Towards developing a management framework for managing inbound open innovation based high-tech SMEs in Hong Kong

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Abstract

Innovation capability is a key factor in defining where a company resides in the competitive landscape regardless of its size. Hence, it is vital to put innovation, execution excellence and entrepreneurial spirit at the heart of an organisation so it remains competitive. The aim of this research is to investigate how individual characteristics and orientations of top management interact with external environments and the management of inbound open innovation adoption.

In taking a multi-dimensional approach, this research was conducted by expanding the model from Russell and Russell based on suggestions provided by the 3H framework. In addition to incorporating core management elements such as transformational leadership, execution ability, and strategic orientation, this study also tried to improve the breadth of existing models by including characteristics of entrepreneurs as individuals and the level of inbound open innovation adoption as indicators of organisational performance.

One hundred and ten valid responses were collected from entrepreneurs tenanted in Hong Kong Science Park at the time of study. This represented a sampling rate of more than twenty percent based on the total number of SMEs operating in Hong Kong Science Park during the same period. By embedding the 3H management framework into the model developed by Russell and Russell, this study was able to develop a revised model to include additional aspects as dimensions of assessment. In the analysis, the reliability in forecasting organisational performance also improved when attitudes of the entrepreneurs towards new technology adoption were included. The results of this study contributed to the understanding of inbound open innovation by empirically confirming entrepreneurial innovativeness alone is not sufficient to attain outstanding organisational performance. Instead, the best performance outcome was achieved when entrepreneurial innovativeness, the three core management elements, and the level of inbound open innovation acceptance were present and positively correlated. In addition, the final model suggested strategy had to work through leadership and execution to achieve desirable organisational performance.

This research study is the first inbound open innovation related research conducted on high tech SMEs in Hong Kong. By combining entrepreneurship, knowledge development, and leadership, this study has shown it is possible to create sustainable competitive advantages. Additionally, Technology Readiness Index can be used as a longitudinal measurement instrument to aid the prediction of organisational performance. The findings of this research also provided entrepreneurs with a new framework to continuously audit the status of innovation adoption in order to improve the long term organisational performance under an inbound open innovation environment.

DECLARATION

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

Signed: Ching Hoi Patrick Lau

Date: 10-12-2023

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by giving explicit references. A list of references is appended.

Signed: Ching Hoi Patrick Lau

Date: 10-12-2023

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for deposit in the University's digital repository.

Signed: Ching Hoi Patrick Lau

Date: 10-12-2023

Dedication

To my parents K. Lau and Y.K. Cheng

and my family Joyce and Emmanuel

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Chapter One – Introduction

1.1) Technology Landscape in Hong Kong

As one of the world's leading financial centers, Hong Kong is embarking on a new journey towards re-establishing its high technology leadership in southern China through the Greater Bay Area initiatives.

Small and medium enterprises (SMEs) are the bedrock of Hong Kong's economy. According to the Commerce and Economic Development Bureau of Hong Kong, SMEs account for more than 98% of enterprises and employ around 45% of the private sector workforce in the city as of July 2024. In addition, the number of research and development personnel working in SMEs is at least 60% more than that in large enterprises. Hence, it is an important segment for driving the success of industry adjustment (Trade and Industry Department HKSAR Government, 2021). On the other hand, research and development spending by Hong Kong business sector accounts for merely 0.97% of GDP in 2021 (Research Office, 2023).

With such a low level of investment in technology, Hong Kong should embrace an inbound open innovation approach, which is the use of purposive inflows of knowledge to accelerate internal innovation. This is especially true for SMEs engaged in emerging technology segments because they can no longer afford all the technological and human resources needed for such endeavours. Instead, they form interdependent and flexible relationships with other firms, including suppliers and competing firms, to fully capitalise on their core competencies through various types of inbound technology adoption (Acs & Preston, 1997). This approach is one of the reasons to enable SMEs to generate more innovations on a per employee basis than larger firms. For example, in 1993, SMEs in U.S. received only 3.8 percent of federal R&D allocation but were responsible for 14.5 percent of industrial R&D output (U.S. National Science Foundation, 1996). These figures indeed provide Hong Kong with an encouraging example to aspire to. Therefore, it is logical to conduct a study on local SMEs, particularly their top management, to gain insights into ways to improve their productivity and GDP contribution.

1.2) Importance of Innovation in the Era of Industry 4.0

The fundamental and global nature of Industry 4.0 means it will impact and be altered by people, corporations and economies from all nationalities where innovators will be one of the largest beneficiaries of innovation as they are the providers of intellectual and physical capital (Schwab, 2017). Changes in technology are probably the most important sources of change in the structure and performance of the world's economies (Porter et al., 1991:194). Schwab also anticipated that there would be four main effects that Industry 4.0 would significantly impact business through innovation, including customer expectations, product enhancement, the level of collaborative innovation, and organisational structure. This is because Industry 4.0 is a techno-economic paradigm that combines interrelated products and processes with organisational, managerial and technical innovations to drive the creation of a new and unique set of technological and economic advantages and produces a large potential improvement for most of the economy (Freeman & Perez, 1988). Industry 4.0 also relies on the derivation of new applications from digitalisation and the internet of things (Jovanovski & Maierhofer, 2020). Through such innovation, Industry 4.0 is creating pervasive effects throughout the economy.

While the shifting paradigm that emerges under Industry 4.0 is exciting for entrepreneurs and technology companies, it is complex and becoming increasingly challenging for management and companies. If companies fail to keep pace with such development, they will have to surrender any early lead and may even become disadvantaged. Competitive success will only arise if a company can realistically produce a distinctive value proposition, rather than just an imitation (Porter & Heppelmann, 2015). This clearly indicates the need to enable technology adoption and collaboration through inbound open innovation as a means to overcome such challenges. Industry 4.0 also changes business approaches to create new value through digital technology. With the appearance of new competitive opportunities and threats, companies are forced to review nearly every element that exists internally to deal with new products and entirely new industries, which alter the nature of competition and industry structure (Porter & Heppelmann, 2015). It is under this background that the study is carried

out because the dynamic situation faced by high technology SMEs in Industry 4.0 requires them to embrace changes through constant innovation.

1.3) Recent Support from Hong Kong Government for Technology Innovation

Back in the late 1990s, the Hong Kong Government recognised the importance of supporting technology innovation for economic development. It has since developed a vision to focus on high value-added industry as a way to readjust Hong Kong's economy through the Chief Executive's 1998 Policy Address (HKSAR Government 2001). Since 2017, the Hong Kong Government has invested over 130 billion HKD in supporting research and development, nurturing talent and assisting the industry with infrastructure development as part of its plan to enhance the innovation and technology ecosystem in Hong Kong. Subsequently, the gross domestic expenditures on R&D in Hong Kong rose from 16.7 billion HKD in 2014 to approximately 26.3 billion HKD in 2019. The total employees working in the innovation and technology sector grew from approximately 35,500 in 2014 to 44,600 in 2019 while the number of start-up companies also increased from 1,070 in 2014 to 3,800 in 2021 (HKSAR Government 2021). In its 2022-23 budget, the government continued its commitment in innovation and technology by allocating an additional 10 billion HKD to set up a new strategic innovation and technology fund (HKSAR Government 2022), aiming to reinvigorate the creation of more value-adding industries in Hong Kong as part of Industry 4.0.

Furthermore, the Northern Metropolis Development Strategy, as shown below, was announced in October 2021, driven by a planning vision and strategy leading up to 2030. It proposed the expansion of the Northern Economic Belt, with innovation and technological industries being the economic engine and the consolidation of 30,000 hectares into a holistic metropolis. This was formulated against the Chinese Central Government's policy to support Hong Kong under the Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area in the National 14th Five-Year Plan. It is estimated that the Hong Kong-Shenzhen Innovation and Technology Park (HKSITP) alone, which is currently under construction and located within the Metropolis programme, can

accommodate about 50,000 innovation and technology (I&T) jobs and provide about 87 hectares of land for innovation and technology use. The gross floor area of HKSITP planned is about three times larger than the existing Hong Kong Science Park. In addition, another 150 hectares has been identified in other parts of the Metropolis project for innovation and technology related expansion if necessary. With an estimated increase of 66,000 to 68,000 I&T jobs, innovation and development produced by this project can potentially drive the technology upgrade in traditional industries, creating new job opportunities in the economy (HKSAR Government, 2021).

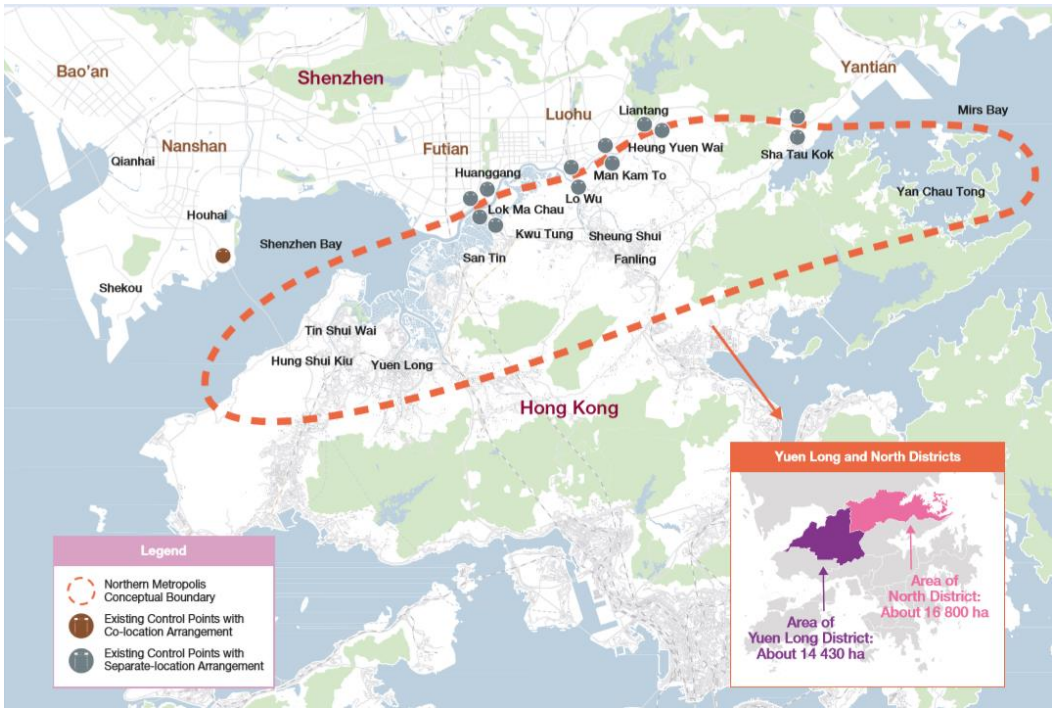


Figure 1.1 - NMD - Northern Metropolis Development Strategy (HKSAR Government 2021)

Since managing risks and incubating new ideas often need prototyping as well as the willingness to invest time and resources for their evaluation, successful pilots and prototypes are often achieved centrally through legislation, or through the dissemination of evaluations which require government support (Mulgan & Albury, 2003). As the Chinese government has already indicated that its investment in technology will be significant and will focus on frontier industries, such as artificial intelligence and semiconductors, in its recent 14th Five-Year Plan, such investment will provide a significant opportunity for Hong Kong to develop supporting and complementary technology. Hence, a better

understanding of how technology management can benefit companies is critical for the future success of Hong Kong and local high tech SMEs.

1.4) Purpose of the Study

Although institutions like HKSTP and Cyberport have been working arduously in recent years to foster technology SMEs that can become champions in the innovation race, the question as to how to improve high tech SMEs' likelihood to succeed through inbound open innovation adoption remains unanswered. In fact, the relative importance of the environmental, organisational, and managerial characteristics in different types of organisations in the process of innovation may differ and current studies have not tested such differences (Damanpour, 2017:21). For these reasons, it is imperative to conduct a study on local high-tech SMEs in Hong Kong to examine the essential factors for creating and sustaining successful technology businesses.

As most of the technology products designed and sold by local SMEs utilise and adopt external technology, a study particularly focused on inbound open innovation adoption is important because many projects have failed due to the lack of knowledge on how to establish inbound open innovation competencies and adopt inbound open innovation as a regular practice in the entire organisation (Zynga et al., 2018). To address the knowledge gap of how innovation should be managed, this study will center on high technology SME segment in Hong Kong since SMEs are significant contributors to local GDP. In particular, this study will collect feedback from top management of local high tech SMEs.

The aim of this study is to ascertain if there are positive relationships between key factors such as organisational performance, core management elements, attitudes of top management, and their receptiveness towards innovation adoption. Findings of any correlations are important because perspectives from an entrepreneur are crucial to sound strategic management (Lyon, 2000:1081) and the ability of managers to develop and combine resources in productive ways determines the size of the opportunity beyond the obvious amount of market demand (Penrose & Penrose, 2009). In another word, the

understanding of such relationships sheds light on how to optimise management strategy and improve bottom line by successfully manoeuvring these key factors.

Devising and implementing different inbound open innovation strategies require different business models (Saebi & Foss, 2015) and only the CEO or someone with comparable power can assume responsibility for sustaining innovation and managing disruptive growth (Christensen & Raynor, 2003). Moreover, a knowledge-driven approach was found to be the strongest determinant that led to a preference for informal inbound open innovation modes (Scuotto et al., 2017). As suggested above, key individuals and their adopted approaches play important roles in innovation management. Hence, this study will attempt to investigate how core elements of innovation management are related to the level of inbound open innovation adoption and company performance.

Despite the importance of this topic, knowledge on managerial innovation is in its infancy and quantitative reviews of the influence of managerial characteristics on organisational innovation have not been conducted (Damanpour, 2017:14). By providing a better understanding of the relationship between management characteristics and approach to manage innovation, this study attempts to address the knowledge gap identified by Damanpour (2017). Research results should also extend the findings that personal traits of key individuals play important roles in innovation (Ahn et al., 2017) and answer why some firms are likely to adopt inbound open innovation practices more frequently than others (Theyel, 2013).

In addition, by using the well-established Technology Readiness Index (TRI) as a tool for individual assessment, this study will demonstrate how management perception towards innovation relates to leadership style, strategy orientation and capabilities development. The perceived company performance will also be measured alongside other benchmarking factors to assess how management elements relate to such performance. This can improve the understanding of the role of inbound open innovation in creating competitive advantages so Hong Kong Technology SMEs can learn to build more sustainable

organisations. The outcome of this research should also reveal if TRI can become an additional forecasting tool for estimating the likelihood of organisation success in the future. More importantly, insights gained from this research should help local academics and officials to deploy new mechanisms to assess the readiness of local Hong Kong companies to make a successful transition into Industry 4.0. Additionally, this study can hopefully generate a Hong Kong specific model to compare with previous studies done that investigated how the human or managerial characteristics of CEO/Founders are related to inbound open innovation adoption and company performance.

1.5) Statement of the Problems

To enhance organisational performance under an inbound open innovation environment, top managers need to understand the relationship and impact of various factors at different stages of innovation process, starting from antecedents, context, and ending at actual performance outcome. Without such understanding, efforts spent on optimising innovation process will be futile and inefficient. As such, the aim of this study is to develop a management framework which can explain high tech SMEs' performance in an inbound open innovation environment in Hong Kong. In particular, the research questions are as follows:

1. How does inbound open innovation influence Hong Kong SME's performance?
2. What are the key elements of a management framework for effective implementation of inbound open innovation in SMEs?
3. What is the causal relationship between the framework elements and:
    3a the benefits of inbound open innovation implementation?
    3b the firm's performance?
4. What are the personal characteristics that are relevant to inbound open innovation in driving SME performance?

1.6) Theoretical Basis of the Study

Continuous improvements in any area eventually transform a firm's operation. They also lead to product innovation, service innovation, new processes and new business. Ultimately, continuous improvements lead to fundamental change (Drucker, 2012:74) that creates genuine innovation. Hence,

innovation is a way for entrepreneurs to utilise changes and transform them into an opportunity. To sustain continuous innovation, it has to be built into the knowledge workers' job and be part of the work, the task and the responsibility of knowledge workers (Drucker, 2012:142). Entrepreneurs can achieve desired results in an unpredictable environment through strategy as strategy allows an organisation to be purposefully opportunistic (Drucker, 2012:43).

From an economic perspective, evolutionary economics provides an interesting lens to view innovation as an element in driving economic development (Nelson & Winter, 2002). On business front, organisational innovation is intended to create focused but purposeful change within potential capabilities of enterprises to achieve economic or social impact (Drucker, 2002). In fact, even multi-national conglomerates, such as Jardine Matheson, believe that continuous innovation, operational excellence, leadership and entrepreneurialism are critical elements in driving business performance and meeting evolving customer needs, as shown in the figure below.

Figure 1.2 - Strategic priorities of Jardine Matheson (Highlights of Jardine Matheson Annual Report 2022)

With such importance, it is essential to analyse innovation from a management perspective as new and external technologies are revolutionising different industries and forcing affected industries to change their very mindsets to learn, acquire and adapt rather than just gaining technical knowledge. In Hong Kong, this revolution mainly focuses on the adoption of innovation, which is the use of purposive inflows of knowledge to accelerate internal innovation. This

process is defined as inbound open innovation and is part of open innovation (Huizingh, 2011).

To meet with the current economic changes driven by technological advances, the ideas of Nelson and Winter, Drucker, Porter, Huizingh and Chesbrough combinedly offer top management a new paradigm of thinking in the domain of innovation management. For instance, during Industry 4.0, technological advances, such as artificial intelligence, are enabling firms to do business and operate in new ways so that new competitive advantages can be developed through innovation as predicted by Drucker (2012). The development of new competitive advantages can be expedited by the clustering of companies which enable continuous exchange of new ideas and knowledge as suggested by Porter (2000). The continuous exchange and inflow of knowledge and information is echoed by Chesbrough and Huizingh's ideas of open innovation, especially from an inbound perspective.

However, having new knowledge itself is not enough to guarantee continuous development of new competitive advantages since the conversion process has to be managed. Shifting from owning knowledge in-house to the concept of sharing and adopting knowledge entails processes that emphasise value creation and value capture. Hence, strategies undertaken by firms adopting open innovation need to balance the tenets of traditional business strategy with the promise of open innovation (Chesbrough & Appleyard, 2007). This requires a focused and purposeful change strategy to transform the present which creates the future. Execution of this change process must be led by a transformational leader who is willing to free resources committed to maintaining what no longer contributes to performance or produces results (Drucker, 2012:74). Therefore, companies with strategic changes and capable leadership in place should have a higher likelihood to succeed in achieving organisational performance during economic disruption.

Since the execution of inbound open innovation is related to a variety of management functions, this section will define the role and the importance of inbound open innovation. In the analysis, the researcher will try to examine the

relevant management factors based on the ideas listed above and determine how they can be combined into a suitable framework. Finally, the influence of personal characteristics will also be included as part of the performance measurement consideration.

1.6.1) What is Innovation?

Innovation is the development and implementation of new ideas by people engaged in transactions with others within an institutional order (Van de Ven, 1986). It is different from invention because invention implies bringing something new into being while innovation implies bringing something new into use. Innovation is important because organisations are interested in whether they can create something new for its own use or for utilisation by others. Innovation can also include the adaptation of pre-existing products or processes, or those created outside of an organisation (Woodman et al., 1993). Although organisational change can include innovation, much of organisational change is not innovation and creativity is also only a subset of innovation.

As a complex, multi-phased activity, innovation starts from initiation, adoption and concludes as the implementation of new ideas or activity in an organisational setting (Pierce & Delbecq, 1977). It is related to the search for, and the discovery, experimentation, development, imitation, and adoption of new products, new production processes and new organisational set-ups (Dosi et al., 1988). Hence, innovation does not exist on its own and will constantly involve interaction in different manners or formats and should be seen as a core activity to increase the responsiveness of services and products to customer needs and expectations rather than as an optional luxury or added burden. It happens when something new is introduced into the marketplace with the potential to transform a competitive environment or organisation and usually occurs in conjunction with corporate venturing or strategic renewal. Innovation is a specific function of entrepreneurship (Drucker, 2002) and is also a core function within corporate entrepreneurship. It drives both strategic renewal and how it exists is shown in the figure below.

Figure 1.3 - Hierarchy of Terminology in Corporate Entrepreneurship (Sharma & Chrisman, 2007)

Furthermore, innovation is a function of interaction among the motivation to innovate, the strength of obstacles against innovation, and the availability of resources for overcoming such obstacles. It is also viewed as a multiplicative function of balancing between the obstacles and resources bearing upon innovation as well as the motivation to innovate (Mohr, 1969). Hence, in general, innovation can be seen as a product or service born out of an entrepreneurial vision to bring something new to the market, delivered by an organisation with the purpose to transform the market through its unique capability and resources to create something different. As such, to succeed in innovation, an organisation must possess an entrepreneurial orientation, be led by a transformational leader, and support the building of a learning-oriented organisation with a passion to acquire new ideas and execute changes.

1.6.2) Defining the Role of Open Innovation

New technology projects often expose many capability gaps within the organisation so it is logical for top management to look beyond its own boundaries and into the larger environment in search of solutions. According to

Porter, a company must identify technology segments that it has the most product insight, possessing the best opportunities for future innovation and competitive advantages so that they can be developed and maintained in-house. One possible approach to creating such competitive advantage is to enable inbound open innovation within firms through the clustering of companies (Porter, 2000). Other elements that will become commoditised or advanced too quickly should be outsourced to suppliers and partners. Most successful companies are those that can decide when to pursue custom development or simply license off-the-shelf, best-of-breed solutions (Porter & Heppelmann, 2015).

To management guru Peter Drucker, an organisation is an innovation where management, as a useful knowledge, enables people of different skills and knowing to work together (Drucker & Maciariello, 2014: 32). The risks of high-tech innovation can be substantially reduced by integrating new knowledge as the source of innovation (Drucker & Maciariello, 2014:129). Companies should be managed to be flexible for rapid changes so it can shift, adapt and innovate quickly to satisfy changing customer needs through alliances, partnerships and joint ventures (Drucker, 2012), which themselves are different forms of inbound and outbound open innovation. As the ability of adopting new knowledge from internal and external sources is key to the success and survival of any organisation, inbound open innovation plays an important role in Drucker's management strategy.

Henry Chesbrough expanded that open innovation is now becoming a type of organisational innovation that integrates external capabilities into the innovation processes of a firm rather than relying solely on its internal capabilities (Chesbrough, 2003). Open innovation has since become the label to identify the purposely use of knowledge inflows and outflows to accelerate internal innovation and expand the markets for external use of the inventor's innovation (Chesbrough, 2011). This concept has since been institutionalised via the open innovation community and is widely used as the basis of various researches. New business models based on invention and coordination by a community of innovators is now made possible through inbound open innovation

and its sustainability is achieved through the balancing of value capture and value creation (Chesbrough & Appleyard, 2007).

1.6.3) Importance of Inbound Open Innovation for Company Performance

As business environment evolves, existing business and management models will reach its limits at some stage. Companies in pursuit of innovation can improve their performance through adopting ideas from users and customers (Dahlander & Gann, 2010; West and Bogers, 2014; Chesbrough, 2003; Nambisan et al., 2019). Therefore, inbound open innovation is necessary for fostering innovation through adoption. For SMEs, inbound open innovation contributes to revenue and market share increase since SMEs lack the necessary resources to generate economies of scale (Spithoven et al., 2013). SMEs are more likely to embrace inbound open innovation because inbound open innovation brings positive effect on SMEs through the introduction of new products and services offering. For example, one SME in Hong Kong Science Park that focuses on developing augmented reality-based surgical assistance software solutions was able to translate cutting-edge 3D visualisation, automated medical image modelling and gaming performance into a new medical software. The CEO of this company, who has extensive medical background, was able to adopt partners' expertise in 3D gaming visualisation and software engineering to create a new medical image viewing application that utilises artificial intelligence. Through the adoption of innovation from gaming industries, the company was able to create new competitive advantages over existing players to win new sales orders in Hong Kong by selling to medical practitioners in leading hospitals.

The need for adopting external expertise is particularly imperative for SMEs in Hong Kong given the limitation of sizes, scale of business, and resources available, as stated previously. Recognising such apparent need for inbound open innovation to support the continuous growth of SMEs in Hong Kong, this research will focus on the role of inbound open innovation in improving SMEs' performance. Empirical studies have consistently found that companies conduct more inbound than outbound activities (Huizingh, 2011) to avoid losing competitive advantages caused by providing knowledge to external

parties. In this study, suggestions from Damanpour (2017) will be leveraged to analyse how characteristics of entrepreneurs, such as attitude and perception, affect innovation adoption. By measuring the level of interaction between inbound open innovation adoption and various management factors, this research attempts to develop a framework that helps to explain how inbound open innovation influences organisational performance.

1.6.4) Identifying Key Elements of Innovation Management for SMEs

The strategy formulation, execution capabilities and organisational climate of SMEs are significantly influenced by owners and CEOs. Successful entrepreneurs are likely to possess the ability to drive multiple areas, such as organisation structure, strategies and leadership in a positive manner to create synergy within business. However, under resources constraint, technology SMEs need to be proactive and innovative in generating new competitive advantages and sustaining existing ones. Innovation also demands the presence of an entrepreneurial strategy to turn opportunities or ideas into marketable reality. Entrepreneurs overcome such challenges by creating growth and changes in a market economy through accelerating the generation, dissemination and application of innovative ideas (Korunka et al., 2003).

Technology companies, in particular, need to be constantly renewing and often transforming their technologies and core competencies to maintain a constant state of transformation. These companies perform best if they are managed by transformational leaders. Transformational leaders are essential for economic development because they demonstrate model behaviors. These behaviors are mimicked by followers to become routine and be ingrained into all artifacts of organisational activities to emerge as organisational culture, which facilitates learning and innovation among all members within a company (Bass, 1998).

Moreover, to succeed in innovation, entrepreneurs need to identify the source of innovation, know how to apply knowledge, and be able to organise it in a systematic manner so that innovation can be replicated (Drucker, 2014). From Drucker's perspective, innovation clearly requires leadership ability to

organise the application of knowledge. Such knowledge also needs to be continuously renewed through the acquisition of new skills and knowledge. Strategic and novel combinations of scattered people, ideas and resources is also part of the innovation process (Obstfeld, 2005). To achieve continuous technological breakthroughs, technology companies need to constantly upgrade itself with new knowledge through adoption and learning supported by internal sharing and a learning oriented culture.

Hence, the management characteristics of technology-focused SMEs are likely to be innovative and proactive in generating new ideas but also tend to be more aggressive and willing to take risks due to the need for sustaining their business. These management characteristics clearly support the idea of pursuing innovation management through capable leadership, entrepreneurial orientation and learning orientation. Previous studies have also established such a relationship between entrepreneurial orientation, learning orientation (Wang, 2008) and absorptive capacity (Lau & Lo, 2015).

Finally, when dealing with the uncertainties that come with rapid changes in the Industry 4.0 era, leaders need to develop a mindset that considers system-level effects and the impact on individuals for future orientation (Schwab & Davis, 2018). Moreover, measuring their mindset and attitude towards innovation can reveal the likelihood of technology adoption within their organisations. As innovation is the key to growth and survival, analysing individual preference of SME CEOs towards innovation and inbound open innovation contribute to a better understanding of how high tech SMEs in Hong Kong may perform in the era of Industry 4.0.

Hence, by establishing a framework that can map the systematic process, this research can expand the understanding of how key components identified, namely leadership, entrepreneurial orientation, learning orientation, and attitude towards new technology, interact. Scholars and managers can capitalise on the understanding of these relationships in the future to drive organisational success for SMEs in Hong Kong and beyond.

1.6.5) Leveraging Management Framework in Innovation

For many high technology SMEs, moving towards an inbound open innovation context requires a great deal of adjustments. Management capabilities required for supporting inbound open innovation are built up gradually through a transitional journey so it can become a sustainable business practice. While clear leadership is needed for making inbound open innovation a visible commitment in an entire organisation, top management must also build up capabilities through knowledge management such as establishing processes, structures and routines.

This knowledge management process must work in conjunction with the acquisition, dissemination and adoption of external capabilities to improve existing in-house process and collaboration so that inbound open innovation can be institutionalised (Zynga et al., 2018). This journey towards inbound open innovation requires a transformational leader who can drive change through a clear strategy and support a learning-oriented setup to enable sustainable knowledge development. One model of transition from closed to open innovation is listed in the figure below.

Figure 1.4 – Model of Transition from Closed to Open Innovation (Zynga, et al., 2018)

Curley and Salmelin have provided an alternate concept of innovation as an evolution by placing closed and open innovation as well as the end point within a context where innovation becomes part of the overall ecosystem. The growth journey of evolving from a closed system is to become an enlarged ecosystem, where all related elements, including the customer, can be used as input for innovation, as shown in the figure below (Curley & Salmelin, 2013). Curley and Salmelin's model is well aligned with Chesbrough's vision, in which the ecosystem becomes completely opened so that all parties along the product

chain, from suppliers to end customers, can provide their valuable contribution to the development of ideas and innovation.

Figure 1.5 - The Evolution of Innovation (Curley & Salmelin, 2013)

As innovation leads to a greater increase in SME performance, it is important for entrepreneurs and SMEs to manage the innovation process diligently (Rosenbusch, 2011). As such, innovation should be managed as a corporate function. Management needs to know how innovation is done rather than simply doing and it should be managed like any other corporate function (Drucker, 2002) as it produces an outcome with a process (Crossan & Apaydin, 2010). In addition, although inbound open innovation is a positive contributor, over-searching may indeed hinder innovation performance because it does incur some cost and going overboard can negatively impact innovative performance (Laursen & Salter, 2006). Hence, it must be managed properly. Moreover, key elements of technology may be implicit and embedded in various elements, such as cognitive and physical processes, people, plant, equipment tools and materials used in a tacit manner (Burgelman et al., 2008). Hence, innovation needs to be managed as it involves making choices that require a supportive climate and culture, enabling structure, processes, systems, as well as financial and human resources. The level of innovation is also reflected in the management of organisations through goals and priorities, and the structure design of processes to conduct corporate activities (Damanpour, 2017).

