modern frameworks are flexible in negotiating the change requirements even towards the latter part of the development (Eeckhout, Maenhout and Vanhoucke, 2019). According to the findings of this study, it was identified that the ability to effectively manage the changes helps to increase the value delivery in the software product companies.

The other important fact that was identified in this study is the ability to provide resolutions for the conflicts that majority of the companies consider as important. According to that, changes in the architectures, software development methods, technology stack or even teams can introduce new challenges and risks. And as the qualitative analysis uncovered, these changes are typical, inevitable and more regular as well. However, poorly managed changes like this can lead to fail (Morin, Harrand and Fleurey, 2017). According to Chen and Dodd (2016), conflict resolutions are important for the software organisations to move ahead by addressing the key conflicts that arise due to the required changes and it has to be part of the governance structure. However, it was identified that the organisations promote self-organising teams to hold them accountable on the changes in the lines of management control, so that the conflicts are managed within the team with no or minimal impact. This helps to assure the timely delivery.

Finally, a simplified service delivery process is a key to assure the software deliveries are on time with the intended quality. When the quality of a delivery goes down, the value of the delivery goes down as well (Chen and Dodd, 2016). This only becomes a governance concern when the development and deployment teams are not in sync, or it is not facilitated within the process. Hence, the medium and large organisations have introduced audit and monitoring controls to determine the risk and manage it effectively whereas the small organisations primarily depend on the quality assurance process outcomes. In addition to that, the large organisations have a separate service delivery function that takes care of the overall software and service delivery throughout the year. In that format, the production environments are owned by the technical operations teams while the lower environments are owned by the development teams. According to the findings, incorporating governance to manage the production environment has a positive impact on customer satisfaction which helps to increase the value. Therefore, having a simplified service delivery function helps the organisations to assure that the deliveries are meeting the customer expectations.

In summary, organisations promote having the right level of governance in place with a proper change management process, addressing the conflicts through self-organised teams and having a simplified service delivery process that assure the quality and timely delivery which increase the value addition in the global software engineering industry in Sri Lanka.

6.2.4.3. Increasing the value addition through proper staffing

In a typical product development organisation, time, scope and cost are considered when deciding the size of a team for specific product requirements. According to the findings, the budget allocations take place based on the anticipated return on investments. The typical product life cycles begins at understanding customer needs and analysing them further to convert them to a software requirement (Maranzato, Neubert and Herculano, 2012). All the organisations follow a generic set of steps when it comes to the product delivery. The investment proposals for the product development are primarily done by the business and product managers at the portfolio level which is later converted into a prioritised list of software requirements. The detailing of the requirements is collaboratively done with the help of the developments teams which are tested by the quality assurance teams to verify all the required details are captured. These requirements are then sent to the development teams for development activities which are verified by the quality assurance teams. The packages are then sent to the production after taking the required approvals. Hence, there are several subject matter experts those who involve at different stages of the software delivery process those who are working in different geographical locations in different time zones. Due to the inherent challenges in the global software engineering, certain organisations have replicated important roles such as product managers and support teams in multiple locations to unblock the software development teams when necessary.

According to Haile and Altmann (2016), to benefit from the resource and infrastructure cost, the product development organisations should focus on optimising the resources by aligning them to the value-based software delivery framework. But, twenty-one out of the twenty-three participants of the interviews confirmed that they do not align the teams based on the value delivery, instead around the project requirements. According to Tyagi *et al.* (2015), product development organisations without proper resource mapping for the value stream end up with wastes, inefficiencies and unintended results at the end. However, large scale organisations are using project-based evaluation techniques to prioritise the work that has a weight for the project value.

Mainly, they consider the business value, complexity and estimated effort for a given task or project to set the priority. This method helps the organisations to arrange the resources based on the intended business values. However, the intended business value calculation is not based on any scientific method, instead it is an assumption based on prior experience where the respective product owners set a value from a one to five scale. As Grissom, Kalogrides and Loeb (2017) have highlighted, strategic staffing helps the organisations to arrange the teams around the high value generating products by assessing the both strategic priorities as well as the business dynamics. But, this term is not popular among the software organisations. Typical assessments that product owners use when arranging the teams are likelihood of the technical expertise, dependability, domain knowledge and ability to work in a team. It was identified that medium and large organisations primarily focused on building small capable teams around the project components while small and start up level are by default cross functional as the total number of employees are relatively low compared to the medium and large organisations.

Large organisations in Sri Lanka have many functional pillars such as software engineering, quality engineering, architecture, project management, product management, infrastructure and support, technical operations, application engineering and information security. Certain organisations have further divided the functional pillars into multiple sub sections such as technical operations team has system support, operations, database, infrastructure, devops and helpdesk. According to the findings, when the companies are growing tendency towards having specialized groups is increasing where small and medium organisations maintain a flat hierarchy by having cross functional individuals attached to the software development teams. Two of the key issues that were highlighted in the results section of having functional teams instead of cross functional teams are the less collaboration and process overheads which leads to waste a lot of time in the delivery pipeline. As Franco, Hirama and Carvalho (2018) have stated, organisations consider shared resources model to share time, people, capital and tools and equipment. But it is inevitable to maintain the same level of collaboration in between the software development teams and the operations teams as the operations team members are shared among multiple projects. Hence, the business priority plays a crucial role at multiple levels. Therefore, the higher-level agreements on team arrangements based on the planned deliveries is important.

It was found that there is a relationship between the software development methodology and the arrangements of the teams. Typically, the start-up and small-scale organisations follow traditional waterfall approach and medium and large organisations have been trying or already adapted agile practices. In the traditional method, there is no limitations for the number of heads per team whereas the agile practices have specified certain qualities and the maximum number of heads per team. Based on the descriptive statistics, average team size in a large organisation varies from 4 to 9 members, medium organisations vary from 5 to 10 members and small and start-up organisations vary from 3 to 14. This implies that teams have been arranged primarily based on the software delivery frameworks and around the project needs. Therefore, product companies could increase the value delivery if they could focus on building value-based software engineering teams.

In summary, the local entities of the global software engineering firms are heavily focusing on building the software engineering teams around the projects with a least amount of focus for the overall value delivery. To increase the value addition, the companies should focus on building teams around the high value generating products that assures the cross functionality and collaboration. Further, a continuous attention to the industry dynamics and environmental factors to right-size the teams could further increase the value addition.

6.2.4.4. Using tools to increase the value addition

Companies are using tools for various purposes throughout the software development lifecycle. Requirements management tools, diagramming tools, development tools, source control tools, testing tools, monitoring tools, service delivery tools, communication tools and document management tools are the common tools that are in use based on the findings of the study which confirms the findings of Faily and Lyle (2013); Jongeling, Datta and Serebrenik (2015) and Krishnamurthy (2016). Medium and large organisations are using additional tools for operational activities such as employee information management systems, performance management tools, information portals, social medial platforms and other corporate tools that help to improve the efficiency of the general management activities that has been partly discussed by Krishnamurthy (2016). Based on the findings of this study, any kind of tool can add value to the overall delivery given that the impact it makes is positive. The four key themes found in this research are criteria for selecting the tools, cost effectiveness of the tools, reliability of the tools and effort for

monitoring and controlling or in other words management cost of the tools. Each area has a relationship to the value addition in the software development practices.

When selection of the tools is considered, companies are primarily focusing on the identifying the exact benefit of using a particular tool along with the alternatives available. It was identified that start-up and small-scale organisations are heavily depended on free and open source (FOSS) software applications while medium and large organisations primarily select commercial applications. One of the main reasons for the small organisations to choose FOSS software is the cost factor while large organisations are heavily focusing on the trustworthiness, support and after sales services. As the findings of this study uncovered, organisations have categorised the tools requirements into two categories. i.e. primary tool requirements: mandatory to continue the business operation and secondary tool requirements: could add more value to the core activities by simplifying the business operations. For the basic needs there is no choice, and they have to invest on them. But selection criteria are still applicable as they are looking at all possible software solutions available. However, there are tools that come under secondary category such as tools for reducing the operational and administration cost, tools for increasing the efficiency of the software development and testing activities by automating the manual processes and tools for knowledge sharing. Therefore, buying any tool that comes under the secondary category needs an excessive effort as proving the value addition is not easy due to unavailability of the tangible outcomes. Given that the current manual process is unmanageable, the companies are willing to invest on the secondary tools to improve the efficiency of the operational and development related activities.

According to Lanubile *et al.* (2010) too much processes, large manual testing, lack of documentation and absence of metrics reduce the value addition of the overall product delivery. As Kyniazopoulou (2012) have highlighted, companies are trying to introduce new rules to their processes to increase the accuracy while they can get even more by results by introducing a tool that increases the overall effectiveness. Another key area that literature has enough evidence is the lack of focus for test automation. According to Krishnamurthy (2016), software product companies waste more than 35 percent of their quality assurance effort on manual testing. A similar view is upheld by Udawatta *et al.* (2019) where they have highlighted the fact that companies would like to spend on human resources than having the right tools. These claims were found in this research as well. Except the large organisation, all other categories are heavily focusing on the capital

investments for a tool instead of seeing the benefits of introducing a tool to increase the efficiency. It was identified that 78 percent of the participants have confirmed their organisations are using effective project management tools, development tools and source control tools. But 81 percent have not agreed with the focus for spending time and money for test automation. In addition to that, process modelling tools, documentation tools, configuration management tools, change management tools and bug tracking tools have got a lack of attention from both local and global companies. According to Gartner (2019), improving the process overheads through tools by removing the impediments have increased the overall efficiency by minimum of 23 percent in software organisations. And further they have argued that use of right tools throughout the software development lifecycles ensures high value delivery given that they reduce the human errors. Therefore, identifying the ways to minimise the running cost of software development activities can increase the value by crippling the potential problems for the core businesses as well as the end users.

In summary, attention for deploying the right tools was low in small and start-up category while medium and large organisations focus on having them to increase the overall value delivery of the software development lifecycle. Primarily, organisations are using strategies to select the tools which assures they fit into their requirement. However, it was identified that the tools which are categorised as secondary could add more value if the organisations have the right intention to look at the big picture. Therefore, tools can add move value by means of increasing the productivity of the team members, increasing the overall efficiency and accuracy of the tasks carried out by respective staff members, reducing the operational cost and through increased revenues.

6.2.4.5. Technology infrastructure for value addition

Results of the qualitative analysis showed that the attention for the investments on technology infrastructure has not been sufficient as the impact of it is not tangible. In a typical software organisation, technology infrastructure spans from the devices, connectivity, development and testing environments, production environments, networking, storage, platforms and general IT infrastructure. The assessment results showed that facilitation and attention for the technology infrastructure is low though the overall operations collapses without the basic technology infrastructure is the foundation for the software development companies to deliver outcome of the work they are

carrying out. Therefore, the absence of these foundational technology services and support impacts any kind of software businesses immensely and apparently the stakeholders cannot get the intended results of an investment. 223 out of the 371 responses in the public survey has confirmed that enough attention is not paid by the management for the required technology infrastructure. As Udawatta *et al.* (2019) have pointed out, information technology enabled service providers should have a separate strategy for the technology drivers otherwise the system of hardware, software, facilities and other service components cannot function.

It was identified that the large software product organisations in Sri Lanka have identified the importance of computer hardware, system software, development tools, application software, communication and networking systems and special purpose tools as key components on software delivery pipeline that assures the intended value is delivered at the end of the product lifecycle. But small and medium scale organisations have not paid much attention to the physical infrastructure and architectures to establish the importance of having right technology infrastructure within the organisation. There were two reasons for not paying enough attention. i.e. lack of focus in the strategy and lack of understanding about the value addition by having the right infrastructure. According to Sanjari *et al.* (2018) capturing and analysing the infrastructure requirements to assure the seamless software delivery is the responsibility of the both technology and operations leaders as overall value delivery is depending on the reliability, security and performance technology infrastructure provided by the company. As they have further highlighted, clients or end users might not be capable of choosing the minimum viable infrastructure and architectures. Therefore, that responsibility relies with leaders of the software development organisation.

Meeting the business needs of a software product development organisation does not limit to the generic software and hardware infrastructure. It goes beyond that, and it should include policies, management processes and continuous services. As the results of the study uncovered, except the large organisations, other firms have not paid enough attention for implementing the required policies around the technology infrastructure at all. As Whittle (2019) has stated, typical software product delivery depends on effective infrastructure that helps the development teams deliver the software applications with the right quality and timely manner. It was identified that the investments for production equal testing environments is low in small and medium scale

organisations compared to the large organisation as the application performance, reliability and security have not been identified as crucial factors. But, Morin, Harrand and Fleurey (2017) have argued that the software product organisations should assure the application performance before deploying it at the client site or actual production environment. Therefore, infrastructure is the highest importance as it facilitates the general software development activities, all aspects of testing, generic connectivity and software deployment which assures the overall value delivery of the software product.

In summary, the attention for the technology infrastructure is minimal in the global software engineering organisations in Sri Lanka that heavily impacts the overall value delivery. Both qualitative results and quantitative results along with the literature findings have proven that having right equipment, devices, network, environments, connectivity along with the policies, management processes and continuous support increase the value addition in the global software engineering industry in Sri Lanka.

6.3. Factors Leading to Decrease the Value Addition in the Global Software Engineering Industry in Sri Lanka

This study discovered five variables that impact to value addition in the global software engineering industry in Sri Lanka which are described throughout the thesis. Along with that, findings uncovered few impediments that organisations would come across when trying to increase the value addition. They can be grouped into three main themes. i.e. process, practices and tools, inflexible team arrangements, and inadequate focus for infrastructure and support. The following sections describe each area in detail.

6.3.1. Implications of Processes, Practices and Tools

Software product organisations are trying to implement solid and comprehensive processes to assure the quality of the product that starts from the requirements elicitation until the product maintenance through agreed service level agreements (Bent and Dient, 2017). When the companies expands themselves, the processes and practices are made strengthen to avoid and falls through cracks, because the impact of a simple mistake would be considerably high (Sanderson, 2017). This requires introducing new gates, approval paths, governance and tools. Hence, each of these areas could impact to the value addition of the overall product if adaptation is not smooth.

According to the findings of the case studies and survey, global product companies have primarily adopted varies extensions of the agile software development practices. As discussed in the data analysis chapter, intention to customise the prescribed agile methodologies is higher in the software organisations due to the internal complexities. However, introduction of unwanted approvals and quality gates to ensure the teams are following the processes for the sake of following leads to erode the overall value delivery. In addition to that, when the process is hectic and many steps to follow to send a new feature or a bug fix to the production environment, it increases the lead time. If the product managers and development teams cannot work together and make the decisions of releasing a change the production, the efficiency is reduced, and teams are spending time on unwanted activities. As CS - D and CS - I elaborated, the inability to catch the potential issues in the preliminary level of testing causes to introduce additional steps to the process to verify the change which increases the headcount as well as the time to market. Therefore, hectic processes kill the value and reduces the ability of the teams to work independently.

The other key finding of this study is the lack of focus for automating the processes using the right tools which reduces the value addition at various levels in the process. In a typical software delivery process, there are plenty of manual activities that impacts the overall team performance such as manual reviews, testing, release readiness activities, deployments and monitoring which leads to waste time as well as manpower (Laudicina, 2021). According to CS - A, CS - K and CS - P, investments on the time and tools for automating the manual activities are low as the organisations does not see the long-term value of them. As Sanjari *et al.* (2018) highlighted, unavailability of the automated practices in the software development companies lead to reduce the efficiency, prone to error, lack of consistency, increase the production cost and reduce the reliability. According to Haile and Altmann (2016), risk of the change increases due to the lack of automation as human errors can lead to impact the business at large. Therefore, value addition is impacted not only due to the hectic process but also due to the unavailability of the required level of automation.

In summary, organisations introduce processes and practices to increase the quality of the work that is being delivered to the end users. But additional gates, approvals, unwanted governance and lack of automation using tools lead to impact the overall value delivery.

6.3.2. Implications of Inflexible Team Arrangements

Survey results showed that the size of the development teams vary from company to company and based on the development practices they use. 79.6 percent have five to nine members in their development teams while 19.1 percent has more than ten members. A typical development team consists of software engineers and quality engineers. 81.6 percent of the teams do not have all required specialities within the team which creates a dependency with a shared resources from another teams. According to CS – A, CS – C, CS – F and CS – L, absence of cross-functional skills within the team lead to increase the waiting time in the production delivery process which slow down the overall delivery. In their respective organisations, database experts, infrastructure experts, network experts and deployment experts are considered as shared resources and any change requests should be through an approval process which requires another project coordinator to assign the tasks to the individuals. This has increased the waiting time and number of people involved in the delivery process. As Whittle (2019) has highlighted, the individual interactions increases the collaboration between the teams and it helps to reduce the time wastes. As he has further argued, division of the skilled based teams increases the requirement of having additional governance. It was identified through CS – A and CS – K that separation of the development teams and operations teams into two separate functional organisations has completely killed the team collaboration. According to Morin, Harrand and Fleurey (2017), poor collaboration in the workplace impacts to productivity, quality and profitability which leads to reduce the overall value delivery at the end.

In summary, rigid team structures reduces the ability of individuals to interact and collaborate on the work they carry out in their day-to-day work.

6.3.3. Inadequate Focus for Infrastructure and Support

Software product development organisations are heavily dependent on the foundational technology and services such as software, hardware equipment, infrastructure facilities and respective support services. The findings of both case studies and survey have shown that the software product organisations in Sri Lanka have faced unlimited number of issues due to the inadequate technology infrastructure to deliver their day-to-day work. According to Eeckhout, Maenhout and Vanhoucke (2019) lack of performance or absence of the required infrastructure directly impacts to the project staff's overall performance. According to CS – B, when distributed

teams work on the same goal, the distractions due to the infrastructure and support blocks the other dependent individuals that increases the idle time and waste of time. As highlighted in CS - H and CS - M, unreliable infrastructure has led the organisations to increase the lead time that decrease the value delivery.

Therefore, inadequate focus for the infrastructure and support from the management heavily impacts the value addition in the global software engineering industry in Sri Lanka.

6.4. Summary

As discussed in this chapter, global software engineering industry has been through frequent changes with respect to the value addition. According to the sources, the value-neutral software engineering has impacted the companies at large. However, adopting value-based systems into the software development lifecycles requires many changes to the current practices. As this study uncovered, the large organisations are emphasising on the improvements related to the value addition in their business practices more often compared to the small, medium and start-up categories. But, due to the unwanted governance in the processes, use of low value adding tools, poor team selection, inefficiencies in the software delivery methods and lack of attention for the technology infrastructure have caused to reduce the overall value delivery.

As this chapter further described, organisations should focus on identifying the respective needs of their businesses by putting a sufficient effort as the requirements vary based on the nature of the business. In order to increase the value addition, irrespective of the type of the organisation, the management should focus on selecting the right methodology, tools, team, governance and infrastructure after a proper and focused study for their business. The factors leading to decrease the value addition can be avoided only by identifying the respective meanings of them in the given contexts. Therefore, continuous attention to the five areas which are described in the chapter are important for all four types of organisations to assure the sustainability of their businesses.

The next chapter concludes this thesis by providing the overall conclusive notes on the findings, analysis results and required recommendations.

Chapter 07. Conclusion and Recommendations

7.1. Introduction

This research aimed to identify the value addition determinants in the global software engineering industry in Sri Lanka. To achieve this purpose, the mixed method was employed. Twenty three face-to-face interviews and three hundred and seventy one survey results are considered for the analysis. Based on a quantitative and qualitative analysis of identifying key factors related to the value addition, it can be concluded that staffing, software delivery process, governance, use of tools and technology infrastructure are the key factors that have a direct impact on the value addition. The results indicate that value addition in the software industry can be increased by choosing the right formation of the teams, adopting the most suitable development process, enforcing right governance, implementing a strategy for tools selection and finally, ensuring the most effective technology infrastructure is in place.

This chapter is devoted to concluding the thesis by presenting the overall conclusion of the study and recommendations for the industry based on the findings of the study. The conclusion section covers the implications aligning to the research objectives, a summary of implications for both industry and theory is discussed while articulating the answers to the research questions and it discusses how the findings confirm certain theories. In addition to that, limitations and few recommendations for potential future researches are provided. The recommendations for the industry section discusses the potential improvements that software engineering companies can do irrespective of the size of the company to reduce the value erosion activities by focusing to embed value considerations into the software engineering teams, processes and practices, employing the right governance, choosing the right tools and paying enough attention to the technology infrastructure. Finally, the chapter concludes with a summary.

7.2. Conclusion of the study

The findings of this research have contributed to the current body of knowledge in the global software engineering industry in Sri Lanka. Arguably, this is the first attempt to uncover the key factors related to the value addition in the global software engineering industry in Sri Lanka. Previous studies, in the general literature, related to the global software engineering have focused

on identifying the challenges in the distributed teams, applicability of software development practices, effective management processes for distributed teams and using value-based practices for software delivery. When the value addition related literature is considered, only a handful of studies have been carried out to identify the impact of value-neutral practices in the software development. But western literature and some of the research carried out in India have contributed to identify the mechanisms to increase the value in the global business in general. More specific research such as application of economic value addition (EVA) for software industry, capturing the value added through value chain based results, lean software development and use of resource based view in software companies have independently contributed to the body of knowledge by addressing the specific challenges in the current software engineering practices. Additionally, use of models such as Kano model, Analytical Hierarchical Process (AHP) and Opportunity scoring for identifying the key priorities have been studied as well. Primarily, these researches have been carried out focusing on the collocated software development teams in western countries. Therefore, none of these have focused on identifying the key factors that impact the value addition in the global software engineering industry in general or specific to Sri Lankan industry.

Identification of the key challenges with respect to the value addition in the global software engineering industry helped discovering the specific elements in distributed software teams that impacts the overall value delivery. Uncovering the relationship of these elements to the value creation in Sri Lankan context through the case studies assisted to formulate a comprehensive questionnaire to capture perception on those variables from a large audience. After carefully analysing the collected data through both interviews and survey, the conclusions were carefully made on the five determinants of value addition in the global software engineering industry in Sri Lanka. Additionally, emerging themes in each area have been highlighted as well to ease the future researchers to carve their research ideas along the side. All the findings were logically presented in each section in this thesis proving the significant contributions to the body of knowledge in the field of global software engineering industry in general as well as the Sri Lankan industry to assure the sustainability by increasing the value addition.

7.2.1. Overall Findings Pertaining to the Research Objectives

This research had four major objectives. i.e. Analyse the nature of global software engineering industry in Sri Lanka through already established facts, critically assess the current processes used

in global software engineering industry to identify the current practices related to the value addition through an exploratory study, analyse the key influential factors on value addition and finally to provide the recommendations through the literature and empirical findings of both case studies and public survey to increase the value addition in global software engineering industry in Sri Lanka. Below sections describe how these objectives are achieved through this study.

7.2.1.1. Objective 01: Identify and Explore the Contextual Specific Factors That Affect on Value Addition

This analysis was carried out to identify the current landscape in Sri Lankan Information Technology industry to set the foundation stones for the research by reviewing the available information on government institutes, non-government institutes and the previous studies. And further to understand the strengths and weaknesses at high level, identify current quality rankings, analyse the current level of manpower and to understand industry specific practices based on the existing literature in order to identify the contextual factors that leads to either increase or decrease the overall value addition in general. Only a few reviews could be found with respect to the software industry in Sri Lanka which are focused on knowledge management, adoption of software development methodologies, use of software metrics, employee perceptions on rewards and use of software policy frameworks which are partly related to the research objective. However, both government and non-government institutes had shared a significant amount of information which are accessible through their annual reports which are reliable and trustworthy. Additionally, industry rankings, evaluation criteria, and competitiveness indexes were available through the leading research institutes as well.

Given that Sri Lankan specific literature is very minimal and contribution from the local authors are insignificant, a substantial amount of time and effort had to be put on collecting the required data to understand the current status of the industry. The information presented in Chapter 03 are the initial outcomes of this study that was achieved as part of this objective. As the findings uncovered, focus of the researchers on this domain is minimal on identifying the facts related to the sustainability of the industry as well. Hence, certain characterises of the industry are identified through the available western literature and some Indian studies. Further, those findings were validated through the exploratory study.

As the industry analysis uncovered, with a highly skilled workforce and a cost-competitive business environment, Sri Lanka is emerging as a hidden gem for information technology, business process outsourcing and knowledge services outsourcing covering several sectors such as financial services, telecommunication, apparel and textile, education, healthcare, manufacturing, media, transportation, food, healthcare and travel and leisure as well. Further, according to the findings through the case studies, Sri Lanka is prime location due to the quality of work and innovation. Therefore, business leaders do not only focus on the cost benefit, in addition to that the aforementioned parameters are considered as well. Hence, Sri Lanka has a high potential in becoming the island of ingenuity through global software engineering.

The literature uncovered that the global teams rely heavily on the domain specific protocols on the value chains. Additionally, organisations have built their own protocols and policies to ensure that the intended value is delivered through their processes such as setting quality guidelines, delivery goals, defining key results, establishing organisational objectives and finally setting the domain specific metrices to evaluate the outcomes. Further, the findings helped to establish the foundation stones for the software development industry that helps to assure the value delivery such as skilled-labour, infrastructure, processes and standards which could be considered as the high level pillars. When it is further studied, the software product development organisations do use their specific processes and practices that are used to increase the value addition which are discussed under objective 02.

As the case study findings discovered, gaps in between the product organisation, development team and operations team cause to have more value eroding activities in the software delivery practices in Sri Lanka. Having least visibility to the investment themes for key leaders, lack of engagement of both teams and local managers and non-value stream based team organisation are highly impacting the overall value delivery of the software product organisations. Additionally, over engineering, lack of feedback loop, lack of interaction and engagement with respective stakeholders, longer development cycles, unwanted quality gates and unnecessary release approvals erode the intended value delivery within the software development lifecycle as well. In addition to that, efficiency of the use tools selected, reliability and effective use of them have a significant impact to the overall value delivery. Finally, use of proper devices, providing reliable connectivity, having right development and testing environments, taking proactive measures for

application monitoring and use of automation increases the value addition. These findings could be categorised into five main areas based on their characteristics. They are staffing, delivery process, governance, use of tools and technology infrastructure.

Additionally, the key constraints for improving the value addition are rigid organisational policies on selection of teams, tools and processes, lack of interconnection between software delivery pipelines, rework due to the infrequent feedback, additional wait times due to the approval bottlenecks and insufficient team engagements. The start-ups and small organisations have the freedom of reorganising the teams based on the needs, but medium and large-scale organisations do not have that luxury due to the complexities in the organisational policies and structures. Large organisations have implemented guidelines for choosing the tools which limits the ability of choosing the most suitable and practical tool. Additionally, poor interconnection in the delivery process from the concept to the go live have caused the individuals to work in their own comfort zones which create gaps in the value delivery. Other than that, medium and large-scale organisations are practicing standard service delivery guidelines which limits the production releases by asking for additional approvals. This increases the time to market.

In summary, Sri Lanka is the second foreign revenue generator in South Asia in the IT-BPM sector that has a massive contribution to the Sri Lankan economy. And Sri Lanka is leading from financial attractiveness, educated skilled workforce and infrastructure among all the countries in the world. In addition to that, government's vision on digital Sri Lanka and bringing IT-BPM industry as the topmost foreign revenue generator by 2025 shows how important is this sector. In general, this industry shows a high potential in competing with the neighbouring countries and establishing more global firms in Sri Lanka that increases the opportunities for the youth. But to be competitive and to assure the sustainability of the industry, it is vital to increase the value addition by optimising the processes, providing the right facilities and assuring there is no any skilled labour shortage in Sri Lanka. Although there are multiple business categories that could be selected to carry out this study further, software product companies that has any type of global engagements were chosen as it is the leading contributor. When the practices, processes and methodologies are further studied, it was identified that value erosion activities still take place at different levels in the software product development organisations. Therefore, the below section further elaborates the specific determinants of value addition those were found through the literature review.
7.2.1.2. Objective 02: Identify the Value Creation Determinants Through a Comprehensive Literature Review

The key literature related to the global businesses, the empirical evidence through the case studies, analytical results of the data collected through the public survey along with the theoretical backing of value addition related theories and models have helped to discover the influential factors for value addition in the global software engineering industry in Sri Lanka. Therefore, after compiling and carefully analysing the findings, five key variables are identified as the key influential factors or determinants for value addition. They are, staffing: arrangements of the software teams, delivery process: step by step process from concept to the market, governance: policies, practices and guidelines for carrying out the deliveries, use of tools: selection and use of tools and finally, the technology infrastructure: facilitating and supporting the software development teams.

The critical success factors for increasing the value addition depends on how well the organisations are aligning their practices in the local industry irrespective of their size of the organisation. The empirical study results through the case studies and public survey have proven that value addition can be increased through the identified parameters which assures the sustainability of the industry.

When the arrangement of the teams is considered, the development team should consist of all the cross-functional skills needed for the software delivery without any third party dependency. In addition to that, the development team should be self sufficient to make their own delivery decisions while assuring the respective stakeholder needs are met. Further, the development teams should be organised around the overall value they deliver through the work they carryout, not based on the project structures. Given that the work prioritisation and assignments happen through proper value stream mapping, the team formation and arrangements could be in accordance with guidelines from the respective value streams. Given that the efficiency and efficacy are assured though setting up the team, the value delivery is not harmed during the development pipeline.

With respect to the delivery process, global organisations have been trying to use a common method or replicate the same method used in the collocated setup with the global teams as well without a proper assessment to understand the applicability of certain practices. As the findings through the case studies discovered, distributed teams need a streamlined delivery process to fast track their software releases. Therefore, certain steps in the delivery processes need to be revisited to increase the efficiency. The high-level changes required for improving the current processes are

optimising the business process by accommodating the right quorum in the business forums, providing the authority to make the delivery goals for the local authorities, introducing new protocols for communication for geographically distributed teams, assurance of the interconnection between the steps in the delivery process and choosing the right methodologies for software deliveries.

Along with the software delivery processes, global organisations have implemented service delivery and governance frameworks as well. Change management, conflict resolutions and general service delivery guidelines are among them. When the number of changes in the systems are increased, the service delivery guidelines are automatically becoming complex. To avoid these complexities, medium and large organisations have chosen the shared service approach which has divided the software development teams and delivery teams. Additionally, the governance frameworks have introduced new quality gates and approvals from certain stakeholders without a proper assessment of the risk of change and the impact. It is inevitable that the service delivery and governance require improvements when the companies are getting bigger but change frequencies should not be reduced just because of the inability to handle the number of changes which increases the time to market. Therefore, simplifications for the service delivery and an effective change management process for software production releases increase the overall value delivery.

The other important area is the use of tools for software development. Traditionally, computer aided software engineering (CASE) tools have been used at different stages to ease the work carried out by the software teams. However, as the technology has been invading the business world rapidly within last few decades, needs in the software development world also have been changed. With the global teams, additional requirements have arisen which are inevitable. When choosing the tools, it is important for the organisations to implement a tool selection policy that focuses on reliability, security, cost and applicability based on the organisational needs. In today's world, automation has become a norm and lack of manual intervention increases the efficiency of the work. Therefore, software development teams should pick and choose the right tools to automate the repetitive activities in the software delivery pipeline to reduce the manual interventions.

Finally, this study has contributed to the body of knowledge by elaborating the importance of having the right technology infrastructure for the software teams to carry out their day-to-day activities. The empirical findings of the case studies discovered the importance of having reliable and sustainable technology infrastructure which spans from the day-to-day hardware requirements to production infrastructure support. Largely the software teams rely on the performance of the hardware devices they are working on along with the stable connectivity. More complex systems require more hardware to carry out their tasks. The investments for the technology infrastructure should reflect the intended value delivery of the respective tasks. Certain systems require additional security protocols to assure the product meets the required security guidelines. In addition to that, pipeline automation is a key to increase the accuracy and improve the efficiency of the work carried out by the engineers. The organisations should focus on getting rid of the manual interventions by introducing the required automation practices to facilitate the fast deployments. Finally, providing the suitable testing environment reduces the risk of findings defects in the production environment which assures the business continuity and customer satisfaction. Therefore, all the organisations in the global software engineering should make sure that they are facilitating their employees with the right technology infrastructure.

In summary, the comprehensive literature carried out by the author led to formulate the initial conceptual framework for the value addition in the global software engineering industry. Later, the exploratory study was carried out to further evaluate that framework and formulate an efficient questionnaire for the public survey. The empirical findings of both case studies and public survey have assured that staffing, delivery process, governance, use of tools and technology infrastructure are the key variables that impacts the value addition in the global software engineering industry in Sri Lanka. These variables are further validated through the exploratory study which are described below.

7.2.1.3. Objective 03: Synthesise the Contextual Specific Factors and Literature Findings to Formulate Definitive Value Creation Determinants

The comprehensive literature suggested that the generic value additional determinants are staffing: formation of the software development teams, delivery process: software delivery method employed by the organisation, governance: product and process governance enforced by the organisation, use of tools: selection and specific usage of the tools and technology infrastructure:

infrastructure and support. The initial conceptual framework was formed based on these findings which was the foundation to prepare the template for the face-to-face interviews. All these variables were carefully considered, and a significant attention was paid during the interviews to validate these variables with the industry experts.

Given that the existing literature did not specifically support for the global software engineering industry in Sri Lanka, the qualitative study was planned to understand the identified variables in detail while assuring those variables are accurate and applicable to the selected industry. Twenty three subject matter experts from the selected organisations shared their expertise on the specified areas. Based on the findings of this study, companies have implemented various strategies to assure the value delivery. However, it is a mutual belief that value erosion is common in most of the organisations due to various reasons. A gist of findings of the exploratory study is provided in the below paragraphs.

The first area of focus was to identify the how well the teams are formed and organised to increase the value addition. It was identified that various strategies have been used by the respective organisations to decide the alignment of their staff. The size of the team and composition of the team are dependent on the size of the company. Primarily, large teams could be seen in start-ups and small organisations where small teams are very common in medium and large organisations. Additionally, the composition of the team was varying from organisation to organisation. But it was common that software engineers and quality assurance engineers play the main role in all types of organisations. However, start-up, small level organisations and certain medium level organisations have tried implementing cross-functionality within the team which was found to be a critical success factor for increasing the value addition. However, matrix organisation structure is common in all the large organisations and some of the medium level organisation. According to the findings, the ability to build the cross-functional teams in the large organisations is limited due to their hierarchy, instead some organisations have introduced partially dedicated teams to fulfil the requirements such as database skills, build and engineering skills, deployment skills and even for security skills. Additionally, value-based team arrangements and rightsizing the teams were highlighted by the participants that impacts the value addition. Therefore, staffing plays a crucial role in increasing the value addition in the global software engineering industry which is proven through the exploratory study.

The next important parameter was the delivery process employed by the organisations to deliver the software applications. As the literature uncovered, organisations are using various methods such as waterfall, iterative, incremental and recent trend is to adopt agile software delivery practices. It was found that Sri Lankan software product organisations are using these methodologies depending on the nature of the product and company. Start-up and small organisations primarily focus on the traditional waterfall approaches, but there are few organisations those who have successfully adopted agile practices. Medium and large organisation are primarily relying on some form of a variant of agile practices. However, these adoptions have not been done in alignment with the objective of increasing the value delivery, instead it is to optimise the software delivery which ultimately contributes to increase the value addition. Majority confirmed that their current processes need amendments as there are obvious value erosion activities. Additionally, selection of the proper delivery framework and assuring the proper interconnection between steps in the processes were highlighted as important to increase the value addition as confirmed through the exploratory study.

The governance practices go hand in hand with software delivery framework as most of the quality gates are primarily integrated into the delivery framework itself. However, it was identified that plenty of custom quality gates and additional approvals have been mandated by certain organisations. Additionally, it was identified that change management processes are common in large organisations and certain medium level organisations, but start-ups and small organisations have not paid much attention to it. Instead, all the production changes are done by the respective development teams without following any specific change management process. As the literature uncovered, having a change management helps to increase the quality of the product, but it has to be effective and value oriented. In addition to that, conflict resolution was identified as a common component of governance where large organisations have implemented them to assure the potential value erosion activities are identified as early as possible and address them. However, these practices cannot be seen in many small and start-up level organisations in Sri Lanka. Therefore, it was proven through the exploratory study that the findings of the literature related to the governance are accurate and it helps to decide the value addition.

The next area was the use of tools within the software development, delivery and maintenance steps. Unanimously, all the participants agreed to the fact that tools help to increase the value addition. Additionally, selection of the tools and organisational policies around that decides the right tool selection which assures the intended value is delivered. It was identified that the tool selection policies are not common in the start-up, small scaled and even in certain medium level organisation. But there are strict policies in the large organisations. Most of the start-ups and small scaled organisations choose free and open-source tools due to the cost factor, but it is not recommended to go with free tools in the large organisations as they are focusing mostly on the reliability and security. In addition to that, project management tools, integrated development environments, communication and test automation tools are heavily used to increase the value addition in all types of organisations, but medium and large organisations pay attention to the monitoring, service delivery, customer relationship management, inventory management and even commercial security assurance tools which helps to increase the value addition. Therefore, it is needless to restate the importance of having the right tools in place to increase the value addition in the global software engineering industry.

Finally, the technology infrastructure was the last parameter that was assessed for its impact to the value addition. The outcomes of the exploratory study showed that the focus for the technology infrastructure depends on the strategic directions. Large organisations and certain medium scaled organisations have specifically started taking initiatives to increase the technology infrastructure with respect the development, testing, delivery and maintenance. But it was identified that development teams have wasted time in the lower development environment due to the internal dependencies as most of the environment are shared among multiple individuals or teams. This increases the time to market while contributing to multiple software wastes. Additionally, the network, development machines, devices and information technology support decide the final value delivery as this study have uncovered. Hence, the technology infrastructure plays a decisive role in the overall value delivery in the software product development organisations.

In summary, software development organisations that deliver products to either local or global customers focus on delivering the intended value in various ways. As this study has proven, the value addition depends on five key parameters. They are staffing, delivery process, governance, use of tools and technology infrastructure. Each parameter contributes to the overall value delivery

through right selection and application. Therefore, the confirmed conceptual framework through the exploratory study was used to formulate the survey to further examine the impact of these parameters which helped to fulfil the requirement of meeting the last objective which is described below.

7.2.1.4. Objective 04: Examine the Impact of the Identified Determinants for Value Addition in Global Software Engineering Industry in Sri Lanka

While the previous studies about in the global businesses have studied the preliminary parameters that impacts the overall value addition, none of them had focused on the global software engineering industry. Hence, the generics from the western literature and certain studies carried out in India were the foundation to formulate the initial research framework. This study focused on identifying these key parameters that impacts to determine the value addition in the global software engineering industry in general. After a thorough literature and comprehensive exploratory study, this is arguably the first empirical study carried out in this research setting to confirm the identified research framework. As discussed in section 7.2.1.3, the finalised conceptual framework was the foundation to formulate the questionnaire which consisted of several sections focusing on the five key areas that are discussed here.

Companies have focused on assuring the value delivery by paying more attention to the various lifecycle steps as discussed above. However, it was identified that majority of the software product development companies in Sri Lanka have not taken a wholistic approach to increase the value addition. Having the development and operations team separately increases the lead time and the process overheads have caused to delay the deliveries. Large organisations have faced a critical issue when it comes to standardise the production change management process, because additional quality gates have reduced the ability of meeting the end user needs within the shorter time span. Additionally, the frequency of the production changes is lowered due to the intra organisational governance practices. When further analyse the outcomes of the survey, it was identified that software wastes are common due to the governance and software delivery process. In addition to that, lack of focus for communicating the value to the respective teams and lack of involvement of the respective stakeholders within the decision making process are key highlights that impacts the value addition within the delivery process.

When the composition of the teams is considered, mismatches between the number of projects and resources, misalignment in the portfolio directions against the value delivery and lack of cross-functional skills within the team has impacted to meet the delivery goals. Additionally, size of the team impact, collaboration between the team members, development artefacts and geographical distribution are key to shorter the delivery time. Further, as the results of the survey discovered, development teams are mostly unaware about the specific value of a given change or feature. As highlighted in the literature, it happens due to the lack of coordination between the respective stakeholders and teams should be built around the specific strategic themes. However, local organisations promote the cross-functionality to have the right quorum within the development teams, but still there is a room for improvement. Additionally, the self-organised and self-motivated teams could help to increase the value addition. Therefore, staffing or in another word's arrangement of the software development and delivery teams helps to increase the value addition.

When further examining the survey results through the comprehensive data analysis process, it was proven that the tools play an active role to ease the work of the individuals those who get involved at different levels in the software lifecycle. Specially, the globally distributed teams require many tools to help their day-to-day activities such as communication tools, programming tools, continuous integration and continuous deployment tools, platform automation tools and more importantly effective project management tools. As the survey results discovered, unanimously, all the participants have confirmed that their organisations use project management tools and integrated development environments in their general development. But only large organisations have focused on identifying the reliable and trustworthy tools to further improve the value delivery. Organisations believe that having proper tools positively impact to the value addition which is proven through this study.