Therefore, the success of organisation innovation in an inbound open innovation environment depends on the balanced management of organisational strategy, purposeful leadership, and the capability to acquire and disseminate new and external knowledge. This management approach corresponds to

incorporating entrepreneurial orientation, transformational leadership and learning orientation in a holistic manner. As such, there is an essential need to develop a framework for Hong Kong SMEs to perform inbound open innovation assessment and optimisation because organisation decision processes often deviate from basic rationality (Nelson & Winter, 2002).

1.6.6) Innovation Management Framework Selection Criteria

A key problem in managing innovation is the need for management to make sense of a complex, uncertain and highly risky set of phenomena. However, as innovation evolves over time, innovation process framework will also change. Balance needs to be maintained between simplifications and representations so innovation management framework can help management to think instead of just giving descriptions of how the process actually operates. The importance of viewing and managing innovation at a system level is growing due to the move towards inter-organisational context. The rise of networking, the emergence of small-firm clusters, the growing use of 'open innovation' principles and the globalisation of knowledge production and application are all indicators of the move to what Rothwell called a 'fifth-generation' innovation model (Tidd and Bessant, 2020:303).

In exploring the limitations of simple models of innovation process, Van de Ven drew attention to the complex ways in which innovations actually evolve over time. How such evolution manifests over time has been explained by Rothwell's five generations of innovation models, which provided a useful historical view by suggesting appreciation of the nature of the innovation process had been evolving from simple linear models to increasingly complex interactive models. As innovation model evolved, he predicted the importance of networking to enable gradually moving away from a linear science/technology push or demand pull process to one that saw increasing inter-activity. Rothwell's vision of 'fifth generation' innovation is essentially based on rich and diverse network linkages accelerated and enabled by an intensive set of information and communication technologies available (Tidd and Bessant, 2020:66).

Through his fifth-generation innovation concept, Rothwell suggested innovation is a multi-actor process that requires high levels of networking and integration at both intra and inter-firm levels (Rothwell, 1992). Although the fifth-generation models and the technologies which enable them appear complex, they still involve the same basic process framework (Tidd and Bessant, 2020). Hence, Rothwell's fifth-generation innovation model will be used as the framework selection criteria for this research. Framework that is linear, with no feedback or no interaction between different elements will be eliminated. The selected framework should be flexible enough to provide tailored responses and able to interact both upstream and downstream through extensive networking. Most important of all, it must be able to evolve to support continuous innovation.

Figure 1.6 - Rothwell's five generations of innovation models (Tidd and Bessant, 2020:67).

Even though no specific framework has been developed solely for innovation management, according to Rothwell, the fifth generation innovation framework must be integrated with extensive networking and also be flexible enough in order for continuous innovation to be supported through customised responses. Based on Rothwell's criteria, a number of popular management models emerge in the literature review as they all meet the requirements but with slightly different focus. For instance, McKinsey 7S (Waterman et al., 1980) and Wang's Relationship Based Model (Wang & Ahmed, 2003) are more extensively networked than others. On the other hand, Four Dimensions of Core Capabilities (Leonard-Barton, 1992), Yu's 3H (Yu, 2021), and Concept of Fit (Naman & Slevin, 1993) are more flexible to extend than others. Finally, 3P (Dyer et al., 2011) and Dynamic Capabilities Framework (Teece, 2018) focus on supporting

continuous innovation through their emphasis on feedback cycle. Each of these models will be examined in detail in the following chapter.

1.6.7) Utilising 3H as an Inbound Open Innovation Management Framework

Inbound open innovation management is part of an evolving process and needs to be managed. The approach to tackling such a management challenge may be found in 3H, a holistic framework for management which includes three core elements of management, namely leadership (Heart), strategy (Head) and execution (Hand), in a simple yet easily extendible configuration as changes occur (Yu, 2022). The concept of 3H framework is to provide management with a holistic view of the current company status with respect to these core elements so that any deviation and areas of improvement that may arise can be identified quickly for remedial actions. Hence, 3H can be applied to extend the conceptual view of evolutionary economists by including leadership as a means to close the gap between strategy and execution.

In the case of implementing inbound open innovation, the introduction of proper process and strategy (Head) through the selection of entrepreneurial orientation is quite suitable because it is a strategic construct that includes management-related preferences, beliefs, and behaviors as expressed among a firm's top-level managers and certain firm-level outcomes (Covin et al., 2006). Subsequently, innovation diffusion can take place by the execution of the right strategy, with the appropriate people, who possess the knowledge either through appropriate talent retention, training or acquisition programme (Hand) and led by leaders with the right calibre and intentions to transform all areas involved with the support of employees (Heart). From that perspective, inbound open innovation provides an excellent context in which 3H framework could become a reference for the generation of assessment and measurement instrument.

1.6.8) Associating Personal Characteristics and Management Elements with Innovation through Technology Readiness Index

The technology readiness index (TRI) was originally developed to measure the propensity of people to embrace and use cutting-edge technology. Through the use of questionnaire, TRI expanded researchers' understanding of

the influence of technology on customers from a marketing and service perspective (Parasuraman, 2000). Since various revolutionary technologies such as mobile commerce, social media, and cloud computing have now become mainstream, TRI 2.0 was updated to be a more concise and robust tool for understanding respondent behavior in face of new and emerging technology. In fact, TRI 2.0 was developed as a robust predictor of technology-related behavioral intentions as well as actual behaviors, aiming at accelerating scholarly investigations in understanding the link between the perceived benefits of a new technology (e.g. innovation) and the actual adoption and use of a technology. TRI 2.0 was also recommended for decision-oriented research in contexts where technology-based innovation plays an important role (Parasuraman & Colby, 2015).

As technology readiness is an individual-level characteristic that neither varies in short term nor changes suddenly in response to a stimulus, it provides important insights into the personal preference and propensity of respondents towards innovation. Higher TR levels are correlated with higher adoption rates of cutting-edge technology, more intense usage of technology, and greater perceived ease in the use of technology. With its four independent dimensions, TRI 2.0 acts as a multivariate framework and helps to explain different dynamics between variables in a technology influenced context. Hence, TRI 2.0 is used as an instrument in this study to assess the technology readiness levels within a group of top management and entrepreneurs to facilitate the understanding of their decision on the adoption of various technologies. In addition, activities related to pre-adoption, adoption decision-making, and post-adoption as well as acquisition of innovation should be evaluated from organisational perspective while user-related attributes such as user acceptance and actual use of innovation part of the individual level examination (Hameed et al., 2012). This distinction actually corresponds with the structure of this research design, which assesses organisational factors through the performance of the organisation as a whole while the individual level examination is being collected in parallel by TRI.

Finally, within an inbound open innovation context, entrepreneurial orientation, learning orientation, and transformational leadership all demonstrate

commonality in proactiveness, innovativeness, trust, and efficient communication. All these elements corresponds to the factors measured by TRI. Entrepreneurial orientation can be revealed through an organisation's exhibition of risk taking, innovativeness, and proactiveness (Covin et al., 2006). It was also found that technology motivators corresponded to themes in the optimism dimension while technology inhibitors emerging from the forum corresponded to themes in both the discomfort and insecurity dimensions in the form of a lack of confidence in using technology, perceived risks and costs, and concerns with security and privacy (Parasuraman & Colby, 2015). As innovation is both conceptual and perceptual (Drucker, 2014), TRI, a perceptual measurement tool itself, offers the potential to predict organisational performance in an inbound open innovation environment.

1.6.9) Utilising Performance Measurement for Assessing Inbound Open Innovation Adoption Outcome

Business performance, which is the outcome of strategic management, is a subset of the overall concept of organisational effectiveness. However, there is no single model that can encapsulate organisational effectiveness as a construct; this responsibility lies with the investigator to chart out the representation (Cameron & Whetten, 1983). The outcome of innovation is often measured by organisational performance because it is the time test of any strategy and managerial importance (Venkatraman & Ramanujam, 1986). According to Man, Lau, and Chan, a company's performance is the combination of effectiveness in three major entrepreneurial tasks. First of all, it is the entrepreneur's ability to perceive and conceptualise opportunity and identify relationships through appropriate vision. Secondly, his/her ability to organise resources to build capabilities, such as innovative ability, quality, cost effectiveness, to create and maintain flexible, organic organisational structures. Lastly, the ability of the entrepreneur to set the right goal and strategy. All of these competencies are tied together by the leadership ability of the entrepreneur through the setting of the firm's processes (Man et al., 2002). By selecting a management framework which is consistent, easy to understand and not too complicated, core elements of innovation can be monitored so that the implementation of the innovation

process can remain smooth (Yu, 2022). For this reason, performance is a measurement of how well resources are directed and organised, whether the right strategy is in place and capabilities are being built, as well as whether opportunities are identified.

Hence, the innovation performance assessment in this research includes multiple dimensions because it is unlikely that any single corporate element could sufficiently encompass all performance dimensions. Instead, organisational performance is likely to be driven by a composition of dimensions. Financial measures are necessary but not sufficient to capture total organisational performance. The collection of several critical control variables, such as company age, size, and risk, are particularly relevant to new ventures and small businesses (Murphy et al., 1996). Besides including financial metrics such as sales growth and profitability indicators like return-on-investment and return-on-sale or return-on-equity, this research will expand metrics collection to capture operational parameters such as new product introduction, product quality, staff stability, other measures of technological efficiency, and value-added features to widen the extent of business performance (Venkatraman & Ramanujam, 1986).

Finally, this study will focus on using organisation performance as a dependent variable to measure inbound open innovation, as it is the causal result of a leader's ability to integrate the three independent variables of that organisation, namely transformational leadership (Heart H1), entrepreneurial orientation (Head H2), and learning orientation (Hand H3). The causal relationship between entrepreneurial orientation, learning orientation, and organisational performance is supported by previous research indicating that either learning orientation (Wang, 2008) or organisational learning capabilities (Alegre & Chiva, 2013) positively mediated the entrepreneurial orientation and performance relationship, especially for more entrepreneurial prospectors. Transformational leadership directly and positively predicted unit level performance and confirmed management support for innovation moderated the relationship between transformational leadership and performance in a longitudinal manner (Howell & Avolio, 1993). Hence, the 3H management elements - entrepreneurial orientation, learning orientation and transformational

leadership - are relevant causal factors in determining organisational performance and will be included in the measurement instrument.

1.7) Academic and Managerial Contribution of the Study

By positioning within the context of Industry 4.0, this study explores how changes brought by technological advances drive inbound open innovation. At the same time, due to the moderating effect of cultural values found in the relationship between transformational leadership and leadership effectiveness (Spreitzer et al., 2005), the findings of this research should provide additional insights for top managers of Hong Kong companies to consider how specific management factors may be affected due to the changes occurring globally. On the other hand, by extending evolutionary economic concept through the application of the 3H framework, this study provides future scholars with a credible yet simple view from an academic perspective of how inbound open innovation may operate inside a high technology SME environment.

1.7.1) Academic Significance of the Research

There is a need for continuous improvement in a dynamic environment as predicted by the evolutionary process (Winter & Nelson, 1982). Although inbound open innovation is very promising for management and has proven itself to be a valuable concept for all types of firms and in various contexts, more integrated theories are needed so that it can be absorbed and integrated into management theories and existing management toolkits (Huizingh, 2011). The context dependency of inbound open innovation is one of the least understood topics because it both relates to transition towards inbound open innovation and the establishment of various inbound open innovation practices within an organisation. Initial studies focused on successful and early adopters of inbound open innovation may not be applicable to following firms because variations exist between early adopters and bigger follower populations. More research, therefore, is needed to understand how the internal and external environment characteristics affects performance (Huizingh, 2011).

On the other hand, Nelson and Winter observed that rapid technological advances in science-based industries where innovations flourish are largely based on the work of one or a few individuals. This notion also offers potential breakthrough for entrepreneurial start-ups to win over larger competitors. The ability of startups to commercialise means even smaller firms could seize the new technological opportunity to beat larger rivals (Nelson & Winter, 2002). This potential was also supported in the case of radical innovation, where the size of the firm appears to have no bearing on its innovative performance (Laursen & Salter, 2006). Such observations are encouraging for industries such as the bio-tech industry, which is emerging in Hong Kong.

In analysing the importance of innovation at a national level, there is widespread acceptance of the idea that innovative processes exhibit systemic properties during their attempt to create a national entrepreneurship assessment index. Hence, it is likely that the dynamics of entrepreneurship can also be categorised at a country/regional level since entrepreneurial performance is driven by complex, systemic interactions and regulated by unique contextual factors, such as culture, formal institutions and resource availability. These factors would likely vary across countries/regions and different times (Acs et al., 2014). Furthermore, international diffusion of SMEs innovations is becoming important for global economic welfare. Startups and SMEs can gain their comparative innovative advantage by exploring new technological areas that may be overlooked by larger firms. This helps to grow the diversity of technological innovation even though there are many barriers related to cost and resources to expand (Acs & Preston, 1997). Nevertheless, regional differences do exist. For instance, while R&D investment positively impacted firm performance in China and Korea (Xu et al., 2018), Chinese entrepreneurs strongly believe in taking risks, pushing ahead and reacting quickly to opportunities. They will constantly search for advantages, small and large, because small advantages will help them to advance ahead of their immediate competitors while larger ones will support their endeavour into new business areas (Tse, 2015). On the contrary, Korean companies are centered on the upper management level while suppressing individualism, an important element of entrepreneurship (Chung et al., 1997).

This existence of regional variation supports the researcher's effort to conduct a Hong Kong focused entrepreneurship assessment.

Finally, formal economic models of evolutionary economists focus on organisational learning, structure, and coordination at an organisational level (Nelson & Winter, 2002). So far, evolutionary economics does not give a clear role of transformational leadership in driving innovation because business study theorists and economists have remained far apart as neo-Schumpeterian has not on the whole succeeded in developing a behavioral theory relating firm strategy to routines and rules of thumb (Freeman, 1994). Hence, through the coupling of transformational leadership, entrepreneur oriented strategy and execution supported by learning orientation, this study should contribute to the body of knowledge in evolutionary economics by including transformational leadership as part of the modelling consideration. This conceptual extension will bridge the knowledge gap highlighted by Freeman (1994) and possibly enable the convergence of evolutionary economists with management and entrepreneurial academics for future studies, as the management model outlined by the 3H framework suggested.

1.7.2) Managerial and Societal Relevance of the Research to Hong Kong

The unique nature of Hong Kong as a global and regional innovation center in Greater China undoubtedly warrants an independent study. According to a research conducted by Loon and Chik, where the authors examined the role technology and innovation played in the design of business models in high technology SMEs in Hong Kong, long-lasting business models must be both efficient and cost-effective. The use of third party technology that conforms to international standards also plays a prominent and positive role in the SME's technology development. Therefore, the use of sophisticated technology is an important way to increase the efficiency of business operations. This also applies to both moderate and radical business models to enhance the success rate (Loon & Chik, 2019). This finding elevates the need to investigate how inbound open innovation can support SME's technology development in Hong Kong.

In the face of new trends where global and national developments are shifting towards a diversified and innovative economy, Hong Kong's traditional strengths, centering on financial services, trading and logistics, professional services and tourism, have been eroded. While new engines of economic growth are yet to be developed, the employment prospects and career development of young people in Hong Kong are somewhat hindered. Hong Kong never lacked scientists and business leaders but has been severely short of professionally talented workers required for re-industrialisation. This is the direct result of the decline in manufacturing industry which once flourished in the 1960s and 70s. Such imbalance in industry structure has also reduced the amount of cooperative opportunities between academia and industrial sectors. Hence, from a social and economic perspective, the re-industrialisation of Hong Kong will serve both social and economic goals by providing new economic drivers as well as new career paths for young generations to pursue professional development.

Going forward, policies of the Hong Kong government will prioritise the use of technology, innovation, and branding to enhance the capabilities of local companies. The performance of technological organisations and their output is strongly influenced by government through R&D, subsidy, and regulation (Porter et al., 1991:70). As such, this study is very relevant to the rejuvenation of the SME segment in Hong Kong. Previously, these enterprises have been relying heavily on its ability to reduce cost through relocating to China and marketing tactics rather than adopting new technologies. By understanding the attitudes toward innovation, this study will contribute to how policies can be adjusted by including more technology focused and value adding components so that more innovation can be fostered in Hong Kong to revitalise the local economy and the business composition. Furthermore, the right policies, practices and measurements at the government level should create proper attitudes and provide proper tools to foster entrepreneurship and innovation (Drucker, 1998). Hence, the collection of individual insights offered by the Technology Readiness Index should also aid in the construction of a theoretical model that is capable of combining effective behavioral prediction with organisation performance forecasting. By utilising the model proposed in this research to identify and

nurture an adequate amount of professional talents, while reviving blue-collar workforce through Industry 4.0, the economic landscape and success of Hong Kong can be re-established (Kan & Zhu, 2019).

1.8) Chapter Summary

Innovation is a multi-faceted process and it requires understanding from a management based, evolutionary economics-minded and contextual perspective. Firms can become more productive in any industry if they employ sophisticated methods, use advanced technology, and offer unique products and services. Due to the rapidly evolving landscape of technology, companies cannot rely solely on internal knowledge as more sophisticated software technology is disrupting labour markets by making workers redundant (Frey, 2017). In fact, 78% of large companies were already practicing open innovation in 2013 and the trend was rising (Chesbrough & Brunswicker, 2013).

Companies also need to adopt external knowledge and technology that can create competitive advantages. This adoption is important as inbound open innovation can offer a step change solution (Chesbrough & Crowther, 2006) to high tech SMEs. Hence, inbound open innovation is critical in generating competitive advantages and ultimately influencing organisational performance. However, the relationship between inbound open innovation and organisational performance was not well defined and understood (Lee et al., 2010). This is particularly true in the case of high tech SMEs in Hong Kong. In addition, according to Khosla, founder of computer networking company Sun Microsystems, large innovations are most likely coming from startups rather than big companies. The best examples are found in biotech industry, which was pioneered by Bob Swanson, founder of Genentech, and electric vehicle revolution, which was sparked by Elon Musk at Tesla (Karlgaard, 2023). Therefore, it is important to conduct a study to provide a more empirical and causal view of how inbound open innovation influences high tech SME performance.

On the other hand, the productivity and prosperity of a region rest on how local industries compete. Countries with relatively high level of intrinsic learning

capability and a small technological distance are more likely to produce new knowledge and win the technology competition race. 'Intrinsic' learning capability depends on variables such as the education of labour force, the quality of infra-structure, and the technological distance between the technology receiving country and the technological leader (Verspagen, 1991). As the intrinsic learning capabilities of Hong Kong remain high, it is likely to benefit from understanding how intrinsic learning can help. Hence, it is worthwhile to study surrounding management factors and related antecedents of inbound open innovation in local high-tech SMEs. Findings can then be applied to enhance the long-term competitiveness of Hong Kong in the Industry 4.0 era.

From an economic perspective, evolutionary economists suggest that knowledge and entrepreneurial orientation are the key elements in driving corporate innovation. Economic models of evolutionary economists also focus on organisational learning, structure and coordination at organisational level (Nelson & Winter, 2002:41). However, evolutionary economists have not provided details on how this can be achieved as neo-Schumpeterian has not on the whole succeeded in developing a behavioral theory relating firm strategy to routines and rules of thumb (Freeman, 1994). Such missing details can be revealed by developing a management framework that formalises the causal relationships between different management elements through including cultural consideration, which is strongly related to behavioral theory.

Moreover, to decide what culture should be implemented to foster innovation, managerial practice requires an underlying structure (Büschgens et al., 2013). Hence, key elements involved in establishing and supporting such structure and framework need to be identified because the differences between actual and expected status of these key management elements can also be good indicators of company performance. Furthermore, a framework allows the classification of cultural values so scholars and managers can assess the cultural relationship with organisational innovation (Büschgens et al., 2013). According to Martins & Terblanche, strategy and behavior that encourage innovation and open communication are determinants of organisational culture (Martins & Terblanche, 2003). In addition, behavior that encourages change and open

communication is a characteristic of transformational leadership (Bass, 1998; Bass et al., 1987). Hence, the inclusion of transformational leadership helps to explain how the framework operates.

This structural and framework requirement is where 3H becomes important since it introduces leadership as one possible element, which was missing in the evolutionary economic model. Since evolutionary economic model already includes strategy and learning in its assumption, the 3H framework, which also includes strategy and leadership, could be an answer to how to complete this framework if continuous learning culture or learning orientation, a key behavior in encouraging innovation (Martins & Terblanche, 2003), can be classified as execution as defined in 3H. So, this study will utilise the 3H framework to investigate how different management factors can collaborate under an inbound open innovation environment.

Finally, this research will enhance the body of academic knowledge, especially in the area of inbound open innovation, by exploring how major elements, such as strategy, leadership and execution, interact causally under a framework structure. As leadership is highly human oriented, this study will also assess how personal characteristics and management preferences act as antecedents. This corresponds to suggestions from Damanpour (2017), who emphasised the need for analysing how characteristics of entrepreneurs, such as attitude and perception, affect innovation. Challenges encountered by management that have not been covered by traditional approaches will be addressed in the following chapters.

Chapter Two - Literature Review

In recent years, significant technological progresses such as Artificial Intelligence, 5G, and Augmented and Virtual Realities are fundamentally shifting the ways that product development occurs in technology companies. It is becoming more difficult for top management of SME technology companies to track and stay ahead of technological trends. Although a company may develop its own specialist knowledge as part of its competency, it is becoming virtually impossible for any single firm to keep up to date on all relevant technological advances. Organisations must draw on a wide range of external ideas, component technologies, and complementary capabilities due to increasing complexity. In fact, the pace of technological innovation is continuously accelerating, with more sophisticated software technologies disrupting labour markets by making workers redundant (Frey, 2017). Therefore, it is becoming increasingly important for top management to understand the types of innovation available today.

2.1) Current Research Gaps in Inbound Open Innovation Management

The purpose of reviewing past literature is to identify key factors that are essential for successful and sustainable innovation management. To that end, that researcher has gone through extensive literature, as detailed below.

To resolve the complexity and gap of turning ideas into products as highlighted by Adams (2006), this study commenced by first reviewing a large number of literature that is related to the measurement of innovation management at company level. In the literature review process, more than six hundred publications were assessed. Besides gathering statistics published by the Hong Kong Government and leading organisations like UNESCO, and World Economic Forum, research articles from more than forty leading scholars with expertise ranging from management, strategy, entrepreneurship to leadership were examined closely. The selection period of publication ranges from 1934, when Schumpeter's metaphor of creative destruction emerged, to 2024.

Key factors essential for successful and sustainable innovation management are identified. For instance, entrepreneurship is included as a key factor as innovation is the central concept of entrepreneurship (Schumpeter,

1934). The identification and inclusion of key factors is to ensure this study provides a broad spectrum of theoretical consideration. Based on the analysis of this research, which is detailed in the following sections, there is clear an evidence of omission gaps in the area of innovation management. Omission gaps occur when importance of an aspect of innovation management is supported in the literature but measures for these aspects are lacking. Omission gaps are particularly prevalent in the elements of innovation management, such as innovation strategy, commercialisation, and knowledge management. This is because product innovation is only one dimension of organisational innovation while processes and organisational innovations are inadequately represented in measurement terms (Adams et al., 2006:39).

The concept of assessing innovation as a process involves a series of separate studies (Adams et al., 2006) and there is no reference model available since the current understanding of open innovation in SMEs is still preliminary (Lee et al., 2010). In addition, organisation specific choices of innovation strategy and business models may have to be made in a context of many unknown and unknowable factors (Christensen et al., 2005). The result of such complexity is the absence of a holistic framework covering the range of activities required to turn ideas into useful and marketable products (Adams et al., 2006). Hence, a new framework that can manage and develop competencies, define and direct organisational strategies, and help the creation of competencies and processes that foster innovation is needed (Siguaw et al., 2006; Adams et al., 2006).

To address the research gaps listed above, this following section will first highlight the impact of inbound open innovation. After that, the question how inbound open innovation influences management decisions will be explored. Different frameworks will then be examined to determine their suitability for innovation management. The selected framework will be utilised to identify and explain how key elements can fit in. Organisational performance enhanced by inbound open innovation implementation through the framework of this research will be presented. Causal relationship between different framework elements will be subsequently explained. The way how attitudes of leaders towards innovation adoption influence management approach within the selected framework will be

analysed. At the end of this section, an extended framework will be proposed and will form the basis of subsequent empirical analysis of inbound open innovation management.

This study will try to address the lack of understanding in how different elements within the inbound open innovation model should be integrated (West & Bogers, 2014:27). By developing a framework, this study can bridge this gap by offering new knowledge on managerial innovation since the state of knowledge on management innovation was in its infancy (Damanpour, 2017:14). By providing the configuration of key elements within the framework, this study will dwell on how to design and manage organisations for innovation, create and maintain a pro-innovation culture and climate across organisations, and drive continuous improvement of operation, systems, and human knowledge as called for by Damanpour (Damanpour, 2017:30).

In addition, this study aims at providing a new and more complete picture of what the exact antecedents, mediators, and moderators are in inbound open innovation processes and demonstrating how they would improve performance as envisioned by West (West & Bogers, 2017:46). The analysis of this search should help other researchers to answer the questions raised by Richard on how specific performance matrices are influenced by the complex combination of context and actions over time (Richard et al., 2009:745). Finally, this research will also examine the end-to-end innovation process, and study the moderators and limits of leveraging external sources of innovation as West suggested (West & Bogers, 2014:31).

2.2) Understanding the Importance of Inbound Open Innovation

Organisations innovate through combinations of existing and new knowledge so they must often turn to external sources to gain new ideas, insights, and expertise (Rosenkopf & Almeida, 2003). This happens as competencies for innovation are distributed throughout a network of actors. This system consists of a network of institutions in the public and private sectors, including customers, subcontractors, infrastructure and suppliers. It also consists of competencies or functions and links or relationships, the activities and interactions of which

initiate, import, modify and diffuse new technologies (Mazzucato, 2011). Therefore, researchers of technology management must understand the impact of inbound open innovation process in order to create an appropriate framework that is suitable for innovation management.

2.2.1) Dissecting the Dynamics of Inbound Open Innovation

Inbound open innovation is an outside-in process of exploring and integrating external knowledge and technology to complement a firm's internal innovation base in order to improve innovation performance (Parida et al., 2012; Sisodiya, et al., 2013; Wang, et al., 2015; Bianchi et al., 2016). This process is a subset of open innovation in which a company can enhance its knowledge base and capability through the integration of external knowledge from suppliers, customers, and other sources to increase a company's innovativeness (Gassmann & Enkel, 2004). This occurs since the difference between a firm's product and knowledge expertise creates opportunities for knowledge trading to achieve fuller utilisation of knowledge. Open innovation also includes outbound open innovation which happens when organisations share their own expertise with others. However, this topic is outside the scope of this research.

Figure 2.1 - Maturity framework of open innovation (Enkel, Bogers & Chesbrough, 2020)

Inbound open innovation is important since companies can no longer afford to keep all the human and technical resources that are required in-house

due to the depth and complexity of the skills and knowledge involved (Acs & Preston, 1997). The best example today is in the software industry where open source adoption is becoming a dominant practice. In fact, without software code adoption from external sources, the operation and product development of most software companies will be halted. Based on research discussions with the top management of twelve multi-billion dollar companies across a range of industries, a comparison between traditionally closed innovation strategies and open innovation strategies was produced in the diagram below (Chesbrough & Crowther, 2006).

Figure 2.2 - Innovation Strategy Map (Chesbrough & Crowther, 2006)

In Chesbrough's view, achieving growth is a one-way process. A firm has to move from closed to open innovation by adopting internal and external options to improve its existing technology assets. During such an adoption process, execution needs to be optimised continuously by management. Therefore, inbound open innovation plays a key role in innovation strategy formulation as all organisations need to adopt external knowledge at some stage. Hence, this study will attempt to understand how inbound open innovation operates in innovation strategy formulation to bring growth and organisational performance to firms.

Through inbound open innovation, removal of knowledge and technology boundaries will not only broaden the minds but also increase the speed and the chance of success of the adoption of new technology. Instead of merely focusing internally, the advice, capabilities, and requirements of customers and suppliers

can now serve as new insights for management to enhance the offerings of organisation against competitors in an inbound open innovation context. Companies engaged in inbound open innovation process are likely to engage in external collaboration and acquire intellectual property from external parties either by purchasing their products or through technology licensing. Other approaches by inbound open innovation driven organisations are listed below.

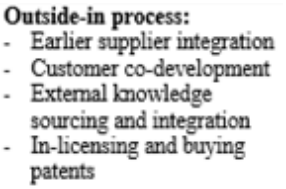


Figure 2.3 – Characteristic of Inbound Open Innovation Process (Gassmann & Enkel, 2004)

Finally, measuring organisational performance only provides part of the inbound open innovation story. Researchers must also examine the processes involved, such as product development and product enhancement, to gather adequate information to enable continuous performance improvement through the development of action plans (Chiesa et al., 1996).

2.2.2) Composable Innovation – A Commercial Consultant Perspective of How Inbound Open Innovation Improves the Management Cycle

Besides suggestions from the academic world, an alternative representation of inbound open innovation has been proposed by Gartner Research, a commercial consultancy with expertise in industry trend analysis and strategy recommendation. According to Gartner's concept of composable innovation, an organisation is a combination of modular blocks and any business asset can be enhanced through replacement or internal upgrade. These modules range from people, processes, and technology to physical assets coming from the internal or external sources of the organisation. Leaders can quickly, easily, and safely recompose and re-orient these assets to create new value in response to disruption. This approach encourages continuous exploration and creation of disruptive business capabilities through the adoption of different modules to create new competitive advantages and better performance. With an emphasis on shorter cycle time and rapid response to environmental changes, composable orientation is offering academic researchers commercial insights into how

inbound open innovation can be assessed within an organisation. A comparison between traditional business orientation and composable orientation is shown below.