Finally, the enough attention to facilitate the development teams by providing the required technology infrastructure has a positive corelation to the value addition. This covers development and testing infrastructure, network, storage, cloud, security and development environment (either physical or virtual). The study has clearly proven that inability to provide the required infrastructure limits the ability of fast tracking the software deliveries which will ultimately erode the value addition. Therefore, the outcomes of the survey have clearly proven the relationship between the technology infrastructure and the value addition.

In summary, the comprehensive analysis of the collected data through the public survey reassures the findings of the literature and exploratory study by accepting the five hypotheses built around staffing, delivery process, use of tools, governance and technology infrastructure. Therefore, the conclusion of the overall findings clearly shows that the value addition in the global software engineering industry heavily depends on these five variables.

7.2.2. Overall Implications of the Research

This research has both practical and theoretical implications which are discussed below.

7.2.2.1. Practical Implications

One of the key findings of this research is to have cross-functional and value-based software development team to increase the overall value addition. It suggests that the formation of the product development teams around the project requirements should be based only upon the respective value delivery of given feature or capability. It further clarifies the alliance between the intended outcome with the investments for the human resources by aligning and utilising the development teams effectively to increase the overall value addition. This finding further highlights the fact that separation of the functions based on the skills and building a functional hierarchy erodes the value. The most efficient and effective way to assure the value delivery is to build the cross-functional and self-organising team.

In addition to that, the findings related to the software delivery framework suggests that the interconnection between the steps has a strong relationship in increasing the value addition. Two primary disconnections were uncovered: disconnect between the concept to the development and development to the deployment. Given that these steps are highly connected, the intended value is delivered. Hence, the product managers and respective functional managers should assure these gaps do not persist within the delivery framework which will ultimately assure the increase of the overall value addition.

Research findings related to the service delivery suggests that current practices could be further simplified to increase the value addition. As the qualitative results uncovered, none of the solutions fits for all types of software deliveries. Hence, choosing the best method is important to assure the most effective time-to-market strategy. However, as the findings suggest, it is not mandatory to

reinvent the wheel and form a new service delivery guideline, instead the organisations can simplify the current practices by identifying the right level of governance for each category of the software products that company owns. This can ensure that there are no unwanted quality gates, unnecessary waiting times or approvals within the company governance policy which assures there is no value erosion activities take place. Given that the service delivery guidelines are streamlined and simplified to suit the business requirements, it increases the overall value delivery by letting the changes to hit the production environments as and when the customers need them.

Another key finding of this research is the selection of the right tools to help the software teams to improve the efficiency of their day-to-day activities. Both qualitative and quantitative analysis results show that large organisations are heavily focusing on acquiring the tools to support the daily activities because the manual work is inefficient and hard to manage as well. Choosing the right tool can increase the overall efficiency and more importantly it helps to increase the overall value addition. Start-up, small and medium scale organisations should think of conducting a proper cost benefit analysis for the minimum required tools to facilitate the development teams to improve the efficiency. Strategically, the large organisations are trying to increase the value by reducing the inefficiencies within the development and delivery pipeline by implementing the required tools which other firms should also try to replicate.

Finally, another important practical implication that was found in this research is that the importance of paying attention for the required technology infrastructure to facilitate the development and delivery of the software products. Specially, the software product companies need to focus on the connectivity, development and testing environments and minimum required underlined security. Based on the findings, the large organisations are gradually investing the time and money on having the right infrastructure followed by the medium level organisations. Start-ups and small organisations should focus on upgrading their infrastructure support given that the value addition is heavily dependent on it.

In summary, the practical implications of this research are paying attention to build crossfunctional and self-organising teams based on the value streams, assuring the interconnection between the steps in the delivery framework, simplifying the service delivery guidelines, having the minimum required tools and finally, facilitating the teams with the required infrastructure to increase the value addition in the global software engineering industry in Sri Lanka.

7.2.2.2. Theoretical Implications

This study helps exploring the facts that increase the value addition in the software product organisations. While studying the relevant factors, two existing theories were considered which are found through the generic literature. i.e. Resource advantage theory and Lean management. Additionally, three models were considered as well. i.e. Kano model, Analytical hierarchical process (AHP) and Opportunity scoring.

Resource advantage theory is built on top of competitiveness for differential advantage theory and resource based view which intangible resources play a crucial role. Both aspects were illustrated clearly throughout the study that as software engineering industry lacks tangible outcomes. This study confirmed the inclusion of competency based strategy for the direct and indirect resources for creating the value through delivering the intangible outcomes. Further, cross functionality and self-organised teams assure the relative resource-produced value that increases the superior value creation at a lower cost. In addition to that, the characteristic of heterogeneous teams that are promoted through the resource based view are confirmed through this study by proving the positive relationship between the staffing and value addition in the software engineering industry. However, lack of business knowledge and the anticipated value delivery of the work that is carried out of the local leadership team and the managers causes the misalignment of the resources that ultimately makes a negative impact to the overall value delivery. In addition to that, the theory explains the process of leading the heterogeneous and imperfectly mobile resources towards differentiation and customer value delivery which will enhance the company performance. Application of this concept to the software product organisations is covered in this study which discusses about identifying the key resources within the organisation and utilise them to delivery promised value to the end users. Finally, the alignment of the product strategy and internal processes to optimise the value delivery is confirmed through this study by having a streamlined and interconnected software delivery process to maximise the value delivery irrespective of the nature of the organisation.

Reduction of the waste throughout the software development lifecycle is thoroughly discussed and proven through this study which is aligned with the lean management concepts. As the findings uncovered, software waste plays a crucial role in decreasing the value delivery. Both streamlined service delivery and inter connection between the steps in the software delivery process confirmed

the importance of removing the software waste within the processes. In addition to that managing a steady workflow and optimising the resources through the accurate alignment between the value delivery and team arrangements are also proven through this study which lean management promotes as way to improve the efficiency. Additionally, this study showed the importance of having the right tools throughout the software delivery process which has not been prominently discussed in lean management concepts. As Lopez, Santos and Arbós (2013) have highlighted, eliminating the non-value added function or activities can be identified only through a series of evaluations and using tools increases the efficiency throughout. As Womack and Jones (2015) explains eliminating wastes does not limit to the process overheads, but also continuous improvements through effective mechanisms. The process overheads are clearly highlighted through this study but not limited to it. Additionally, the ways to increase the value delivery through disciplined teams, streamlined processes and having right tools in place are proven as well. More importantly as Kupiainen, Mäntylä and Itkonen (2015) has argued, current challenges in the global teams needs an extended tool support to carry out their daily tasks effectively which lean management does not cover. A similar view is upheld by Abdulmalek and Rajgopal (2017) where they have highlighted the fact that complexities among the global software engineering teams is not only about process flows but also about how efficiently they can work together. Therefore, the inclusion of the tools throughout the application of lean management to software engineering industry certainly increases the efficiency of overall application when the literature and findings of this study are combined.

When the impact that makes for the chosen models are considered, the findings of this study has uncovered the absolute importance of identification of the value through proper measurements for software requirements by the product management teams. The qualitative study's findings shows that an extension of Kano model is in practice among the software engineering business teams where they use four categories when prioritising the features and tasks: must haves, should haves, could haves and will not (won't) haves. Further, business analysts and product managers believe that minimum-threshold features are based on subjective measures, but an effective numerical method helps to reduce the impact of subjectivism.

In addition to that, both case studies and public survey results prove that value addition in the global software engineering industry depends on the technology infrastructure that has not been

covered in the current literature. IT infrastructure was identified as a moderating variable in the generic value addition related literature, but it had not been considered as an independent variable. However, while this study was carrying out, an equal attention was paid for the overall technology infrastructure as software industry seemed to be heavily depending on the underline infrastructure. As a result, the case studies uncovered and proven that technology infrastructure is a must to increase the value addition in the global software engineering industry in Sri Lanka. None of the theories covered this area yet, hence the same effort was put into the public survey also to further analyse it. The results have clearly shown the importance of the technology infrastructure for value addition by assuring a strong and positive relationship. Further, reliability, security and performance have been identified as the key criteria for selection of the technology infrastructure for software organisations. According to the findings of the case studies, implications of not having the required technology infrastructure for the software development teams are inability to carry out the day-to-day development activities, the waste in manual testing, unwanted manual checks, complexities in manual deployments, identification of bugs in later stages in the development cycle and lack of support for production systems monitoring. When these key themes are carefully considered, all of them impacts to the efficiency of the software teams based on the assessments. Further, the public survey results clearly showed the importance of having the right technology infrastructure along with the required support to increase the value addition in the overall software development process. Therefore, a key contribution of this study for the literature and theory is the addition of the technology infrastructure as in independent variable that has a positive impact on the value addition in the global software engineering in Sri Lanka.

In summary, this study has theoretical implications that contribute to the body of knowledge in the value addition in the global software engineering industry as described above. It helps to assure the relevance of resource advantage theory and applying lean management in the software development industry while considering the potential applications of Kano model, analytical hierarchical process and opportunity scoring. This study has highlighted the variations of these models that are used in the current software engineering companies in Sri Lanka which help to increase the value addition. In addition to that, one of the key contributions of this study is the introduction of the technology infrastructure as a key variable that impacts the value addition which is also described above. It has proven how much this study has contributed to both theory

and practice at large. Below section discusses about the specific limitations and potential future work.

7.2.3. Limitations of the Study and Future Work

This study was carried out to identify the determinants for value addition in the global software engineering industry in Sri Lanka. But the findings of this study have to be seen in light of some known limitations. In addition to that, this research has tossed up many questions that are required to be answered with further research which are discussed in the below section.

7.2.3.1. Research Limitations

Lack of previous research studies on this topic has impacted heavily at the beginning to lay down the theoretical foundation for the research questions that were in investigation. Hence, the generic literature findings were heavily dependent on the value addition in business instead of value addition in global software engineering industry. In addition to that, all findings related to the global software engineering is from the western literature and some are from India. Value addition determinants related to the global businesses were carefully chosen by the researcher based on the similar characteristics. i.e. as the research was limited to the software product companies, the focus of the generic literature is set to the global product companies that has distributed teams in multiple geographical locations. In addition to that, global software product companies that has either distributed development teams or contracted vendors in other geographical locations.

One of the key challenges faced during the initial phases of the research is to access the industry reports through the industry bodies and government institutes. The content of the primary literature and industry overview are based on the publicly available information. In addition to that access to the company information via the SLASSCOM: the national chamber for the IT/BPM industry in Sri Lanka had also been restricted for the non-members. Therefore, scoping the qualitative analysis and finding the sample for the study was difficult. However, researcher managed to get access to information by obtaining the membership while the research is being carried out and the relevant industry reports and required information about the registered companies with SLASSCOM were obtained. But information about the non-member companies have not been considered for this research which can impact to the overall results of the study.

The other important limitation is the impact of the conflicts on the personal issues which could be categorised as socio and cultural issues. Given that the exploratory study required participants from all four categories: large, medium, small scale and start-up, researcher had to put more effort on convincing the individuals to take part in the interviews. More importantly, all the interviews had to be conducted via online methods due to the travel restrictions imposed by the government after the Covid outbreak, certain participants were reluctant share the actual information. To reduce the impact, researcher made sure that the recommendations are taken from the known parties when approaching the unknown parties to schedule the interviews.

In summary, lack of literature, limitations due to lack of access to the data required and social cultural limitations have impacted the outcome of this research.

7.2.3.2. Recommendations for Future Research

The global software engineering industry in Sri Lanka is young compared to the other countries in the region. Therefore, there are plenty of research areas that requires more attention related to the value addition in the overall industry. However, the specific new themes that are introduced with this research are impact of formation of the development teams for value delivery with respect to the organisational cluster, criteria for adopting the software delivery methods for large organisations, cost benefit evaluation criteria to increase the value addition in tools selection and increasing the value by having the minimum viable technology infrastructure.

This study has partly covered the formation of the teams in the selected companies as part of the descriptive analysis. But it requires more attention to the skills, cross-functionality, qualities against the value delivery in all four categories of the organisations to further understand the right formation of the development teams to increase the value addition. As the findings uncovered, 59 percent of the public survey has confirmed that they have small teams which consists of 5 to 9 members, whereas the small and start-up companies maintain large teams which consists of more than 10 members. This must be further studied to conclude on the ideal team size as well as the skills required to increase the value addition.

It was identified that 62 percent of the organisation are using generic agile scrum practices, but 100 percent of the large organisations are using a custom version of it. Given that any organisation is adopting the generic version, the change management is easy as there are enough case studies to follow, but if any organisation is trying to customise the practices and adopt, it requires an

additional effort during the rolling out stage. The reason behind selecting the software delivery methods was not studied as part of this study which should be further studied to suggest the best method for adopting a methodology for large organisations.

Use of tools in software engineering is very common to ease their day-to-day activities. However, commercial tools have a cost associated with each licence that company obtains. Certain tools used in the software companies are very expensive such as security tools, infrastructure monitoring tools, certain project management tools and tools used for automation. A proper analysis is required understand the benefit vs cost in alignment with the overall value delivery by employing those tools. In addition to that, use of proper communication tool was highlighted throughout this study to increase the value addition in the global software engineering industry, but it requires a further analysis to understand the actual benefit of having proper communication tools.

Finally, the investments related to the technology infrastructure found to be very low compared to the other investment themes in companies. But the study showed that there is a positive relationship between the technology infrastructure and the value addition. Given that overall value addition can be improved by having the right infrastructure, a comprehensive analysis is needed to understand why and how the companies should focus on implementing them. Technology infrastructure is cost effective in countries like Sri Lanka due to the lack of availability. Hence, a thorough study that covers both benefits as well as the cost incurred along with the respective value that it can generate would come in handy to assure the sustainability of the global software engineering industry in Sri Lanka.

In summary, selection of the teams, adopting software delivery methods, choosing tools and investments on the technology infrastructure to increase the value addition in the global software engineering industry in Sri Lanka should be further researched.

7.3. Recommendations for the Industry

This study proposed a comprehensive framework for the global software engineering product companies to understand how each parameter contributes to the value addition of the overall product delivery. It covers the whole spectrum of the software development lifecycle by paying attention to each and every aspect that has an impact to the perceived value delivery. According to the findings, it was concluded that staffing, development process or framework, governance, use of tools and technology infrastructure directly contributes to the value addition in this industry. Additionally, this study proposed subthemes under each category that impacts to the main parameter as well. Therefore, the below sections provide some recommendations that the companies can implement to increase the value addition.

7.3.1. Embedding Value Considerations into Teams, Practices, Processes and Frameworks

As the study articulated, most of today's software engineering activities take place in a value neutral manner which has caused to reduce the overall value delivery of the software piece that is being developed by the distributed teams. Once the investment themes are decided at the senior management level, the rest of the activities should be in alignment with the respective value stream priorities. i.e. identification of the minimum required skills, capacity for the delivery, composition of the development team, and assignment of the work should be based on the priorities decided based on perceived value delivery. Any organisation should use a mathematical model to decide the priority that considers value as a parameter. Based on the findings of this study, Kano model or weighted shortest job first approach are fine selection for any organisation. The priorities of the rest of the work should be revisited at regular intervals that is agreed between the senior management and the mid/low level management to make sure that the priorities are up to date.

Another important finding from this study is the adoption of the conventional team arrangements, processes, practices and frameworks that impacts the value addition. As the findings section clearly discusses, traditional software development methodologies have been built to help the collocated teams and to cater to the requirement of large software applications that takes long time to deliver. The demand in the global setup is entirely dissimilar and all the organisations are competing in a fast-moving market. Additionally, it was clear that seventy percent of the large and medium scale organisations have either already adopted or in the process to move from the traditional methods to agile based approaches which shows a positive trend towards increasing the value delivery. However, out of those organisations, only sixteen percent is using a customised agile based process or framework. As the literature uncovered, it is vital to understand the current context and customise the processes in order to be better with respect to value delivery. Therefore, it is important for the organisations to understand the scope of the work, time zone differences, culture specific challenges, and local policies and processes when implementing a software delivery framework or process as discussed in detailed in the discussion section. Further, teams should be

organised around the value streams to maximise the value delivery which means that the skills, capacity and formation should be decided based on the value stream needs to build the software development teams.

When we consider the software development processes, it is unavoidable to implement a proper governance policy to make sure that the deliveries are in accordance with the organisational policies. Below section provides few important recommendations based on the findings of this study.

7.3.2. Implementing Right Governance

As the research findings uncovered, 86 percent of the large and medium scale organisations are practicing ITIL (Information Technology Infrastructure Library) framework which describes a set of detailed practices for information technology service management that focuses on aligning organisational policies, services and practices with the respective needs of the business. Out of that more than 60 percent confirmed that they have implemented the generic ITIL model without a proper analysis and customisation. Moreover, it was identified that service portfolio and development portfolio misalignments have increased the number of quality gates in the process which erodes the value within the process. Additionally, having a proper software delivery assurance policy that includes release plan, environment plan, quality assurance process, deployment management approach and more importantly governance gates help the organisations to increase the value addition. However, as discussed in the discussion chapter, misalignments, absence of metrics, unclear expectations, and lack of transparency have led the organisations to implement unwanted governance which erodes the value.

Therefore, organisations should plan the governance policy around its business goals while assuring that the proper performance metrics, solid quality process, right level of transparency and proper alignment within the business units are in place. To do this, a proper top down analysis is needed to identify the respective expectations of each business unit to implement an accurate governance structure. Given that the objective of each unit is aligned to the organisational goal, right level of governance can be implemented that avoids unwanted gates and waiting time in the pipeline when delivering the software features to the end users. Therefore, it is recommended to identify the minimum required governance to assure the organisational objectives are met while the software development teams are not blocked due to the unwanted gates.

The other important area is the use of tools in the software development lifecycle which is explained in the below section.

7.3.3. Using the Appropriate Tools

As articulated in both data analysis chapter and discussion chapter, organisations are using various tools during the software development lifecycle to improve the efficiency by easing the software professionals' lives. It is vital to have the minimum required tools in place to improve the productivity such as integrated development environments (IDEs), build tools, tools to support methodology, source control and one or more testing tools. However, as clearly discussed in the data analysis chapter, it was clear that the focus for the automation should be increased to assure the value delivery and to increase the same. But, it was closer to 20 percent those who are using test automation tools effectively. Therefore, it is recommended to identify the test automation requirements, implement a test strategy, socialise a proper plan and write automated tests to increase the productivity.

When choosing the tools, it is important to consider the usefulness: should be validated against the need and the type of the tool, applicability to the environment: not all tools are applicable to all types of organisations, environments and teams, company standards: depending on the need and company guidelines tools should be chosen, prior team experience with tool: the cost of learning curve, integration: ability of integrating the tool with other existing tools, overhead: complexity of using the tool, and last but not least, the cost and license agreement: the cost of buying, implementing and maintenance should be considered.

It is recommended to develop a selection criterion and a pool of tools that serves the respective needs for any given organisation to avoid the redundant effort in researching about the tool, minimise the burden for the development teams, avoid buying unwanted software and to choose the best fit for the given requirement. This checklist can be developed using a series of questions that each individual should ask when choosing a tool. Additionally, the tools should be provided for the software professionals from the concept to the customer that covers the whole spectrum of software development lifecycle to increase the productivity. Given that any organisation has the right pool of tools, it is not a waste of giving the ability to use those in the development process. Moreover, in the licensing models, it is important to choose right access levels and facilitate the software development teams to increase overall value delivery.

Technology infrastructure is a key area that can make or break the project as Devins (2018) says. Therefore, the below section provides the recommendation with regards to the technology infrastructure in a software product development company.

7.3.4. Paying Attention to Technology Infrastructure

Infrastructure includes the software, hardware, communication and support for all the aspects of them. This study uncovered the importance of paying attention to the technology infrastructure in various ways. Obviously, this has a direct impact to the value addition in the global software engineering industry. Additionally, if an organisation does not pay right attention to providing the required infrastructure for the employees, the overall operation fails at some point without being able to complete certain activities.

Software requirements cover the system software and application software. It is a common understanding among the organisations that everyone in the software development companies need the minimum required software applications to perform their day-to-day activities. Additionally, just-in-time support for software related issues, continuous attention to upgrades and patches, and frequent audits help the organisation to keep up with the software needs as found through both literature and survey. Moreover, educating the individuals to attend to the basic system software related changes help to reduce the burden and waiting time in the support services which will ultimately contribute to add more value to the end users.

The hardware covers the whole spectrum of needs in the software development pipeline that spans from a typical laptop or desktop to production environments. Additionally, the network, data connections and facilities and communication tools come under the communication category. Given that the minimum required facilities are provided with respect to both hardware and communication, the teams can perform their day-to-day activities effectively and efficiently. However, these are adding costs to the organisation. Therefore, a selection criterion should be in place to make sure that each request or need is captured and evaluated consciously before purchasing the respective hardware or spinning up the respective environments. Additionally, delivery goals should have a weight for the technology infrastructure subgoals as well. As clearly explained in the discussion chapter, it is important to identify the infrastructure needs upfront and plan accordingly with the value stream priorities for specific demands. Therefore, an organisation should pay attention to all these three aspects in order to capitalise the be more productive in order to assure the overall value delivery.

Below section summarises the chapter.

7.4. Summary

This study was carried out to identify the influential factors for increasing the value addition in the global software engineering industry in Sri Lanka. Given that the literature focusing on this topic could not be found, the study was initiated as an exploratory study later converted into a descriptive study after forming the conceptual framework. The initial framework was tested through the exploratory study which was later used as the foundation for the public survey. All the data collected through both case studies and public survey are analysed thoroughly using NVivo and SPSS to interpret them effectively. All these empirical results are considered when formulating the outcomes of the research and providing the recommendations. Overall findings section clearly described how well the findings are aligned to the set research objectives.

Additionally, this chapter discussed about the practical and theoretical implications of this study. The practical implications are aligned to having cross-functional and value-based software development team, implementing the right governance, assuring the proper interconnection between the steps in the lifecycle, and facilitating the teams with the required infrastructure to increase the value addition. The theoretical implications covered the applications of lean management and resource-based view along with Kano model, analytical hierarchical process and opportunity scoring. More importantly, inclusion of technology infrastructure to the scope can also be found.

The limitations of this research as well as the potential future research are discussed as the last part of the first section. The identified limitations are lack of literature, limitations due to lack of access to the data required and social cultural limitations. The potential future research based on the findings of this study are impact of formation of the development teams for value delivery with respect to the organisational cluster, criteria for adopting the software delivery methods for large organisations, cost benefit evaluation criteria to increase the value addition in tools selection and increasing the value by having the minimum viable technology infrastructure. The second segment primarily covers the recommendations for the industry and respective software product organisations to increase their value delivery. It covered all important aspects of staffing, delivery framework, governance, use of tools and finally the technology infrastructure.

This chapter covered the overall findings pertaining to the set objectives, both practical and theoretical implications along with the limitations of the study. Given that new research areas were discovered in the study, few future research recommendations are also provided along with the recommendations for the industry which is concluded with a precise summary.

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Appendices

Appendix A

Interview Templates, Data sheets and Results

Interview Template

Demographic / company information

- 1 Your current role is
 - i. Engineer
 - ii. Manager
 - iii. Director
 - iv. Head of a dept
 - v. Support or shared service
- 2 Overall years of experience
 - i. Less than 5 years
 - ii. 5 to 9 years
 - iii. More than 10 years
- 3 Number of years of experience in the global software engineering industry
 - i. Less than 5 years
 - ii. 5 to 9 years
 - iii. More than 10 years
- 4 Size of the current company or the company that you have experience with global software engineering
 - i. Less than 50
 - ii. 51 to 100
 - iii. 101 300
 - iv. More than 300

- 5 Are Development teams collocated?
 - i. Yes
 - ii. No
 - iii. Some

Q.1. Why should any organisation think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Q.2. What factors lead to make the decision of moving to low-cost centres?

Question

What factors lead to make the decision of moving to low-cost centres?

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why should any organisation follow a standard process? Or why not?

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What is the composition of it?

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Q.19. How is a completed software evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Datasheets

Responder Classification Sheet

Person	Discipline	Emp Category	Experience	Occupation	Org Cluster	Sex
Cases\\CS - A	Software Engineering	CXO	5-10	Director	Start-Ups	Male
Cases\\CS - B	Software Engineering	CXO	30-40	CEO	Small	Male
Cases\\CS - C	Product Management	Manager	10-20	Director	Large	Male
Cases\\CS - D	Software Engineering	CXO	20-30	GM	Medium	Male
Cases\\CS - E	Architecture	Manager	10-20	Architect	Medium	Male
Cases\\CS - F	Project Management	Manager	10-20	Manager	Medium	Female
Cases\\CS - G	Architecture	СХО	10-20	Architect	Small	Male
Cases\\CS - H	Project Management	Manager	10-20	Manager	Start-Ups	Male
Cases\\CS - I	Project Management	Manager	10-20	Manager	Small	Female
Cases\\CS - J	Project Management	СХО	20-30	GM	Medium	Male
Cases\\CS - K	Project Management	Manager	10-20	Manager	Start-Ups	Female
Cases\\CS - L	Product Management	Manager	5-10	Director	Start-Ups	Male
Cases\\CS - M	Project Management	Manager	10-20	Manager	Small	Male
Cases\\CS - N	Software Engineering	CXO	20-30	MD	Medium	Male
Cases\\CS - O	Project Management	Manager	10-20	Director	Small	Male
Cases\\CS - P	Quality Engineering	Manager	10-20	Manager	Start-Ups	Male
Cases\\CS - Q	Product Management	Lead	10-20	Lead	Start-Ups	Male
Cases\\CS - R	Technical Operations	Manager	10-20	Director	Medium	Male
Cases\\CS - S	Software Engineering	Lead	5-10	Lead	Start-Ups	Female
Cases\\CS - T	Software Engineering	CXO	20-30	CEO	Small	Male
Cases\\CS - U	Software Engineering	Lead	10-20	Lead	Start-Ups	Male
Cases\\CS - V	Project Management	Manager	10-20	Manager	Start-Ups	Female
Cases\\CS - W	Quality Engineering	Manager	10-20	Manager	Small	Male
Cases\\CS - X	Project Management	Manager	10-20	Manager	Start-Ups	Male

Variable	ariable Label		%
	Software Engineering	7	29.17
	Product Management	3	12.50
Dissipling	Architecture	2	8.33
Discipline	Project Management	9	37.50
	Quality Engineering	2	8.33
	Technical Operations	1	4.17
	СХО	7	29.17
Employee Category	Manager	14	58.33
	Lead	3	12.50
	5-10	3	12.50
Experience	30-40	1	4.17
Experience	10-20	16	66.67
	20-30	4	16.67
	Director	5	20.83
	CEO	2	8.33
	GM	2	8.33
Occupation	Architect	2	8.33
	Manager	9	37.50
	MD	1	4.17
	Lead	3	12.50
Candar	Male	19	79.17
Gender	Female	5	20.83
	Start-Ups	10	41.67
Org Cluster	Small	7	29.17
	Large	1	4.17
	Medium	6	25.00

Case Study - A

Q.1. Why should any organisation think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Mostly our management looked into new markets. Specially APAC region didn't have any office. So, they wanted to open something in this region. Initially they started an office in Singapore and then they wanted to have a development centres also nearby. Singapore was their choice initially. But compared to that Sri Lanka was cheap and quality of our work is also considerably high. So, they chose us.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Resource availability, infrastructure and quality of the work would the first 3 priorities.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

Our customer segments vary from North America, Europe and certain countries in APAC also. And we are trying to move to China as well. So, those business decisions are made by the product organization with the help of the senior management and carve the initial business case.

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Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

We don't have specific and common delivery model for all software application development. Mostly we focus on the time. Then we change the scope and staff if necessary. So, we do fast delivery. As of now I don't see any issues in the current process.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

Since we follow the generic waterfall and Agile scrum, I hope that interconnection is already in place.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

That would be an interesting area to consider in the future. Currently I know there is some form of software waste due to the current way of deliveries.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

We are not heavily focusing on the process. We focus on the software delivery. Somehow we get the work done. But, there are times where we have thrown away certain POCs and prototypes. And even certain unwanted documents too.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

It should be based on the objectives of the organization. If we heavily focus on the quality output, it's always better to go with the standard process. But, if we focus on the fast delivery to capture the market, you can always take short cuts.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

We only have few managers at the moment in the local setup, but there are plenty in the other part of the world. I believe they get involved in the higher level discussions much than the development related meetings. It's something that we should try it seems. We need to let our managers also consider the importance of the value delivery.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

We deploy our solutions and transfer that responsibility to the sales team. They basically go and pitch to the customers. If customers are happy about our product, I believe we have delivered the value.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We still don't have the concept of value streams. But, in certain cases I have also felt like we are spending time on low value generating projects since that segregation is not there.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have formed teams to support the respective products they own. Some teams are small and some teams are comparatively large. Developers and Quality Engineers work on the development and testing while project managers focus on the delivery.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

Currently it's based on the delivery dates. We haven't implemented code quality guidelines, quality process or even release check points.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

We have some implementation engineers and operations support engineers in other locations. Sometimes I have felt like we should have certain standards and guidelines for them as they don't follow our instructions. So, better to have a process when you have people working from multiple geographical locations.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Sometimes it can add unnecessary burden to the teams. But, it's worth to implement it given that the governance is important for certain organizations. For us, it's not yet important.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Except few, yes we are using the right tools. There are some unwanted paid and free tools that we need to remove as soon as possible.

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Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Software development tools, automation tools, project management tools, monitoring tools and even basic office package can add value to a delivery. Tools are necessary in todays businesses to increase the value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Technology infrastructure is the key to deliver anything. Without a proper infrastructure we are failing to meet the targets. Specially in Sri Lanka infrastructure is expensive. We need to make sure that we have the right instruments along with the right facilities if we need to compete in the region.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

It depends on how well our customers buy or subscribe to our tools. If we can gain more attention, that means we have delivered something unique.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

We are growing and improving. We may take some time to reach that goal. But, yes we should be ready as soon as possible.

Case Study - B

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

One reason is the time zone overlap and clarity of the expectations. And another reason is the local marketing support. And even to generate more profit through saving cost.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Cost is primary, but there are certain industries which have certain qualities. Other than that quality of the work matters and it's high in Sri Lanka. And quality of the people matters.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the teams' level.

Answer

We have our clients other side of the world. Our model is to basically connect to the client organisations directly and work with them. Or we are using outsourcing model where the whole work is completely is outsourced and we are responsible for the delivery. In both cases we get the requirement and focus on the delivery.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

If it's referring to the service industry, normal process is followed which has potential improvements. I think there are lot of things that we improve. In my opinion our own product, we need to understand the market need clearly and that has to be clearly communicated to all stakeholders to assure that they understand the real value of the work which is not happening at all in most of the companies.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

It's really important to have a model that encourages communication to assure that interconnection.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

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Answer

Well, I don't have a very specific answer for that. But, we always look at the process and see if there is any ways to improve it. One thing that we always do is the frequent communication between the stakeholders to get frequent feedbacks. So, that can assure we are on the right track and no value is eroded.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Yes. I think we do it well. But, if you are asking do we do at each level. My answer is no. We don't do it well at each level.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Following a standard process is easy for any organisation to assure that what they follow is correct and proven. Without following an ad-hoc method, it's always good to follow a standard process.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

We do not have a specific manager layer. Our engineering team gets involved with the client's management teams directly. So, they do involve on daily basis according to my understanding.

Q.10. How does a new requirement is validated against the market needs?

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Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

It all depends on the business case. But, in theory we have a gap their to fill. However, with my experience specially in the global model, this is a must have to ensure that the right value is delivered to the end users.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We don't have value streams in our current business model. Hence, teams are not organized in to the value streams.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

It's based on the customer needs. Sometimes it is on site or it could be off site. But, we decide it based on the work that we need to deliver. But, is it based on the value, I think it's not. It's based only on the urgency.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

High level guidelines are set such as dates, quality and completeness. Other than that respective project managers define their own delivery guidelines.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes, absolutely yes. Because there are cultural differences and challenges. Hence, having a customized version of whatever the process you are using is a must.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes, if it's not the right model. But, if you are using the right level of governance, it will assure that you do the right thing.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Tools are really important given that people in the organization are conformable using them. But, we have certain tools that we have bought which might not be suitable for us to improve the value delivery.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

There are different types such as communication tools, project management tools, modelling tools, diagramming tools etc.. All these tools contribute to the final outcome. So, it's really important to know what you need to deliver the value you intend.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

As a country we need to seriously think about it. Whatever we do to develop and deliver software applications, that doesn't make any sense if we don't have the right infrastructure. It has to be built properly by the government and allow the businesses to focus on the business development, so the value delivery in the industry goes up.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

It is done by the respective clients. I think they use the basic feedback model to do that, which might not be the one and only way to do it.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes, as a company and industry as well given that the local industry is properly finetuned to assure that we have the freedom to work on our goals.

Case Study - C

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

One area is where the market demand is key to make that decision. Other side is where resources are available.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

The first one is the cost. Other factors are skilled resources, support and quality of the work.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

Earlier we had every 3 year releases, but we have recently changed that frequency to every 6 months. So, the changes or features are decided by the people those who work with the customers and share those requirements with the respective product owners. They do the initial level of evaluation and create the detailed requirements for the development teams to start working on them.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Yes, as I said we had many issues in the previous model and we changed it. But, still we have to further understand the importance of having certain steps in the process. Some of them are just time wasting activities. So, we need to get rid of from them and let the development teams to working on the required features and delivery it ASAP.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

It's not something that we do it as practice as I understand. But, it's a must. We need to assure that the value is properly communicated to the development teams and the respective managers should assure that it's properly delivered within the process.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We have kind of a retrospective meetings to understand those things. But, it's not happening always. Better to have it very frequently.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I think, yes. But it is not 100%. We have a room for improvement. Currently this is happening via discussions.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Well, it's easy. But, you need to choose it wisely. Always the standards processes are not giving what you are looking for.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Everyday they get involved in our process. But, in certain cases managers might not be well aware about the actual value.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

I think, it's through the marketing teams where they get the customer feedback.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We have product wise value streams where a vice president is assigned to each product line. They decide what should be built next and those requirements are added to the backlogs of the teams. So, the respective managers get the development teams to work on them.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

Primarily development and quality engineering teams are working on the features and products.

Q.13. In general, how do you define the project delivery guidelines?

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Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We focus on the quality and timeline aspects. Then we decide the scope. Once, they are clariid and clear, we decide what are the high level guidelines.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Not really, but there may be situations where you need to have certain special guidelines. So, in certain cases we might need special or additional processes.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Governance is needed, but the right level of governance. Unnecessary governance can lead to erode the value for sure. I have seen in certain organizations, development teams cannot deliver what they develop quickly to the production due to the governance.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Yes, we are using right tools, but still there are lot's of the tools that we should think of using as they can add more value to our processes.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Currently we are using project management tools, quality assurance related tools, monitoring tools, communication tools etc. I think they are needed to delivery the value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

It's really important to have the basic infrastructure as it's crucial part of the development work as the value cannot be delivered without it. I would rank it at number one or two. It might only be second to people. So, it's really important.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

It's done by the respective product owners with the support of the business leaders. Basically, they evaluate it against the business cases.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

We are already a global company. But, in Sri Lanka, we have challenges which we need to sort out soon. So, many organizations can go global and serve better.

Case Study - D

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

The management can focus on expanding their business or simply to support their customer around the clock. And sometimes they can even think of the cost factor where they can save cost by moving to countries where the human resource and infrastructure cost is low.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Quality of work, work ethics, cost and willingness to work are key factors that people might consider when moving to other countries.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

Normally the portfolio level makes the product or feature decisions based on the objectives of the company and do a high level prioritization before they are adding to the team's backlogs. Once they are ready for the development, teams take them up and delivery. Afterwards, they will be under the operations team.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

I cannot say, no. But, we always look for improvements. Obviously there are things that can be considered as wastes.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

I am not too sure if we look at our process in that angle. But, it's crucial to maintain this interconnection for assure that value is not eroded within the process.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer
We always do retrospective to understand how well we do work. It's more of a discussion forum for everyone to come and comment or share their ideas. We take action items and act on them to assure no value erosion activities take place. Having said that, still we cannot say waste is zero. There is always a new waste when you change something.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I think we deliver the maximum value, but we haven't thought of such measure to evaluate and see it.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

People want to go with standard processes as they are proven. But, in my opinion they should think how well they are fitting into their respective business models. Even, we didn't do such in depth analysis.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

We don't go into the business areas, but as a technology centre we get involved within the implementation phases.

Q.10. How does a new requirement is validated against the market needs?

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Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Honestly, we don't have that visibility. But I think it's through certain themes and strategic objectives.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Currently we use Agile scrum. But we are moving to SAFe. Normally the requirements are decided at the higher level and cascaded down to the teams when the product owners feel the particular requirement is ready for development. So, the development teams start building what is being assigned to them. Then it goes to the quality assurance process followed by the operational activities.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

Simply they are scrum teams. Developers and Quality engineers which is managed by a manager.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We mainly focus on dates and quality of the output as the technology centre. Other than that respective departments are defining their own standards and guidelines.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Well, no. It may erode the value anyway. However, in certain cases you might need additional guidelines due to the cultural barriers or communication challenges.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes. Unwanted governance can erode the value since that kills the freedom.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

I believe, yes. But certainly we have to improve.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

There are many aspects. Communication, infrastructure, project management etc. All these tools can help to increase the value if you do it wisely.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Definitely it is a very important factor. Specially if you look the current situation, without a proper infrastructure you cannot do anything. If you are software guy, to continue your work you need it. Specially as a country our infrastructure is not sufficient and costly also.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

To be honest, I don't have the visibility. But, I assume it's via the feedback.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

I believe we have a journey to reach there. We are working very hard to achieve it.

Case Study - E

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

There are two reasons. The first one is getting mass production done and amount of resources needs. Sometimes, with many resources you can deliver a large product within a shorter time span which cannot be done in their onshore locations.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Typically the cost is the primary factor. Other than that skillsets of the people and availability of them at a lower cost. And even infrastructure cost is considered.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

One type of requirement we get is the new features, but there are many other types of requirements such as regulatory changes, tech debts, policy changes, technical enhancements and even

architectural changes. So, source of these requests can come from many sources. Sometimes, even the teams raise these as requirements. But, investments decisions are made by the product owners.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Not really. We are okay with the current process. I don't see much issues.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

There are certain discussions happening even now at different level to understand the process improvements. Our current process is heavily managed by the quality engineering leadership. According to them, there are gaps in between the steps in the process.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

Not proactive measures. But, there are certain reactive measures are taken. Teams itself share their thoughts on certain limitations. Once our management get those ideas, they evaluate and do the necessary changes.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Yes. Otherwise we cannot survive. But, we can certainly improve many areas such as requirement prioritization, forming the teams, setting delivery guidelines etc.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

It's not a standard process, but it's a tailormade process as every organization might have their own flavour of standard process. As a large organization, we need to have some form of a process. Otherwise management is not easy.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Our 2^{nd} level managers involve at the teams level, but level 1 team gets the opportunity to work with the business teams. They take the necessary steps at each level to assure that they deliver the value.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Mostly via the R & D teams it happens. They understand the real value of a feature with the prior experience and through the CRM stats. So, they validate easily with those measures.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

In our case, each value stream has their own budget. So, they do plan their features based on those allocated budgets. These value stream leaders closely work with the architecture department to understand the form of delivery and high-level efforts. Once that's decided, teams get those requirements as a prioritized list.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have dedicated development teams as well as quality engineering teams. Architects are closely working with the development teams to deliver the features.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We have a set of guidelines that we already got from the standard Agile practices. Other than that there are couple of internal guidelines we have set in order to further improve the quality of the delivery. But, it doesn't normally depend on the release or specific product. They are also common across all the products and teams.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

No. If you properly structure them, you can easily manage it with the simple process.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes. Personally I don't like to work with many unwanted governance in place. So, the creativity and freedom are key in software development. I strongly believe governance is needed only for critical stuff.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

We have many tools. Most of them are right and some not giving us the right support.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

It's a lengthy list. It contains marketing research tools, project management tools, diagramming tools, development tools etc. So every tool can add value, but you should select it carefully.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Technology infrastructure is the foundation of whatever we do. Without it how can we deliver anything. So, companies should focus heavily on implementing the right infrastructure.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

Our business teams work with the sales teams to understand those gaps and document them for future release. Normally, it's through feedback.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Yes. My current organization is one of the leading firms in Sri Lanka. I think with smaller amount of effort, we can go miles and miles.

Case Study - F

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Nowadays it's very rare that all the skillset required can be found in one single location and even in certain cases some might need hardware items as well. So, doing this in one place would be costly. So, as organizations they have to look for options available outside of their home locations.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Cost is a factor for sure. But, I didn't pick up in the previous question because cost is not only the factor when signing outsource agreements or building development centres. They are seeking for availability of resources, skillset, hospitality in some cases, quality of the work, history, condition of the infrastructure etc..