Figure 2.4 - Traditional Versus Composable Orientation (Costello & Rimol, M., 2021)

2.2.3) Potential Benefits of Inbound Open Innovation for SMEs from Growth and Technological Perspectives

Even though SMEs are specialists in their business activities, they must maintain efficient interaction with other firms and R&D institutions to support innovation through the exchange of knowledge and commercialisation activities (Oslo Manual 2005). Nonetheless, the ability to acquire knowledge from external entities is limited by the existing expertise and experience of the organisation (Nelson, 1985). Thus, possessing the ability to adopt new ideas and innovation is not only the key to success but a matter of survival for SMEs due to their limited resources. For example, artificial intelligence will bring new benefits to firms, similar to those brought by computers when they first appeared. However, entrepreneurs need to identify the sweet spots where AI can bring most benefits to develop their business and deliver organisation performance (Autor, D., 2024)

Many service organisations are reliant on value chains which include suppliers, intermediaries, customers and financial partners, who combine their capabilities to build and create value added processes (McManus & Ardley, 2020). For this reason, inbound open innovation is possible as the strength of cooperative ties across a range of productive activities within the value chain are

important facilitators for SME innovative capability (Tomlinson & Fai, 2013). Also, smaller firms tend to use alliances to reach scale of economies with minimum cost while firms that are more dominant in market scale rely more on internal capabilities to expand (Acs & Preston, 1997). High tech SMEs can thrive under inbound open innovation through co-operations through better access to knowledge and skillsets that may be previously beyond its scope of expertise.

In a study of 293 small and medium manufacturing companies in USA that mainly assessed the adoption of inbound open innovation practices in the form of joint development, more than 50 percent of firms were already engaged in inbound open innovation to some extent during technology and product development and commercialisation. Firms are more innovative when they use technology development collaboration with their suppliers to improve their products, and product development collaborations with their customers in order to improve their processes (Theyel, 2013). Potential benefits of inbound open innovation are discussed below.

A) Higher Levels of Product Differentiation

Inbound open innovation enables SMEs to gain benefits through new ideas, new market opportunities, and new combination of knowledge. As such, the level of inbound open innovation indicates a firm's ability to produce competitive advantage in the form of product differentiation. For instance, technology sourcing is linked to better radical innovation performance while technology scouting supports incremental innovation performance (Parida et al., 2012). A company must stay ahead of others by introducing invading products before it has been overtaken during its product lifecycle (Foster, 1986; Christensen, 1992). Through product differentiation, innovation, which can now be observed, noticed, and valued by customers, is also demonstrating its significance as a value-added novelty in economic and social spheres. Without innovation, established products are destined to be overtaken by invading products that are driven by continuous innovation as explained by the S-Curve model (Foster, 1986).

Figure 2.5 - Technology/Marketing S-Curve Phenomena (Foster 1986)

B) Faster Creation of Competitive Advantages

Creating strategic and competitive advantages through external sourcing requires the integration of external activities and technologies. The importance and potential contribution of such integration is recognised by the growing research on strategic alliances, virtual/online corporation, technology collaboration, and closer buyer-supplier relations through outsourced manufacturing (Teece, et al., 1997). Furthermore, as found by a recent survey of general managers conducted by Gartner, better use of advanced technology, that may come from external sources, has been identified as a key enabler to grow a company beyond its core competencies and develop more competitive advantages (Costello & Rimol, 2021). Hence, the effectiveness of new technology adoption is another observable indicator of whether inbound open innovation is assisting the development of competitive advantages in the organisation.

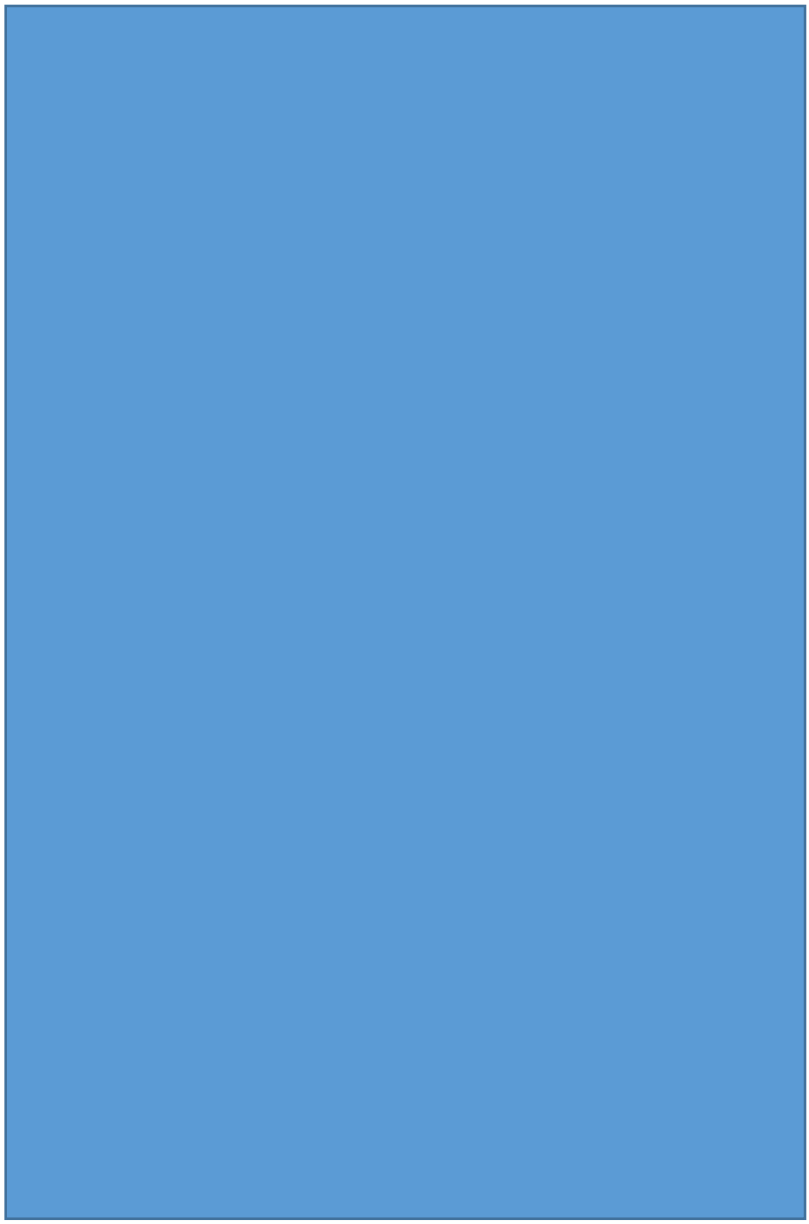


Figure 2.6 - Sources of Competitive Advantage (Costello & Rimol, 2021)

C) Bringing in a Broader Range of Perceived Benefits

To accentuate the importance of inbound open innovation, different technology organisations have conducted various studies to qualify the effectiveness of different innovation adoption strategies. Understanding such effectiveness is important since the infusion of new digital technologies has removed certain uncertainties in both processes and outcomes (Nambisan et al., 2019). For instance, due to new technologies brought forth by digitalisation, large corporations, such as GE and Boeing, have even restructured their innovation strategies and practices.

Besides in-house innovation development, other forms of innovation adoption have been proposed by research institutions such as IESE (2017, 2019), commercial organisations such as Telenor and Vodafone, as well as consultancy firms such as McKinsey. Their studies collectively lead to the conclusion that inbound open innovation can bring a range of benefits to the organisations. For instance, based on survey of 1,430 qualified respondents involved in shaping the suppliers and company technology requirements, Vodafone highlighted the range of benefits from innovation adoptions (Vodafone, 2019).

D) Enabling the Adoption of External Resources that Complement Internal Resources

Due to the increasing importance of long-term strategic relationships with both customers and vendors along the value chain, relationship management with external parties is also becoming part of the organisational core competence in the context of inbound open innovation. By focusing on customer value and relationship management to achieve better outcomes, a much stronger coordination within the organisation, an elimination of internal boundaries between management functions, and a blurring of the boundaries between the firm and its market environment may become possible (Webster, 1992).

Conversely, strategy needs to align with structure and the competitive environment (Chandler, 1962). Hence, inbound open innovation can be used as a strategic tool to strengthen different internal elements based on the adoption of external technologies that complement the existing pool of technologies available. Such arrangement enables a company to benefit from external knowledge sources necessary to achieve innovation (Laursen & Salter, 2006).

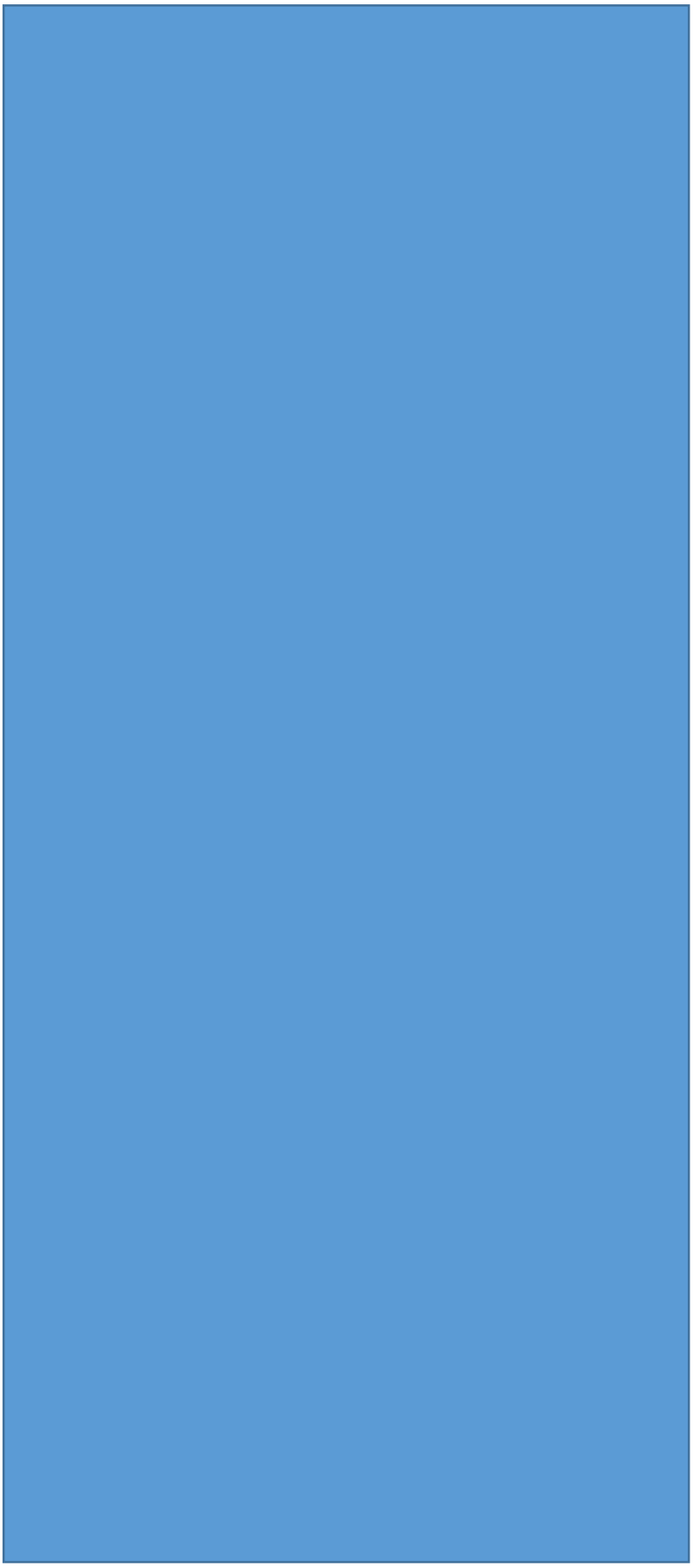
E) Improvement of Organisational Life Cycle Management Process

As an individual organisation develops through different stages of its unique life cycle, the areas of emphasis and strategy will also adjust to fit the operating environment. To represent the variation of requirements, the model shown below was developed to include four quadrants of "effectiveness values". Organisation alignment to these different criteria of effectiveness should change over time due to the variation of activities and characteristics of organisations (Quinn & Cameron, 1983). Since different stages of a company lifecycle require

different levels of inbound open innovation adoption, understanding of such requirements based on Quinn and Cameron's interpretations (1983) can enable entrepreneurs to manage the adoption level and implement a better lifecycle management process to maximise organisational performance.

For instance, during entrepreneurial stage, organisational success tends to be defined primarily by how well the organisation meets the criteria of growth, resource acquisition, external support, and readiness (Quinn & Cameron, 1983). Adopting an open systems model becomes a key strategy for growth. This search for external support and resources echoes inbound open innovation driven strategies favored by the high-tech and entrepreneurially focused SMEs in this study. On the other hand, as business becomes more steady and routine, companies tend to adopt a rational or transactional approach that is driven more by internal process and rational goal. Hence, inbound open innovation level may need to be adjusted accordingly to allow management to include more focus on control to maintain stabilities as shown by the control and structure stage.

Figure 2.7 - Four Models of Effectiveness Values (Quinn & Cameron, 1983)



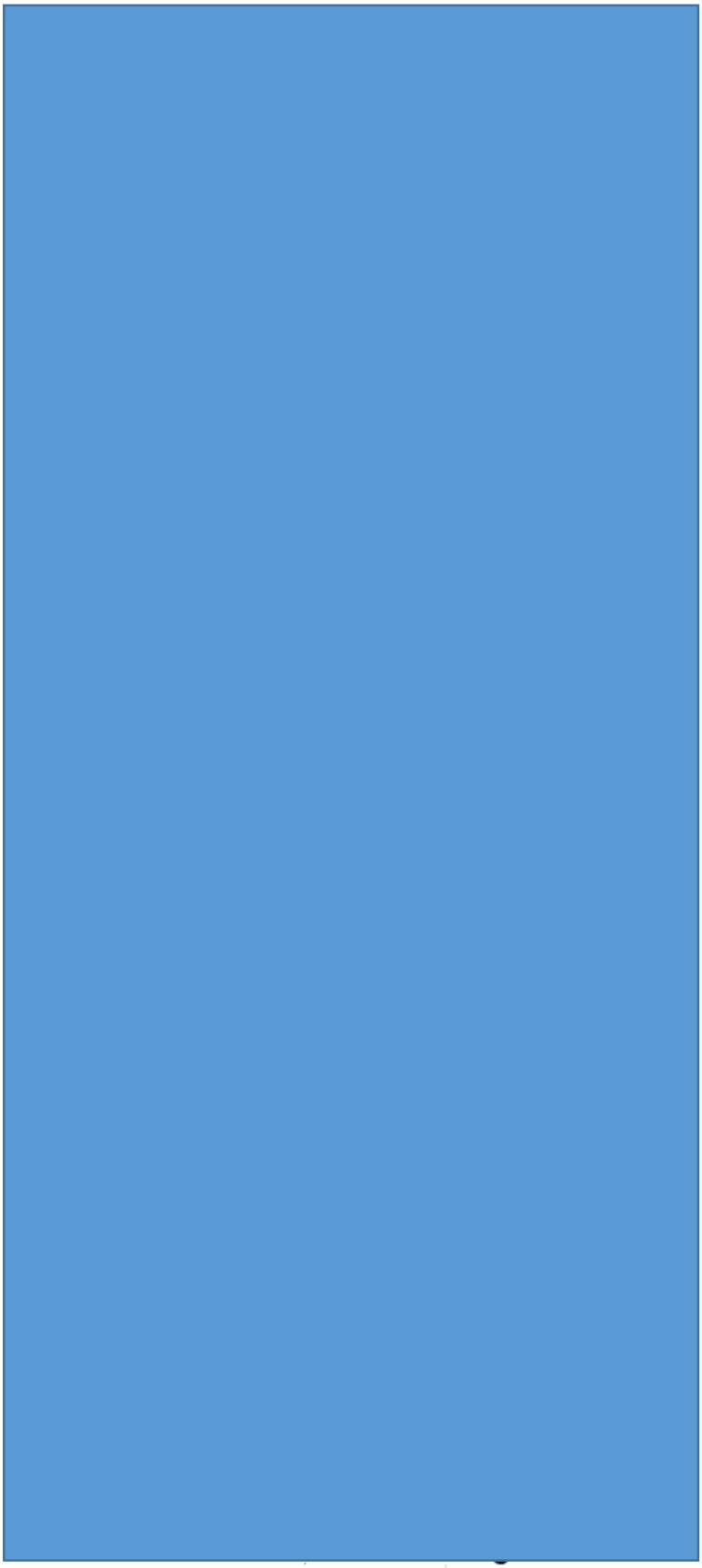


Figure 2.8 - Four Stages of Organisational Growth Cycle (Quinn & Cameron, 1983)

2.2.4) Impact of Inbound Open Innovation on Management Framework Design

Despite the effort required to resolve complex interdependencies among internal R&D activities and external technologies, the benefit of inbound open innovation is long-lasting and capable of creating organisational architectures to advance the organisation later on (Chesbrough, 2003). With the improvement of communication methodologies such as 5G, video conferencing, and high-speed internet, the flow of knowledge can now be obtained regardless of geographical context. Hence, the effectiveness of alliances and people mobility should increase when technological or core competence between companies is more different (Rosenkopf et al., 2003). This has important implications for inbound open innovation adoption in high technology SMEs since new technology and disruptive innovation often starts small at niche application, offering SMEs the opportunities to pursue new but small markets due to their greater capability to specialise than larger firms (Vanhaverbeke et al., 2012).

Access to new external technology also enables the launch of genuine innovations in the marketplace (Christensen et al., 2005). On the other hand, under the wave of market changes driven by new technology, high tech SMEs must adopt innovation in a collaborative manner to remain as technology leaders. Collaboration partners could range from young, dynamic and entrepreneurial firms, academic institutions, or organisations in entirely different sectors that offer radically different perspectives, approaches, or market access (Schwab & Davis, 2018). Therefore, inbound open innovation is alive and continuously evolving from a strategic, leadership, and cultural perspective (Enkel et al., 2020). Given the fact that this is an ongoing and complex process that significantly impacts organisational performance, a framework that is designed to accommodate such a wide range of management and collaboration scenarios should be made available to high tech organisations, especially SMEs.

2.2.5) Hong Kong Specific Considerations for Inbound Open Innovation Management Framework Design

As an externally oriented global city, Hong Kong has always been known for its openness in accepting and adopting foreign culture and ideas. Such openness in culture also extended to all aspects of corporate management. As its economy is relying heavily on the continuous flow of trade, information, and financial resources, entrepreneurs in Hong Kong are one of the earliest adopters of new ideas globally. In addition, since the late 1990s, the Hong Kong Government has developed a vision to focus on high value-added industry as a way to readjust Hong Kong's economy through funding for local technology development (HKSAR Government 2001). These factors are combining favorably for the culture of inbound open innovation to thrive locally in Hong Kong. However, the interrelationships and the extent of impact due to different management aspects are yet to be quantified in the local high tech industries. A study of local entrepreneurs should help to answer some of the questions which remain unanswered so far in the context of Hong Kong.

2.3) Is there a Suitable Management Framework for Innovation Management in SMEs

Studies by numerous scholars (Naman & Slevin, 1993; Waterman et al., 1980; Dyer et al., 2011; Yu, 2021) suggested a framework should be leveraged to co-ordinate various determinants to produce the best outcome for innovation management. Unfortunately, even after studying twelve existing measurement and six frameworks that measures entrepreneurship, a technical report published by the European Commission on digital entrepreneurship concluded that a large majority of these frameworks have no links or weak links with innovation (Bogdanowicz, 2015). This is because the rationality of human action is bounded and it is difficult for modelers and users to deduce an optimisation strategy based on all the elements involved especially when these elements also evolve as time progresses (Nelson & Winter, 2002). Hence, it will be a challenge to find a suitable framework that effectively drives inbound open innovation in SMEs.

Moreover, organisational boundaries were drawn to support existing operations and may impede new innovations that could lead to the creation of new structure (Christensen, 2016). In this scenario, if there is a flexible framework that can link technical decisions dynamically to economic outcomes at different stages of company growth, it can help companies of all sizes to convert technological potential into economic value through a business model (Chesbrough, 2003). Therefore, this study will try to explore if such a framework exists based on previous studies and will try to identify and modify key elements, if necessary, to accomplish this endeavour.

2.3.1) Why SMEs Need to Manage Innovation

Technological changes are significantly impacting competition and, therefore, forecasting the path of technological innovation is crucial for firms to maintain and improve its competitive position. This is especially important for SMEs due to their limited financial resources, lower bargaining power against larger firms, and difficulties in recruiting and retaining high calibre workers. With the increase of innovation complexity, induced by technical and scientific progress, the knowledge base of many firms has become inadequate to control all aspects of the innovation process (Spithoven, 2013). As successful innovations are those accepted by the market, top management needs to select and manage the type of innovations to be adopted. For this reason, top management need to anticipate or comprehend abrupt changes in the business environment in order to manage the bridging of knowledge gaps. Hence, there is also a real need for management themselves to be receptive to innovation under a competitive environment to support organisational growth (Porter et al., 1991:199).

Every company in the twenty-first century needs to adopt technology so that the management of innovation will need to respond swiftly to maintain organisational competitiveness. Strategies focusing mainly on cost reduction without innovation will be less effective than those that offer products and services in a more innovative manner (Schwab, 2017). Unfortunately, slow development of capabilities is more likely to inhibit performance (Selassie, 2022). Benefit for a company can only be realised when strategies that encompass

important technology and reinforce the firm's competitiveness are selected (Porter, 2008). Hence, companies cannot confine their modes of innovation management to one particular set of routines since there are important cyclical aspects of innovation strategies (Christensen et al., 2005).

As the management of inbound open innovation is complex, the primary task of SME management is to establish the coordination necessary for the integration of specialist knowledge that resides with individual employees into sellable goods and services (Grant, 1996). Since driving innovation streams requires multiple organisational architecture inside one business unit (Tushman, 1997), there is a need to have some mechanism or framework to control, co-ordinate, and adjust different aspects for continuation of synergy. This multi-dimensional design will be part of the framework proposal of this research summarised in the following sections. In addition, to master the discipline of innovation, management needs to be conscientious and stay focused on the mission, define the results being pursued and have the ability to assess what and how it is being done (Drucker, 1998). Only through professional management, the premiums generated for innovative products can outweigh the costs (Rosenbusch et al., 2011). The complexities faced by any innovation management framework is highlighted by a Gartner research report which defined open innovation as one item of the many processes in their innovation management cycle (Beale, 2022).

2.3.2) Innovation as a Process

Innovation is a tangible procedure or product development process within an organisation that is intentional, new to a social setting, not routine and aimed at producing benefits, and public in its effects (Kezar, 2011). Innovation covers the entire process when a new idea is brought into productive use by engaging multiple parts of organisation and eventually diffused into society. Innovation capability is the most important determinant of firm performance since it enables organisations to gain competitive edge to survive (Calantone et al., 2002). In comparison, creation, invention, or discovery only focus upon the conception of the idea and may remain in an individual's brain (Adair, 2007). From this

perspective, innovation is a process that needs to be managed effectively to achieve the best outcome for an organisation and it is realised by the theory of diffusion of innovations (Rogers et al., 2014).

Organisational innovation is complex, multi-level, multidimensional, and context-dependent because it overlaps with several other concepts such as creativity, invention, imitation, as well as organisational and technological change and is often used as an umbrella concept covering all of the above (Damanpour, 2017). The concept of innovation orientation has also been interpreted as a multidimensional knowledge framework. It includes learning philosophy, strategic direction, and trans-functional beliefs which ultimately foster the development of organisational competencies so companies can recognise and respond to shifts in a dynamic market environment (Siguaw et al., 2006). With this multi-dimensional nature, innovation and its management is a sophisticated process for any top management to foster and facilitate. Innovation involves the resolution of complexities, such as identifying new key factors, evaluating the strength of existing obstacles, and preparing for the provision of resources.

According to Hameed (2012), for innovation to be adopted, relative advantage, security, observability and trialability must exist to qualify the process as an innovation. Organisations must have both top management and infrastructure support with the right IT expertise in place. Favorable ecosystem elements, such as partner readiness, and government support through policy, should also be available. Furthermore, company's top leaders should be innovative, having the attitude to succeed and being backed by related technical knowledge, education level, and tenure. Finally, user acceptance considerations such as perceived usefulness, ease of use, attitude towards use, compatibility, behavioral intention, organisational support, and user experience should be addressed to ensure the success of innovation adoption. Success of innovation process is achieved only by allowing innovation progress to be accepted, getting integrated into the organisation, and allowing individual users to continue using the innovation (Hameed et al., 2012). Hence, advancing innovation within an

organisation is a challenging task and requires guidance through a well-structured framework.

Figure 2.9 - Conceptual Model for the Process of IT Innovation Adoption (Hameed et al., 2012)

2.3.3) Challenges of Managing the Innovation Process

To achieve stable and significant relationships for organisational innovation, thirteen determinants were identified. However, managing these determinants to establish an innovative organisation is no easy task. These determinants include specialisation, functional differentiation, professionalism, centralisation, managerial attitude toward change, technical knowledge resources, administrative intensity, slack resources, and external and internal communication (Damanpour, 1991). While working with these determinants, a firm's entrepreneurial vision must be conveyed to different levels of the firm in order to align organisational goals with business processes (Wang, 2008). Management of these determinants is important because innovation is about change and according to Van de Ven, there are four central problems in the management of innovation. These problems range from developing ideas into an implemented reality (execution focus), ensuring attention being paid to new ideas and innovation (organisational behavior or culture), part-whole relationships in which individuals involved in specific transactions or parts of the innovation do not lose sight of the whole innovative effort (vision), and strategic problem solving when leaders have to link these self-organizing innovative units into a larger and more encompassing organisational mission through the strategy context at the institutional level (strategy oriented) (Van de Ven, 1986). Since

organisations are evolving entities, the figure below summarised the remedial emphasis that should be considered at various stages to achieve the best outcome for the organisation (Smith & Sharif, 2007).

Figure 2.10 - Different Technology Assets Make Different Types of Contributions to the Growth and Competitiveness of a Company as it moves through its Lifecycle (Smith & Sharif, 2007)

2.3.4) How Can Inbound Open Innovation Influence Management Decision

Innovation is by nature a creative, non-routine, and unpredictable task. Since individual companies are unable to keep up with the pace of the development of technical and managerial knowledge, there is a great need for sourcing knowledge through different means of organisation–environment relations (Damanpour, 2017). Openness in organisations is crucial to innovation activities because innovation cannot occur in isolation within a firm's boundary. Sources of innovation can be derived purely from internal or external competencies that enable firms to integrate external knowledge within its own operating boundaries (Di Stefano et al., 2012). However, the incorporation of inbound open innovation involves making strategic decisions to create favorable processes to seize opportunities, create disruption, and enhance diffusion of information. This is because organisational innovation is an indication of

behavioral change (Rogers, 1995). For this reason management needs to be purposefully involved.

Moreover, inbound open innovation is a distributed innovation process based on knowledge flows being purposely managed across organisational boundaries. It needs to operate in line with an organisation's business model because these flows of knowledge may involve knowledge inflows to or outflows from the focal organisation or a combination of both (Chesbrough & Bogers, 2014). Additional levels of diversity will emerge as a company becomes more innovative because functional differentiation were found to facilitate the adoption of innovation (Moch & Morse, 1977). Hence, inbound open innovation will impact how organisations should be structured to support knowledge flows and the corresponding change in the level of diversity.

In addition, disruptive innovation can also be a competence or capability-destroying breakthrough, bringing major changes or improvements for current processes or technology (O'Reilly & Tushman, 2021). Leaders must also pick areas in which to innovate while also borrowing from other areas because they are not trying to invent everywhere (Bryan, 2020). Therefore, when innovation takes place, top management needs to take a broader view of the collective priorities and work on strengthening areas where positive changes can be created by collaborating and co-operation (Schwab & Davis, 2018).

For an inter-organisational innovation to succeed, business partners must also select what to adopt (Prescott & Conger 1995). This is an extended form of innovation diffusion because input from the external community, including suppliers, customers, research institutions, and sometimes even competitors, can become a major determinant of an organisation's innovation behavior (Baldridge & Burnham, 1975). Furthermore, a porous environment clearly favors the deployment of inbound open innovation as a means to infuse new external innovation especially when a firm's innovation capability depends on innovation diffusion (Calantone et al., 2002). In fact, some of the largest global growth and development achieved in the past two decades has been associated with the acceleration in the diffusion of technological change and worldwide access to codified knowledge, also known as "research without frontiers" (Freeman &

Soete, 2009). In the pursuit of inbound open innovation, management should enable organisations to remain competitive by staying at the "early" half of Roger's innovativeness spectrum, as shown in the figure below.

Figure 2.11 - Adopters Categorisation on the Basis of Innovativeness (Rogers & Williams, 1983)

Once new innovation is crystalised in the organisation as a new type of "common sense", it will influence management and design (Freeman & Perez, 1988). Therefore, innovation diffusion must be addressed by management as it is an essential part of the production or adoption, assimilation, and exploitation process (Crossan & Apaydin, 2010). Five strategies ranging from changing the perceived attributes, activating peer networking, changing the norms of existing systems, using key opinion leaders and champions, and providing education to staff to promote the benefits of inbound open innovation diffusion were suggested (Rogers, 2002). To accomplish what was suggested by Rogers, leadership that drives change, strong execution and learning platforms, and the support of an appropriate management strategy should be in place so that the actual diffusion need of the organisation under inbound open innovation is realised.