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Simply we use Agile SAFe. It's portfolio level to program level then to the team level that requirements are flowing down. All the business related decisions are isolated at the portfolio and product management level, teams do only the assigned work.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

One key thing is that they are not aware of the "why" factor. They don't know why they are doing certain tasks which means value is not properly being communicated to the team. Therefore, local management and certain service delivery related people are making unwanted paths for release approvals which wastes a lot of time. We need to improve them.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

Internally at project management level, we can evaluate it and do the modifications. We do every two retrospectives to see if there are any improvements. But, beyond that we cannot change anything in the release approval paths or change approval board.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

I don't know if we do anything proactively. But, we have that open discussion with teams though we don't use the term value much.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I hope that evaluation is happening at the project management organization with the help of product organization. Hence, I believe they get what they intended for.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

I am a strong believer of following standards processes such as SAFe because they have been researched and proven. Hence, the risk is low when you follow such a process.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

I as a program manager get involved with the product teams weekly. Other than that project managers and functional managers also get involved with them at least bi-weekly. So, our process is aligned to facilitate it.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

That's the responsibility of the product team. When they come up with a new requirement they do that initial market research and sometimes pilot runs also with clickable UIs.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

As I said earlier, it's the SAFe practice we use. Typically, solution architects take care of the design up front and once the design is ready they share it with the product architects those who work with the development teams. They are working with the local functional managers and project managers to assign those tasks to the development teams.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have scrum teams. There are developers, quality engineers those who work on the assigned features. Functional managers, architects and project managers do the management stuff.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We have well established guidelines already with SAFe. We just follow them. It's very rare that we change them based on the projects.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

I don't think it requires any additional processes, instead you may need to optimize the selected process as there can be certain team specific challenges.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

May be. But, if you properly select the governance it might not be adding any additional burden.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Yes. We use many tools. To best of my knowledge they have already been evaluated by many people in the organization. I hope they all add value. However, certain organizational restrictions do not allow us to select the best tool, instead we have to go with some other tool.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Any tool that helps to deliver fast can add value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

IT has become a must have now. Even during the last few month we all experienced it. Without it we cannot deliver any value. It's the platform or the medium.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

Once the product is ready it goes to the pilot or research labs for the initial evaluation. Once it has the required features, they give the go ahead to push it to live.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes. But that doesn't mean that there is no room for improvements.

Case Study - G

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

In our case, they looked at resource availability and quality of the work. Obviously the cost is the primary factor for them to look at this side. However, I think if any organization sees more opportunities in the global landscape, they should think of implementing it as a strategic initiative and make a move.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Cost is the primary thing. Other than that quality of the work, delivery timelines, availability of the resources, academic background, and infrastructure as well.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

We have our business teams and leadership team in USA. They primarily make the business decision on new product development. Once the business case is final, they do the initial solution design with architects and share the high level requirements with our business analysts. Afterwards, they add the required information and share it with the respective teams. Once the development work is complete, we do the demonstrations and push it to the live environment.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

A few. Obviously, the initial level discussion outcomes are not visible to our local leadership teams also. So, there we waste time on repetitive discussions to sort out things. And other than that our development process also has many unnecessary gate to pass. Which should be taken out ASAP.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

I don't think we have evaluated our process in that sense. I hope it may be interconnected up to a certain level as we follow the standard Scrum and Kanban processes. But, not totally.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Mostly we try to understand our performance on monthly basis and we see how well we are improving as the development team here in Sri Lanka. But, at the global level we don't get a chance to talk on those matters much.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

As I don't have much visibility to the initial steps of the product development, I cannot comment on how things are happening there. But, in our case we try hard to assure we deliver the right value to the end users.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

It's easy and proven. But, mostly we go wrong when selecting the processes. Sometimes, the standard processes should be customized to match out requirements which are hardly happening in the local companies.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Locally we have project managers and architects those who manage our teams. They get the opportunity to get involved once the business analysts share the initial requirements with them.

Afterwards, they heavily focus on the delivery and technical aspects. But, it's very rare that I hear they talk about the value delivery.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

That happens in the respective markets. North America, Russia and Germany. They do market analysis before coming up with the requirements and then they do pilot runs as well.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

It's the scrum practices we use here and for some team we are using Kanban as well. Typically, the new needs are added to the teams' backlogs and teams take it forward from there.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have developers, quality engineers, project managers and architects those directly work in the teams. They are small teams.

Q.13. In general, how do you define the project delivery guidelines?

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Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

Majority of them come from our USA counterparts. The CTO and his direct reportees do them. We can only decide how and when we deliver the particular product or component. In addition to that we do the quality engineering guidelines locally.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

In my experience, I have come across many difficult situations due to unavailability of proper guidelines. Hence, I think it's must.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

If it's not done intelligently, yes. It can simply kill the freedom of the teams.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Yes. Definitely. With my experience some of our leaders also have tool phobia. They don't want to spend money to buy the right tool. It wastes the time. So, tools are critical for value delivery.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

More or less any tool that can help to improve the efficiency of the development and delivery can add value. Ideally it should start from the portfolio level until the CRM.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Very critical. Without it this industry is nothing. Everything is based on the infrastructure now. So, it's really important to work on that side to improve it.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

As I said earlier, it happens through pilot programs and demos.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes, but needs improvements.

Case Study – H

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Primarily the cost is considered and then availability of the resources and the business opportunities.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Other than the cost, they consider the skills, availability of the resource, quality of the work

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the teams' level.

We use Agile Scrum and at the portfolio level the business decisions are made. We are not involved in that level. Once the requirements are finalized, we assign the teams and deliver what is promised.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Of course yes. There are many in my opinion. Primarily we do not consider the value of certain activities. We have more gate keepers which are not adding any values. I believe, we should get rid of from them.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

I don't think we do such thing in our current process. But, in an ideal work flow, it's really important to have them properly interconnected.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

As I said earlier, we do not specifically do that evaluation at our level and I don't think it happens at even the higher level. However, recently we initiated a process optimization activity, but that also happens within the given standard guidelines which doesn't make sense.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I believe value is considered at the higher level, but at the development and delivery process it's rare that teams and managers understand the value delivery. However, we need to make sure that the intended value of any business requirement is communicated to the teams which is not happening right now.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

I am a firm believer of following processes to give quality outputs, but which process, when to apply, how to apply it and how we can assure the end users are getting the benefits of the process are some questions we need to ask from our selves. Given that we have answers, we should pick a process and follow.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Once the requirements are decided by the business, managers get those to their buckets and thereafter at different levels they get involved. Primarily for engineering and architectural related work, they get the leadership.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Usually it happens at the portfolio level. We do not get or rarely get chances to comment on them.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We have value streams, and we follow Scrum. The process is similar to what's mentioned in the Scrum process where the requirements are developed and delivered in an incremental way.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We small teams which consists of developers and quality engineers which is managed by respective managers and projects are managed by the project managers.

Q.13. In general, how do you define the project delivery guidelines?

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Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We primarily focus on the dates. But, quality guidelines, development guidelines and any other delivery guidelines are set by the respective departments. For specific projects, we follow the given standards.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

I think, yes. Definitely, we need to have additional processes. But, the respective managers at the local centres should have the authority decide whether to follow them or not.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

I think so. It can kill the freedom. So, we need to carefully decide which type of governance is good for the organization.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

I think we are using right tools, but if you ask if there is any room for improvement, yes and yes. There are plenty of room for improvement.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

We are heavily using project management tools, diagramming tools, development tools, performance testing tools and many more. I think every tool helps to deliver the value. Specially, we should think of automating the processes without relying on the manual stuff.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Very good point. I believe that's a key to deliver the value. Without it we are nothing nowadays. We need to think beyond the individual level and we need to have these as a mandatory facility at every level. Specially for software development, it's really important.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

As I said earlier, we really don't get the opportunity to get involved at that level which is highly important for us, but unfortunately in the current process we don't have that visibility. But, as far as I know, they do pilot and they have R & D teams also do that.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes, we are ready. But when I go through the list of questions you have asked here, we have lot to improve as well. However, we can change and do it.

Case Study - I

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Based on my experience, software development companies go global and build distributed teams due to two reasons. The first one is the cost and other is the skill set. Certainly in some countries they don't find the required skill set even at a higher cost. So, they look at outside of their home locations to build new teams.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

The first reason is anyway cost. But, when selecting a country in a particular region, they look at many other factors such as education system, support from the government, political situation, infrastructure, communication skills, attitude, quality of the work and many more.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

I can speak about my previous organization as we don't have global teams in my current company. There we had product directors and program managers those who work closely to decide the product roadmaps which are presented to the management to get the funds approved. After that those features are assigned to the architects for their initial work. Once everything is ready and reviewed, those features are coming to the teams level.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

There were lot and even the local management formed a team to look into them. They actually proposed a nice model that reduces the waste in the process. But, how well it was implemented is what mattered to the company.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

It has never been evaluated to best of my knowledge. However, there are certain over the wall ball passing within the process due to the wrong org structure.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

The functional managers try to keep the hierarchical ball passing to the minimal while project managers build the unity within the team. But, still we find many software wastes within the process.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Up to a certain level, yes. But can be improved significantly.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

We were asked to follow the process by then by the project management leadership in USA. They had decided it already and we just had to adapt. But, how I interpret it is, the local management should have the authority to decide which process works for them.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Regularly they used to work with the teams. But, not with the upper side. They don't get much opportunity to decide which feature might add value than other. The reason may be, they assume we don't have the visibility to the market.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Product director does it. Basically, he presents his idea to the leadership team along with the future roadmap. So, using some technique they decide it.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We used Agile scrum. Each value stream comes up with their changes and features. Once the features are ready with the minimum required information, the local managers get together and decide which team can take what. Then teams backlog will be updated with the respective features.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

We had scrum teams. Developers, quality engineers, database engineers and sometimes performance engineers also were in the team. Functional managers and project managers were managing the teams.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We didn't have authority decide the development or delivery guidelines. Instead we got to follow what was already there. In that framework, certain guidelines were there.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

I think so. Because, when you deal with distributed teams, it's not easy stick into the basic models. It requires and additional thinking.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes. In our process there were so many unnecessary governances. Specially the release approvals. Those unnecessary things kill the value and the freedom of the teams as well.

Q.16. Do you think you are using right tools?

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Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

It depends. Certain tools are really meaningful and useful. But, I have heard from developers and quality engineers that certain tools they use are not giving the maximum benefits to them.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Any tool that can save our time and increase our productivity can add value. There are lots of such tools in the market.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Technology infrastructure has become a crucial factor for global teams. If you collocated, sometimes certain infrastructure might not be needed such as chats. But, when you have people in different geographical locations, you need the right infrastructure.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Once the development is over, the product is added to the market which is taken by sales team. So, that evaluation happens based on how well the market is accepting the product.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes. Though we have lot to improve, we have been successful competing with Indian in certain cases. But, we can further improve.

Case Study – J

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Very broad area. But, if we only focus on the global software engineering as outsourcing partners or development centres, they look at the cost factor, resource availability and infrastructure.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

There are only two ways that you can increase your margins. One way is to increase sales which leads to increase the revenue or the other way is to reduce the cost. So, obviously they look at low

cost centres to save their money by getting the same work done from even a more qualified and skilful engineer in this side by paying a very low wages.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the teams' level.

Answer

We follow Agile SAFe and we have certainly customized it to suit us. At the portfolio level the new business decisions are made and product manager and solution level they can make the enhancements and stability kind of decisions. However, all these changes land at the project management board in the respective value streams and get the assigned to the respective local program managers. They take it forward to delivery.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

It's yes and no answer. I believe what we have is efficient that what we had earlier. But we have to deal with this for sometime and see if this actually delivers the value what's intended. So, for now there may be certain improvements that we need to do.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?
We don't specifically do anything to do that. We focus on the big picture. We evaluate overall delivery goals against the achievements.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

Same answer as above. We focus on the outcomes or achievements. If we see our objectives do match with what's delivered, I think we are okay. So, no additional measure would be needed. But, I think as a firm we need to proactively look at it and decide in the future.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

We might not use the term value within the process, but that's what we communicate to the development teams. They understand the value they deliver through their work, so current model works perfectly for us.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Following a standard process is easier than taking short cuts because they are proven techniques. I would suggest to go with a standard process.

Q.9. In what situations usually managers get involved in value related decisions?

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Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

They get involved in day to day basis. But, I highly doubt they get involved at the right level at the right time because they are not invited for the upper level discussions which we have been requesting for a long time now.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

That happens at the portfolio level. They may be using a model to get it validated. I have not been exposed to such activity.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Value stream owners take the responsibility of that. They understand what needs to be done in the respective applications. So that they cascade it down to the right program.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We are using Agile Scrum at teams level. A typical team consists of developers, quality engineers, project manager and an architect. Typically the team size is not more than 8 people.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We already have well established guidelines which we have got from our mother company. We follow them. But from engineering, architecture and quality engineering point of view, we set our own guidelines. Those initiatives are primarily local.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. We faced many difficulties during the last few years as we tried to implement the Scrum practices as is. So, we had to deviate and customize certain things to assure that we properly manage our work.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

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Answer

If we add unnecessary things to the governance structure, yes. Otherwise you can easily manage that pressure as well. As long as the teams are encouraged to do the right thing, implementing a good governance process would not do any harm.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

More than 80% yes. But there are certain legacy tools that we are using which need to be taken out as soon as possible. They don't add any value to our deliveries.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

I think any tool that helps the delivery in a positive manner can add value. Only the issue is sometimes leaders are not willing to go for tools due to the cost.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

I would say the majority of the value addition comes from the infrastructure. Without it we cannot do anything in nowadays businesses. So, we have provided all required infrastructure within the office premises as well as for them to do their work from home without any interruptions. It's mandatory if you want to deliver the maximum value to the end users.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

That happens during our quarterly evaluations based on the business plans that we lay down before doing the development. If the sales targets are on track, we believe we have delivered the right value. If not, we need to seriously think why it is not capturing the market properly.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes. Definitely. We are working hard to do it.

Case Study - K

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

My background is quality engineering Question. So, I believe initially the businesses started out sourcing or having global teams for only selected job categories such as quality engineering, operational support and may be for finance and accounting. But, later they figured out how they

can cost effective when they build development centres in countries like Sri Lanka. I think India is leading in our region, but we also have a good contribution.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Cost is the primary factor, other than that availability of the resources and infrastructure are also considered in our case. And our communication is also good which helps us to be competitive.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

I don't have any visibility to the business side, but as far as I know the responsibility of the product owners is to identify the product needs and build the business cases. After that they present it to the management for their approvals. Once they approve it comes to the teams' backlogs for the actual development. There are certain research works that's being carried out which doesn't really follow the above process. There we build POCs to evaluate the product.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

In the current process, it takes a lot of time to get the business requirement to the development team. It goes in cycles and sometimes product teams do not provide the minimum required information also due to the last minute approvals. We can improve that approval process. And within the development process also we have unnecessary approvals that we can avoid and let the development teams to take care of them.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

It doesn't happen at all. We are working in silos and we don't really work collaboratively.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

In our local setup we have process review meetings in each quarter, but it's up to the head of the department to optimize their respective processes. So, according to my knowledge they do it based on the feedback of respective teams.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

We have a lot to improve in the process. We use very traditional processes. We don't even practice incremental approach for top urgent work. We don't focus much on the value aspects within the process.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Well, the current process was enforced by our counter parts. They have been following this process for more than 20 years now with simple modifications. I think we need to relook at it and follow a standard process because it can help us to streamline the current processes quickly and effectively. I don't believe the short cuts will help to do proper justice to the customers.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Very rare. They don't get involved at all in certain cases. We only have functional managers those who only work on the delivery side.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

That happens at the product owners end and the top managers use their own template to evaluate the new requirements. They are using a scoring method to identify the priorities. If they feel their numbers are accurate, they will choose it as a market need. Other than that, I don't think they do real market researches.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

It's a typical waterfall kind of a process. All the requirements are coming as software requirement specifications. So, the project managers sign the agreements and make sure they deliver what's in the document.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have business analysists, project managers, delivery managers, developers and quality engineers. Operations team work separately. We have teams from small to large based on the projects.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We stick into the common software delivery guidelines that are specified in the software requirements document. We only change the internal deadlines, quality assurance process and code quality requirements if needed.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. Specially when you have team members from multiple countries, you need to set proper guidelines to follow. Otherwise, it's hard to work together.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes, in certain cases I have seen it. Management should be flexible to remove unnecessary governance if they feel they are unwanted. But, that doesn't happen.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Not really. We are still using the tools that have been recommended by our USA office. Those are not really meaningful. We need to spend on the right tools.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Many. Specially, project management, software development tools, automation and monitoring tools are really helpful.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

A lot. It's really important factor. In our organization we do provide all the required infrastructure to the teams. But, as a country we have so many challenges when it comes to the connectivity which slows down our productivity. As a country also we need to invest money to assure we have the right infrastructure.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

It's through the ROI measures. That's the responsibility of the product owners to show how well their products perform with the help of the sales team.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes, but when I listened to your questions, I feel we have lot more things to do to be competitive in the region.

Case Study – L

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

My background is primarily the business development, but I am coming from the software background. So, when I first got the opportunity to work with our senior management in Australia, they had the idea of moving the development centre to a different geographical location due to few reasons. The first one is the current Covid situation. With that they had to go through lots of issues. And then the difficulty of looking for resources. The next one is the 24/7 support service. Obviously cost is a key in all aspects.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Same thing what I just mentioned above. Cost of everything, resources and to support 24/7.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

In the current model we work together on new business ideas and try to pitch it to the senior management to get their approvals. Once we are confident enough to share it with the development

team, we brief the idea to architects and business analysts. They do their work and share with us the high level effort. Once we agree, they take it to the development phase.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Sometimes, I feel the development process is not heling the business much. It's not in favor or doing quick releases. It has to be changed.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

From business end we all communicate daily and keep us up to date. But, I am not sure how it's happening at the upper level. There is a disconnect between us and the upper level. From development point of view, we meet weekly or bi-weekly to see what they have done so far, there we discuss and agree on everything.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

One key thing is to make sure that we do the right thing throughout the software development journey. However, we do not spend enough time on assessing our ideas by doing POCs. That's discouraged by the management too. So, that's why sometimes we have to throw away some of our work.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

As I answered the above question, we have some improvement points in that process. If we build our cases around the value, we can improve our current process easily.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

I think we are following a customized version of a standard process. That fits for our purpose as of now. But, when we grow beyond 20-30 people, we might not be able to do the same. Currently we all sit in the same floor and we see each other, but when we grow, we will not be sitting next to each other. So we may have to switch to a standard process.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

In the current model we get involved with the teams so frequently to see if we are on the right track. So, it can assure we make the right decision to deliver the right value to the end users.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

In the current scope, we are heavily based on assumption and some 3rd party research data. We don't do much studies.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

It's a very basic model. We decide the scope, technical leaders do the initial assessments and assign the resources to deliver it.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

From business side we have only few folks. Technology teams do have developers, architects, quality assurance engineers etc. They work on several products at once.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We are not involved there. But, as I have learnt, project managers work with the development teams to set the guidelines.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

I don't have anyone working in different locations except within Sri Lanka. Still I believe certain additional clauses might be needed.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Of course yes. It will add more restrictions as well. That doesn't help to deliver the software application faster. But if that's necessary to have certain guidelines we can't help too.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Yes. A lot. Since I am coming with some software background, I don't waste much time on doing basic stuff. But, I have seen some of my managers are wasting a lot of time on manual activities.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

For us, we need modelling tools, drawing tools, user experience designing tools, budgeting, marketing research data modelling tools etc. Those tools are really helpful. And from the development side, they are also using a lots of tools.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

We used to work from the office a couple of months ago. But now we all work from home. We haven't had the luxury to decide it. So, technology infrastructure is a crucial thing for any business now. It's not only software.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

Based on the feedback and sales progress we can decide it easily.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Not really. We are a small company. We need to gradually go there.