2.3.5) Possible Framework to Manage Inbound Open Innovation

In management world, no single framework is comprehensive enough so that others can be rejected entirely. Different types of industries may need different framework components in different proportions (Smith & Sharif, 2007). The most appropriate frameworks for the particular application should be based on empirical findings and supported by extensive literature evidence. In the area

of technology and innovation management, it is important for companies, big or small, to understand the key elements involved. Technology, which can be embodied in people and processes as knowledge and skill, is used to develop product and services (Burgelman et al., 2008). Technology is also the process that any company uses to convert inputs such as labor, capital and information into outputs of greater values (Christensen & Raynor, 2003). Many great firms of today grew out of technological changes that they were able to exploit (Porter, 2008).

Hence, from a technology innovation management perspective, the desired framework should ensure the organisation can produce output that is of greater values than the input by capitalising on the people, processes and knowledge existing within the organisation through management actions. Furthermore, under an inbound open innovation environment, SMEs need to acquire external knowledge due to limited expertise and experience of the people within the organisation (Nelson, 1985). Such knowledge acquisition also require efficient exchange of knowledge and commercialisation processes (Oslo Manual, 2005). All these happen as a company matures or is transformed by changes in its social or technical context or environments (Smith & Sharif, 2007).

Therefore, an effective innovation management framework for SMEs must be able to support effective transaction of new ideas under the context of inbound open innovation. To cater for SMEs which evolve continuously, this framework should be able to integrate and organise most of the proposed dimensions (Cameron & Quinn, 2011). Strategic management researchers have also identified the importance of aligning systems, structure, and strategy with the environment (Mintzberg et al., 1998), thereby acknowledging the importance of managing inbound open innovation through a framework.

As one of the more frequently cited models in innovation management, Van de Ven's model (1986) provides researchers with a simple yet systematic view in addressing the challenges listed above for SMEs so it is adopted as the basis of framework assessment in this study. According to Van de Ven, innovation focuses on four basic factors (people, new ideas, transactions, and institutional context) where people and processes, in the form of transactions,

corresponds to definition from Burgelman. On the other hand, new ideas are essential for introducing technological changes as suggested by Porter. Finally, inbound open innovation acts as an institutional context that SMEs need to deal with if they are to succeed.

Nevertheless, the four factors highlighted by Van de Ven in turn create four major challenges for top management. These include management of employees so that they become more attentive to new ideas. Employees can also be empowered to maximise their potential for the companies to implement processes that can manage new ideas and turn them into beneficial reality. Structure and relationships should also be formed to help employees to operate as part of the whole innovation endeavor. An infrastructure that is conducive to innovation and organisational learning should also be created, if necessary (Van de Ven, 1986). As this study focuses on innovation and the subsequent change of management process which is driven by entrepreneurial desire to succeed, this research has selected seven frameworks that exhibit certain level of alignment to Van de Ven's model. These models are also related to innovation or entrepreneurial management from well-known scholars and analysis on how they manage innovation based on Van de Ven's proposition is summarised below.

A) McKinsey's 7S

The McKinsey 7s framework is often used when organisational design and effectiveness are at question. This model was developed by Waterman, Peters, and Philips in the 1980s and assumes organisation management is multi-dimensional. It is used to plan and implement organisational change by showing how different internal organisational elements are interrelated, forcing management to concentrate on interactions and fit because the pace of change is geared to all seven S's (Waterman et al., 1980). Its focus on change management makes 7S a relevant candidate for driving innovation, which is all about changes. The seven elements (strategy, structure, systems, shared values, style, staff and skills) are mutually reinforcing and need to be aligned for an organisation to perform.

This framework is related to innovation management because skills is one of the crucial attributes to characterise an organisation and innovation is identified as one of the capabilities that constitutes this group of attributes (Waterman Jr, R.H. et al., 1980:24). The lack of hierarchy among these factors suggests that significant progress in one part of the organisation will be difficult without working smoothly on the others (McKinsey Quarterly, 2008). This framework can be used to identify what needs to be realigned to improve performance, or on how to maintain alignment and performance in different situations to ensure that wider impact of changes made in one area is taken into consideration. Hence, the most common uses of this model are to facilitate organisational change, to assist the implementation of new strategy, to identify how each area may change in the future, and to facilitate the merger of organisations (Ravanfar, 2015).

Figure 2.12 - The 7S Framework (Waterman, Peters and Phillips 1980)

It is easy to understand the model but much harder for organisations to apply since it is difficult to come up with a common understanding of what well-aligned elements should be. Also, the seven elements are dynamic and change constantly. Therefore, adjustment in one element always affects other elements

and requires implementation of new organisational design, making it necessary to continuously review each of the seven areas. As observed by Leonard-Barton, the more dimensions are included, the greater the potential for misalignment between project and capability (Leonard-Barton, 1992). Therefore, this model can be time-consuming and difficult for SMEs to manage.

B) The Four Dimensions of Core Capabilities

While this framework was originally proposed as a solution to overcome traditional core rigidities that inhibit innovation (Leonard-Barton, 1992), it was also suggested by Smith and Sharif as a possible solution for companies as they grow (Smith & Sharif, 2007). In her study focused on technological innovation, Leonard-Barton believes core capabilities, namely technical systems, skills, and managerial systems, are traditionally treated as clusters of distinct elements. They are deeply rooted in values which have been overlooked but have been identified as the fourth dimension in her model. Nevertheless, these traditional core capabilities inhibit innovation due to their rigidness. Therefore, her new model tries to assist managers of new products and process development projects to take advantage of core capabilities without being hampered by internal factors (Leonard-Barton, 1992). As core capabilities are being distributed and are constantly enhanced from multiple sources at different paces, this model tries to enlarge the boundaries of standard project management theory through the inclusion of considerations towards interactions between development of capabilities and strategy.

Figure 2.13 - Four Dimensions of Knowledge that Contribute to Organisational Capabilities (Leonard-Barton, 1992)

Unfortunately, this framework also concluded that the replacement of some core capabilities will happen over time and beyond the lifecycle of a single project (Leonard-Barton, 1992), making it more of a planning focused than an execution-friendly approach. Moreover, individual capabilities are difficult to change because managers try to avoid actions that challenge the accepted modes of behavior. As such, the concept of values and norms are used as drivers for change management (Leonard-Barton, 1992). Finally, the framework does not offer any strategic recommendation on how to coordinate different elements together, leaving management an open question on how to execute smoothly.

C) Yu's 3H

The main problem in strategy had turned out to be execution. How to organise effectively becomes an important element because this ability helps to achieve outcome. Ineffective organisations can create a circular problem for strategy and execution (Waterman Jr, R.H. et al., 1980:16). This is how 3H can assist innovation because the central theme of the 3H framework is the strategic alignment of three key domains, namely, people management through leadership, strategy formulation supported by systems and structure, as well as execution backed by competence. The 3H framework strives to create a people-oriented, win-win, and responsible culture, starting from the leader down to the followers, organisation to organisation, industry to industry, community to community, and nation to nation (Yu, 2022).

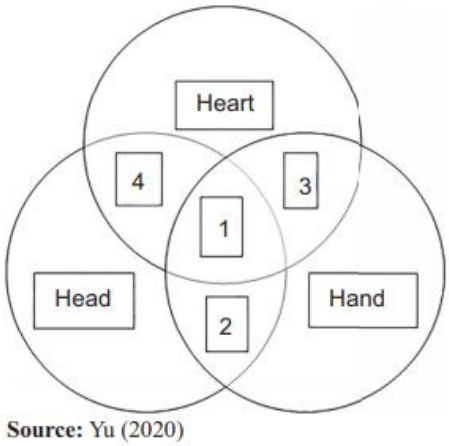


Figure 2.14 - Structure of 3H Framework (Yu, 2021)

In providing a simple yet holistic model for management, Yu's 3H is offering high tech SME management the opportunity to cover different aspects of innovation management, from strategic consideration, leadership mediation and intervention, to execution tracking and optimisation. This holistic solution means leaders can effectively and efficiently manage all three domains through influencing their followers and integrating different aspects to deliver and sustain the best performance for the organisation on an ongoing basis.

D) Christensen's 3P

In a rapidly changing world of SMEs within the high technology industries, the boundaries are becoming increasingly blurred between what an organisation is and what a team is (Dyer et al., 2011). To overcome this scenario, Christensen suggested that companies can become innovative by building the code for innovation right into the organisation's people, processes, and guiding philosophies. However, management can still remain clueless about how to embed them deeply into the organisational culture (Dyer et al., 2011).

Figure 2.15 - People, Processes, and Philosophies in the World's most Innovative Companies (Dyer et al., 2011)

Although 3P also recommends the creation of structure and the allocation of resources to power new ideas to the market, it does not address in detail how management should lead small project teams to work together besides staffing

with the right people. A major challenge in using 3P framework for ongoing organisational management is how to make it feel real to employees as the details in doing so are not clearly provided (Dyer et al., 2011). This comes about because the framework itself is mainly focusing on the innovation aspect rather than providing a holistic approach to cater for variation during execution.

E) Entrepreneurship and the Concept of Fit

The model of fit was developed after an empirical study designed to investigate entrepreneurship in small-and-medium sized high technology manufacturing firms was conducted. Entrepreneurial style, organisational structure, and mission strategy were included in this study and the ability to innovate was one of the core assumptions about entrepreneurship. It was an attempt to determine how a firm fits within its environment and the performance of firms was found to be positively related to the measurement of fit. Model of fit defines fit as a characteristic that offers synergy among content or process variables of the organisation and environment. It provides a basis for specifying fit as well as giving guidance on how to prioritise efforts, progress evaluation and knowledge management to enable diagnosis and correction of 'misfit' for individual organisations (Naman & Slevin, 1993).

Figure 2.16 - Entrepreneurship and the Concept of Fit (Naman & Slevin, 1993)

Through using this EOM model, strategic managers can be more proactive in managing their strategic choices so that the strategic consequences are more beneficial. However, this model provides only a limited perspective on the multi-dimensional construct in the area of strategy. It expects higher

education of labour and management existing in technology organisations to support the implementation of such model (Naman & Slevin, 1993). This reliance of individual ability to make choices under a limited perspective may not be holistic enough to ensure the successful implementation and execution of management decisions in turning new innovations into a commercial reality.

F) Relationship Based Model

To create competitive advantages in the new era of knowledge economy, a new approach should be adapted for dynamic and continuous structural change in organisations. For organisations to compete based on dynamic capabilities and knowledge management, the use of higher dimensional factors such as informal relationships, trust-based relationships, emotionally inclusive relationships, and externally oriented relationships have been suggested (Wang & Ahmed, 2003a). This model requires wholehearted leadership through the adoption of a human-centric organisational structure and is shown in the figure below. Organisations can be more open, create more interaction, be more flexible, and enable trust to be built between members involved. This combination makes it a good model to embrace inbound open innovation where interactions among internal and with external parties are key to creating competitive advantages. This approach is also similar to the human relation models suggested by Quinn and Cameron (1983) and is more relevant to the collectivity stage of organisation growth rather than for the entrepreneurial stage.

Figure 2.17 - Developing Dimensions of Organisational Structure (Wang & Ahmed, 2003)

G) Dynamic Capabilities Framework

Dynamic capabilities reflects interdependence between different elements. It is combined with strategy to create and refine a defensible business model. Dynamic capabilities guide organisational transformation and innovation to address or even shape changes in the business environment by developing and coordinating resources from the firm and its partners. The goal of dynamic capabilities framework is to maintain competitive advantages of firms through the use of distinctive processes, which is responsible for coordinating and combining resources, supported by the firm's specific capabilities, such as difficult-to-trade knowledge assets, and the evolution paths it has adopted or inherited (Teece et al., 1997). Ideally, this allows the enterprise to sustain and enhance its capabilities and resources but the model has been focused on providing a broad overview rather than a set of testable propositions (Teece, 2018).

Figure 2.18 – A Simplified Schema of Dynamic Capabilities, Business Models, and Strategy (Teece, 2018)

The ultimate purpose of such a framework is to enable business model innovation by supporting rapid implementation, testing, and refinement of new and revised business models. As shown below, this framework enables an enterprise to upgrade its ordinary capabilities and direct these, and the

capabilities of partners, toward high-value endeavors. However, this framework did not highlight the importance of execution as part of the framework as it mainly focuses on capabilities and technology alignment, development and preparation as a means to support organisational changes.

2.3.6) Summary of Comparison and the Selection of a Reference Framework

The strong connectivity linking various factors within the frameworks listed in the previous section suggests that there is a need for top management to regularly monitor and balance refining factors because a systematic approach for innovation requires feedback ranging from economic activity to institutional setup (Lundvall, 1999:72). A management framework that is innovation-focused must be dynamic enough to define and direct organisational strategies, possess distinctive processes to coordinate and combine specific capabilities of firms, and act toward the creation of competencies and processes that foster innovation.

To compare the various models identified, Van de Ven's suggestion (1986) of innovation management was chosen as this research's reference for model comparison since he has provided researchers with important guidelines toward understanding the process of innovation as well as the factors that facilitate and inhibit the development of innovations. After identifying four core factors that can facilitate the development of innovational processes in an organisation over time, Van de Ven also highlighted that resistance against these four factors would grow due to procrastination and human preference to maintain the status quo. Such resistance would continue to develop and proliferate among members of the organisation over time and eventually emerge as the four central challenges that act against innovation within the organisation.

Traditionally, the role of top management is to break the shackles of resistance when they become severe hindrances to innovation. However, according to Van de Ven, if management can inject new guidelines and approaches to the organisation, people can change their perception and awareness to enable innovation to happen earlier. More importantly, by collecting periodic snapshots of core factors, longitudinal comparison or auditing can be made between the expected and actual statuses of these factors to determine the extent

of rising challenges. Hence, management can have a better understanding of the level of resistance existing within an organisation against innovation at different times (Van de Ven, 1986:604). By using Van de Ven's baseline reference of expected behavior as a potential longitudinal instrument of innovation study, it is now possible for management to detect and resolve the root cause of resistance against innovation much earlier. Such proactive approach will ensure the four core factors remain vibrant so that the organisation can stay alert to new innovation opportunities and be able to achieve continuous performance improvements through inbound open innovation. Therefore, an innovation management framework that consists of these four core elements are likely to offer users the ability to refine and optimise the management of innovation successfully.

In addition, Van de Ven believed management of innovation and new ideas through processes involved setting action thresholds for individuals. These thresholds will empower them to appreciate and pay attention to new ideas and opportunities. Paying attention to new ideas and innovation also means that top management should put organisational practices and processes in place for staff to overcome human resistance towards non-routine issues and turn ideas into attainable goals and reality. However, the realisation of innovation is complex and comes with many interdependences. Therefore, management needs to have the ability to turn individual transactions from parts into collective achievement for the organisation as a whole. The establishment of structure, process, and internal relationship through the proliferation of management functions and roles is essential for achieving this part-whole relationship outcome. Finally, institutional leadership is required to create a cultural context that fosters innovation. In establishing organisational strategy, structure and systems that facilitate innovation through institutionalisation, norms, and values become infused into an organisation which produces a distinct identity, outlook, habits, and commitments for its participants over time (Van de Ven, 1986:601).

The following table proposes a comparison summary on how different frameworks use their established components to deal with Van de Ven's four basic factors of innovation, namely people, new ideas, transactions, and

institutional context. For the purpose of this study, the institutional context would be high tech SMEs operating under inbound open innovation for all models. This context is chosen as it provides a scenario that can meet with Van de Ven's requirement by acting as an infrastructure that is conducive to innovation and organisational learning (Van de Ven, 1986).

Management Model	People	New Ideas	Transactions	Institutional Context
McKinsey's 7S	Staff, Style	Strategy	Systems, Structure, Skill	High Tech SMEs operating under Inbound open Innovation
Four Dimension of Core Capabilities	Managerial Systems Value & Norm	No clear approach to handle new idea	Skills & Knowledge Technical Systems	
Yu's 3H	Leadership	Strategy	Execution	
Christensen's 3P	People	No strategy, just take smart risk	Process	
Concept of Fit (EOM)	No clear answer, just rely on individual ability	Mission Strategy, Entrepreneurship	Progress evaluation and management	
Relationship Based Model	Use of Relationship to approach others	No clear approach to handle new idea	Use of Relationship to complete tasks	
Dynamic Capabilities Model	No clear indication of leadership	Strategy	Done by Dynamic Capabilities	

Table 2.1 – Comparison of Different Management Models vs. Van de Ven's 4 basic factors of innovation

In addition to the four basic factors, Van de Ven (1986) also suggested four challenges that management needs to overcome in order to become successful in innovation. These challenges include the following:

1) Management of employees to ensure they become more attentive to new ideas and be empowered to maximise their potential for companies. This

clearly relates to the leadership trait of entrepreneurs and can be achieved by empowering employees to maximise their potential in relation to new ideas.

2) Having strategy and vision in place to implement processes that can manage new ideas and turn them into beneficial reality.

3) Formation of a structure and relationship to support employees to operate as part of the whole innovation endeavor as driven by the leadership.

4) Creation of an infrastructure that is conducive to innovation and organisational learning, if necessary, to facilitate innovation and its execution.

This study will use these challenges from Van de Ven as a reference and would attempt to resolve them by listing the relevant elements from individual frameworks identified for evaluation. The results are listed below.

Management Model	Empowerment of Employee for New Idea	Process to turn ideas into reality	Employees support through relationship and structure	Create Organisational Learning Culture
McKinsey's 7S	Staff, Style	Strategy & Systems	Systems, Structure, Skill	Skill
Four Dimension of Core Capabilities	Managerial Systems Value & Norm	Mix of Managerial & Technical Systems	Skills & Knowledge Technical Systems	Skill & Knowledge
Yu's 3H	Leadership	Strategy + Execution	Leadership	Execution + Leadership
Christensen's 3P	People	Philosophies of risk taking, Process	Process	People
Concept of Fit (EOM)	No clear indication of empowerment	Mission Strategy, Entrepreneurship	Progress evaluation and management	No indication of culture
Relationship Based Model	Use of Relationship	Mechanistic structure	Use of Relationship	Knowledge based structure
Dynamic Capabilities Model	No clear indication of empowerment	Strategy, Sense, Seize and Transform	Transform to align structure	Transform to add new capabilities

Table 2.2 – Comparison of Different Management Models vs. Van de Ven's 4 Challenges of Innovation

The analysis of this search suggested a reference framework that can meet all of Van de Ven's criteria does exist and can be used to manage organisational performance. However, based on the results of the three comparison tables above, it is obvious that most frameworks failed to meet both the four basic factors and four challenges test suggested (Van de Ven, 1986). This leaves McKinsey's 7S, Christensen's 3P or Yu's 3H as possible models for the study of inbound open innovation. However, 7S is rather complex for high tech SME management to pursue due to the knowledge and attention span involved, based on its pre-determined set of organisational elements which may bind or frame managers' perspectives in analyzing people and organisational issues. Although 3P could remain a secondary backup model, it is also difficult to make 3P feel real to employees (Dyer et al., 2011). Hence, 3H from Yu, will be adopted as core research model due to its simplicity and ability to be adjusted continuously, which is crucial for innovation management success. Moreover, as knowledge and skill appears in three models, namely Four Dimensions of Core Capabilities, McKinsey's 7S, and Relationship Based Model, knowledge and skill will be included as an important consideration in the subsequent management framework design for inbound open innovation.

By placing 3H within an entrepreneurially oriented environment, this study is also testing how it will react to the surrounding context. This should reveal new knowledge that can contribute to existing theories as the contextual elements are innovation-driven, and, therefore, are dynamic and constantly changing. However, by minimizing the number of elements for framework operation, this research is also reducing the probability of any misalignment that may exist between project and capability (Leonard-Barton, 1992). As such, this research will commence investigation by using a three element approach, suggested by the 3H framework.

2.4) Key Elements of an Effective Management Framework for SMEs

To achieve organisational excellence, top management needs to ensure innovation characteristics are being addressed in the inbound open innovation adoption process. Compatibility, relative advantage, and complexity have been identified as the three major innovation characteristics (Tornatzky & Klein, 1982). To reduce complexity and improve compatibility of inbound open innovation, it is critical to figure out which missing pieces should be internally supplied and how to integrate both internal and external pieces into systems and architectures (Chesbrough, 2003). On the other hand, relative advantage can be addressed by the creation of innovative capability that is lacking in an organisation. Such creation requires the simultaneous possession and collaboration of innovativeness in strategic, behavioral, product, marketing, and process functions in the organisation (Wang & Ahmed, 2004). The presence of personal mastery, transformational leadership, shared vision, proactivity, and environment also helps an organisation to become more innovative and more learning oriented (García-Morales et al., 2006).

As inbound open innovation is about combining internal research with external ideas and deploying them within the business of an organisation, or even through other companies' business, the corresponding company structure may need to allow a certain degree of organisational permeability to facilitate the inflow and outflow of knowledge across organisational boundaries (Chesbrough, 2006). To drive organisational innovation, five main determinants (strategy, structure, support mechanisms, communication, and behavior) were identified as relevant. These determinants cover strategy (vision and mission), leadership (structure and communication), and learning (continuous learning culture, idea generation, and creative people) and are shown using the model below (Martins & Terblanche, 2003).

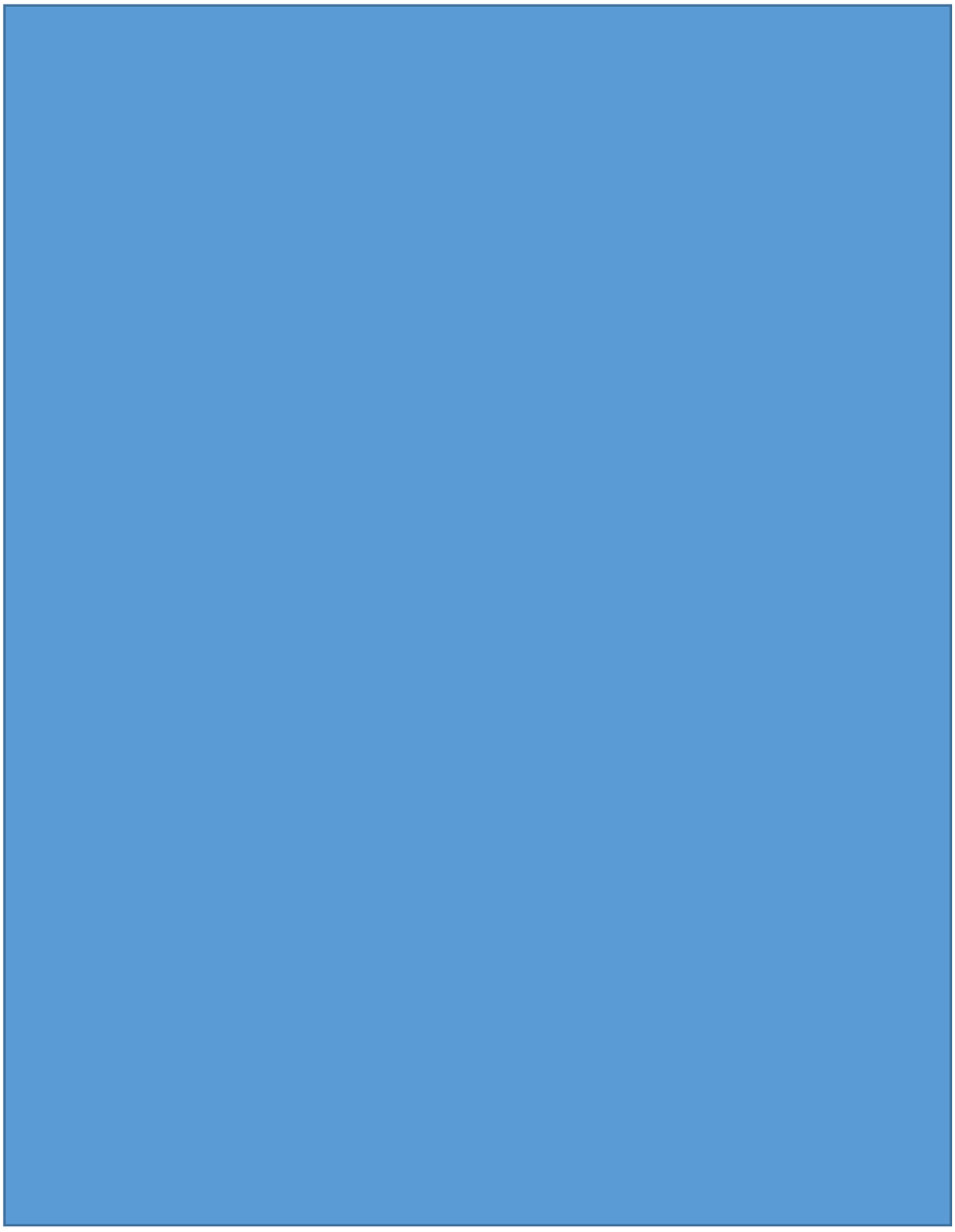


Figure 2.19 – Influence of Organisational Culture on Creativity and Innovation (Martins & Terblanche, 2003)

Based on the suggestions above (Martins & Terblanche, 2003; García-Morales et al., 2006; Wang & Ahmed, 2004), it is obvious that leadership, strategy, and learning culture are key elements for delivering innovation and performance. On the other hand, factors that are relevant to execution such as resources, behavior, process, and culture are also mentioned. Such observation is well aligned with previous notion that the chosen framework, 3H, which consists of leadership, strategy, and execution, is an appropriate framework for this study

of inbound open innovation. In the subsequent analysis based on the context of inbound open innovation, the researcher will try to build upon previous suggestions (Martins & Terblanche, 2003; García-Morales et al., 2006; Wang & Ahmed, 2004) and identify approaches that are directly related to strategy, leadership, and execution that fit into the 3H model.

2.4.1) Strategy and Inbound Open Innovation

Strategy is characterised as the manner with which a firm decides to compete, encompassing the pursuit, achievement, and maintenance of competitive advantage in an industry (Morgan & Strong, 2003). Any change and reinvention need to be supported by a strategy which is a plan that relates ends and means, goals and tactics, but such plans must vary according to context (Nye, 2008). Leaders have to define strategy by making decisions on the breadth of product and service offerings, target customer groups, technology strategy, execution timing, and vision (Tushman, 1997).

On the other hand, innovation is often possible in a visionary organisation where there is a purposeful strategy for innovation. Such an organisation should be good at idea generation and willing to take risks because it can handle mistakes properly. It should also be proactive (García-Morales et al., 2006), innovative in strategy (Wang & Ahmed, 2004), and backed by a flexible organisational structure that supports interactions between groups with sufficient resource allocation (Martins & Terblanche, 2003). Hence, a successful strategy to fulfill inbound open innovation requirements also needs to address all the factors listed above.

A) How Strategy Supports Inbound Open Innovation

To deliver innovative products or services to the market, companies need to create the right structure, allocate the right resources and combine different project teams to execute their plans (Dyer et al., 2011). The connection between core competencies and the degree of coherence between different parts of the firm is a reflection of how resources are strategically allocated from an organisational economics perspective (Dosi et al., 1992). Since inbound open innovation environment is highly uncertain, the corresponding strategy is likely

to be adjusted as opportunities arise. Aligning internal aspects of companies with their business models through strategy is important since delivering different inbound open innovation strategies requires different business models (Saebi & Foss, 2015). Through continuous adjustments, new strategies often emerge from collaborative contacts between organisations. Organisations also learn and borrow, intentional or not, when they trade and work together. These new strategies also enhance inbound open innovation through the creativity of managers as these managers explore new ways of doing things more effectively (Mintzberg & Lampel, 1999). Hence, in order to ensure organisational success, one key role of strategic management is to match the requirements of a changing environment with the organisational capabilities and firm's development (Teece et al., 1997:515).

B) Entrepreneurship is Part of Innovation

Entrepreneurship is a dimension of strategic posture represented by a firm's risk-taking propensity, proactive manners, tendency to act competitively, and reliance on frequent and extensive product innovation (Covin & Slevin, 1991). The heart of entrepreneurship is innovation (Drucker, 2002) and entrepreneurship itself is the practice or activity of creating or innovating (Drucker, 2014). During the innovation process, entrepreneurial leaders also exhibit a higher level of market scanning ability and possess a stronger ability to identify market opportunities (Zahra, 1993). This is because an entrepreneur has the ability to notice changes that have already occurred. He can also detect inconsistency between existing relationships and the conditions required for equilibrium earlier than others before the market is driven back towards a new equilibrium (Mises 1949).

To support dramatic leaps forward in the face of uncertainty, strategy is often made under an entrepreneurial mode in the active search for new opportunities (Mintzberg, 1973). Through their strategic decisions and operation management philosophies, top managers from entrepreneurial organisations exhibit entrepreneurial management styles (Covin & Slevin, 1988). This management style also enables entrepreneurial organisations to identify new equilibrative forces and discover emerging opportunities in the market before

others by generating new ideas. Highly innovative organisations are also more willing to follow through on new ideas (Delbecq & Mills, 1985). This willingness occurs because entrepreneurship is a key manifestation of accumulating, converting, and leveraging resources for competitive purposes from a resource-based perspective (Dess et al., 2003).

Quite often, strategic flexibility alone is not enough for organisations to seize new opportunities, but innovation can fill this gap. This is because innovation can deliver the required aggression and adaptability as innovation is the central concept of entrepreneurship (Schumpeter, 1934). In fact, innovation-related norms provide significant explanation for the variation in entrepreneurial strategy and is positively correlated to successful entrepreneurial strategy. It also plays a mediating role between environmental uncertainty and entrepreneurial strategy (Russell & Russell, 1992). Hence, innovation and entrepreneurship are tightly coupled and should be jointly considered during strategy formulation process.