Case Study – M

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

I can give you answers based on my current organization and previous organization as I had the opportunity to get involved from the initial level of discussions. They heavily considered the availability of the skilled resources at a lower cost. That's it.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Other than that, they focused on our previous engagements, quality of work, ethics and education system to see if we get right resources in the future.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

In my current organization, we run as programs. Each program has their own requirements to fulfil. So, they evaluate the business needs and come up with a list of prioritized features that comes to the program bucket.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

In that process, it's optimal in my opinion. But the overall development process has many unnecessary steps that we can take out. But, our management is not willing to do that now as we are trained to follow that. However, gradually we need to take them out.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

That's the challenge here. From one step to the other, there is a gap. The value is not delivered from step to the other.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We are trying to mitigate the impact of having value erosion activities within the program management organization. But, we have very limited scope. As the head of delivery I have lots of responsibilities making sure that we deliver the value to the stakeholders.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Yes, but not 100%. We have to improve it.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

I am a true believer of Agile. Following such a proven technique is important and easy. It reduces the risk of failure. But, I strongly suggest to understand the contexts before applying it. Once we are clear, we can do the proper tailoring and apply it.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

All our managers are delivery focus. So, within that scope they frequently get involved with the development teams to improve the value delivery.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Honestly I don't have much visibility. But, it happens through our current business model. We have 3rd party research bodies those who share their stats after doing researches. We rely on them.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Once the requirements are landed at the program level, we assign them to the teams. So, respective project managers take it forward. Each program can be considered as a value stream though we haven't named them as value streams.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have small teams which consists of developers and quality engineers. These teams are managed by project managers.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

Well, we have many guidelines in the process we follow. And from my end also I have set certain gate passes to approve the releases.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. We need. Because, our cultural habits are different. Our education systems are different. So people are different. We need to have common guidelines.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

In certain cases, it can restrict the teams taking new initiative and coming up with their own ideas.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Yes, but there are still some unwanted tools that we need to remove ASAP.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Most of the tools that we currently using are adding more value. We have project management tools, dependency mapping tools, software quality checking, code quality checking, security, and even diagramming tools. These tools help us to expedite the delivery while assuring that we deliver the right thing.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Many organizations that I worked couldn't understand the importance of this. Technology infrastructure is the key in the value delivery pipeline. Because, without it whatever you do cannot be delivered in the global setup. So, we should spend enough to improve the quality of the technology infrastructure.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

Initial evaluate takes place at program level and then it's taken care by the product team. We highly depend on the feedback loops.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

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Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

We have more things to do. But, even at this level we are competing with neighbouring countries.

Case Study – N

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Companies are focusing on cost heavily. They are not much focusing on the technology because they can train the individuals easily. Other thing is they focus on the language skills. Good English is a considered as a positive factor.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

They can save a lot of money as the cost of engineers and even infrastructure is low in this part of the world.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

Product owners decide what to build and they document them. They get these requirements directly through customers or some of them are from our company's product owners itself. They share those information with the development teams as user stories. So, the development teams work on them to deliver the product or features.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Current process is not optimal. Specially, the development teams don't get involved in the initial phases. So, sometimes we are late in the game when deciding the technology blockers. And we are not connected with the product organisations directly. Other than that development process also has certain inefficiencies. We are working on them to improve.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

We don't do anything like that.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We always look at our process for improvements. Recently we adopt Agile scrum as our development practice. But, some of our practices do not align 100% with the scrum guidelines also. So, there are areas that we need to further work on.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I hope so, but there is always room for improvements. And I think it's not always 100% correct to say we are delivering the value, there may be areas to improve.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

We were not following any special process earlier, but it is not easy to track the progress and to even manage the teams. Following a process is good for any organisation. It will make the management also easy.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

It's when the requirements come to the backlogs. And during the development also some of the managers get involved. But, if you are referring to value or value delivery, mostly our technical

managers are lacking in those areas. Sometimes, they don't understand the value of doing certain things. There we have a lot to improve.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Our product managers do that based on the market needs. There is no particular method they used according to my knowledge.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

As I said, we follow Scrum. Features are added to the backlogs and teams start the development once they understand the features and plan out the work.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have different sizes. Some are 3 to 5 members and some of them are having around 8 to 10 also depending on the requirement.

Q.13. In general, how do you define the project delivery guidelines?

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Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We don't use any standard method for that. We just come up with the dates for the delivery and communicate it to our product team. And quality assurance steps are taking place to assure what we build it properly tested and production ready. Other than that we don't follow any specific method.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Sometimes yes as we have to deal with multicultural people. The way we work here in Sri Lanka is different how our other teams work in Ukraine. So, I would say a proper process is needed.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

If we don't do it with a proper intention, yes it kills the freedom. Unnecessary governance is always eroding the value. It needs to be balanced out. Processes help to the business if it's used properly.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

I think so. But, sometimes we are using some old techniques also. And tool selection is very important for distributed teams.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Communication tools, project management tools or even basic email are important. But, to be honest I don't know if we have decided our tools based on the value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Specially with this Covid, we experience how important is technology infrastructure. It's a mandatory component when you are working remotely. And as a country also we need to have proper infrastructure. In addition to that these cost of these cervices also should be low.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

To my knowledge, we don't specifically do such validation.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes. We are ready. But always we need to look at our processes and improve. In our current process also there are value erosion activities. I just noticed some of them when you ask these specific questions.

Case Study – O

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

So, most easiest answer is current covid situation. It is a good example. The companies that do not have a proper strategy to enable their businesses to reach out the their customers though there are certain other blockers. So, to have an uninterrupted business services having global team is a good strategy.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Reducing the operational cost is the key for any organisation to make that decision in my opinion.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the teams' level.

Answer

We have sales and marketing team those who report to the same CEO. Our organisation is a product organisation. The business team looks for the customer needs and get the product team to get those requirements implemented by the development teams. So, product managers bridge that gap between the team and the business. We follow scrum. And development teams follow the normal development process to deliver the product.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

I m not exposed to it much, but yes there are things that we should improve. One thing is the lack of engineering involvement at the initial level. Other than that the development process has certain many things that we need to really look at and improve. Good thing is that, we are working on it to improve.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

We do our planning session to assure that value is not eroded in the process. Pretty much the team can understand the requirements easily. So, the team can deliver the value what we promise.

However, teams do not have complete visibility to the whole picture. So, I would say yes there are couple of issues when these steps are not interconnected.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

We do continuous evaluations to check it. But, there is no standard process to do that. It's a subjective measure we currently use.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Following a standard process is easier for any organisation as they are proven. But, Agile is something that people haven't understood properly. Implementing Agile in a wrong manner leads to let the people to work on their respective silos and it leads to reduce the value delivery.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Well, at each level there is some involvement. But, due to the lack of visibility they might not be well aware about the value delivery.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

I am not sure how they do it in the practical side as I said earlier. They just do a continuous check with the development teams to assure that the teams are doing the right thing.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We still do not have value streams. We are working on improving our process.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have development teams here in Sri Lanka and product teams in US. It's purely based on the product needs. However, we are keeping it to the minimal heads as much as possible.

Q.13. In general, how do you define the project delivery guidelines?

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Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

Well, we do not have such KPIs yet. We need to work on them. But, we are normally settings standards for the overall delivery.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Not really. But, when you have multi-cultural people those who work for the same organisation in different countries, you might need additional processes.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

It's tough question. It depends on the nature of the teams. So, when there is over governance teams are working as robots. Flip side is, when there is lack of governance teams might not do the right thing. So, it should be right level or governance.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

In software engineering, it is really really important to have right tools which are agreed upon upfront. Because the tools are really important to deliver value to the end users.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Yes, but there is a room for improvement. The basic tools are in place, but we need to further evaluate it and select better tools.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

It's definitely important. Without having a proper infrastructure you cannot do anything. It's so important to have it in place to deliver the basic value, just forget about the additional value creation.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

There is a process. We are using feedback mechanisms.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

I believe, yes. But is it the best? No, not yet. We are still in the learning process. Probably in a year or two we will be there.

Case Study – P

Q.1. Why any organisation should think of moving to global software engineering?

Questions

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

My current organization is there in Sri Lanka for more than 16 years now. While they were coming to Sri Lanka, cost might be the one and only factor they might have considered. But, now it's different. Now they look at the opportunity of moving to countries like us. That may include skillset, economy, pollical situation, new businesses, ease of management, etc

Q.2. What factors lead to make the decision of moving to low cost centres?

Questions

What factors lead to make the decision of moving to low cost centres?

Answer

Basically they look at availability of the resources, education system, attitude, quality of the work, passion, innovation, etc...

Q.3. What is your current business model?

Questions
Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

We are into digital medical business. So, we are looking at future always. So, our R & D teams do the initial researches to understand the future demands and set directions for the business. So, as the development teams we focus on delivering them.

Q.4. Do you see any unnecessary step in your software delivery process?

Questions

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Our release cycle is more than 6 months. Just imagine, how many things would have changed during 6 months. So, there are lots of waste in the process.

Q.5. How do you validate each step in the process are properly interconnected?

Questions

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

Internally we can evaluate it easily as we see how well we deliver what we have promised. But, from business to the development team and development to the operations team there are always gaps. Those processes are not properly aligned.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Questions

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

Though we try to fix small issues in the process, they don't add much value. We need to focus on the big picture and address the issues that are there first. Then we can think of fixing the smaller issues or those smaller issues may get fixed automatically.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Questions

How well you deliver value within your current model or process?

Answer

Yes, up to a certain level. But, we have a lot to improve.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Questions

Why any organisation should follow a standard process? Or Why not?

Answer

We actually follow what we have been taught by our management. These are inherited from the mother company. But, our culture is different. How we do things is different. So I think always we need to focus on certain customizations to the standard process. Taking shortcuts is not recommended.

Q.9. In what situations usually managers get involved in value related decisions?

Questions

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

We don't have many managers. Only a few. They don't get much opportunities at the busines level discussions. They heavily focus on the delivery. They get involved at delivery level discussions and make decisions on the value delivery side.

Q.10. How does a new requirement is validated against the market needs?

Questions

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Sales team does it. Once the promised features are delivered, they go and pitch it. At the same time they share the feedback also with our product team as well as R & D team.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Questions

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

It's more of single value stream we have though we have many products. So, only one path for us to get the requirements. But in reality, we get multiple injections as there is no one single place to set the priority for those requests.

Q.12. How have you organized your teams?

Questions

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

We have development teams and quality assurance teams locally and product team in the many other countries. Other than that we have local R & D team focusing on the technical side while the global R & D team focusing on the business side.

Q.13. In general, how do you define the project delivery guidelines?

Questions

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We mainly follow our standard process. There we have defined certain parameters such as number of open defects, quality guidelines, unit tests etc.

Q.14. Do you think managing distributed teams requires additional processes?

Questions

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. It's necessary to customize. That's why I said earlier that we need to customize our current process also to suit with Sri Lankan setup.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Questions

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

If we enforce anything unnecessary, it can reduce the freedom of the team members as it's not helping the delivery.

Q.16. Do you think you are using right tools?

Questions

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

We have so many restrictions in the tools side. But, what we are using are the rights tools. However, if we have more freedom to select tools we can do a better job.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Questions

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

In software delivery we can name many tools. All those tools are important for the value delivery.

Q.18. How well technology infrastructure can help to create value?

Questions

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

It's one of the key factors. It influences the value delivery for sure. Having the right technology infrastructure can change many things.

Q.19. How a completed software is evaluated against the intended value proposition?

Questions

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

Through feedback systems, number of incidents and return on investment.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Questions

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

We need to improve a lot. It's a long way ahead.

Case Study – Q

Q.1. Why any organisation should think of moving to global software engineering?

Questions

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

I am coming from business and product background Questions. So, I think mostly they look at if there are business opportunities and when tech side is considered, they look at the resources. Given that we have skilled employees here in Sri Lanka at lower costs, they will choose us easily. I think it's applicable to other countries also who are trying to capitalize the IT sector.

Q.2. What factors lead to make the decision of moving to low cost centres?

Questions

What factors lead to make the decision of moving to low cost centres?

Answer

Low cost centre means, they focus on the cost. It's not only the resource cost, they focus on infrastructure and overhead cost too. Other than that, availability of the skilled resources, quality of work, culture and even political situation.

Q.3. What is your current business model?

Questions

Please describe how your business operates such as how a requirement is identified and cascaded down to the teams' level.

Answer

It's not a standard kind of a process. It's a customized version of Scrum. Normally, it's recommended to use a business proposal initially, but normally it's not happening much in the current process. Product owners come up with ideas and features which are assigned to the development teams.

Q.4. Do you see any unnecessary step in your software delivery process?

Questions

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Yes, a lot. In our current process there are many software wastes. If we follow a standard process, we could avoid them.

Q.5. How do you validate each step in the process are properly interconnected?

Questions

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

I don't think we do such thing in our current process. But, in an ideal work flow, it's really important to have them properly interconnected.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Questions

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

I really don't think our management focuses on that as the direction is coming from the senior management from USA. So, internal process is also ad-hoc and catering to the global requirement.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Questions

How well you deliver value within your current model or process?

Answer

Form the product management perspective, we assure the information captured in the user stories do contain the value section as well. But, how well it's communicated and understood by the team is still questionable.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Questions

Why any organisation should follow a standard process? Or Why not?

Answer

Following a standard process is recommended. I think that's the easiest way to assure that we do the right thing, because they are proven. At the same time we need to think of aligning too.

Q.9. In what situations usually managers get involved in value related decisions?

Questions

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Very rare, because we have only functional managers and non-technical project managers. So, we only focus on the delivery.

Q.10. How does a new requirement is validated against the market needs?

Questions

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Questions

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Simple ad-hoc, but a bit of Scrum practices are there. Normally, it comes as software requirements which are converted to user stories by our business analysis's team. The development teams make sure that what's mentioned in the user story are developed and delivered.

Q.12. How have you organized your teams?

Questions

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have development teams and quality teams separately. They are not aligned to the product or specific projects. They work on the priorities set by the project managers.

Q.13. In general, how do you define the project delivery guidelines?

Questions

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We only focus on the delivery dates as of now.

Q.14. Do you think managing distributed teams requires additional processes?

Questions

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

If the management is confident enough about the teams, it's not necessary to have additional process. Just the standard process is sufficient.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Questions

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes of course. The freedom will be killed with unnecessary governance.

Q.16. Do you think you are using right tools?

Questions

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

We have restrictions when selecting tools. It's actually a list of tools that they have already used in USA, So we are also using the same. I think they add value for sure.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Questions

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

I only know what we use at product organization. But, I am sure there are other tools that are used by other departments as well. So, in our case we are using many drawing tools, prototyping tools and project management tools as well. So they all are important for value delivery.

Q.18. How well technology infrastructure can help to create value?

Questions

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

It's really really important. Otherwise we as software people, we can do nothing. So, I believe a proper infrastructure makes our job a reality.

Q.19. How a completed software is evaluated against the intended value proposition?

Questions

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

We don't see how do they do that. But, it's the marketing team those who validate it. What we do it se demonstrate what we do regularly to them.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Questions

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

We have a long way to go. But, we can surely cater to the current demand.

Case Study – R

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

For couple of reasons, to support the business around the clock, diversified skillset and having certain resources closer to the customers. So basically when they are distributed, the process is easier.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

It's a package that consists of cost and quality. In addition to that, tax component, banking facilities other infrastructure would also be considered.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

From top to bottom we are an Agile organization and from operations side we are moving to site reliability engineering side to support the business. In that sense, we get daily requirements as well

as long term needs as well. So, the business model would also vary based on that model. Primarily, the senior management decides what to do and teams get the direction to deliver.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Not really, but how well people interpret it is what matters. It's communication gap in my opinion. We need to work on that to make sure that our process is aligned properly. It's bit hard to fix it.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

Yes, I think it's important to have that interconnection also.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We do not use the term value in anywhere to my knowledge, specially those who are infront of a the keyboard would not even worry about it. But, as the leaders and managers, we need to make sure that we set the right guidelines.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

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Question

How well you deliver value within your current model or process?

Answer

Yes, again to my knowledge. But, cannot give you numbers how much we have contributed since it's not measurable.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

You can either use the process against the people or you can use it to get the output effectively also. It's very subjective. Ideally the process is there to help people, if the process doesn't work, we should change it.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Ideally they should get involved from the very beginning. But, we don't have that luxury. Instead, we only get the chance to change that are within our control. So, our managers do get involved with their subordinates much, but I am not sure if those engagements are heavily value oriented or not.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

In our case, we do mandatory changes as they are important for the business. So, we don't do any additional evaluation, but when making the decision of doing it, we ask certain questions to clarify if it's a high priority item that we should do.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Normally we get requirements through our VP. He decides our organizational priorities and share it with me. Which I share with respective managers those who are working in different sections. We don't have a particular value stream from operations end, but for the busines side we do have value streams. I believe our VP gets involved in those decisions with the respective value stream leaders.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have small teams those who work in the normal shift and some of them work in 24/7 model. We cater to daily requests as well as some project based needs also. Hence, we have organized our teams to deliver what's assigned to them.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

They are already set and we have used ITIL standard delivery guidelines. So, nothing changes in between. We just follow the process.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

If the teams are autonomy, no need. But, mostly it's not how the teams have been built. So, any additional process might be needed to manage it.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Governance board is very common now in many businesses because it's important to have it. But, I don't say all the processes and governance will help. Probably majority of them contribute to value delivery, but some may be there which can kill the freedom and value delivery too.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Majority of the tools have been selected after carefully evaluating. But, there are certain tools that have been bought without proper evaluations. So, those tools are not adding any value.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

For us, we are heavily depending on the tools such as monitoring, security, application performance, incident management, and many more. So, any tool that helps to reduce the time taken for any particular activity would add value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Yes. It's a key area that everyone understands that how important is it. If the right infrastructure is there, it definitely contribute to the value delivery.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

Normally we are not involved in that process as we are more into the operations. But, as far as I know it happens at the business end. What they do is, they go through the check lists and evaluate the ROI of those development changes.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes. That's why our parent organization has decided to build a firm here. But, if you ask are we ready to be competitive within the region, we have more to do.

Case Study – S

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

We are still starting in Sri Lanka. When our management was choosing to implement distributed teams, they searched for talent at low cost. After that there were secondary priorities such as the new market opportunities that we might get in the region. Other than that basic other things were checked such government support, tax system, internal policies, etc.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

For us it was primarily the cost and then the availability of the skilled resources. Initially we studied a bit about the education background and qualifications of the individuals here.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

We normally do not rely much on the documents and POCs. Instead, we use fast phase development and trying to capture the market. So, there is no particular model that we use.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Once we implement a process, when we grow we may have to look into it.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

In our basic workflow, I think they are properly interconnected.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

This is a very low attentive area in my opinion. We have never talked about value based deliveries yet. We have to think about it in the future.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Well, as the basic process assures that they deliver what we asked them to deliver, I hope we deliver the value. But, certain decisions are not yet value driven. We try to take the advantage of fast delivery.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

In my previous organization we used the standard Agile practices. But, I was bit against to it as it may slowdown the overall delivery process. It might be other way round too. I don't have facts to prove. In the current organization we still follow the standard waterfall model. As of now, it works for us and very well proven. So, following a standard process is good for any organization given that it suits them.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

In our case we only have 3 layers as of now. So, we get involved in all important decisions. But, value related decision are not heavily discussed. Instead we look at the market opportunity. I believe, if we properly address the market need, automatically value requirements are covered.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

We use the POC or prototype model.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Currently we have business analyst who takes the responsibility of writing software requirements. He communicates the same to the team including the project manager. They then attend to the development work.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have developers and quality engineers. Certain quality engineering functions not fully taken place internally. Other than that we have project managers and business analysts.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

We have set certain code quality guidelines, but not much. Currently we stick into the basic delivery guidelines such as date and quality requirements.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

In our case, I don't think we need any other additional processes. But, when the company grows, we may have to.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

I believe so. Governance is needed when the companies are large. Even at that level, we need to carefully think about governance.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Currently we are using only few basic tools. They were selected based on our prior experience and reviews also. So, I think they are the right tools.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

I think we should use tools to assure that we don't waste our time on manual tasks. So, any tool can add value if we properly use it.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

It is must. We also provide so many facilities to our teams. Currently they are working remotely. So, it is a basic need. Without it we cannot even work in nowadays setup. So, it's a mandatory requirement.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

We basically try selling them. If we have properly addressed the intended problem, I believe we have delivered the value.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Not easy to say yes for now. But, we will be ready soon.