C) How Entrepreneurial Orientation Enables Organisation to Perform Under Inbound Open Innovation

In an organisation driven by entrepreneurial orientation, new programmes will be established during the attempt period to capture new opportunity. These programs usually cut across existing specialties and require interdisciplinary efforts and rearrangement of the existing categorisation (Mintzberg, 1983:209). During rearrangement, new organisational units may be created with the responsibility of innovation. In some cases, innovation may affect the structure of the entire organisation (Rogers & Williams, 1983). The flows and interrelationships are arranged linearly in which one element follows neatly after another (Mintzberg, 1983:9) and organisational structure is just a representation of connections to serve corporate needs at any particular moment. Moreover, closer collaboration with external partners and the mutual exchange of knowledge between partners are encouraged by entrepreneurial business structures (Saebi & Foss, 2015). Hence, any organisation aiming to grow through inbound open innovation must be constantly establishing new connections within

itself in the form of organisational structure changes to capture and direct systems of flows by defining interrelationships among different parts.

The risk-tolerant nature of entrepreneurial orientation is essential to support such rearrangement due to the uncertainty involved. This is because when top management's strategy is highly innovative, proactive, and risk-taking, this strategy is defined as an entrepreneurial orientation (Cools & den Broeck, 2007). Entrepreneurs could also use external pressures, such as technology advancement, social style, or value changes to increase the rate of connection and stimulate opportunity recognition within the organisation (Stevenson & Gumpert, 1985). Leveraging external input is possible because organisation is influenced by industry, markets, competitors, external environment, internal operations and processes while scouting for opportunities (Zahra, 1991).

By incorporating the latest knowledge acquired from inbound open innovation, entrepreneurial orientation enables management to implement a constructive reconnection or restructuring process through which entities are connected to increase efficiency and organisational performance. Such reconnection supports the rearrangement process, and it also leads to the creation of new competitive advantages. This is critical as the economic system is also constantly being structured and restructured so that connections are constantly being formed and refined to create economic change and growth of knowledge (Potts, 2000).

Finally, entrepreneurial orientation favors inbound open innovation by favoring allocation of resources to create more value, develop more ambitious goals and proactivity with more effective risk analysis and risk-taking (Rosenbusch et al., 2011). Entrepreneurs also have significantly higher attitudinal ranking in the area of innovation, personal control, self-esteem, and achievement than non-entrepreneurs (Robinson et al., 1991). Therefore, entrepreneurial orientation will be included as the strategic element within the 3H framework since it is a key element in an organisation to ensure the success of inbound open innovation.

2.4.2) Leadership and Inbound Open Innovation

In technological organisation, there is normally an abundance of inventive ideas but boundaries are normally set by the rather powerful social and economic interests of leaders as innovation is an expensive and risky activity. Innovation can create positive outcome on firm performances but can also generate negative outcome such as cost (Jiménez & Sanz-Valle, 2011). A well-led innovation is important for the development of competitive advantages (Porter, 1990) as total competitiveness of a business is positively influenced by a founder who can pay attention to the detailed operations of the business, especially when the business is small (Slevin & Covin, 1995). In fact, one of the major determinants of SME competitiveness is the founder or top manager because the concentration of decision-making power within the SME structure influences the firm's overall strategy (OECD, 1993). As a matter of fact, only the CEO or someone with comparable power can assume responsibility for sustaining innovation and managing disruptive growth (Christensen & Raynor, 2003).

Besides being competent, innovative leaders should be transformational (Burke & Litwin, 1992; García-Morales et al., 2006) and they should support shared vision, collaboration, and team work (Martins & Terblanche, 2003; García-Morales et al., 2006; Wang & Ahmed, 2004). They are also likely to support change and open communication (Martins & Terblanche, 2003). In the following sections, the ways how leadership drives SMEs' performance in the context of inbound open innovation to meet the requirements listed above will be explained.

A) Characteristics of Leadership under Inbound Open Innovation

Inbound open innovation process requires competent leaders to identify and select the best source of potential knowledge to effectively meet the firm's innovative strategies (Dahlander & Gann, 2010). When an organisation grows, it will eventually need to emphasise structure and standard procedures in order to control the expanding responsibilities (Cameron & Quinn, 2011). The creation of such structure and procedures is the job of leaders because they have to lay a

foundation for future growth. Leaders can drive organisation resources to meet these requirements by understanding the nature of innovation, the threat it poses, and identifying new ways of doing business that can keep pace with ever-evolving technology, industries, and customers (Christensen, 2016). Little to no organisational benefit will be achieved if resources are managed by incompetent individuals who cannot appreciate and leverage these resources to the full potential (Katkalo et al., 2010).

Top management also needs to possess the ability to create an institutional framework so that the company's norms and values are widely shared. All these would make a significant contribution to the prevention and resolution of downstream challenges because the reputation for integrity may be so strong that most leaders and employees want to win the right way (Wren, 2013). An example that typified these observations is a study of one hundred and sixty six small businesses in Singapore (Thong 1999). It was confirmed that a decision maker's characteristics, specifically the CEO's innovativeness and the CEO knowledge of information systems are positively associated with the decision to adopt technology in small businesses. If a CEO understands the benefits of information systems adoption and is willing to invest scarce resources in new technology projects, the small business will be able to take advantage of the promised benefits of information systems adoption, including improved organisational efficiency and effectiveness (Thong, 1999). Hence, top leaders' personalities and their attitudes towards change and inbound open innovation significantly determine the ultimate success of inbound open innovation for the organisation.

B) Leveraging Leadership to Change Company Culture to Support Inbound Open Innovation

Organisational culture is the way things are done "around here" to succeed (Lundy & Cowling, 1996) and it represents the way people perceive residing practices within the organisation and what goes on in their organisational environment (Hofstede, 2011). Since culture is shaped by leadership behavior, which is a set of structures, routines, rules, and norms that guide and constrain

behavior (Schein, 2010), leaders of an enterprise can do a great deal to promote innovation by encouraging creativity (Adair, 2007:63). Norms of innovation culture are positively correlated to successful entrepreneurial strategy because they are mediators between environmental uncertainty and entrepreneurial strategy (Russell & Russell, 1992). CEOs are also more willing to experiment with open innovation if they are more closely associated with cultures that emphasise adaptability and such adaptiveness is positively linked to revenue growth (O'Reilly et al., 2014).

On the other hand, leaders operating under innovation must be able to change or drive the organisational culture because when followers share perceptions about the importance of specific organisational goals with their leaders, they may assess leadership behaviors positively, irrespective of actual leader behavior (Colbert et al., 2008). This happens because competence is the perception and expectation that the leader is capable of delivering on a promise and upholding commitments (Dervitsiotis, 2006). Under such an environment, motivation for excellence and independence will be increasingly driven by the collaborative desire of employees and management.

From an inbound open innovation perspective, leaders play an important role in linking organisation and the environment, from which the organisation must achieve acceptance and support for its inbound open innovation and learning orientation (García-Morales et al., 2006). Organisational culture supports such acceptance by acting as an integration function to socialise with new members, absorb new knowledge through the creation of new boundaries, and coordinate various functions to create competitive edge by making sense of the environment. Hence, leadership ability to make organisational culture more adaptive is critical for SMEs since firms with adaptive cultures can become an awesome competitive machines which produce superior products and services faster and better (Kotter, 2012).

C) How Transformational Leadership Excels in Delivering Inbound Open Innovation Performance

Transformational leaders are more likely to succeed in time of change while transactional leaders are more suitable for a well-ordered environment (Bass, 1985). This could be due to the cultural behavior of transformational leaders who possess a high level of risk-taking and risk tolerance. In fact, risk-taking and tolerance for taking risk are important characteristics of supporting innovation (Hurley & Hult, 1998). As a result, transformational leaders perform better in more innovative environments than transactional leaders (Howell & Avolio, 1993). By achieving higher effectiveness and satisfaction than transactional leadership alone, transformational leadership increases the ability to predict the levels of innovation, risk taking, and creativity (Bass & Riggio, 2006).

Information assimilation and how a firm creates, transfers, and applies knowledge are rarely possible without simultaneously altering the culture to support new behaviors (De Long, 1997), which means that innovation will also result in cultural transformation. Transformational leaders accomplish this cultural change by providing modeling behaviors that are emulated by followers even at multiple levels below so that their behaviors will be ingrained in all organisational activities and their artifacts which form the organisational culture (Bass, 1998).

Organisational cultures that support creativity encourage innovative ways of finding solutions. They can also significantly affect the extent of how creative solutions are supported and implemented (Lock & Kirkpatrick, 1995). Innovation is a subset of organisational change while organisational creativity is a subset of innovation (Woodman et al., 1993). Therefore, support of creativity indirectly influences organisational change implementation. A culture that is more receptive to new ideas and innovation is associated with a higher level of innovation because a firm which encourages learning and its development includes participative decision-making is likely to be more innovative (Hurley & Hult, 1998).

Besides acting as role models, successful leaders need to navigate through an organisation by influencing the attitudes, abilities, and behaviors of followers

(Bass et al., 1987). In addition, transformational leaders, who are normally caring and communicative, can also gain guaranteed commitment from members during changes. This is achieved by conveying core reasons, which comply with moral excellence, through easy-to-understand language that avoids ambiguity (Bass, 1998). Transformational leaders are also good at committing behavioral elements such as organisational encouragement, supervisory encouragement, work group encouragement, and freedom/autonomy which are all positively related to innovation (McLean, 2005). So with the ability to align support from internal parties through better communication skills during the scaling stage of new innovative ideas, transformational leadership can address a crucial challenge of internal political dynamics, thereby improving the chance of innovation success (O'Reilly & Tushman, 2021). This may be the result of transformational leadership being able to better align with a more educated workforce that is more eager to apply and develop its abilities on the job (Hater & Bass, 1988).

Finally, as an organisational culture is an important determinant of the climate for innovation (Sarros et al., 2008), leaders must be capable of delivering such a cultural adjustment since if an organisational culture cannot fulfill its functions as both an integrator and a coordinator, the efficiency of an organisation will be greatly reduced (Martins & Terblanche 2003). As transformational leadership can have a powerful effect on organisational culture (Antonakis, 2001), it can support inbound open innovation by driving organisational change. It is also worth noting that the impact of transformational leadership is enormous because it is rated as a final ingredient of renewal and is more important than any other factors (McCormick, 2023). Hence, transformational leadership will be selected as the leadership domain element under the 3H framework.

2.4.3) Execution and Inbound Open Innovation

For any effective execution to occur, utilisation of knowledge is essential, regardless of complexity. Innovation is the creation of new knowledge that is necessary to replicate the process leading to innovation outcomes (Quintane et al., 2011). Since knowledge is continuously evolving, learning must be ongoing and be dynamic enough to support corresponding knowledge development. As

such, learning orientation plays a critical role to enable effective innovation in inbound open innovation. In particular, in a highly competitive business world, such as the one that high technology SMEs in Hong Kong are faced with today, the environment is characterised by highly competitive markets, increasing strategic discontinuities, and disequilibrium conditions. To overcome these challenges, organisation must encourage learning (García-Morales et al., 2006) and maintain innovativeness in their processes (Wang & Ahmed, 2004) to ensure effective execution of innovation.

A) Effective Management of Knowledge in Innovation

Innovation requires hard, focused, and purposeful work that is supported by diligence, persistence, and commitment. Otherwise, talent, ingenuity, and knowledge are all of no use (Drucker, 1998). Innovation begins with creative ideas and the implementation of new products, programmes or services are driven by good ideas (Amabile et al., 1996). Hence, the cultivation of good ideas through knowledge development is key to innovation. Successful knowledge management, which is critical to creating competitive advantages, also requires the coordination of multiple functional areas within the organisation (Cabrera & Cabrera, 2002). Sometimes, organisational structure is modified to support the proliferation of learning in order to cope with the extra information processing requirements due to the increasing dynamic, hostile, and complex environment (Miller & Friesen, 1983). This adjustment is essential since effective organisations are management practices that facilitate the development of knowledge so that they become the basis for competitive advantages (Slater & Narver, 1995).

Skills and the general body of knowledge in modern times are the accumulation of internal and external experience and apprehended in terms of causal sequence (Veblen, 1898). Firms that engage in higher-order generative learning also have close and extensive relationships with customers, suppliers, and other key constituencies (Wang, 2008). To support the development of entrepreneurial competencies, constant learning should be used to increase the level of higher order thinking (Cascio, 1995). Management can also provide

continuous support to the learning and renewal of organisational skill sets by adopting the generative characteristic of learning organisation during project implementations (Leonard-Barton, 1992). In addition, the application of learning orientation in leadership development, through a combination of adaptive and generative learning, enables organisations to be more capable of responding to both explicit and latent environmental forces during innovation (Baker et al., 1999).

Finally, top leaders have to recognise that the evolving intellectual capital of an organisation over time is dependent on knowledge management (Bontis et al., 2002). Inbound open innovation also plays a mediating role in SMEs by enhancing organisational performance when top management values knowledge and influences inbound open innovation through knowledge sharing practices (Singh, et al., 2021). However, the concept of learning in an innovation system is different from learning in a business-systems approach. Business-systems approach tends to take the institutional setup as given while the innovation system approach looks for feedback effects from the economic sphere to the institutional setup (Lundvall, B., 1999). Furthermore, challenges in managing internal only innovation activities and the handling of interdependencies between internal and external processes are different (Lichtenthaler, 2011). Under major disruption, such as Industry 4.0, disequilibrium presents itself as an opportunity for entrepreneurs to build deeper understanding of higher order learning outcomes either through double-looping, which is the core of the organisational learning theory, or via transformative learning (Cope, 2003). Hence, management needs to constantly look inside and beyond the existing knowledge pool in the organisation and manage the firm effectively to support learning development under an inbound innovation context.

B) Role of Learning in Supporting Execution

In an entrepreneurial society, knowledge is continuously replaced or at least refurbished by new learning, new skills, and new knowledge (Drucker, 2014). Organisational learning provides a firm with the potential to expand its learning capability, promoting its development and growth (Senge, 1990). It will

ensure that better execution quality can be achieved since superior organisational knowledge allows a firm to devise a more productive system of organisation (Spender, 1994). Moreover, a knowledge practice driven by top management in dynamic markets is crucial in supporting effective sensing and seizing of occasions for innovation (Singh et al., 2021). Successful firms can consistently source, create, and adopt new knowledge and new technologies before diffusing them effectively within the organisation as part of execution.

Organisational learning supports organisational knowledge development (Slater & Narver, 1995) and learning occurs when members of the organisation respond to changes in the internal and external environments of the organisation by detecting and correcting errors in the organisational norm. In younger firms, learning orientation is critical since these firms need to establish an efficient mechanism to internalise knowledge rapidly (Calantone et al., 2002). The new knowledge created by the change agents is then embedded in new "maps" of the organisation (Argyris & Schon 1978:23). Although the success of SMEs' innovation strategies heavily rely on their capacity to learn, SMEs' flexibility also offers faster learning opportunities to produce competitive advantages (Dodgson et al., 2008). Hence, small firms can avoid being commoditised by converting products and services into experiences through learning (Vanhaverbeke et al., 2012).

However, for SMEs to achieve continuous learning, an appropriate organisational context should be created and renewed through tangible and concrete management execution. Such context can influence the actions of all those within the company (Ghoshal & Bartlett, 1994). Learning orientation is particularly important here because the motivation for sharing and creating knowledge in organisations might be limited. People often try to protect what they know, which accentuates the need for leadership (Von Krogh et al., 2012). Hence, for SMEs to execute successfully, they must possess a learning orientation culture to support a constant renewal of knowledge.

C) Sustaining Organisational Performance through Learning Orientation under an Inbound Open Innovation Environment

The continuous ability to generate knowledge is among the major determinants of a firm's ability to develop and sustain core competencies, including during periods when its competitive landscape undergoes radical changes (Hamel & Prahalad, 1994; Zahra et al. 1999). Firms that can learn more effectively than their competitors possess the basis for more rapid improvement, ability to increase in profitability, a bigger market share, and the ability to create sustainable competitive advantage (Day, 1994). Successful leaders must have the ability to create both absorptive and adaptive capabilities (Boal & Hooijberg, 2000) as both are relevant for performance delivery. This is because innovation and competitive advantages require new knowledge and in an entrepreneurial society, knowledge will have to be replaced or refurbished by new learning, new skills, and new knowledge (Drucker, 2014).

A knowledge driven approach was also found to be the strongest determinant that led to a preference for informal inbound open innovation modes (Scuotto et al., 2017). Inbound open innovation is particularly effective for situations in which outside partners, such as suppliers and professional consultants, are available when they are needed promptly (Stevenson & Gumpert, 1985). Increasingly, companies are forming interdependent and flexible relationships with other firms, including suppliers and competing firms, to fully capitalise on their core competencies to achieve organisational performance (Acs & Preston, 1997). This approach is now more feasible as boundaries between companies are becoming more permeable so that unused ideas in one party can become useful for another (Chesbrough, 2003). Through inbound open innovation, more quality knowledge becomes available which will improve learning efficiency. The availability of better knowledge and understanding through knowledge acquisition will facilitate behaviour change to deliver performance improvement (Lopez et al., 2005). However, it is most important that organisations understand the new situations so that they can make use of what they already know (Hargadon, 2002).

To implement learning within an inbound open innovation institution, Damanpour (2017) believed open innovation has followed the concept of absorptive capacity, which highlighted the importance of leveraging external

sources of knowledge for the generation of technological innovations (Cohen & Levinthal, 1990). Absence of access to publicly available knowledge and learning will also position the firm at a competitive disadvantage relative to rivals (Zahra et al., 1999), reducing its ability to use entrepreneurial orientation as a path to create a new organisation and engage in strategic renewal or successful innovation (Dess et al., 2003).

Finally, even though entrepreneurial leaders are good at discovering opportunities, innovation needs the skills of people who excel at execution (Dyer et al., 2011). Hence, it is important to ensure an organisation is populated with staff having strong discovery skills and enough knowledge to execute because the fastest way for an organisation to fail is to stop executing. Development of a workforce with such discovery skills can be achieved through learning orientation because the provision of knowledge and efficient talent development are crucial in enabling the generation, replication, and scaling of skill for sustainable innovation. Hence, learning orientation will be selected as the execution domain factor under the 3H framework.

2.4.4) Summary

The use of entrepreneurial orientation to support new innovation has been shown as an important strategy. Nevertheless, it is obvious that entrepreneurial orientation and strategy alone cannot deliver organisational performance. Instead, companies have to rely on structural adjustment within organisations to deliver the desired outcome. However, the execution of structural adjustment will require transformational leadership to achieve the desired outcome by gaining commitment from staff to accept changes together. Finally, ongoing excellence and improvement in execution must be aided by continuous learning and knowledge development via learning orientation.

After careful analysis, entrepreneurial orientation, learning orientation, and transformational leadership are chosen as the essential elements for the effective operation of the inbound open innovation management framework in this study based on mapping their inbound open innovation characteristics against Van de Ven's four factors of innovation management. Furthermore,

innovation orientation drives strategy, learning, and functional interaction of the firm together towards the goal of innovation (Siguaw et al., 2006:560). The summary is listed in the table below.

	Management of New Ideas	Management of Staff Attention	Relationship & Transaction (Part-Whole)	Institutional Leadership and Innovation Context
Entrepreneurial Orientation	Trigger the pursuit of new ideas	Allocate resources to create new value	Support Reconnect Intra and Inter Organisational Connections	Encourage organisation to reconstruct to support new opportunities
Transformational Leadership	Enable cultural adjustment to adopt new ideas	Leaders become role models	Change & transformation of organisation to support new transactions or relationship	Willing to transform organisational culture
Learning Orientation	Identify and absorb new ideas to support change	Encourage staff learning to support effective execution	Learn new skills (part) to support organisational growth (whole) via execution	Produce new knowledge to support new culture & structure in organisation

Table 2.3 – Mapping of the Selected Innovation Management Element vs. Van de Ven's 4 Factors

In addition, a number of past research articles have been identified and listed below to highlight their relevance to the key management elements under an inbound open innovation context. Nonetheless, the inclusion of more factors are avoided because if more dimensions are included, greater misalignment could potentially exist between project and capability (Leonard-Barton, 1992).

	Inbound Open Innovation & Transformational Leadership	Inbound Open Innovation & Entrepreneurial Orientation	Inbound Open Innovation & Learning Orientation
Saebi, T. and Foss, N.J., 2015			Deep integration of external sources drive business models & resources structure to support knowledge transfer
Lei, D., Slocum, J.W. and Pitts, R.A., 1999			Management develop an organization that promotes rapid knowledge-creation and information sharing through open innovation
Russell, R.D. and Russell, C.J., 1992	Innovation related norms which is part of organizational culture, organizational structure & environmental uncertainty provided significant explanation for the variation in entrepreneurial strategy.		
García-Morales,V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006		An organization that promotes entrepreneurship will learn and innovate, encouraged by the presence of key preexisting internal/external attributes that enable it to change, renew and reinvent itself.	

Table 2.4 - Observed Relationship between Inbound Open Innovation & Key Elements Identified

2.4.5) Causal Relationships between Key Elements of Management Framework Listed by Previous Studies

Strong evidence from previous academic researches support the existence of a coherent, causal relationship under a bi-directionally constructive cycle by combining the three management elements identified in this research. It is encouraging that these relationships are supported in a reciprocal manner. A coherent integration of relationships also indicates the possibility of a sustainable

cycle. By combining different findings together, the selection and combination of entrepreneurial orientation, learning orientation, and transformational leadership in this search have demonstrated the possibility of creating a coherent cycle under inbound open innovation. The causal relationship between these management elements is shown in the figure below.

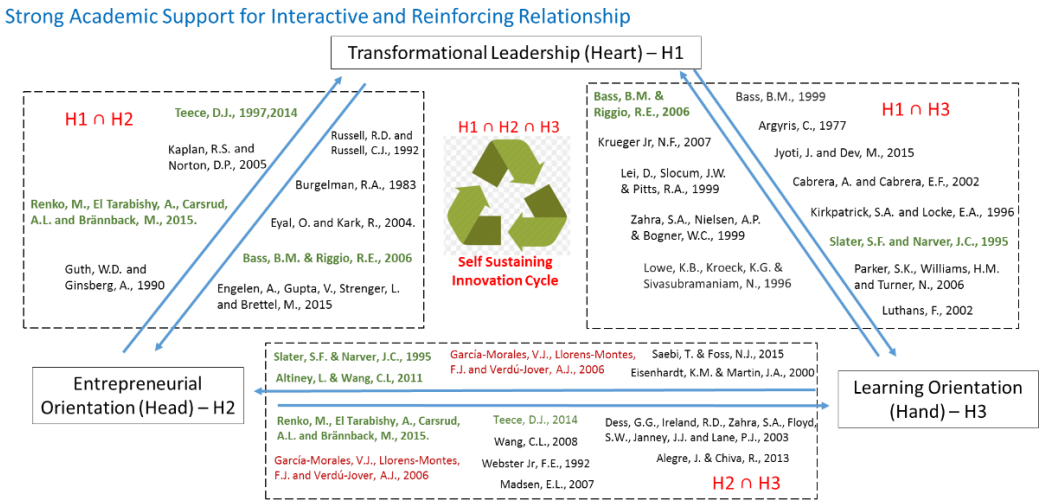


Figure 2.20 - The Causal and Coherent Cycle of Relationship between Entrepreneurial Orientation, Learning Orientation & Transformational Leadership

In fact, economic innovation performance was found to be positively correlated with sustainable innovation performance, especially in the presence of higher open innovation collaboration intensity with external customers (Rauter et al., 2019). This finding leads the researcher to investigate how the inclusion of inbound open innovation can affect the coherent cycle of relationship in this study. Meanwhile, the relationship between the key elements of the framework of this research, as noted by different researches, is listed in the table below. Some of the survey questions from these studies were used as part of instrument in this research to collect information about respondents' beliefs towards entrepreneurial orientation, learning orientation, and transformational leadership. A full listing of the questions is provided in **Appendix One**.

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Cabrera, A. and Cabrera, E.F., 2002	Leadership breaks wall to increase knowledge sharing to improve learning (Leadership -> LO)		
Teece, D.J., 2014		EO via Dynamic Capability to seize opportunity and guide learning & org structure (ldr) renewal for future (EO -> Leadership) (EO -> LO)	
Luthans, F., 2002	Proactive and positive organizational behavior is also open to learning, development (Leadership -> LO)		
Slater, S.F. and Narver, J.C., 1995	culture and climate that maximizes learning and its benefits (Leadership -> LO)		
Ghoshal, S. and Bartlett, C.A., 1994	Trust and support (leadership) help to influence the levels of individual initiative, and collective learning within companies (Leadership -> LO)		
Eisenhardt, K.M. and Martin, J.A., 2000			learning mechanisms guide the evolution of dynamic capabilities (LO -> EO)
Krueger Jr, N.F., 2007			changes in knowledge to develop entrepreneurial expertise & mindset (LO -> EO)

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Engelen, A., Gupta, V., Strenger, L. and Brettel, M., 2015	transformational leadership at top level was found to moderate the EO performance relationship and EO produces the best performance when transformational behaviors are at their highest. (Leadership -> EO)		
Renko, M., El Tarabishy, A., Carsrud, A.L. and Brännback, M., 2015.		Entrepreneurial leaders' passion, creativity, and vision motivate others to experiment and learn for themselves. (EO -> LO) They set examples and encourage others to emulate their behavior and challenge status quo. (EO -> Leadership)	
García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006			Organizational Innovation & Organizational Learning work jointly to promote organizational entrepreneurship and to increase competitive advantages. (LO ->EO)
Parker, S.K., Williams, H.M. and Turner, N., 2006	Trust created by transformation leadership implies that coworkers will accept mistakes as learning experiences and likely to encourage individuals to try things beyond core tasks and enhance their self-efficacy (Leadership -> LO)		
Zhou, Kevin Zheng, Chi Kin Yim, and David K. Tse, 2005		organizational learning acts as a partial mediator between strategic orientations and technology based innovation (EO-> LO -> performance)	

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Webster Jr, F.E., 1992		focus core competencies to devote scarce & strategic resources to develop new knowledge and skills (EO -> LO)	
Wang, C.L., 2008		Entrepreneurial Orientation & learning orientation–performance linkage and dependence (EO -> LO)	
Altinay, L. and Wang, C.L., 2011			educational attainment of an entrepreneur makes a positive impact on a firm's entrepreneurial orientation. (LO -> EO)
Slater, S.F. and Narver, J.C., 1995			learning organization reconfiguring quickly to focus on the emerging opportunity or threat (LO -> EO)
Argyris, C., 1977	CEO create organizations capable of continuous learning e.g adopting the double loop learning approach (Ldr -> LO)		
Alegre, J. and Chiva, R., 2013			Organizational learning capabilities & innovation performance should be enhanced to boost EO–performance link (LO -> EO)
Kirkpatrick, S.A. and Locke, E.A., 1996	Transformational leaders give better task cues and clarity through their communication skills for better learning requirement (Leadership -> LO)		
Pinchot III, G., 1985		Entrepreneurial orientation create significant opportunities for multi-dimensional organizational learning (EO -> LO)	

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Madsen, E.L., 2007		Higher level of EO also increase the use networking as a knowledge resource (EO -> LO)	
Bontis, N., Crossan, M.M. and Hulland, J., 2002			organizational learning is a dynamic process of strategy renewal and impact all three levels of the organization, namely individual, group and organizational wide (LO -> EO)
Brown, L.M. and Posner, B.Z., 2001			leadership development & learning process will also create a culture of leadership and learning within the organization (LO -> Ldr)
Eyal, O. and Kark, R., 2004.	transformational leadership sets the most favorable managerial circumstances for entrepreneurial activism in the organization and more closely associated with proactivity than organizational innovativeness (Leadership -> EO)		
Bass, B.M. and Riggio, R.E., 2006			learning orientation can enhance the effectiveness of transformational leadership (LO -> Leadership)
Bass, B.M., 1998 & (Bass, B.M. and Avolio, B.J., 1990			transactional & transformational leadership behaviors can be learned through training programs so individuals leaders can develop transformational and transactional behaviors (LO -> Leadership)

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Zahra, S.A., Nielsen, A.P. and Bogner, W.C., 1999			New knowledge generation enables the self-renewal of established companies (LO -> EO)
Guth, W.D. and Ginsberg, A., 1990		Entrepreneurship is transforming the corporate bureaucracy as environment of firms continues to accelerate. change is the company's overriding goal (EO -> Leadership)	
Kaplan, R.S. and Norton, D.P., 2005		strategy establishes goals and pull people toward the overall vision by adopting behaviors and actions to arrive at those goals (EO -> Leadership)	
Lowe, K.B., Kroeck, K.G. and Sivasubramaniam, N., 1996			development of leaders across all organizational level for transformational leadership & organizational effectiveness (LO -> Leadership)
Burgelman, R.A., 1983	top management controlling the level and the rate of change to make sure that entrepreneurial activities will correspond to their strategic vision and continue autonomously (Leadership -> EO)		
Howell, J.M. and Higgins, C.A., 1990	Transformational champions attempts to articulate their compelling vision (Leadership -> EO)		

Table 2.5 - Proposed Relationships between Different 3H Elements by Previous Studies

2.5) Enhancing Organisational Performance through Inbound Open Innovation Framework

The new organisations of the 21st century are bringing in dramatic changes and affecting the world of work, resulting in increased global competition and shifting from vertically integrated hierarchies to networks of specialists. Companies need to evolve from imitation to innovation and move away from cost-based practices to differentiation-focused business so that local economy can become an advanced economic entity (Porter, 2000). This evolution is crucial because the economic development of any region is driven by its level of productivity to achieve long-term and sustainable development in the standard of living. Prosperity for a particular region depends on how productivity is utilised. It also depends on continuous upgrades of its competitive advantages through sophisticated methods and advanced technology.

2.5.1) The Importance of Competitive Advantages

The competitive advantage of any company depends on its ability to create more value than its rivals. Such an advantage can be achieved by the renewal and enlargement of products, services, and markets, as well as the development of new methods of production and the establishment of new management systems (Crossan & Apaydin, 2010). Innovation, flexibility, and responsiveness are widely regarded as a critical source of competitive advantage in an increasingly interconnected global environment (Dess & Picken, 2000). On the other hand, competitive advantage hinges on innovation and the search for strategic differences (Porter, 2000) while value creation depends on the firms' ability to innovate successfully since innovation is an essential driver of competitiveness (Śledzik, 2013).

An organisation must stay innovative to survive in a volatile environment (Calantone et al., 2002) such as Industry 4.0. This is because the time gap between revolutionary events for high-tech industries is very short and revolutions are triggered by discontinuous environmental shifts which break incremental change and continuous improvement (Tushman, 1997). In addition, the changing environment is giving more opportunities to smaller companies that employ fewer people by revolutionizing the paradigm of doing business while breaking traditional practices from making a product to providing a service (Cascio, 1995). Enterprises that choose to adopt innovation can create competitive advantages in the core elements of their business compared to their competitors. For instance, Covid-19 has created major disruptions in business operations while enabling the rapid growth of internet-based business that are more adaptive to remote interaction. Another example is in the car insurance industry, where the adoption of connected devices in vehicles has allowed insurers to have a better understanding of driver behavior and can adjust their insurance premium accordingly. These are good examples of how inbound open innovation creates new competitive advantages for firms, which will be discussed in more details below.

2.5.2) The Role of Inbound Open Innovation in Creating Competitive Advantages in Industry 4.0

For an organisation to sustain its competitive advantages, it must continue to adopt innovation from the broader ecosystem via a corporate venturing approach to maintain its competitive advantages (Sawers, 2020). Technology innovation can also be expedited through adoption either in the form of partnership, partial investment, and tech ventures or by full acquisition of the company (IESE, 2019). Moreover, external knowledge acquisition through networking is an effective way to facilitate and enhance inbound open innovation performance among SMEs when they upgrade their innovatory capabilities through collaboration and inbound open innovation (Lee et al., 2010). The continuous success of Apple demonstrated how inbound open innovation through acquisition can be accomplished when Apple's CEO Tim Cook told media that his company "buys a company every two to three weeks on average" as the company is "primarily looking for talent and intellectual property" (Feiner, 2019).

Inbound open innovation is important for creating competitive advantages because within the Industry 4.0 context, no one group can tackle the challenges alone, nor these issues can be resolved solely through the use of technology. Inbound open innovation is a process by which leaders allocate resources and technological assets across organisational boundaries in order to internalise external knowledge. As part of the inbound open innovation implementation, firms can gain competitive advantages by acquiring knowledge, implementing strategic changes, and increasing the rate of innovation. Knowledge acquisition can be achieved through multiple approaches, ranging from drawing on existing knowledge available within the organisation to learning from observing the surrounding environment, other organisations, and products or services sourced externally (Huber, 1991).

The success of any given innovation depends on how well changes in the firm's environment are handled as a firm exists within an ecosystem of interdependent innovations (Adner & Kapoor, 2010). Hence, the benefit of inbound open innovation is not just about cost reduction or outsourcing of the R&D function. Instead, leveraging external research results before adoption

through inbound open innovation can be a complement rather than a substitute in delivering the performance of internal R&D activities (Chesbrough & Crowther, 2006). This inbound open innovation approach is extremely important for SMEs with limited resources and Porter suggested that one possible method to implement inbound open innovation is through the clustering of companies. This approach avoids isolation. It also facilitates earlier perception of both the need and the opportunity for innovation in products or services, and provides a flexible channel capacity to act on them quickly (Porter, 2000). Benefits of clustering has been observed in the Hong Kong Science Park as companies within the park interact easily and frequently.

Conversely, leaders can also drive the strategic, operational, and executive aspects of an organisation to fulfill the requirement of inbound open innovation through either recruitment of external talent or alliances with external organisations. Through partnering with other firms, alliances can generate knowledge accumulation, create new growth opportunities, and enable partnering firms to achieve their strategic objectives (Zollo et al., 2002). Company structure also become more networked and collaborative friendly within Industry 4.0 (Rossler, 2015). Businesses will become increasingly organised around distributed teams, remote workers, and dynamic collectives, where a continuous exchange of data and insights about the things or tasks being worked on will play a key role (Schwab, K., 2017). Close linkages with buyers, suppliers, and other institutions are important for both efficiency and the rate of improvement and innovation (Porter, 2000). These scenarios are precisely the center piece of inbound open innovation where Porter sees that clustering of companies can offer similar benefits (Porter, 2000).

As examples of inbound open innovation, larger firms today often prefer to license higher risk technology or outsource the most risky parts of new product development to smaller high-tech companies. They may even try to reduce the risks involved in carrying out R&D by collaboration with others through publicly sponsored or enabled programmes, such as SEMATEC and IMEC in nano-electronics, or through so-called open innovation collaboration (Freeman & Soete, 2009). In a Cisco led study, which surveyed 1,845 IT and business decision

makers, 60% of the respondents believed forming partnerships is critical for the success of IoT projects. Organisations with the most successful IoT initiatives leveraged ecosystem partnerships most widely, implying strong partnerships throughout the process can smooth out the learning curve (Cisco, 2017). This clearly confirms the advantages of inbound open innovation so SMEs should follow suit to avoid being left out by not responding.

Figure 2.21 - Porter's Value Chain (Porter, 2008)

2.5.3) Summary

The management must maximise the adoption of inbound open innovation because inward-looking organisations will not be able to tackle changes in the environment proactively. In the fast moving high-tech business environment, organisations may not survive even though they may possess sophisticated knowledge and technology. Sources of inbound open innovation in firms include continuous interactive learning from internal sources as well as from a wide variety of external sources such as customers, suppliers, contractors, universities, government agencies and laboratories, consultants, licensors, plus licensees (Freeman, 1994).

In turbulent knowledge environments, such as those facing high technology industries, an organisation that can positively deal with changing environments will not only process information efficiently but will also be able

to create information and knowledge by establishing a link between the organisation and the environment (Lopez et al., 2005). This link can in turn act as a feedback mechanism to assist top management to maximise the benefits of inbound open innovation and adjust organisational strategies accordingly. Finally, as part of the strategic orientation to sustain competitive advantage, organisational learning needs to incorporate creativity and radical innovation (Wang & Ahmed, 2003). Such incorporation highlighted the important role of learning and the need of transformational leadership to support radical changes within the organisation to deliver quality performance in an innovative environment.

2.6) Personal Characteristics as an Antecedent in Influencing Organisational Performance through the Inbound Open Innovation Management Framework

A company is not a machine but rather an individual with its own sense of identity and fundamental purpose (Nonaka et al., 1995:97). Company efforts to catch new waves of disruptive growth will need to be guided through emergent processes (Christensen & Raynor, 2003). To establish such emergent processes, top management needs to deal with existing attitudes, beliefs, and other knowledge structures within the organisation because people's beliefs about innovation are related to beliefs about other aspects of organisational system (Hurley & Hult, 1998:52).

In many situations, adoption or rejection of innovation is based on the individual's perceptions of the innovation. The chosen decision is always right in the eyes of the individual who is assessing the situation surrounding the innovation at the time of the decision (Rogers, 1963:100). Hence, it is essential to understand the company from the perspective of the most influential individual who is either the founder or a member of the top management team.

2.6.1) Possibility of Using Personality Assessments to Enhance Organisational Performance Predictions

Organisations do the things they do and perform the way they do because of the biases and dispositions of their most powerful actors in the form of top

executives. All human decisions made in relation to entrepreneurship are of speculative character and exist within an open-ended framework (Von Mises, 1949). However, each person is unique, which means that no two leaders will be exactly the same. This uniqueness arises because elements of their own personality influence the way they approach leadership and management philosophies. They are also likely to be influenced by the industry or business that they work in. It is also of particular interest to understand the leaders on an individual level since the attitudes, personal qualities, and skills of leaders in organisations are important ingredients in innovation (Adair, 2007:63). Moreover, the inclination of top management as an individual who remains over-confident could play a make-or-break role for an organisation (Grant, 2021).

Furthermore, the importance of different experiences in top management teams is a key source of innovation, especially in transforming resources, notably managerial resources, and it fosters organisational growth (Penrose & Penrose, 2009). This combination of personality and experience will give the teams a viewpoint and approach which is unlike that of anyone else. Therefore this supports this research's endeavour to understand members of management as an individual, especially under the inbound open innovation context because the norms that promote exploitation, such as incremental improvement and attention to detail, are substantively different from those needed for exploration such as risk taking and flexibility (O'Reilly & Tushman, 2021). Hence, performing a local study for Hong Kong is necessary to reveal how to correlate personal attitude towards inbound open innovation and the role of personal attitude in the business decision process within the local context.

2.6.2) Understanding the Strategic Decision Making Process

Before exploring the traits of individuals, it is also important to understand that the situation facing a strategic decision maker is complex and the phenomena could be more complicated than he or she could possibly comprehend. During the decision process, selection occurs subconsciously because top management usually take mental shortcuts and engage in limited search to arrive at their choices, especially when they are under job pressure (Hambrick et al., 2005). Individuals will be drawn to what has worked for them

before, what they find familiar or comfortable, and what fits their cognitive schema (Axelrod, 1976; Starbuck & Hedberg, 1977). These personalised construals are a function of the executives' experiences, values, and personalities. As executives vary and the strategic alternatives available to them also vary (Hambrick & Mason, 1984; Cunningham & Lischeron, 1991).

Strategic choices are made based on a person's interpretation of the stimuli, which was selectively perceived or grasped, due to the limited field of focus attention or based on the executive's interest in the technological issues (Finkelstein et al., 2009). They will economise in their strategic decision making by relying on their experiences to search for and interpret information as well as to select among options (Hambrick & Mason, 1984).

Recognising the importance of top management perception in affecting interpretation, the Bounded Rationality model was built to present the causal elements, including organisational performance. This model below shows how filtering occurs because an executive selectively perceives only a portion of the stimuli within his or her field of vision (Finkelstein et al., 2009). As the filtering of various inputs can limit actual company performance, it is important to investigate how individual attitudes affect strategic decisions in this study.

Figure 2.22 - Strategic choice under conditions of bounded rationality: the executive's construct reality vision (Finkelstein et al., 2009:45)

2.6.3) The Role of the Individual

The DNA of innovative organisations is a reflection of the DNA of innovative leaders because most innovative companies in the world have leaders

who understand innovation at a deeply personal level (Dyer et al., 2011:191). Decisions made by executives who are under significant job demand will closely reflected their backgrounds (Mischel, 1977). These included their functional backgrounds (Kimberly & Evanisko, 1981), educational experiences (Wiersema & Bantel, 1992), age and tenure (Finkelstein & Hambrick, 1990), and their psychological dispositions (Miller & Droge, 1986; Hambrick et al., 2005).

Opportunities are perceived within organisations as individual entrepreneurs have access to unique information and are willing to accept ideas based on subjective criteria. To capture such opportunities, the strategic direction chosen for the firm by top management normally should focus on their strategic understanding and beliefs toward innovation (Slater & Narver, 1993; 1995). In addition, entrepreneurship is not rational or necessarily purposeful because opportunities and ideas emerge from individual experience (Floyd & Wooldridge, 1999:138). Hence, a small business firm is simply an extension of the individual who is in charge (Lumpkin & Dess, 1996), and its characteristics reflect the individual. For example, the profile of a CEO explains a significant proportion of the sample variance in firm R&D spending when corporate strategy, ownership structure, and other firm-level attributes are controlled (Barker & Mueller, 2002).

Finally, diffusion of innovation is an important change strategy which focuses on individuals rather than the whole organisation (Kezar, 2011). Human factors derived from personality, experiences, values, social connections, fatigue, envy, and so on play a substantial role in affecting organisational outcomes (Finkelstein et al., 2009). Furthermore, organisational policy and adoption of innovation programmes are more inclined towards the preference of the elite within the organisation (Hage & Dewar, 1973). Hence, it is important to measure the individual attitude of the elite towards innovation to predict innovation adoption within the inbound open innovation context.

2.6.4) Overview of Technology Readiness Index (TRI)

Technology Readiness Index (TRI) was first developed in 2000 as an individual-level construct with thirty six-item scale. It is based on literature that

focused on adoption of new technology and people-technology interactions. TRI 1.0 was aimed at measuring ‘‘technology readiness’’, which was a classification of people’s tendency to embrace and use new technology in order to accomplish their goals in home life and at work (Parasuraman, 2000). This instrument is composed of four relatively distinct dimensions to measure attitude towards technology. Optimism and innovativeness are ‘‘motivators’’ while discomfort and insecurity are ‘‘inhibitors’’. Individuals can possess different combinations of technology-related traits and are profiled as a combination of these four alternate elements after assessed by TRI.

A more concise version, TRI 2.0, was released after fourteen years of review and optimisation to keep up with new technology developments in the same period. This version was also updated to facilitate the understanding of the dynamics behind the adoption of various technologies and it offers itself as a robust predictor of technology-related behavioral intentions. TRI 2.0 is particularly useful for assessing psychographic variables in applied, decision-oriented research in contexts where technology based innovation plays an important role at an individual level (Parasuraman & Colby, 2015:14). TRI 2.0 is well aligned with the context of this research because respondents with high technology readiness will be interested in advanced functionality and will be capable of mastering new high-tech offerings with minimal help. This also implies the existence of their ability to appreciate and adopt new innovations coming from external sources.

A positive relationship between factor measurement by TRI and leadership characteristics of an entrepreneur is confirmed by different scholars and has been summarised in the figure below (Carland et al., 1984). This relationship exists because certain key attitudes or beliefs robustly predict intentions and these key attitudes and intentions are perception-based (Krueger & Brazeal, 1994). For instance, an entrepreneur is characterised by a preference for creating activity, which is manifested by some innovative combination of resources for profit and innovation is the main difference between an entrepreneur and an owner of small business. These findings support the researcher’s belief that TRI can be used as a relevant instrument to correlate

SMEs' strategy because TRI offers insights into technology-related behavioral intentions and helps to identify key elements that drive the adoption of various technologies. The outcome of this study will also help the development of a conceptual framework to differentiate entrepreneurs from small business owners.

Figure 2.23 - Characteristics of Entrepreneurs (Carland et al., 1984)

2.6.5) The Relevance of Using Technology Readiness Index (TRI) as a Measurement Tool for SME Performance

The actions and attitudes of SME founders have a profound impact, especially in the formative stages of a company's processes and values. Strong desire for achievement, high internal locus of control, and medium risk taking preference are the personality characteristics of successful new business owner-managers (Korunka, 2003). For simple firms that are normally small, power is centralised at the top, entrepreneurship would be determined by the characteristics of the leader (Miller, 1983; Mohr 1969). In smaller firms, size could be a less significant predictor of structure than CEO personality (Miller & Droge, 1986). If the SME CEO is an internal person, who believes that the consequences of his behavior stems from his own efforts, then he will favor innovation strategies and focus more on planning for the future, leading his/her competitors and taking risks (Miller & Toulouse, 1986). For instance, small businesses are more likely to adopt new information technology innovation when the CEOs are more innovative, have a positive attitude towards adoption of IT, and possess greater IT knowledge (Thong & Yap, 1995).

A climate that encourages adoption of innovations can be stimulated by key psychological aspects of the human capital existing within the organisations,

such as innovativeness and SME entrepreneurs' basic personality traits (Marcati et al., 2008). Furthermore, management attitude towards change is indeed identified as one of the major antecedents of organisational innovation. This is because individual characteristics such as personality cannot be easily changed (Tornatzky et al., 1990). The attitude of managers and personnel towards change is defined as part of the "Organisational Rigidity" measurement which may hamper all areas of innovation (Oslo Manual, 2005:113). Hence, a favorable attitude toward change in management is essential for creating a climate conducive to innovation by motivating members to stay engaged and remain committed to support innovation (Mumford, 2011). This is shown by a Canada based study of two hundred and nineteen companies which confirmed that there was a strong linkage between CEO characteristics and technological innovativeness (Kitchell, 1997).

When top managers are faced with such common decision challenges such as information overload, ambiguous cues, and competing goals and objectives, executives' perceptions of stimuli are filtered and interpreted through cognitive bases and values. As these psychological constructs are unobservable, observable managerial characteristics are efficient proxies that provide reliable indicators of the unobservable psychological constructs (Carpenter et al., 2004). This is because entrepreneurial intentions and cognitive maps to entrepreneurial behaviors and intrinsic motivation refer to a personal interest in the entrepreneurial task (Carsrud & Brännback, 2011). Moreover, the corresponding organisational flexibility depends on the leaders at the top. The ability to change requires that the leaders have cognitive and behavioral complexity and flexibility (Boal & Hooijberg, 2000:517).

In this regard, since most of the SMEs selected in this research are classified as simple firms (Miller, 1983), the measurement of the firms' entrepreneurship can be based on collecting information to analyse entrepreneurial characteristics of top managers through TRI. This approach is possible because perspective from an entrepreneur is crucial to sound strategic management (Lyon, 2000:1081). According to the Theory of Planned Behavior, personal attitude toward entrepreneurial behavior and action is determined by the

total set of accessible behavioral beliefs linking entrepreneurial behavior to various outcomes, including organisational performance, where the strength of each belief is weighted by evaluating the outcomes. It works with subjective norm based on individual's perception of the social pressures to engage in entrepreneurial behavior or not (Ajzen, 1991).

Figure 2.24 - TPB Theory of Planned Behavior as Proposed by Ajzen (1991)

In addition to organisational performance, top management attitudes towards new technology adoption will also be collected through the use of TRI to predict the impact and likelihood of inbound open innovation for these Hong Kong high technology SMEs. As an established and consistent instrument, TRI offers management the option to identify longitudinal changes. TRI also enables organisations to benchmark crucial adjustments in strategic direction, leadership approaches as well as learning and execution requirement when new beliefs and assumptions emerge due to new experience. All these imply that TRI is potentially a powerful instrument to predict the probable outcome of organisational performance on an ongoing basis.

2.7) Introducing a New Framework for Inbound Open Innovation Performance Management

After identifying the key management elements and align them to personal characteristics relevant to inbound open innovation in the previous sections, this study will try to combine them together based on the 3H approach. A model developed by Russell and Russell (Russell & Russell, 1992:645) was chosen as the starting structure of this research because it contains many key management elements that this study has identified. These include entrepreneurial strategy, organisational outcomes, organisational structure,

organisational culture, and the management of innovation as a process. The framework used in this search design approach also corresponds to suggestions from Damanpour, who has identified three antecedents of organisational innovation, namely environmental (external, contextual), organisational (structure, culture), and managerial (leadership, human capital). The inclusion of environmental uncertainty as an external factor in Russell and Russell's model makes the new proposed model in this research highly relevant to inbound open innovation because the intersection of innovation and organisational change associates closely with the adoption of innovation (Damanpour, 2017:9).

In addition, Damanpour suggested a possible fourth dimension, which is the attributes and characteristics of innovation that may affect the speed of diffusion (Damanpour 2017:46). Hence, this study would explore if this fourth dimension is related to the personal characteristics, such as attitude and perception, of the entrepreneur. This could be achieved by measuring the level of correlation between inbound open innovation and various management factors within the high technology SME environment. This suggestion from Damanpour actually fits well with Russell & Russell's model (1992) which identified innovation related norms, such as belief and behaviour, as important characteristics that are strongly related to the success of entrepreneurial strategy.

2.7.1) Structure of the New Framework

In the newly proposed model of this research, organisational outcome is specifically replaced by organisational performance. Since organisational culture (innovation norm) is closely related to leadership, organisational culture will be represented by transformational leadership in the model of this research. Strategy will be directly replaced by entrepreneurial orientation while the management of innovation process, which is responsible for supporting execution, will be replaced by learning orientation in this study. Finally, these management elements will be combined to become part of the proposed operation model under the 3H framework, which consists of leadership, strategy, and execution. In addition, this study will explore whether these elements within the 3H framework are influenced by a fourth element as suggested by Damanpour (2017). Hence,

the new model will also include an assessment of a possible fourth element, which is the cognitive characteristics of top management, using TRI version 2.0.

To complete the suggested model of this research, environmental uncertainty in the original model will be replaced by level of inbound open innovation adoption since this research context is set within an inbound open innovation environment. By conducting subsequent empirical data analysis, this study should be able to confirm the possibility of combining these elements into one framework as an ongoing instrument for inbound open innovation performance management. The outcome of this study should help to answer the research questions.

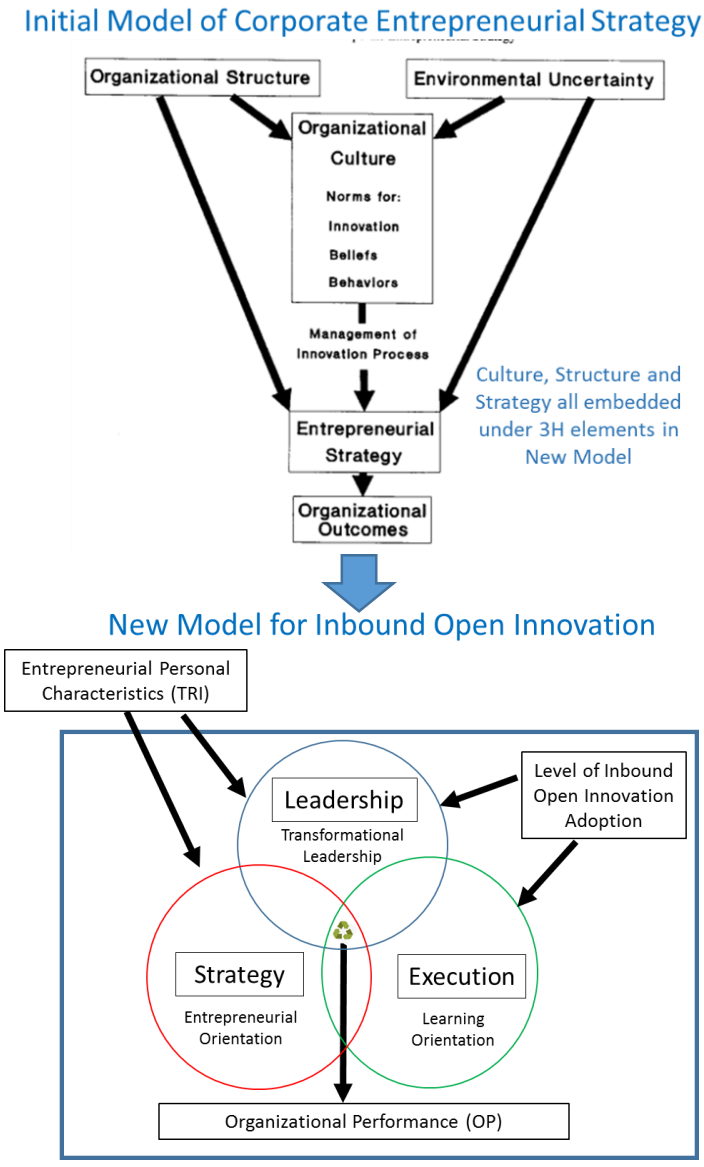


Figure 2.25 - Suggested Model for Framework Research

2.7.2) Benefit of Implementing the Selected Framework for Performance Monitoring

Feedback enables organisations to continuously detect changes in their business so that they can take corresponding actions. Important components of organisational-level knowledge stocks include systems, structure, strategy, and all of the storehouses of learning need to be aligned in order to deliver desirable business performance (Bontis et al., 2002). Hence, an effective organisation calls upon top management to regularly monitor and refine factors since a system approach for innovation requires feedback ranging from economic activity to institutional setup (Lundvall, 1999:72). Unfortunately, it is quite common that managers only focus on one or two domains so that they can only partially resolve their problems without developing the capability to balance different aspects of innovation management.

By choosing Yu's 3H as the core component of this research, this research is offering high-tech SME management the opportunity to monitor and manipulate different aspects of innovation management under a simple yet holistic instrument. The 3H framework starts from strategic consideration (Head), supported by leadership with mediation and intervention (Heart), to competence with agility through execution tracking and optimisation (Hand) (Yu, 2022). Through this framework, management can equip itself with the capabilities to create and manage a closer customer and market relationship so that all functional activities and organisational processes will be better directed toward anticipating and responding to changing market requirements ahead of competitors (Day, 1994).

Besides offering the flexibility to expand according to the particular need of an organisation, the 3H is also dynamic enough to offer management the ability to adjust easily to support the maintenance of a firm's competitive advantages. In an ideal situation, the organisational performance (OP) may even reach a state of continuous self-optimisation as represented by $OP = f(H^1 \cap H^2 \cap H^3)$ (Yu, 2022). This holistic management solution means leaders can now effectively and efficiently manage all three domains through integrating different

aspects to achieve a good and sustainable performance outcome for the organisation.

2.8) Summary of Hypotheses

Before listing out the details of the hypotheses of this research, a summarised view of their relationship is provided in the table below.

	Managerial Characteristics of Organisation			Personal Characteristics of Top Management			
	EO (Entrepreneurial Orientation)	Leadership (Transformational Leadership)	LO (Learning Orientation)	Optimism	Innovativeness	Insecurity	Discomfort
Organisational Performance	H2a	H2b	H2c	H4a	H4b	H4c	H4d
Inbound Open Innovation	H1a	H1b	H1c				
Performance Impact due to Relationships between Management Elements	H3						

Table 2.6 – Hypothesis Mapping of Individual Elements vs. Organisational Performance & Inbound Open Innovation

1) **Hypothesis One - Inbound Open Innovation Positively Related to three Core 3H Management elements**

   H1a –Entrepreneurial Orientation is positively related to the Level of Inbound Open Innovation

   H1b –Transformational Leadership is positively related to the Level of Inbound Open Innovation

   H1c –Learning Orientation is positively related to the level of Inbound Open Innovation

2) **Hypothesis Two - Positive Correlation Exists between Entrepreneurial Orientation, Transformational Leadership, Learning Orientation and Organisational Performance**

H2a – Entrepreneurial Orientation is positively related to Organisational Performance

H2b – Transformational Leadership is positively related to Organisational Performance

H2c – Learning Orientation is positively related to Organisational Performance

3) **Hypothesis Three – Positive Relationship between Management Elements can Enhance Organisation Performance under the Context of Inbound Open Innovation**

H3 – If Entrepreneurial Orientation, Transformational Leadership and Learning Orientation are all positive, organisational performance is also positive

4) **Hypothesis Four – Personal Characteristics of Top Management are Related to Organisational Performance**

H4a - Managerial Optimism, as measured by TRI, has a positive impact on Organisational Performance

H4b - Managerial Innovativeness, as measured by TRI, has a positive impact on Organisational Performance

H4c - Managerial Insecurity, as measured by TRI, has a negative impact on Organisational Performance

H4d - Managerial Discomfort, as measured by TRI, has a negative impact on Organisational Performance

2.9) Chapter Summary

Although inbound open innovation has been a relatively new research topic, there has been a number of encouraging discoveries from different scholars. For example, knowledge sourcing through inbound open innovation can offer direct performance benefits and is independent of a firm's internal managerial capabilities for innovation. It can either leverage the overall ecosystems for new ideas through deeply synergetic interactions with a diverse set of sources, taking an application-oriented approach which is more selective, or it can simply interact with distant partners along the value chain (Brunswicker & Vanhaverbeke, 2015). Alternatively, firms can also simply involve external consultants in their R&D outsourcing activities to directly acquire, embed and strengthen the impact of inbound open innovation on performance. The use of consultants is particularly relevant for firms with a relatively low levels of R&D outsourcing expenditures but want to increase their product innovation performance on an ad hoc basis (Bianchi et al., 2016).

These different approaches mean management need to have a better understanding of business environment in order to select the most appropriate path forward for the particular situation. It is essential for management to have such an understanding because open innovation is more suitable for dynamic and highly competitive environments (Huizingh, 2011). Such dynamic environment is similar to those environments experienced by high tech SMEs in Hong Kong. Based on the hypotheses of this research, which focus on how to increase the effectiveness of inbound open innovation, this research will try to develop an approach based on proven instruments to collect relevant data to answer the research questions raised in the literature review. The theoretical logics behind the instrument design of this research and the methodology development processes will also be summarised in the following chapter.

Chapter Three – Research Methodology Development

Innovation is social and in most cases the result of well-orchestrated teamwork through formal or informal social networks, and a process of intense collaboration combined with a tradition of prior knowledge (Weisberg, 1993). Unlike invention, innovation cannot be accomplished by a single individual because of the complexity involved. Besides exploiting and implementing ideas, the core activity of innovation is the creation of new knowledge. Top managers need to study knowledge processes as they exist at the root of every innovation and lead to "new" insights that become the foundation for a particular innovation, for a new product or a new business model (Peschl & Fundneider, 2012).

Although knowledge processes are the key of innovation, knowledge is not a neutral phenomenon. It is intertwined with the pursuit of societal values and objectives. Knowledge processes are developed and used according to strategic consideration and objectives. Many innovation scholars emphasised the need to shift target outcomes from an exclusive focus on economic growth to the inclusion of societal and environmental concerns (Ludwig et al., 2022). Hence, the objective of this research is to address this shift by conducting a study that will produce a model to improve the effectiveness of innovation management.

By expanding the understanding of innovation management from both practical and philosophical perspectives, this research attempts to explore approaches to improve the productiveness of high tech companies of Hong Kong. The findings will further enhance the competitiveness of SMEs in Hong Kong. Before establishing the research design to validate the proposed framework, the context of this research, which includes understanding the innovation status in Hong Kong, will be examined to ensure this study is reasonable and practical. In addition, this study will also define how innovation is being viewed philosophically and what approaches should be adopted to measure organisational performance as the outcome of variations. Hence, prior to explaining the detailed research processes and considerations of this research, the researcher will try to address these questions ontologically, epistemologically and methodologically as suggested (Guba & Lincoln, 1994:108). In addition, axiological consideration will also be included.