Case Study – T

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Recently it is based on the strategic directions on having global presence. Other than that, it's because of the skilled resource availability, low cost and around the clock support specially in the software industry. And I have seen certain support services also now in distributed setup. It's because of the cost and uninterrupted service.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Other than the cost, it's the market opportunity, skilled resources, infrastructure, political stability and culture too.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

We have our business teams who are working with sales team to understand the product requirements. They do the initial assessment and understand the priorities. Afterwards, these are evaluated against the market needs with a proper business plan before we do the development. Only those high priority items are considered for the development.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Obviously yes. But, certain steps are important to have even though they are not necessary. Having said that, we cannot say our process is perfect. So, there are certain things that we can optimize.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

We use weekly, monthly and quarterly review to see if we are on track with respect the internal processes along with the business reviews. During those meetings we discussed certain things and take action items if there are any improvements that need to happen immediately.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We mainly look at why those steps are needed in our process. If that makes sense to us, we keep it. Otherwise we try to avoid it. But, when you are working with global teams certain practices are coming from our counterparts which we cannot avoid. So, I personally believe there are unwanted activities in our pipeline.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Of course yes. That's our key and that's what we are trying to do also. But, what's lacking is the measurements to validate it.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Following a standard process is the easiest thing for any organization. However, the managers should be very careful to understand how well our organization can fit into those standard processes. We have failed a couple of times when we tried new process. Specially Agile.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Our local managers do not get that chance to heavily involve there. But, we are tyring to give them the opportunity to at least listen to the product folks and understand the importance of certain things we do.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

It's done by the product managers after collecting the new requirements by the sales team or through the R & D team. They use typical measure such as ROI to assess if the demand is there and if there is any return.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We still don't have value streams. We only have few product pipelines where we work on the set priorities by the respective product owners. Development teams work on incremental kind of a development process where they delivery small software pieces in a shorter time frame.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

We have development and QE teams here. Product folks are from USA, UK and Netherland.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

Well, we stick into the typical software development guidelines such as delivery, quality and engineering.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. Certain customizations are required as there are lots of cultural differences and time zone gaps. Specially we have to implement certain governance to assure the busines can run smoothly.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

Yes and a No. It may add restrictions and it can lead to lack of freedom for the teams. But if you do it in a more practical way you can avoid it.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Not 100%, but majority of them are right fit for us. And I certainly believe that the tools can add value to our stakeholders. It's not only the development teams and customers, but for the managers, HR, Administration, finance etc. Right tools will make sure that we are doing an effective work.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

More or less all the tools that we are using in software development can add value. But, how well you choose is what matters. If you choose the right tool, it can add value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Very important. Even in the current Covid situation we experience how it's important. It's not at the individual level, it should be a basic need in the country level as well. And when it comes to the server infrastructure, we are working on certain mission critical products which need additional internal infrastructure as well. It's a cost for us, but ultimately it assures the business stability.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

As I said earlier, we don't have value streams to compare it and see. But we do it based on the outcomes. We compare it with the original business plan and see if we have delivered what was intended.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Obviously yes. But, we have a long way to go to be competitive in the region.

Case Study – U

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

I recently joined this organization. So, I m not too sure which facts they considered when establishing the development centres here. But in general, business leaders have started see new opportunities when they have distributed teams. It could be new market opportunities, new skillset, new thinking, innovation or even new way of working. So, they make the decision based on them and they consider the cost factor too.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Quality of work, experience, policies in the country, infrastructure and education system are key. Other than that they may consider the hospitality and how people's attitude also.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

We have dedicated product owners those who come up with new development ideas and engineering leaders those who decide the engineering related features and improvements. All of them are considered when deciding our priorities. Once all in the management or majority of them agree to a certain scope we get them as the list of priorities. That's the normal process. Other than that we don't have much visibility to the higher level processes.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Yes, there are many. Specially the release process is hectic.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

We don't specifically evaluate it. But, our process is quite mature now. So, I hope it is properly interconnected.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We don't do any special thing. But, we do retrospectives for each release and even for some critical sprints. So, if we find any areas to improve, we act on them.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I hope so. This is the practice for more than 6 years now with least amount of changes.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

I think it's easy, but a proper customization is needed. Tailor made processes make sense more than following a generic process.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Locally we get them involved starting from very beginning. But, at the global level it's very rare that we get an opportunity to talk at the business decision making process.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

It's based on the outcomes of our R & D team's work. They do the initial level of research and share their findings. After that, our product owners come up with the solutions.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

We don't have value streams for all our products. Primarily, it's one value stream. It comes down to the teams via their managers. Once the product owner sets the priority for the features, engineering leadership decides what to include from the engineering side. Thereafter, teams work is decided.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

We have development teams. They are quite large teams. And we have shared quality engineers. Other than that architects, product owners, project managers and engineering leadership are there.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

That comes through the current process and in certain cases for specific project needs. Teams are instructed to just follow them.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

In our case, we have customized guidelines for different geographical locations. I think that's because of the challenges they have faced in the history.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

I have heard it from my teammates. They don't like much governance. They want the freedom.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

We are not using high end tools which can add more value. It's a basic series of tools.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Yes of course. Tools are adding more values as it helps us to reduce the time taken to complete a particular task. But, wrong selection of the tool can lead to unnecessary cost which is a waste.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

We believe that infrastructure is one of the key things to deliver value. Because whatever we do cannot be delivered without a proper infrastructure. It could be development infrastructure or even underlined infrastructure such as internet. They are mandatory for a proper value delivery.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

It comes as the return on whatever we do. It could be the customer feedback or even as money.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

Yes. We have been competing in this for some time now. But, if we can further improve, we can do a better job here.

Case Study – V

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

As you know my background is service delivery. In my point of view, majority of the organizations are going global to expand their businesses and looking for new markets in general. But when global software engineering is considered, it is more of a hybrid goal that business leaders have set. In one aspect they look for new markets and in the other aspect they look for human resources at a lower cost.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

On top of cost, they consider the clear communication, education background, political stability, availability of the resources and even cheap infrastructure.
Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

In our case, we don't develop software, instead we only focus on the assurance of the software deliveries and stability of the production environment. But, we do infrastructure changes and maintenance which are also releases. Those requirements are also coming as new changes where our senior vice presidents set the direction and once the priorities are identified, we assign those requirements to the respective teams. They plan it based on the specified deadlines and do the releases.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

Mostly the unnecessary approvals are waste of time and effort of both teams and even managers. We do follow ITIL standard processes without a proper customization. I think we need to seriously consider about them.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Simply no. We have huge gap between software development teams and delivery teams. And even without our service delivery department also we have gaps due to the unwanted software delivery processes. So, I don't think each step is properly interconnected.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We as the management group always try to improve ourselves. So, we are looking at different aspects in our process to improve it by any means. But, I really doubt if we take value as the measure there.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

Given that our teams understand the value of their work, yes our process delivers the value. But, I am sure majority of them don't understand the value of the work they do, because they have never been told it by the respective owners such as senior leaders.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Simply because we have to follow the global guidelines. Other than that I don't see any other reason to follow it. But for any other firm it is something that they can pick and choose.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

We get involved in daily basis with the teams on the delivery related matters. We focus on the deadlines, quality and stability.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

Normally, we don't know certain aspects. But, it's based on the outcomes as far as I know.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Initially they land at our bucket and we decide which team should do the change. Based on the skills, prior experience and abilities we assign it to teams. They plan their sub tasks on their own and set the delivery dates.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

Mainly we are operating in Kanban style. So individuals are working on their assigned tasks. But, with development teams we have some dedicated engineers those who work with the development teams to do the deliveries.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

Well, we follow our global guidelines and ITIL practices. Other than that, we have set certain guidelines for our managers to assure what's being delivered is properly validated before pushing it to the production.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Of course yes. It's really hard to manage multi cultural people if you don't have a proper process. Sometimes, the proven methods like Agile, SAFe or even lean techniques should be customized and applied.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

I would agree to certain level. But, minimum required governance should be in place. Otherwise, we cannot assure the stability of the production environments.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

No. We are using what we are asked to use. It's not the right way to do it. Ideally we should have a pool where we can go and select based on the product that we are working on.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

For us, service management, monitoring, incident tracking, call centre tools and even calling tools are also important to assure we deliver the right value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Very important. Simply, we cannot do anything without a proper infrastructure. As individuals they should have the right infrastructure to work and companies should provide it. At the country level, the ruling parties should be able to make sure that we have the right infrastructure.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

I am not too sure how they do it as it's not in our scope. But as I have learnt, normally they do it based on the ROI.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Answer

We have to improve a lot as a company and if you are focusing on the overall industry, we may be competitive in the local segment but not in the region. Hence, we have to focus on improving our value delivery a lot.

Case Study – W

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Majority of the organizations are now into digitalization of their processes. With that there are lots of opportunities coming up and as the based of digital economy digital currencies are blooming. So anyway, they have to transform from the traditional teams to global teams. It's not an option.

It's a necessity. Specially for software organizations there are enormous opportunities to gain more profits.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Actually there is a currency advantage if you move to low cost centres. Second is the niche opportunities. One example is the security related outsourcing now happens in Israel. Other than that amount of the work force, political stability, previous work and quality of the work are the other key factors.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

We are an incubator that facilitates other businesses while developing some of our own products. But, we name ourselves as a service based organization. We look at the businesses in that angel. We support external businesses as well as internal process in the same way. In that business model we do the ideation and then go to the development after comparing with the real business needs.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

There are lots of standard models which are developed for mostly mature organizations in the other parts of the organizations. So, applying them directly won't make sense. Hence, we have to tailor those and apply. In current process I see improvements in that sense.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

We follow value stream analysis. Every function has a very specific role that is aligned to the value stream objectives. So, every department has their own objective to achieve. So, internal value creation process is important for achieving that. In that sense, we have considered the interconnection between these processes.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We do two things, one is the proactive measures and reactive measures. We do process accounting by giving some points and convert it to the monetary values. So, we can easily understand what elements can contribute positively and negatively as well.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Yes. We are actually focusing on that very much. Our clients won't sign with us if we don't do it properly. So, we are 100% compliant with the process and we can assure we deliver the right value.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

Though it's a process or framework, we need to focus on the suitability of them for the business you are into. You shouldn't go and pick just because they are popular.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Managers should own their decisions while understanding the requirements properly. But, in the current scope, it's not seen in our organization much. They only focus on what's assigned to them.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

Answer

We do value model analysis or domain analysis before starting anything to understand what exactly our customer wants. Then we do a validation and understand if we can deliver that value through the software application. If so, we take it. Otherwise, we go for another round of discussion to further fine tune it.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

Normally our requirements review board makes the decision to further move with those requirements or not. Once the decision is made to develop, we just decide the teams and add them to their work logs. So, they do a detailed planning session and share the timeline with customers.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have pods that consist of developers and quality engineers. Other than that we have business analysts and project managers. These pods are assigned to value streams. Other than that we have few other contributing teams outside of the development teams such as process team and architecture team.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

Answer

In the project on boarding process, we make that decision. We defined which tools to use, which process to follow and which kind of paths to take along with the generic delivery guidelines.

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Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. Some additional elements are needed. One thing could be defining the SLAs for communications when you have teams in multiple time zones. Otherwise we cannot do our work productively.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

No if you do it consciously. It happens when you do it without considering the real problem. We shouldn't go with individua cases. Instead, you have to consult the respective teams and implement them.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

Yes, but we haven't defined a set of guidelines for selecting tools. Without it we drain the value.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

Every team is using certain tool set for project management, document management, development, automation etc. But, if you select the right tool kit your time taken for the training is low and you can easily get used with them. In the development also, you should go with easy and most suitable languages. That will make your life easy.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

Yes, but it depends on the complexity and types of project. There are many other factors that you should think when you make that decision. One example is selection of the cloud infrastructure.

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

It happens through the value streams. Ideally, we compare it with the value stream objectives. If those are met, what we have done is correct.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

Yes. That's why we are leading in the service model among other companies.

Case Study – X

Q.1. Why any organisation should think of moving to global software engineering?

Question

Can you briefly tell me why any organisation should consider going global to get their software requirements fulfilled?

Answer

Majority of them make that decision based on the cost. But, they might consider other facts such as new sales options, good relationships, people, hospitality, or even good government.

Q.2. What factors lead to make the decision of moving to low cost centres?

Question

What factors lead to make the decision of moving to low cost centres?

Answer

Low cost centres means you save money by paying a less amount for people and all other overhead costs. But, they really want to get the out put also at the level of quality they expect. So, while they focus on the cost, they focus on the quality, people and political situation also.

Q.3. What is your current business model?

Question

Please describe how your business operates such as how a requirement is identified and cascaded down to the team's level.

Answer

We closely work with the business teams and collect the business requirements. Our business analyst document them and get the priority from the respective product owners. Once they approve it, we get our head of the department to decide which team does what. Based on that we present the work to the respective teams. There after we work with the teams to come up with the deliver plan.

Q.4. Do you see any unnecessary step in your software delivery process?

Question

In your current software delivery process, do you see any step that should be taken out or any step that does not add any value to it.

Answer

We had a couple of issues in the current process and we spoke about it. Then we decided to take out certain unwanted activities. But, I am sure there may be more.

Q.5. How do you validate each step in the process are properly interconnected?

Question

In your current process, how do you see if the anticipated value is delivered through your delivery model and how well your internal processes are interconnected?

Answer

We have process evaluation segment in our core meeting. There we discuss if things are okay. If not, we take action items to fix them.

Q.6. What kind of measures are you taking to assure no value erosion activities takes place within the software delivery pipeline?

Question

In many process driven organisations, there are obvious value erosion activities. What measure have you taken to assure no such activities are there in your pipeline?

Answer

We have certain KPIs on the delivery side. So, it's the responsibility of the respective managers to assure they don't do any non-value adding activities in their pipelines. But, in the mandated process there can be certain value draining activities which we haven't evaluated much.

Q.7. Do you think the value is captured and delivered in your current process? If so, how?

Question

How well you deliver value within your current model or process?

Answer

I hope so, because we get a lot of positive comments from our business side. We don't have any other mechanism to evaluate it.

Q.8. Are there any special reasons for following a standard process or taking short cuts?

Question

Why any organisation should follow a standard process? Or Why not?

Answer

I am not a process person, but I am not against the process also. Right process always helps the team do deliver the maximum. So, selection of that is up to the management.

Q.9. In what situations usually managers get involved in value related decisions?

Question

You may have managers aligned to work with teams. Within you model, when do they get involved in the value related decisions?

Answer

Daily we should do that. But, we don't get the opportunity. However, we are trying to fix it ASAP.

Q.10. How does a new requirement is validated against the market needs?

Question

Once someone decides a feature/capability or even a new product, how do you validate it against the real market need?

This is one of the key issues in the current company. We don't do it much. We go on with the assumptions and wate time and money. This has caused for many disappointments too. People are leaving due to these reasons.

Q.11. What is the standard process of moving a feature down to the development teams through the respective value streams?

Question

Once a feature or a product is approved to be developed, how does it come to the next levels? What's the standard process that you follow?

Answer

If the requirement is ready with the minimum required information, we as the project managers get those into our funnel. Once we understand the requirements we get the teams to evaluate them and plan them out.

Q.12. How have you organized your teams?

Question

It is important to organise the teams to deliver what is promised effectively. How have you formed the teams? What's the composition of it?

Answer

We have developers and quality engineers working in one team.

Q.13. In general, how do you define the project delivery guidelines?

Question

Once you agree on a project scope, the next step is to come up with a project delivery guideline or if you already have an established one, asking the teams to follow it. How do you define the project delivery guidelines?

We have a development pipelines and a release pipeline. Majority of the guidelines are mentioned there. We don't go by the projects or specific releases. Instead, we follow the generic guidelines.

Q.14. Do you think managing distributed teams requires additional processes?

Question

When you have distributed teams, you may or may not need certain additional processes to manage them effectively. Do you have any? Or Do you think it requires any additional processes?

Answer

Yes. At least in certain areas we need to have specific guidelines. One key problem is the multiple priorities. Specially with the shared resources we have to go the top management to get certain things done. Therefore, we need proper guidelines.

Q.15. Would the governance add more restrictions to the freedom of the teams?

Question

It says certain governance can kill the freedom of the teams. Do you believe so?

Answer

It may add an additional burden, but there can be advantages also.

Q.16. Do you think you are using right tools?

Question

Another important area is the use of tools. Do you believe tools help in value creation and do you think that you are using right tools?

Answer

We are using a limited number of tools. But, I think we have selected the right tools to deliver the things effectively.

Q.17. What kind of tools are helpful to assure the intended value is delivered?

Question

In your way of interpreting, what kind of tools can help in value creation and delivery?

Answer

More or less all the tools are helping us in many ways. Our responsibility is to understand how best we can utilize them to assure we deliver the intended value.

Q.18. How well technology infrastructure can help to create value?

Question

Please tell me about how important is to use proper technology infrastructure for value delivery.

Answer

It's a must. We need to have it. And as organizations we need to provide it. This is not only limited to the development infrastructure, it should be other infrastructure such as internet connection, communication infrastructure, devices etc..

Q.19. How a completed software is evaluated against the intended value proposition?

Question

Once the development is completed, the product or feature goes live. Afterwards, how do you validate if you have delivered the anticipated value to the customers?

Answer

This is taken care by our business teams. We highly depend on their feedback. And in certain cases we evaluate the number of incidents we get too.

Q.20. How potential is your organisation in assuring the maximum value delivery by making sure least or none of the value erosion activities are taken place in the software pipeline?

Question

As an organisation who may be already catering to a global company/client or who wants to contribute in the future, how potential is your organisation to assure the maximum value delivery?

We are still improving certain areas, but we have come a long journey also in the same line. So, we can compete for sure.

Delivery Process	24	218
Defining Delivery Guidelines	24	36
Custom Guidelines	1	1
Follow what's in process	14	14
No guidelines	6	6
Project Specific Goals	11	11
Quality Guidelines	4	4
Interconnection	24	30
Assume the process covers	7	7
Gaps exists	13	13
Haven't considered	9	9
Properly Connected	1	1
Proactive Measures	23	32
Depends on Feedback	5	5
Depends on retrospectives	7	7
None	10	10
Not proactive, but reactive	5	5
Process Mapping	3	3
Value Stream Mapping	2	2
Standard process over ad-hoc process	24	35
Easy to manage	16	16
Low risk	2	2
Mandated by management	4	4
Proven	10	10
Quality output	3	3
Value Delivery in Current Process	24	34
Lack of focus	2	2
Needs improvements	15	15
		1

Code Book of the qualitative analysis based on the keywords.

Not at all	1	1
Not at all levels	11	11
Perfectly fine	5	5
Value Erosion	24	51
Additional Governance	5	5
Lack of Knowledge	5	5
None	3	3
Non-Value Based Activities	11	11
Process Alignment Issues	2	2
Process Overhead	18	18
Redundant work	2	2
Software Wastes	4	4
Technical In capabilities	1	1
Global Teams	23	68
Global Software Engineering	0	0
As a business strategy	3	3
Communication	1	1
Infrastructure	1	1
Low Cost	18	18
New Market	10	10
Quality of Work	3	3
Skilled Resources	17	17
Time Zone Overlap	5	5
Low Cost Centres	23	67
Attitude of People	4	4
Communication Skills	2	2
Education	6	6
Infrastructure	10	10
Political Stability	6	6
Quality of Work	15	15

Resource Availability	18	18
Support	2	2
Support from the Government	1	1
Tax System	1	1
Work Ethics	2	2
Governance	24	30
Any Level Eroding Value	6	6
Killing Autonomy	2	2
Neutral	2	2
Right Level Adding Value	16	16
Subjective	4	4
Staffing	24	102
Involvement of Managers	24	43
At business level	3	3
Frequently	8	8
Lack of focus	3	3
Lack of involvement	13	13
No involvement	2	2
Only at lower level	14	14
Managing Distributed Teams	24	59
Additional Elements Needed	12	12
Authoritative Protocols	3	3
Communication Protocols	4	4
Culture Specific Protocols	11	11
Guidelines to Follow	9	9
No	6	6
Yes	14	14
Organization of Teams	0	0
Large Teams	10	10
Non-Value Stream Based	15	15

On Site	1	1
Product Based	17	17
Small Teams	23	23
Value Stream Based	6	6
Technology Infrastructure	24	57
Expensive	2	2
Highly value adding	20	20
Lack of focus	5	5
Must	23	23
Needs to improve	7	7
Using Tools	24	107
Adding Value	21	22
Any Tool	11	11
Automation Tools	3	3
CASE Tools	9	9
Communication Tools	11	11
CRM	1	1
Eroding Value	2	2
Infrastructure	2	2
Limited Tools	4	4
Monitoring Tools	6	6
Project Management Tools	12	12
Using Right Tools	22	23
Wrong Tools	1	1
Value Addition	24	96
Biz to Dev	0	0
No such process	5	5
Non-Value Stream Based	13	13
Standard Kanban	3	3
Standard SAFe	4	4

Standard Scrum	9	9
Value Stream Based	9	9
Waterfall	9	9
Business Process	24	43
Ad-Hoc	6	6
Agile	9	9
No Visibility	11	11
Portfolio Management is onshore	17	17
Requirements validation	23	53
Depends on Strategy	7	7
Gap exists	9	9
No such process	4	4
No Visibility	12	12
R & D	8	8
Taken care by product team	13	13
Validation of Value Delivery	0	0
Customer Feedback	10	10
Goals Achievements	14	14
Incidents	3	3
None	1	1
Pilot Program	4	4

Word Clouds for Each Focus Area

engineering marketing restrictions performance departments life suitable manual low centre believe better efficiency communication experience leaders without assure certain organization businesses document set easy document set quality level activitie incident know delivery Value select heavily ideally time add tools project lot call start room al adding basic project incident know delivery value select bought final adding basic management improve kit limited security different still software important automation training possible list waste every monitoring diagramming research checking modelling dependency remove contribute portfolio increase languages code giving rested unwanted expedite actually effectively



studied policies qualifications experience facilities overhead timelines bower hospitality background factors mittaly lower hospitality background factors mittaly consists infrastructure support tax side passion key political quality cost people priorities engineer skilled resources market attitude resources stability low lanka package clear competitive communication banking primarity component skillset delivery opportunity willingness government individuals

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Appendix B

Questionnaire and Quantitative Analysis Related Content

Questionnaire

Title

Value Addition in Global Software Engineering(GSE) industry in Sri Lanka

Purpose and objective of the questionnaire

The purpose of this survey is to validate the impact of key influential factors on delivering more value in the global software engineering industry. Your decision to participate in this study is completely voluntary and you have the right to withdraw at any time without any penalty. All comments and responses are anonymous and will be treated confidentially. If you have any questions relating to the study or this questionnaire, please contact the researcher Chathuranga Manamendra at chathuranga.it@gmail.com or his supervisor Dr.Renuka Herath at **renukaherath@kln.ac.lk**.