3.1) Establishing Innovation Research Foundation

3.1.1) Technology Innovation Status in Hong Kong from a Research and Development Perspective

Ranking second (2019), fifth (2020, 2022) and seventh (2021, 2023) in World Competitiveness Ranking (IMD, 2023), Hong Kong has always been one of the most competitive cities in the world. In fact, the 2019 Global Innovation Index rated the Shenzhen-Hong Kong technology cluster, which includes Hong Kong's innovation and technology sector, as the second largest in the world. According to an InvestHK report published in 2019, the total number of start-ups in Hong Kong reported an increase by 21% to 3,184 and the total employees grew by 31% to over 12,000 when compared with those in 2018 (InvestHK, 2019).

Major area research by Hong Kong start-ups include information and communication technology (ICT), Internet of things (IoT), data analytics, new material, biotech, artificial intelligence (AI), robotics, virtual reality (VR) and augmented reality (AR). In terms of applications, financial technology, smart city, smart home, healthcare, and big data applications are among the most popular sectors (Yuen, 2020) and fit neatly in Industry 4.0.

		Gross domestic expenditure on R&D					
		HK$ million			Percentage share in respective sector (%)		
Type of R&D Expenditure		Current expenditure	Capital expenditure	Total	Current expenditure	Capital expenditure	Total
Sector	Year						
Business sector	2020	9,640.5	1,403.4	11,043.9	87.3	12.7	100.0
	2021	9,285.1	2,414.3	11,699.3	79.4	20.6	100.0
	2022	10,071.9	2,298.8	12,370.7	81.4	18.6	100.0
Higher education sector	2020	13,259.8	869.6	14,129.3	93.8	6.2	100.0
	2021	13,898.7	836.5	14,735.2	94.3	5.7	100.0
	2022	15,242.8	1,112.7	16,355.5	93.2	6.8	100.0
Government sector	2020	1,274.0	106.4	1,380.4	92.3	7.7	100.0
	2021	1,268.1	124.2	1,392.3	91.1	8.9	100.0
	2022	1,290.7	121.5	1,412.2	91.4	8.6	100.0
Total	2020	24,174.3	2,379.3	26,553.6	91.0	9.0	100.0
	2021	24,451.9	3,375.0	27,826.9	87.9	12.1	100.0
	2022	26,605.4	3,532.9	30,138.4	88.3	11.7	100.0

Table 3.1 - Gross domestic expenditure on R&D by performing sector by type of R&D expenditure in Hong Kong from 2020 - 2022 (HKSAR Census and Statistics Department, 2023)

In terms of innovation and competitiveness ranking, Hong Kong remains among the top 10% globally. By establishing new functions, such as Office for Attracting Strategic Enterprises, to attract high tech companies from overseas,

the Hong Kong Government has been trying to reverse the decline of global competitiveness ranking due to political and economic tensions targeted at China.

Global Rankings	2020	2021	2022	2023
Global Innovation Index	11/131	14/132	14/132	17/132
IMD Digital Competitiveness	5/63	2/64	9/63	10/64

Source: Global Innovation Index Reports; IMD World Competitiveness Centre

Table 3.2 - Global Innovation and Competitiveness Ranking (Cheung 2024)

The competitiveness of Hong Kong has been reinforced by the continuous generation of high-quality human capital, especially in science and engineering. The human capital has been supplied by local universities which have respectable ranking throughout the years, according to the Times Higher Education and the QS University Ranking.

Hong Kong Universities with Top-100 Ranking by Subject

Subject	University (Rank)
Electrical & Electronic Engineering	HKUST (36), HKU (69)
Computer Science & Information Systems	HKUST (40), CUHK (53), HKU (61)
Chemistry	HKUST (55), HKU (77)
Chemical Engineering	HKUST (73), HKU (84)
Mathematics	HKUST (59), CUHK (66), HKU (84)
Medicine	HKU (31), CUHK (32)

Source: QS World University Ranking by Subject 2023

Table 3.3 - Ranking by Subjects in Hong Kong Universities (Cheung, 2024)

All these competitive rankings exist despite corporate spending on research and development in Hong Kong has been minimal. Nonetheless, its ratio of researchers per million inhabitants is similar to ratios in some developed countries (UNESCO, 2018). This ratio is partly due to the significant investment made by government in the higher education sector, which accounted for more than 50% of the gross domestic expenditure spent on research and development in Hong Kong (HKSAR Census and Statistics Department, 2023). The establishment of InnoHK since 2021 has further strengthened collaboration between high tech companies with leading institutions in Hong Kong, China and other global institutions. This major initiative by the Hong Kong Government allows research discoveries to generate tangible benefits for collaborating firms, including Hong Kong and global SMEs and universities. This also accentuates the strong potential of Hong Kong to develop its own niche position through technology innovation adoption to enter the era of Industry 4.0.

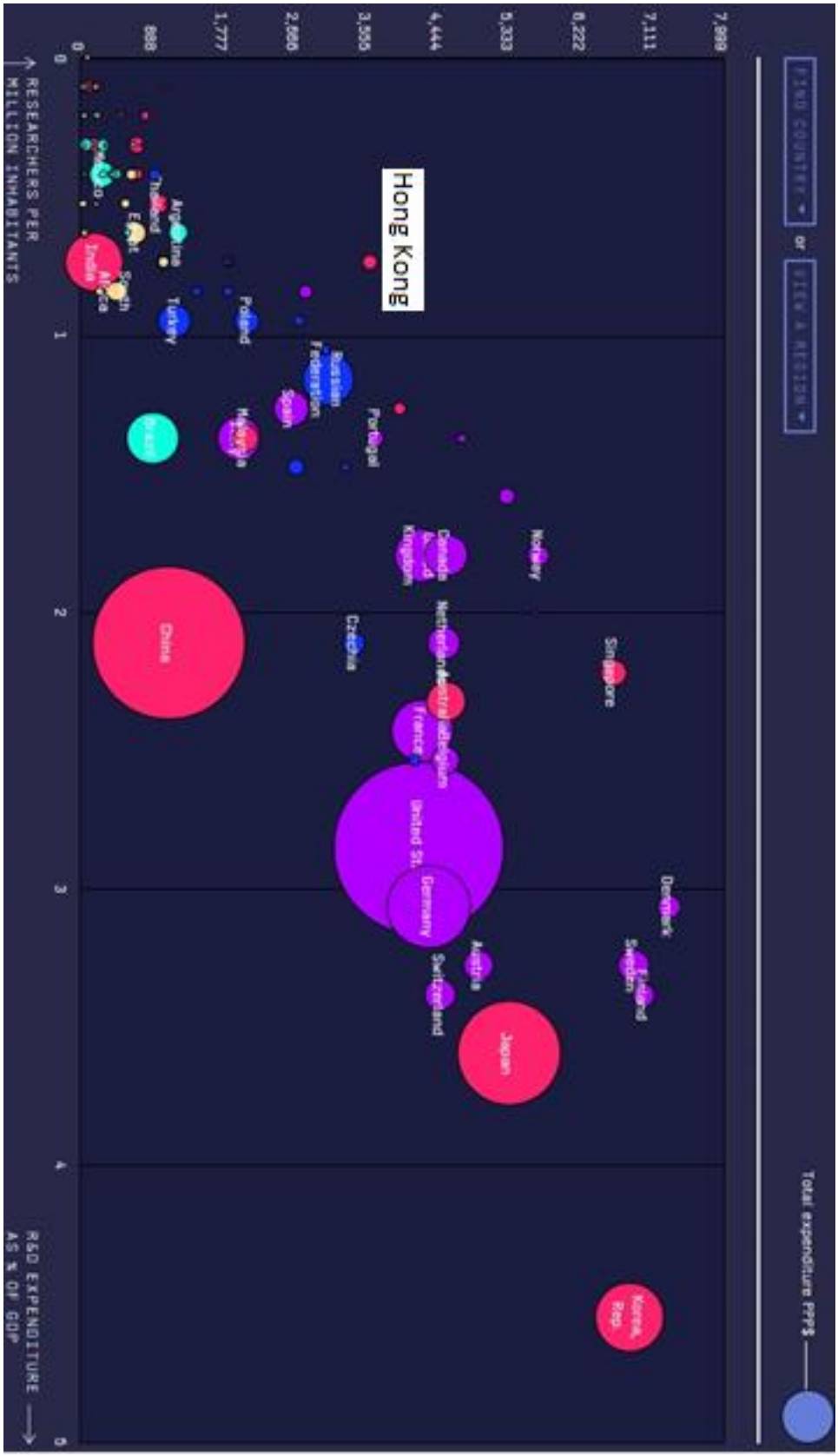


Figure 3.1 - Researchers Density vs. R&D Expenditure (UNESCO Institute for Statistics Dec 2018)

Due to the abandonment of functions that may not be considered as core to R&D a few years ago, many companies in Hong Kong and beyond are now relying on working with external partners, such as hardware and chipset suppliers, and organisations like InnoHK. It becomes essential to investigate and validate how innovation adoption began in high technology companies as a way to sustain and drive the development of new technologies and products. The experience shown by Tokyo–Yokohama, Japan, which is listed as the largest science and technology cluster in 2024, is an important benchmark because fifty five percent of Tokyo–Yokohama's scientific articles are published in collaboration with organisations outside Tokyo-Yokohama, with the top three collaborating locations being Osaka–Kobe–Kyoto, Nagoya and Sendai (World Intellectual Property Organization, 2024).

Figure 3.2 - Global Innovation Index scores & GDP per capita in PPP US$ (bubbles sized by population) (Dutta et al., 2019)

In addition, as part of its plan to build a mega chip cluster in Gyeonggi Province, Korea authorities aim to facilitate the entry of foreign experts into the country by adjusting visa regulations as part of its vision to support inbound open innovation and cultivate local talent dedicated to the chip industry (Ko, 2024). How the Korean government develop this mega cluster will help researchers in Hong Kong to acquire a better understanding of the challenges involved to complete such an enormous task. Finally, sixty percent of Shanghai–Suzhou's scientific articles are published in collaboration with other organisations with the top three collaborating locations being Beijing, Shenzhen–Hong Kong–Guangzhou and Nanjing (World Intellectual Property Organization, 2024).

In Hong Kong, the recent establishment of research centers by AstraZeneca (HKSAR Government, 2023) and Shanghai Pharmaceuticals (HKSTP, 2024) in Hong Kong Science and Technology Park were positioned to bring together relevant startups to build a more vibrant medical innovation ecosystem. From an inbound open innovation perspective, these centers reinforce the adoption of frontier research of distinguished medical research institutions, experts and scholars of Hong Kong and the Guangdong-Hong Kong-Macao Greater Bay Area to create new momentum for pharmaceutical research and development in the region. However, only a small scale case study was previously done to investigate the innovative aspects of a few small and medium-sized technology companies located inside Hong Kong Science and Technology Park (Loon & Chik, 2019). Hence, this study will help local officials and researchers to understand how Hong Kong can achieve an innovation ranking similar to those of Korea, Japan and France as shown in the figure above, published by World Intellectual Property Organisation (Dutta et al., 2019).

3.1.2) Ontological Consideration

Ontological questions in social science research are related to the nature of reality (Tuli, 2010). People often understand reality through concept. Therefore, concept formation inevitably raises the issue of ontology as it specifies what is inherent and important in the empirical phenomenon, represented by a concept (Goertz & Mahoney, J., 2012). Ontological beliefs have to do with the essence of phenomena under investigation methods (Orlikowski & Baroudi,

1991). In choosing Hong Kong Science Park as the key survey location, this study is ontologically grounded in the core of Hong Kong high tech SMEs' innovation. This location is also aligned to Porter's concept of clustering by which the efficiency and rate of innovation improves and drives new business formation and innovation due to close linkages with buyers, suppliers, and other institutions (Porter, 2000).

By collecting the perceived "reality" of organisations from the lens of their top management, this study is capturing the conceptual and cultural view of organisations from a broad and top down perspective. Since strategy development processes and top management thinking are also captured in the analysis, this study aims to gain insights into several aspects of an organisation's culture, shared value system, and corporate vision (Hart, 1992; Pascale, 1985). Moreover, since respondents are responsible for planning, leading, and operating an organisation, they are also implicitly responsible for future performance of the organisation. Hence, it is reasonable to classify the collected reality as macro and holistic so the ontological assumption is close to the reality surrounding the organisation as a small business firm is simply an extension of the individual who is in charge (Lumpkin & Dess, 1996).

The proposed framework of this research is also based on the ontological spirit of the 3H by adopting transformational leadership as one of the key management elements. In doing so, the reciprocity in the interpersonal relationships of human beings is included. The expected management style of transformational leaders under inbound open innovation context is also being addressed by this study. In addition, since the proposed framework also possesses a hierarchical structure, in which individual elements can be measured through established survey instruments, it can help to assess the underlying concept empirically and quantitatively. The researcher will also adopt an indicator-latent variable approach and seek to identify good indicators that have a causal relationship with the latent variable. By using a quantitative approach, concepts are constructed through the identification and aggregation of indicators that are caused by (or perhaps cause) the concept of interest (Goertz & Mahoney, J.,

2012:215). Hence, subsequent discussions about concepts in this research can be based around collected data.

3.1.3) Epistemological Consideration

Organisations are the "structural container" in which most of innovations come about. They also provide a social and/or structural context in which individual systems or a group of interacting systems are embedded (Peschl & Fundneider, 2012). Epistemological assumptions concern the criteria by which valid knowledge about a phenomenon may be constructed and evaluated (Orlikowski & Baroudi, 1991:25). Hence, it is necessary to understand the innovation aspect of the organisation from a social, cultural and epistemological process perspective in order to define the assumption of Hong Kong specific reality in this study to validate against the proposed framework.

However, the challenges of knowledge generation in quantitative analyses are closely linked to 'error', which is understood as the difference between an estimated value and a true value through the production of valid knowledge in a context. Error is inherently epistemological because it concerns the quality of knowledge. So if a good understanding of how valid the knowledge is when it is applied can be attained, there should be minimal errors. Hence, quantitative scholars feel the least certain about cases with extreme values and most certain for cases with middle values (Goertz & Mahoney, J., 2012) as the deviation from the true value is less in the case of middle values.

By leveraging instruments developed by previous studies and taking an epistemological approach, this study attempts to view the world of phenomena by assuming that the objective reality can be measured and that relationships between entities in this world can be captured in data that is reasonably representative and accurate (Straub et al., 2004). Through the collection of numerical data, cognitive thinking of entrepreneurs, and their management approaches, this knowledge will be extended to address the subtleties in management behaviour and organisational dynamics. In addition, by combining entrepreneurial orientation, transformational leadership, and learning orientation under the structure suggested by the 3H framework, this study should enable the

testing of causal relationships between these elements. This approach was selected because the study focus is based around innovation management and the context is similar to the information systems study conducted by Straub (2004).

Through validating the selected framework by a survey driven quantitative analysis approach, this study can utilise a positivistic approach in which reality is constructed from the identification of events that occurred (Orlikowski & Baroudi, 1991). Moreover, through self-responding survey, based on delivered published instruments, the data gathered is as objective as possible. The result should provide a relatively accurate representation of the underlying phenomenon which is paramount for positivist science (Straub et al., 2004:7).

3.1.4) Axiological Consideration

By constructing a new framework based on a combination of the 3H and the Russell and Russell's model (1991), this research's investigation of organisational performance is not only assessing the impact of different management elements together, but also including considerations of external knowledge adoption and entrepreneurial attitude. The new framework can either be used on its own for innovation management optimisation as suggested by the 3H or can become an auditing tool for external consultants when organisational performance needs to be reviewed. From an axiological perspective, this study should make a significant contribution towards the extension of knowledge.

3.1.5) Justification for Conducting a Quantitative Study

There are significant similarities between the selected area of interest of this search and the sixteen propositions raised by Ireland, Covin, and Kuratko (Ireland et al., 2009). Both Ireland's propositions and this research are focused on using corporate entrepreneurship as a useful focal point for integrating and synthesising key elements within corporate entrepreneurship's intellectual domain. More importantly, both Ireland's model and my study aim at creating and validating models that include: (1) the antecedents such as individual entrepreneurial cognitions of the organisation's members and external environmental conditions that invite entrepreneurial activity, (2) top management's entrepreneurial strategic vision for the firm, organisational

architectures that encourage entrepreneurial processes and behavior, and the generic forms of entrepreneurial process that are reflected in entrepreneurial behavior, and (3) organisational outcomes resulting from entrepreneurial actions, including the development of competitive capability and strategic repositioning.

According to Ireland et al., their propositions are sources for empirical studies' understanding of corporate entrepreneurship. They also believed a particular type of organisational strategy would emerge as scholars complete empirical studies examining the phenomenon suggested by them (Ireland et al., 2009:40). In addition, the Russell and Russell's model (1991) was developed based on a quantitative study. As Russells' model provides a reference for the framework used in this research and Ireland's propositions are also highly related to this research area, it is logical for this research to be conducted using a quantitative approach to develop possible extensions to these models.

Figure 3.3 - An Integrative Model of Corporate Entrepreneurship Strategy (Ireland et al., 2009:24)

3.2) Identification of Assessment Factors

3.2.1) Respondent Profiling and General Background Consideration

Besides capturing the entrepreneurial, leadership, and learning orientation profile of the participants, understanding their individual background

is also important in this research. Numerous studies covering social media acceptance, as well as attitude and acceptance towards e-commerce have been conducted to correlate various independent factors or antecedents that are specific to individual respondents and their readiness to adopt technological innovation. Hence, this study will consider their findings to be part of the background analysis. Major independent factors that will be included are listed below.

A) Age Group Segmentation in Profiling Participants

In a study funded by the US National Institute of Health (Czaja et al., 2006), it was concluded that in general, older adults were less likely than younger adults to use technology. On the other hand, for the 1 in 1,000 fastest growing new ventures in the United States during the years 2007-2014, the mean age of the founder at company commencement was 45.0. The mean age was similar for high-technology sectors and entrepreneurial hubs, thereby disproving the common belief successful entrepreneurs are all young-aged (Azoulay et al., 2020). Hence, there is potentially an optimal age that is a balance of experience and youthfulness. As most SMEs surveyed by this study are managed by their founders, the age of the founder is likely to be same as the age of the CEO. Hence, the questionnaire of this research will reference Azoulay's study and use the age segmentation as shown in figure below, giving a final range of <30, 30-40, 40-50, 50-60, 60+.

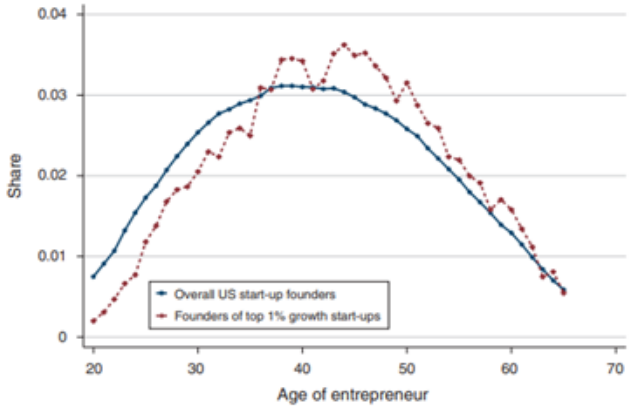


Figure 3.4 - Founder Age Distribution: All Start-Ups and High Growth Start-Ups (Azoulay et al., 2020:74)

B) Education Level of Respondents in Company

The education level of an individual has a definitive influence on his or her technology adoption behavior because education is the most consistent predictor in explaining a person's willingness to adopt new technology (Rojas-Méndez et al., 2017). Other academic studies, such as the one done by Porter and Donthu (Porter & Donthu, 2006), have also found a positive relationship between the level of education and the perceived ease-of-use of the internet. In addition, the average age and the average education level of top management teams in small businesses are significant predictors of the extent of IT adoption, supporting the idea that the age and education composition of managers as current/future top management are critical in facilitating the extent of IT adoption in SMEs (Chuang et al., 2009). Therefore, academic qualification of respondents will be collected and assessed to reveal the likelihood of technology adoption by SMEs in Hong Kong.

C) Experience in the Industry Similar to that of the Current Company

Experience of the top management in the same industry enables them to enjoy compatibility, which was defined as "the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of the adopters" (Rogers, 2003:15). On the contrary, complexity was defined as "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2003:15). This is giving relevant experience an important but also a contradictory role in innovation. The presence of both complexity and compatibility demands the management to be well versed in the similar industry that they worked for so that they can become capable in adopting technology innovation. This is because prior experience in the specific industry also indicates a much greater chance of entrepreneurial success (Azoulay et al., 2020). When one is attempting to identify and select critical elements for inbound open innovation, a lack of existing expertise and experience within the organisation, especially if it is within its top management, will hinder the ability to optimise the identification process (Nelson, 1985).

Experience occurs in the organisation as tasks are performed but experience is also temporal (Argote, & Miron-Spektor, 2011). The knowledge base of managers, which is derived from their past experience and exposure, becomes part of the competitive advantage through a resource-based approach. When managers are moving between different organisations, they bring in experience and other knowledge that may create new competitive advantages and have a potential to determine the level of success in this new organisation (McKelvey, 1982). Previous experience gained by the entrepreneurs in the same or similar industries will influence final performance because experience interacts with context to create knowledge (Argote & Miron-Spektor, 2011) and knowledge eventually drives organisational performance. Hence, industry experience should play an important role when inbound open innovation and learning orientation are being modelled together.

Figure 3.5 - A Theoretical Framework for Analyzing Organisational Learning (Argote & Miron-Spektor, 2011)

However, there are some exceptional cases when outsiders may bring in new business ideas and be able to successfully run companies under a different industry segment from their own experience. One of the best examples is how the ex-CEO of Ericsson, Carl-Henric Svanberg, who was brought in from Assa Abloy, with no prior management in telecommunication industry. He was able to turn the loss-making business of Ericsson around successfully. This example shows that inbound open innovation can bring in new entrepreneurial ideas for an organisational renewal but also has to be evaluated carefully alongside other

organisational factors. This study also intends to look at the correlations between different organisational factors.

D) The Role of Respondents in the Management Hierarchy within Company

Managing innovation is now a key factor in enhancing organisational sustainability, especially in the area of information technology adoption in SMEs (Berkhout & Green, 2002). Top management needs to create and maintain a sustainable competitive advantage as part of an ongoing requirement to connect internal strategies and processes with external environmental changes and pressures. In the case of Hong Kong high technology SMEs, this process is a virtuous cycle created by the combination of innovation and competitive advantage (Loon & Chik, 2019). Hence, the current role and position of the respondent within the management hierarchy should have a positive correlation with the adoption of technology and will be investigated as part of the background information analysis.

E) Tenure of Management in Company

Competent managers are seen as a source of competitive advantages (McKelvey, 1982), therefore, having a stable management team is important for any organisation. Moreover, a longer tenure with a company also indicates a stronger attachment to the organisation. Hence, when a decline in performance is detected, top management team with longer tenures and high diversity in expertise is likely to result in greater determination and level of strategic changes (Boeker, 1997-B) to revitalise the company. Tenure in the company also influences decision making approach (Finkelstein & Hambrick, 1990). The effects of executive migration are influenced by attributes of the executive and characteristics of the top management team of the organisation. The impact of such migration on product-market entry is stronger when new managers are more technically oriented, are part of top management, and possess greater industry experience (Boeker, 1997-A). A combination of short organisational history with a manager who has had a relatively long tenure at the top level usually leads to strategic changes as the result of external elements such as an outsider joining the company or the adoption of external ideas as in the case of inbound open

innovation (Wiersema & Bantel, 1992). This combination echoes well with the fast changing high technology SMEs environment.

F) Size of Company

The first factor influencing information technology adoption is the organisational or internal environment, which includes the size of the firm, the firm's goals, people within the firm, their behavior, culture, identity, structure and knowledge (Watson, 2006; Ngyuen, 2009). For an organisation to function successfully, organisational characteristics such as size, main technology and environment need to fit into its culture and structure (Watson T. 2006:456). Moreover, when management assesses whether or not to adopt new technology, they should consider the size of the business, employees' knowledge of technology, and the amount of information that the organisation possesses (Premkumar & Roberts, 1999; Lee & Xia 2006). As organisational structure is a crucial element in the diffusion of technological innovations, the size of the company needs to be considered since it will influence the technology innovation adoption process (DeCanio et al., 2000). In the survey of this research, which is specific to Hong Kong high technology business and does not involve manufacturing, a small and medium-sized enterprise (SME) is an entity that employs fewer than 50 persons (HKSAR Government, 2012). On the other hand, a business that employs fewer than 10 employees is defined as a micro enterprise and will be filtered out from the quantitative analysis.

3.2.2) Measuring Organisational Performance under the Context of Innovation Management

Organisational performance is important to academia across all domains of management research even though scholars from different disciplines adopt their own specific measures. However, the complexity and uncertainty of the environment affects the degree, type, organisation and management of innovation (Tidd, 2001). Performance represents the time test of any strategy and managerial importance of business performance. It is clearly exhibited by the many prescriptions offered for performance improvement as it is at the heart of strategic management (Venkatraman & Ramanujam, 1986). Assessing progress

and measuring the impact of innovation activities enable management to adjust strategy before mistakes become expensive or disruptive ideas are rejected. Hence, continuous monitoring and measuring innovation and general organisational performance remain as the key tasks for the survival of every business. In addition, performance provides important feedback about the efficiency of learning within an organisation and affects how organisation will conduct learning going forward (Mintzberg et al., 2003). Hence, using organisational performance to measure outcome should cover strategic and learning or execution aspects of an organisation.

In a hostile environment, performance among small firms was positively related to an organic structure, a strategically entrepreneurial orientation, and a competitive profile that has long-term orientation with predicted industry trends (Covin & Slevin, 1989). Fortunately, organisational innovation influences organisational performance positively and was confirmed empirically (García-Morales et al., 2012). This happens because innovation capability is the most important determinant of firm performance (Mone et al., 1998). However, performance is multi-dimensional and too complex to be measured effectively with any single item, and/or any single measurement approach (Conant et al., 1990).

According to Tidd and Bessant, innovation performance should include measure of market share, market differentiation, and amount of new products and ratio of return on investment (Tidd & Bessant, 2020: 536). Research evidence suggests a strong correlation between market performance and new products (Tidd, 2006). New products help capture and retain market shares, and increase profitability in those markets (Tidd & Bessant, 2020: 6). In addition, innovative SMEs typically achieve stronger growth or are more successful than those that do not innovate as enterprises that gain market share and increasing profitability are those that are innovative (Statistics Canada, 2006). By collecting corresponding information about a firm's market performance, the frequency of new product launch, and its sales growth through a survey instrument, its innovation performance could be captured for further analysis. To provide a

better understanding of metrics related to inbound open innovation, this research will also highlight in the following sections how performance metrics evolve towards a more innovation focused context. This research will also examine the role of TRI and 3H framework in assisting performance optimisation.

A) Evolution of Performance Definition and Measurement

In a fast changing environment like Industry 4.0, the existing systems that were set up to measure innovation may not match the challenges facing high technology SMEs today due to the emergence of new business and technology pattern. Bititci et al. (2012) proposed a possible trend of performance measurement by mapping the evolution of the previous performance measurement literature in Figure 3.9. Their study clearly recognised the importance of R&D, innovation, management of knowledge, and intellectual property in contributing to future competitiveness of an organisation. Factors such as trust, relationship, and innovativeness are important dimensions of performance evaluation in response to changes in the organisations' inner and outer operating environment (Bititci et al., 2012:24). Change will be disruptive and transformational. Therefore, it is clearly corresponding to indicators such as transformational leadership (trust/relationship) and entrepreneurial and learning orientation (innovativeness) under an inbound open innovation framework.

This dependency on technology and knowledge collaboration between organisations, under both inner and outer operating environments, clearly points to a future in which organisational performance will be assessed under an open innovation environment. The disruptive and transformational changes in business environment due to Industry 4.0 are already forcing companies to move further towards inter-organisational collaboration as predicted. Such collaboration has created a complex network of highly specialised organisations that work together to create competitive advantage and value.

One major example of such collaboration is The 3rd Generation Partnership Project (3GPP) that unites seven telecommunications standard development organisations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, and TTC). These "Organisational Partners" provide a stable environment to produce

specifications that define the 5G mobile communication technology. Similar organisations also emerges in other industries (e.g. 5G Automotive Association (5GAA)) as new technologies appear.