Research Background

This questionnaire is embedded within a dissertation focused on value addition in global software engineering industry in Sri Lanka.

Research Objective

The research proposal focuses on the study of the 5 key areas i.e. staffing, use of tools, processes, governance and technology infrastructure within the organisations to understand their influence and impact to the value creation process.

This research is compliant with the guidelines given by the university which are explained here (https://www.uwtsd.ac.uk/research/research-ethics/).

By submitting this questionnaire electronically, you are giving consent to the following:

1. you have read and understood the information described the aims and content of the following questionnaire.

2. you are aged 18 years or older.

Questionnaire guideline

This questionnaire consists of 6 sections as below

- 1. Demographic Information
- 2. Project management and delivery process
- 3. Change management and governance
- 4. General team formation and delivery frameworks
- 5. Tools that are used within the processes
- 6. Technology Infrastructure

Section 01: Demographic information

- 1. What best describes the primary business of your organisation?
 - a. We are a product-based company
 - b. We are a service-based company
 - c. We have both product and service-based development
 - d. We only have operations
 - e. Other
- 2. Your product(s)/service(s) is/are for
 - a. Local customer(s)/business(es)/community(ies)
 - b. Global customer(s)/business(es)/community(ies)
 - c. Both local and global customer(s)/business(es)/community(ies)
- 3. Size of the organisation
 - a. 1-25 Employees
 - b. 26 100 Employees
 - c. 101 500 Employees
 - d. 501 1000 Employees

- e. 1000+ Employees
- 4. Which best describes your discipline
 - a. Software Engineering
 - b. Quality Engineering
 - c. Project Management
 - d. Product Management / Business Analysis
 - e. Architecture
 - f. Technical Operations
 - g. Leader / Manager
 - h. Other.....

Section 02: Project management and delivery process

This section has 15 questions under 2 subtopics that focus on the project management practices within the organisation and the delivery process.

Scale: 1	strongly	disagree/	never; 5	strongly	agree/al	ways
	0,	0		0,	0	2

#	Question	1	2	3	4	5
	Section 2.1 - Project management process and work patter	erns				
1	Project management organisation acts as a separate organisation / department	0	0	0	0	0
2	Project delivery responsibility relies on project manager	0	0	0	0	0
3	Existing process assures the timely delivery	0	0	0	0	0
4	Ongoing project statuses are visible to the stakeholders	0	0	0	0	0
5	Customer satisfaction is considered important	0	0	0	0	0
6	Progress is evaluated daily basis	0	0	0	0	0
7	Risks are identified upfront	0	0	0	0	0
	Section 2.2 – Project Management Process and best pract	ices				
8	Company's top managers are aware of the methodology used for managing projects	0	0	0	0	0

9	Project management processes are well documented	0	0	0	0	0
10	Project management processes are continuously updated	0	0	0	0	0
11	All company projects are managed using the same methodology	0	0	0	0	0
12	Process helps to meet projects' operational performance goals	0	0	0	0	0
13	Process helps to meet projects' technical performance goals	0	0	0	0	0
14	Process helps to assure the projects meet their deadlines	0	0	0	0	0
15	Stakeholders are satisfied about the project results	0	0	0	0	0

Section 03: Change management and governance

This section has 14 questions under 3 subtopics that focus on the requirement change management, software change management and governance.

Scale: 1 strongly disagree/never; 5 strongly agree/always

#	Question	1	2	3	4	5		
	Section 3.1 – Requirement Change Management Proce	SS						
1	Requirement changes are properly prioritised	0	0	0	0	0		
2	Requirement changes are evaluated before accepting	0	0	0	0	0		
3	Conflicts are identified before committing to the change requests	0	0	0	0	0		
4	Requirement changes are controlled formally	0	0	0	0	0		
	Section 3.2 – Service Delivery / Change Management							
5	Operations environment(s) is/are managed by technical operations	0	0	0	0	0		
	team							
6	Production changes are done through a change approval process	0	0	0	0	0		
7	Changes are signed off by the stakeholders	0	0	0	0	0		
8	Change approval process is efficient	0	0	0	0	0		
9	Changes are approved based on the business value	0	0	0	0	0		
10	Change requests can be made at anytime	0	0	0	0	0		
	Section 3.3 – Collaboration between teams							
11	Development and operations team work collaboratively	0	0	0	0	0		
12	Resource allocation for changes is formal	0	0	0	0	0		

13	Open communication is encouraged	0	0	0	0	0
14	Management focuses on continuous improvement to increase the	0	0	0	0	0
	collaboration					

Section 04: General team formation and delivery frameworks

This section has 14 questions under 3 subtopics that focus on the teams, how teams have been formed and the delivery framework.

Section 4.1: Basic Team information and delivery process

- 1. What is the size of a team in general?
 - 1-4
 - 5-9
 - 10 +
- 2. Who are in a typical development team?
 - \Box Developer(s)
 - □ Quality Assurance Engineer(s)
 - □ Application Engineers / DevOps Engineers
 - □ Product Owner/Manager
 - \Box UI/UX Engineer(s)
 - □ Database Administrator(s)
 - □ Project Manager
 - □ Software Engineering Manager
 - □ Software Quality Engineering Manager
 - □ Software Architect
- 3. Who makes the delivery call?
 - Team
 - Product Manager/Owner
 - Project Manager

- A Functional Manager
- Other
- 4. Which software development practice is followed by most of the teams?
 - □ Waterfall
 - □ Iterative
 - □ V Model
 - □ Iterative
 - □ Agile Scrum
 - □ Agile Kanban
 - \Box Agile custom
 - □ SAFe or Other Framework
 - □ Other

Scale: 1 strongly disagree/never; 5 strongly agree/always

#	Question	1	2	3	4	5
	Section 4.2: Teams and formation of the teams	1				
1	Current delivery framework is effective	0	0	0	0	0
2	Current delivery framework helps to create more values to the stakeholders	0	0	0	0	0
3	Teams are formed based on project needs	0	0	0	0	0
4	The value of the work is clearly communicated to the development teams	0	0	0	0	0
5	Teams understand the value of the delivery	0	0	0	0	0
	Section 4.3: Project Portfolio Performance					
6	Number of projects and resources matches	0	0	0	0	0
7	Portfolio decides the high-value projects	0	0	0	0	0
8	Company's portfolio has an excellent balance of projects	0	0	0	0	0
9	Company's projects are aligned with the business strategy	0	0	0	0	0

10	The budget allocation between projects in the portfolio reflects the	0	0	0	0	0
	business strategy					

Section 05: Use of tools within the processes

This section has 10 questions that focus on the tools that are used within the organisation to deliver the software products.

Scale: 1 strongly disagree/never; 5 strongly agree/always

#	Question	1	2	3	4	5
1	Effective project management tool(s) is/are used from ideation to production	0	0	0	0	0
2	2 Proper development tools are used by the development team				0	0
3	Reliable tools are used for source control	0	0	0	0	0
4	Automation is part of the development using proper tools	0	0	0	0	0
5	Process modelling tool(s) is/are used	0	0	0	0	0
6	Documentation tool(s) is/are used	0	0	0	0	0
7	Configuration management tool(s) is/are used	0	0	0	0	0
8	Change management is tracked using a tool	0	0	0	0	0
9	Proper bug tracking tool(s) is/are in place	0	0	0	0	0
10	Monitoring and controlling dashboards are generated through tools	0	0	0	0	0

Section 06: Technology Infrastructure

This section has 5 questions that focus on the technology infrastructure provided by the company or fulfilled through customers for software deliveries.

Scale: 1 strongly disagree/never; 5 strongly agree/always

#	Question	1	2	3	4	5

1	Enough attention is paid by the management for the required technology infrastructure	0	0	0	0	0
2	Teams understand the value of having right technology infrastructure	0	0	0	0	0
3	Reliable tools are used to manage and monitor the technology infrastructure	0	0	0	0	0
4	The current technology infrastructure helps to deliver the intended value to the stakeholders	0	0	0	0	0
5	Provided technology infrastructure is utilised and mapped properly with the value delivery	0	0	0	0	0

Thank you for taking the time to complete this survey. I truly value the information you have provided. Your responses will contribute to my analyses of the value addition in the global software engineering industry in Sri Lanka.

If you have any comments on the survey or the project, please leave a comment below.

Many thanks,

Chathuranga Manamendra

Regression Results

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS R ANOVA COLLIN TOL

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT value_addition_f

/METHOD=ENTER delivery_process governance staffing tool_use tech_infra

/SCATTERPLOT=(*ZRESID,*ZPRED)

/RESIDUALS DURBIN

/SAVE ZRESID.

Regression

Output Created		16-MAY-2021 18:12:31		
Comments				
Input	Data	C:\A\phd- other\Chathu\SPSS\GSE Survey.sav		
	Active Dataset	DataSet1		
	Filter	<none></none>		
	Weight	<none></none>		
	Split File	<none></none>		
	N of Rows in Working Data File	371		
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.		

Notes

	Cases Used	Statistics are based on cases
		with no missing values for any
		variable used.
Svntax		REGRESSION
		/MISSING LISTWISE
		/STATISTICS COEFF OUTS R ANOVA COLLIN TOL
		/CRITERIA=PIN(.05) POUT(.10)
		/NOORIGIN
		/DEPENDENT value_addition_f
		/METHOD=ENTER delivery_process governance staffing tool_use tech_infra
		/SCATTERPLOT=(*ZRESID ,*ZPRED)
		/RESIDUALS DURBIN
		/SAVE ZRESID.
Resources	Processor Time	00:00:00.14
	Elapsed Time	00:00:00.13
	Memory Required	9088 bytes
	Additional Memory Required	0 bytes
	for Residual Plots	
Variables Created or Modified	ZRE_3	Standardized Residual

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	tech_infra, delivery_process, staffing, tool_use, governance ^b		Enter
- a. Dependent Variable: value_addition_f
- b. All requested variables entered.

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.873 ^a	.762	.759	.28569	2.044

a. Predictors: (Constant), tech_infra, delivery_process, staffing, tool_use, governance

b. Dependent Variable: value_addition_f

Model Sum of Squares df Mean Square F Sig. 1 5 .000^b Regression 95.309 19.062 233.541 Residual 29.792 365 .082 370 Total 125.100

ANOVA^a

a. Dependent Variable: value_addition_f

b. Predictors: (Constant), tech_infra, delivery_process, staffing, tool_use, governance

Charts



Regression Standardized Predicted Value

EXAMINE VARIABLES=ZRE_1

/PLOT BOXPLOT STEMLEAF NPPLOT

/COMPARE GROUPS

/STATISTICS DESCRIPTIVES

/CINTERVAL 95

/MISSING LISTWISE

/NOTOTAL.

Explore

Notes

Output Created		16-MAY-2021 18:12:42
Comments		
Input	Data	C:\A\phd- other\Chathu\SPSS\GSE Survey.sav
	Active Dataset	DataSet1
	Filter	<none></none>

	Weight	<none></none>	
	Split File	<none></none>	
	N of Rows in Working Data File	371	
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.	
	Cases Used	Statistics are based on cases with no missing values for any dependent variable or factor used.	
Syntax		EXAMINE VARIABLES=ZRE_1 /PLOT BOXPLOT STEMLEAF NPPLOT /COMPARE GROUPS /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING LISTWISE /NOTOTAL.	
Resources	Processor Time	00:00:00.37	
	Elapsed Time	00:00:00.31	

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	Ν	Percent	Ν	Percent	Ν	Percent
Standardized Residual	371	100.0%	0	0.0%	371	100.0%

Descriptives

			Statistic	Std. Error
Standardized Residual	Mean		.0000000	.05156543
	95% Confidence Interval for Mean	Lower Bound	1013981	
		Upper Bound	.1013981	
	5% Trimmed Mean		0029070	

Median	.0194327	
Variance	.986	
Std. Deviation	.99322026	
Minimum	-2.46683	
Maximum	2.95884	
Range	5.42567	
Interquartile Range	1.19377	
Skewness	.026	.127
Kurtosis	006	.253

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.044	371	.085	.994	371	.166

a. Lilliefors Significance Correction

Standardized Residual

Standardized Residual Stem-and-Leaf Plot

Frequency Stem & Leaf

- 4.00 Extremes (=<-2.4)
- 3.00 -2.022
- 26.00 -1. 55555666666666666667777888999
- 26.00 -1.0000000011111112223333344

97.00 0.

- 40.00 0. 555555555566666677777778888888888899999999
- 35.00 1.000001111111223333333333333333444444
- 15.00 1.5556666666677999
- 4.00 2.0001
- 5.00 Extremes (>=2.4)
- Stem width: 1.00000
- Each leaf: 1 case(s)







Standardized Residual

Demographic Distribution of the Dataset

Appendix A

Business Nature

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	product-based company	142	38.3	38.3	38.3
	service-based company	9	2.4	2.4	40.7
	both product and services	215	58.0	58.0	98.7
	operations	5	1.3	1.3	100.0
	Total	371	100.0	100.0	

Target Customers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	local and global	89	24.0	24.0	24.0
	global	282	76.0	76.0	100.0
	Total	371	100.0	100.0	

Size of the organisation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 25	36	9.7	9.7	9.7
	26 - 100	141	38.0	38.0	47.7
	101 - 500	112	30.2	30.2	77.9
	501 - 1000	55	14.8	14.8	92.7
	1000+	27	7.3	7.3	100.0
	Total	371	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Software Engineering	69	18.6	18.6	18.6
	Leader / Manager	26	7.0	7.0	25.6
	CEO	1	.3	.3	25.9
	Quality Engineering	89	24.0	24.0	49.9
	Project Management	117	31.5	31.5	81.4
	Technical Operations	12	3.2	3.2	84.6
	Architecture	37	10.0	10.0	94.6
	PRDM / BA	20	5.4	5.4	100.0
	Total	371	100.0	100.0	

Discipline

Reliability of the impact of the delivery framework for value addition

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PMO as a separate organisation	31.29	32.297	.118	.832
Delivery responsibility relies on project manager	31.98	32.251	.183	.819
Ongoing project statuses are visible to the stakeholders	32.79	29.273	.617	.782
Customer satisfaction is considered important	32.38	29.923	.411	.799
Progress is evaluated daily basis	32.83	29.132	.625	.781
Risks are identified upfront	32.92	29.339	.611	.782
Company's top managers are aware of the methodology used for managing projects	32.01	30.886	.375	.801
Project management processes are well documented	32.62	30.733	.439	.796
Project management processes are continuously updated	32.92	29.790	.605	.784
All company projects are managed using the same methodology	32.52	31.775	.286	.808
Process helps to meet projects' operational performance goals	32.87	29.814	.599	.784
Process helps to meet projects' technical performance goals	32.85	30.006	.528	.789
Process helps to assure the projects meet their deadlines	32.81	29.096	.672	.778

Reliability of the impact of governance for value addition

			Corrected Item-	Cronbach's
	Scale Mean if	Scale Variance	Total	Alpha if Item
	Item Deleted	if Item Deleted	Correlation	Deleted
Requirement changes are	31.23	42.789	.613	.810
properly prioritised				
Requirement changes are	31.60	41.646	.759	.798
evaluated before accepting				
Conflicts are identified	31.53	44.514	.621	.811
before committing to the				
change requests				
Requirement changes are	31.58	44.066	.631	.810
controlled formally				
Operations environment(s)	29.61	53.741	099	.858
is/are managed by technical				
operations team				
Production changes are	30.20	50.882	.105	.847
done through a change				
approval process				
Changes are signed off by	30.66	48.437	.277	.836
the stakeholders				
Changes are approved	32.08	43.229	.664	.807
based on the business value				
Change requests can be	31.71	47.648	.362	.829
made at anytime				
Development and operations	31.36	44.967	.573	.814
team work collaboratively				
Resource allocation for	31.37	45.000	.556	.815
changes is formal				
Open communication is	30.96	47.247	.568	.818
encouraged				
Management focuses on	31.65	44.024	.662	.808
continuous improvement to				
increase the collaboration				

Reliability of the impact of staffing for value addition

			Corrected Item-	Cronbach's
	Scale Mean if	Scale Variance	Total	Alpha if Item
	Item Deleted	if Item Deleted	Correlation	Deleted
Current delivery framework	19.45	23.183	.617	.869
is effective				
Teams are formed based on	19.12	23.076	.589	.872
project needs				
The value of the work is	19.68	25.154	.598	.871
clearly communicated to the				
development teams				
Teams understand the value	19.72	25.055	.608	.870
of the delivery				
Number of projects and	19.15	22.829	.613	.870
resources matches				
Portfolio decides the high-	19.32	22.616	.682	.863
value projects				
Company's portfolio has an	19.68	23.629	.712	.861
excellent balance of projects				
Company's projects are	19.37	24.179	.659	.865
aligned with the business				
strategy				
The budget allocation	19.21	24.360	.628	.868
between projects in the				
portfolio reflects the				
business strategy				

Reliability of the impact of use of tools for value addition

	Scale Mean if	Scale Variance	Corrected Item- Total	Cronbach's Alpha if Item
	Item Deleted	if Item Deleted	Correlation	Deleted
Proper development tools are used by the development team	18.84	19.601	.665	.834
Reliable tools are used for source control	18.65	20.238	.534	.846
Automation is part of the development using proper tools	19.34	20.214	.388	.867
Process modelling tool(s) is/are used	19.30	19.626	.727	.830
Documentation tool(s) is/are used	19.00	19.905	.580	.842
Configuration management tool(s) is/are used	19.30	19.639	.754	.828
Change management is tracked using a tool	18.32	21.002	.293	.877
Proper bug tracking tool(s) is/are in place	19.30	18.887	.789	.822
Monitoring and controlling dashboards are generated through tools	19.35	19.546	.752	.828

Reliability of the impact of technology infrastructure for value addition

	Scale Mean if	Scale Variance	Corrected Item- Total	Cronbach's Alpha if Item
	Item Deleted	if Item Deleted	Correlation	Deleted
Enough attention is paid by	6.30	4.320	.630	.747
the management for the				
required technology				
infrastructure				
Teams understand the value	6.50	3.721	.716	.703
of having right technology				
infrastructure				
Reliable tools are used to	7.14	4.539	.688	.721
manage and monitor the				
technology infrastructure				
Provided technology	6.99	5.559	.466	.817
infrastructure is utilised and				
mapped properly with the				
value delivery				

Reliability of the value addition in the global software engineering industry in Sri Lanka

	Scale Mean if	Scale Variance	Corrected Item- Total	Cronbach's Alpha if Item Deleted
Existing process assures the	11.90	8.868	.478	.729
timely delivery				
Stakeholders are satisfied about the project results	12.01	10.003	.349	.758
Change approval process is efficient	12.95	7.492	.519	.730
Current delivery framework helps to create more values to the stakeholders	12.50	8.732	.613	.696
Effective project management tool(s) is/are used from ideation to production	12.05	8.551	.593	.698
The current technology infrastructure helps to deliver the intended value to the stakeholders	12.71	9.522	.509	.725