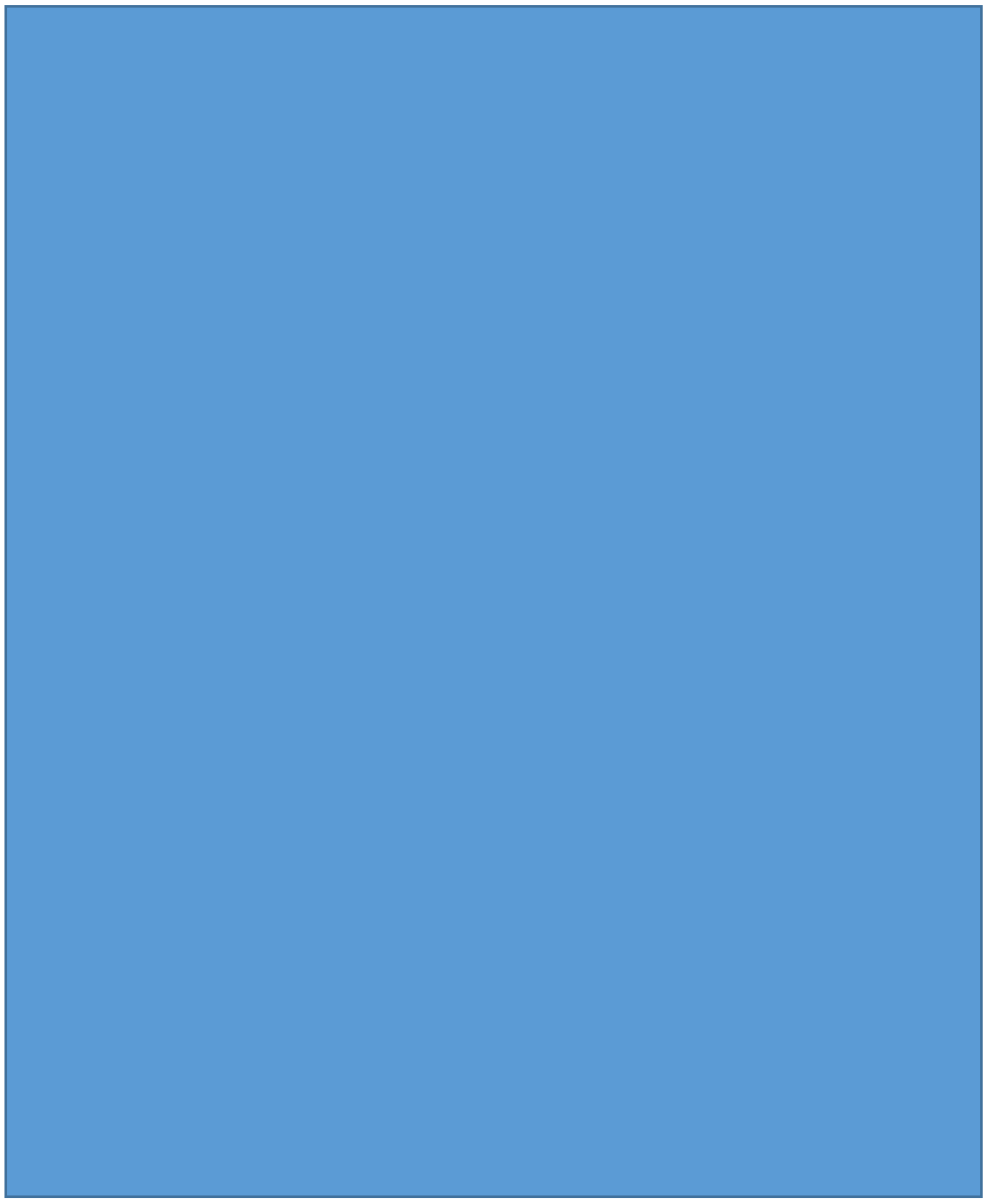


Figure 3.6 - Development of the performance measurement literature and global trends (Bititci et al., 2012:26)

Therefore, the importance of inbound open innovation will only continue to grow due to the increasing pace of knowledge sharing and information proliferation. The performance of an organisation and an individual will be assessed by the network or community they belong to rather than as a closed system as the nature of work and the economics of production will depend more on the globalisation of science and technology as well as knowledge workers

with greater complexity of skill (Bititci, et al., 2012:28), making performance measurement based on inbound open innovation a key element in the future.

B) Selecting Organisational Performance Measurement Metrics Relevant to Inbound Open Innovation

Understanding firm performance in an innovation ecosystem, which is highly dynamic, requires a change in the way strategy, value creation, and firm performance are linked. Relationship is no longer limited to the innovation challenges facing the firm but also includes the innovation challenges confronted by external partners (Adner & Kapoor, 2010:307). Unfortunately, traditional studies focus on characterising the magnitude and nature of the internal innovation challenges confronted by focal innovators (Adner & Kapoor, 2010:310). So, management may often overlook important areas from external partners and not able to adjust strategies and execution approaches accordingly.

In comparison, the openness of inbound open innovation process in R&D management is crucial for achieving a high level of direct and indirect innovation output. In particular, openness towards customers, suppliers, and universities has a significant and positive impact on the different innovation performance measures (Inauen & Schenker-Wicki, 2011:496). Measurement of performance outcome related to innovation should also shift from stand-alone innovations to synchronous innovations as innovation has to facilitate both internal and external fit. Instead of only focusing internally, it is also necessary to consider how firms relate to their competitive and institutional environments (Damanpour, 2017:25).

Actual performance also relies on organisational ability to generate new and competitive advantages to win customers. Organisation can also defend its competitive position by producing differentiations that are difficult for rivals to imitate. High performance includes an extraordinary financial outcome, a commanding market share, a culture of innovation, and a portfolio of compelling products and services (Benko & Anderson, 2010:172). Although the use of simple quantitative metrics, such as increased number of customers and increased number of product output, can provide more consistent view of performance, SMEs are less open to disclose the exact monetary and sales related figures.

Hence, questions are selected to avoid accessing sensitive financial topics so high-tech SMEs management can address them openly and honestly. Answers should not be strictly right or wrong and responses would remain anonymous to reduce the chance of common method bias (Podsakoff et al., 2003).

Questions related to direct comparison against competitors were also avoided to remove any subjective input from respondents. As a possible solution to the performance assessment challenge, the questionnaire of this research will focus on new product introduction rate (Ireland et al., 2009:40) and business sales growth rate. Hence, the performance measurement metrics of this research will be based on comparing the current company performance against its performance in the past three to five years.

3.3) Research Design and Instrument Development

After identifying entrepreneurial orientation, transformational leadership, and learning orientation as the three main elements for implementing inbound open innovation based on previous review, this study will proceed to investigate how to combine these three components together under the 3H framework. This research will commence this investigation by referring to the model developed by Russell and Russell for management of innovation strategy and this research will try to assess how these different elements will interact with inbound open innovation and organisation performance (Russell & Russell, 1992).

3.3.1) Understanding Inbound Open Innovation Adoption

To measure the level of inbound open innovation acceptance by respondents, questions covering interaction between new product development considerations and external factors (Sisodiya et al., 2013; Singh et al., 2021; Cheng & Shiu, 2015) will be used as part of the survey instrument. In addition, innovation performance measurement metrics covering sales growth, customer footprint, new product count, and return on investment based on subjective evaluation will also be used to establish the basis of organisation performance over the last three to five years (Calantone et al., 2002; García-Morales et al., 2006; Hughes & Morgan, 2007; Venkatraman & Ramanujam, 1986; Bontis et al., 2002).

3.3.2) Establishing General Background Context

To improve the quality of collected data, multiple dimensions other than performance should be included wherever possible through the addition of several critical control variables such as industry, age, and size of the firm (Murphy et al., 1996:15). Age of firm is particularly important in the examination of learning orientation in smaller entrepreneurial firms during the start-up, breakout, and maturing stages (Wang, 2008:649). As such, the following will be collected as general information.

(1) Age of respondent
(2) Age of firm
(3) Education level
(4) Position of respondent in company
(5) Year of experience in the industry
(6) Company size

3.3.3) Independent Variables

A) External Environment Management

Based on the suggested model of this research, adoption preference of inbound open innovation will be the main independent variable to reflect how the external environment is handled within an inbound open innovation context. For actual measurement, a more recent instrument from Sisodiya and his team was deployed (Sisodiya et al., 2013) to assess participants under their organisational context.

B) Entrepreneurial Characteristics

To attain the final organisational performance, the initial model suggested that there will be up to four independent variables coming from Technology Readiness Index, namely optimism, innovativeness, discomfort, and insecurity. Technology Readiness Index is used because personal attitudes are specific to the individual. Therefore, measurements made by this index would be reflective of the respondent attitude. The instrument of this research leverages the questionnaire within Technology Readiness Index as an established instrument

to measure the individual respondent characteristics which will be treated as the main antecedents of the 3H framework under an inbound open innovation environment. Detection of deviation could act as an alert mechanism to ensure the continuous operation of the well-balanced, constructive and self-sustaining 3H framework.

C) Mediating Role of Entrepreneurial Orientation, Learning Orientation and Transformational Leadership

As proposed in the model of this research, entrepreneurial orientation, learning orientation, and transformational leadership are hypothesised as the framework mediators. Moreover, the performance of the organisation would also be the outcome of these mediators. The results from Technology Readiness Index and adoption level of inbound open innovation would likely be mediated by these three elements as defined within the 3H framework. The measurement instrument used for measuring entrepreneurial orientation and learning orientation is Wang's (2008), which is a modification from Miller's (1983) while leadership measurement was based on proven instruments developed by Avolio and Bass (2006), Carless (2000), and Podsakoff (2003).

D) Entrepreneurial Experience and Attachment to the Organisation

The organisation is a coalition of groups and interests, each attempting to obtain something from the collectivity by interacting with others, and each with its own preferences and objectives. Organisations, then, are quasi-markets, in which influence and control are negotiated and allocated according to which organisational participants are most critical to an organisation's continued survival and success (Quinn & Rohrbaugh, 1981:138). Such negotiation is best explained by the Competing Value Approach where experience in managing innovation can have significant impact on organisational performance because management has to choose between three sets of competing values, namely flexibility versus stability, means versus ends, and organisation versus people (Quinn & Rohrbaugh, 1981).

However, managerial task skills, which are highly related to the depth of management experience, were viewed as composite indices and, therefore, is too

general conceptually for further consideration (Quinn & Rohrbaugh, 1981: 129). To manoeuvre around this challenge, this study will embed the measurement of critical values, such as morale, communication, flexibility, treatment of people, growth, and human resources development, into other parts of survey instrument. Not only can this embedment help to avoid subjective bias from survey respondents, the objective measurement of values proposed by the Competing Values Framework can also provide an ideational aspect of organisational culture (Büschgens et al., 2013). In addition, other studies (Wang, 2008; Murphy, 1996) have also indicated that management tenure and industry experience are relevant to the performance of an organisation. Hence, industry experience and attachment will also be included as part of the questionnaire in this study to capture the cultural traits of the leader and the organisation.

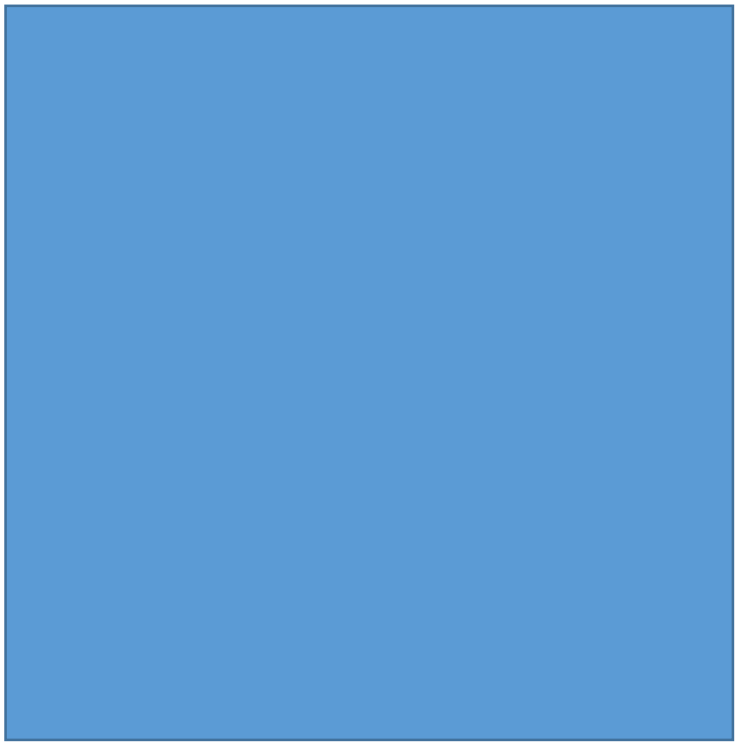


Figure 3.7 - A summary of the competing value sets and effectiveness models (Quinn & Rohrbaugh, 1981:136)

3.3.4) Dependent Variable - Organisational Performance

To assess the effectiveness of the SMEs, performance of the past three to five years was requested from the respondents in order to provide a relative picture against the independent variable and the mediators in the model of this

research. The performance metrics cover both sales and product range to broaden the current understanding of the SMEs' performance from different perspectives.

3.4) Instrument Development Detail

3.4.1) Survey Introduction and Confidentiality Declaration

An introduction statement is provided to ensure that respondents have a full understanding of the purpose of this survey. Details of the survey were listed in Appendix One. There was also a clear statement to ensure that respondents understand their feedback will remain anonymous and confidential according to the guidelines provided by the Ethics Review Committee of the University of Wales TSD. Respondents were reminded about their right to exit the survey if they choose to do so (World Health Organisation, 2020). These statements are located at the beginning part of their consent to the data sharing agreement, which is above the submit button.

3.4.2) Increasing Survey Response Rate

To increase the response rate of the survey, the following recommendations were adopted during the survey design of this research (Nulty, 2008:305).

1) Inform respondents about how their responses will be used: This is stated in the introduction statement in which respondents are informed that their responses would be part of the input to create a Hong Kong specific entrepreneurial profile.

2) Distribute the survey: By embedding the survey link as part of the email and WhatsApp message, the questions are being presented to the respondent, making it easy for them to access and respond.

3) Include channels to seek constructive criticism: A comment entry box is inserted at the end of the survey before submission so that respondents can provide their opinions as part of survey feedback.

4) Assure participants the anonymity of their responses to enhance response quality.

3.4.3) Survey Scale Development

In order to create a consistent experience to the survey participants, a drop-down list selection approach was adopted in which five answers, corresponding to a 5-point Likert scale, were made available for selection for each question. Although the original scale of most survey questions are either 5 or 7 point Likert, the 5-point scale was chosen because the 5- and 7-point scales were found to produce the same mean score once they were rescaled (Dawes, J., 2008; Joshi et al., 2015). In addition, since the Technology Readiness Index uses a 5 point Likert, consistency can be maintained if instrument is also aligned to the 5-point scale utilised by Technology Readiness Index 2.0.

5 point Likert was also used by a number of studies such as role based performance (Welbourne et al., 1998) and balance scorecard vs. organisational performance (Hoque & James, 2000). Furthermore, 5 point Likert has also been used for organisational climate measurement especially in the area of support for innovation (Anderson & West, 1998). Hence, 5 point Likert is chosen to be the scale of the survey instrument of this research from a performance measurement perspective.

3.4.4) Instrument Validity

All measurement items were selected after careful literature review as summarised in the previous sections. All variables collected in the study cover many items and the source of these instruments is listed in Appendix One.

3.4.5) Optimisation Procedures Taken for Survey Instrument

Before the mass dissemination of the questionnaire, Chinese translations of the questions were introduced and located alongside the English questions throughout the entire instrument. Including the Chinese translation ensures respondents can have better understanding of both the survey's ethical standard and the actual questions, in case ambiguities arise in either English or Chinese. The research instrument was then pretested with eleven different researchers, entrepreneurs, and experienced managers from technology companies. The primary purpose of the pretest was to improve wording and to increase the ease

of administering the instrument. Two verification stages were conducted. In Phase One, the general structure of the questionnaire and the understanding of the questions were improved while additional changes were made based on the entrepreneurial points of view in Phase Two.

A) Phase One – Initial Verification

Six individuals, experienced in high technology or entrepreneurship, were invited to review the draft of the questionnaire after initial comments from the director of study and supervisor for this research were incorporated. Since these participants were not entrepreneurs themselves, they simply provided the researcher with a general overview of the questionnaire. The backgrounds of the five individuals are listed below.

1) Director of a venture capital fund
2) Product management head of the Asia Pacific branch of a high technology MNC based in Hong Kong
3) Retired business development head of a technology certification organisation
4) Director of a research department within the School of Communication in Chinese University of Hong Kong
5) Co-Director of BBA Joint Degree programme in Chinese University of Hong Kong
6) Former marketing manager of an information technology services provider

Result:

i) One question about technology support was expanded to improve understanding.

ii) Topic was revised to improve clarity and understanding.

iii) Ethical standards, such as privacy and data integrity protection were added.

iv) Chinese Translation was provided to ensure respondents' full understanding of the original questions.

v) Survey questions that are personal and company specific were moved to the end of the survey to increase completion rate of survey according to the suggestion from one academic.

vi) Some of the TRI questions were rephrased to make sure they address directly at the respondents.

vii) Introduction of consistent timeframe by focusing on the last three to five years for all performance related questions.

B) Phase Two – Refinement Interview

After incorporating the feedback from Phase One, owners or CEOs of seven high technology small and medium enterprises in Hong Kong were invited to review the survey questions in detail. The main business focus of their companies include artificial intelligence, integrated circuits design, bio-medical engineering, electronic healthcare, smart property management and next generation video and audio technologies. These technology areas are rated as the most important and innovative industries for Hong Kong going forward by the Hong Kong government. From an age perspective, they are all in their mid-forties to mid-fifties, which also corresponds to the CEO age pattern exhibited by the fast growing startups in the US (Azoulay et al., 2020). Hence, their feedback on the questionnaires are tightly coupled to the future success of Hong Kong from an innovation management perspective. Besides ensuring that they have a clear understanding of the purposes of the survey, the relevance and effectiveness of the survey questions were discussed in a physical interview so that the researcher could record both their reactions and feedback to the instrument.

i) Comments from founder of a local medical implant company (~thirty staff members, started company in his late forty, previous sales and product head in local machinery companies, a reputable high school graduate) – Questions are easy to understand and length is acceptable. Additionally, he prefers to develop his own IP but is willing to turn university ideas to commercial products also through in-house research.

ii) Founder and CEO of an Internet of Things and platform company (~ten staff members with specialisation in IoT, around thirty staff in Platform – started

company in early to mid-40s after former employer, freescale, closed HK office) – minor wording adjustment, looks good otherwise.

iii) Founder of medical monitoring devices company (~twenty five staff members) – highlighted the importance of clarifying to respondent that questions for technology perception assessment is for daily life rather than for work. Expect questionnaires can filter out those experienced entrepreneurs from beginners.

iv) Founder of fabless IC company (PhD and Adjourned professor) – suggested three questions about inbound open innovation has a certain level of overlapping and it has since been combined into two questions only. Also highlighted the use of the word "sometimes" in TRI (for question 9 & 11 – insecurity and discomfort) may in biased respondent to reply with "agree".

v) Founder of an AI based customer behaviour Analytics Company – good questions for entrepreneurs and staff to rethink about management. Suggest to add questions or measurement for other personal aspects such as how to see raising kids and travel plan as an additional psychological measurement area. Also how they invest stocks and what other investment habit they would take. Inclusion of items like what YouTube channel they watch and frequency of using technology – these will be part of future research to expand the understanding of entrepreneurial profile to make it more comprehensive. However, the suggestion of adding item like Crypto to make questions more contemporary is implemented.

vi) Founder of video and audio streaming product company – questions are easy to understand, good measurement for area such as execution (as he likes to keep the team together), leadership (as the team has grown together like a family) and entrepreneurship (adjustment of product and business market strategy to adapt to market need)

vii) Founder of AI-IOT Device Company – questions reminded him a lot of things in managing a company

3.5) Questionnaire Summary

The details of the questions and the relevant references can be found in Appendix One. The nature of the questions is summarised in the table below.

Area Being Surveyed	Reference	No. of Questions
General Background	Dawes, J., 2008	6
Technology Readiness Assessment	Parasuraman, A. and Colby, C.L., 2015	16
Transformational Leadership	Carless, S.A., Wearing, A.J. and Mann, L., 2000, Kouzes & Posner, 1990, Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung, Podsakoff, MacKenzie, Moorman, & Fetter, 1990	5
Learning Orientation	Wang, C.L., 2008	9
Entrepreneurial Orientation	Wang, C.L., 2008	8
Level of Inbound Open Innovation	Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013, Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021, Cheng, C.C. and Shiu, E.C., 2015	3
Performance of Organisation	Calantone, R.J., Cavusgil, S.T. and Zhao, Y., 2002, Venkatraman, N. and Ramanujam, V., 1986, Bontis, N., Crossan, M.M. and Hulland, J., 2002, García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006, Hughes, M. and Morgan, R.E., 2007, Costello and Rimol, M., 2021	4

Table 3.4 - High Level Summary of Survey Instrument Composition

3.6) Chapter Summary

In this study, a well-established instrument, such as TRI 2.0, will be utilised to define the research methodology based on a quantitative approach. This should help us to establish a balanced approach instead of a pure positivist or non-positivist approach and ensure the perspective of this research is compatible with own research interests and predispositions, while remaining open to the possibility of other assumptions and interests (Orlikowski & Baroudi,

1991:25). Google survey form will be used as the primary tool for collecting respondent feedback. By offering participants an anonymous questionnaire, the survey does not only protect the privacy of the respondents but also enables them to have a direct channel to provide results to the researcher and help to reduce of common method bias (Podsakoff et al., 2003). The sampling period run from mid-August till mid-December 2022 so due to time constraint, it was not long enough to support a longitudinal study.

The entrepreneurial part of the survey is based on the instrument used by Wang (2008) which was originated from the entrepreneurial orientation study by Miller (1983) and extended by subsequent studies (Covin & Slevin, 1986, 1989; Naman & Slevin, 1993) with the refined scale that is now known as the Miller/Covin and the Slevin scale (Brown et al., 2001). Wiklund (1998) identified at least twelve studies based on this scale, and these studies suggested that this measure is a viable instrument for collecting firm-level entrepreneurship. Proactiveness is assessed by asking managers about the firm's tendency to lead, rather than follow, in terms of developing new procedures, technologies, and new products or services (Covin & Slevin, 1989; Miller & Friesen, 1978). Firm risk-taking is assessed by asking managers about the firm's propensity to engage in risky projects and managers' preference for bold versus cautious acts to achieve firm objectives (Lumpkin & Dess, 1996). Lumpkin's and Dess' (1996) innovativeness instrument is used to measure attitude towards innovation. In total, eight items were included in the entrepreneurial orientation scale.

This study also incorporated Wang's (2008) learning orientation scale, which was first developed by Sinkula et al. (1997) and retested by Baker and Sinkula (1999), who further corroborated its validity and reliability. Nine items related to the learning orientation portion, which was grouped into three first-order factors (i.e., commitment to learning, open-mindedness, and shared vision), were used. Commitment to learning is measured by examining the extent to which firms place value on organisational learning and consider learning as an investment rather than as an expense (Sinkula et al., 1997). Open-mindedness is measured through examining whether a firm critically reflects on existing assumptions and business processes (Sinkula et al., 1997). Shared vision is

measured by examining the extent to which a firm holds a common goal at different levels and promotes a sense of direction (Baker & Sinkula, 1999). For transformational leadership, instrument were adopted from findings of Avolio et al. (1999), Carless et al. (2000) Hitt et al. (1998) and Rafferty et al. (2004). To measure the extent of inbound open innovation, the research used established tools from Sisodiya et al. (2013), which Singh et al. (2021) and Popa et al. (2017) had also adopted in their studies.

In order to collect the critical innovation performance factors highlighted by Tidd and Bessant (Tidd & Bessant, 2020: 536), this study used survey questions from a number of scholars (Calantone et al., 2002; Venkatraman & Ramanujam, 1986; Bontis & Hulland, 2002; García-Morales et al., 2006; Hughes, & Morgan, 2007). As such, measurement of new products, ratio of return on investment, sales growth and market share, as well as status of customer base expansion was captured. However, due to time constraint, the focus of this study is mainly on management elements so psychological elements beyond those listed in TRI 2.0 were not included. Details of the items can be found in Appendix One.

Finally, prior to the final questionnaire design, two rounds of exploratory interviews were conducted. The initial survey instrument was reviewed by professionals in the high-tech industries but not founders or top management. The updated instrument was then assessed by seven top executives as part of Phase Two review to ensure all questions are easily and appropriately understood. All feedback was subsequently included in the final questionnaire and the following chapter will be devoted to describing the results collected.

Chapter Four – Empirical Data Collection and Results Analysis

The survey data collection period began in mid-August 2022 and ends at mid December 2022 to ensure the external environment is relatively consistent before the re-opening of the Chinese border. With the close relationship between many Hong Kong high technology SMEs and the mainland, this change could play a major role in redefining the trading and organisation performance in Hong Kong that may affect the response due to new uncertainties.

4.1) Approach Used for Data Sampling

The firms selected for this study are Hong Kong SMEs from high technology sector. These companies were selected in order to ensure inbound open innovation is relevant due to the fast moving nature of technology business. As the home to many Hong Kong high technology companies, the Hong Kong Science and Technology Park (HKSTP) is chosen to be the core area of the sampling of this research due to the iconic concentration of high tech SMEs. This selection is supported by the fact that HKSTP has a R&D population in excess of 13,000 individuals, which was around one third of the total R&D personnel (39000 in full-time equivalent) in Hong Kong (HKSAR Census & Statistics Department, 2023).

Furthermore, the high level of entrepreneurial activities amongst HKSTP companies is providing a solution to the challenge raised by Ireland (2009) for corporate entrepreneurial research. According to Ireland, firms with highly entrepreneurial strategies may be few in number. However, researchers must be able to identify samples of firms that exhibit corporate entrepreneurial strategies to various degrees. Particular difficulty for researchers will be identifying firms exhibiting highly entrepreneurial strategies as most firms may not possess robust entrepreneurial strategies. In fact, many firms employing highly entrepreneurial strategies are vulnerable to collapse (Ireland et al, 2009:40).

The final questionnaire was directly distributed to at least 150 of Hong Kong based SME entrepreneurs or top management members via Google Forms using electronic media such as email and WhatsApp with the survey link embedded to make accessing the survey easy. These entrepreneurs are located in

the Hong Kong Science Park and distributed across key industries. As the total number of local SMEs tenanted in HKSTP at that time was around 500, this represented the survey was sent to around 30% of the population. Moreover, since the target respondents of this research are from the high-tech industries, it is most likely their preferred method of communication is online survey instead of paper based survey. All respondents will remain anonymous unless they purposely put their contact as part of the survey feedback. To improve the response rate, the questionnaire was sent by researcher who knows these entrepreneurs personally and follow up reminders were also sent where necessary.

As mentioned in the optimisation section, data was collected in three stages. After an initial review, a pilot study was subsequently performed and following that Google forms were used to conduct a questionnaire. Five SMEs were selected from the HKSTP tenant list to perform the pilot study. Based on their responses and subsequent interviews with participants in the pretest, minor modifications were made to the questionnaire and summarised in the optimisation section. Responses from the firms that participated in the pilot study were not included in the final sample. The survey was ran between mid-August and mid December 2022 by using Google Forms. In total, a final dataset of 110 valid cases was obtained, yielding a response rate of 73%. Data was examined for non-response-bias by comparing the characteristics of early and late participants in the study. Results of comparison revealed that non-response bias does not represent a threat for the results obtained and their interpretation.

According to Kline, there should be a minimum of 10 samples for every parameter that's estimated and in the initial model of this research, 9 parameters exist: 4 from TRI, 1 from acceptance level of inbound open innovation, 3 from management framework and 1 related to organisational performance. Hence, the total number of responses is sufficient to produce a meaningful model (Kline, 2015) and this research will proceed with the selected model for parameters validation based on the collected responses. Finally, as the pilot study samples were collected evenly from each of the key industries operating in the Hong Kong Science Park, the risk of pilot data biasing is low. In fact, the mass survey data collected subsequently from SME entrepreneurs were also evenly distributed

across key industries in Hong Kong Science Park so biasing towards specific characteristics was inherently avoided.

4.2) Demographic Background of Respondents

4.2.1) Participant Role in the Company

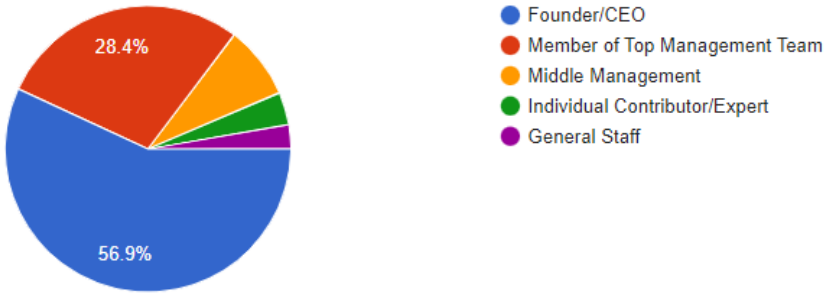


Figure 4.1 - Role of Respondents in the Company

More than 85% of respondents are from the top management of the organisation. If middle management (~9.3%) is included, 95% of the respondents in the survey are mid- to high-level decision makers.

4.2.2) Tenure in the Company

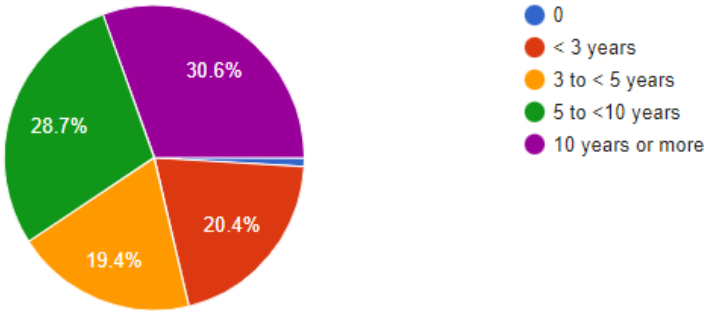


Figure 4.2 - Tenure of Respondents in the Company

The tenure of respondents in the company is fairly evenly distributed, enabling a broader spectrum of opinion to be included in the analysis of this research from an on-the-job duration perspective.

4.2.3) Age Distribution of Respondents

The largest respondent group is from the 40 – 50 age group and the total from 50 – 60 group is not far behind. This age group distribution is slightly higher than the distribution results shown by a similar survey done in the US

for high-tech startup which could be the result of higher conservatism in Asia in general. Nonetheless, the dominancy of the 40 – 50 age group in the survey still corresponds to the CEO age pattern exhibited by the fast growing startups in the US (Azoulay et al., 2020).

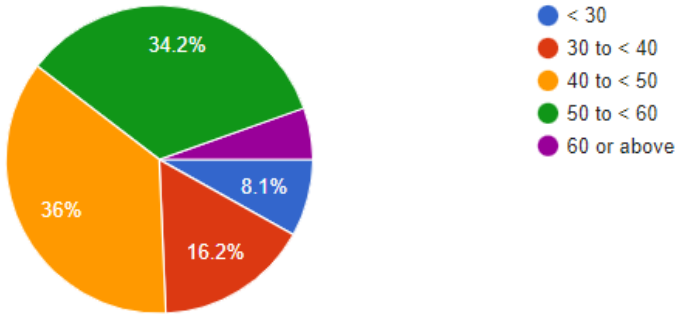


Figure 4.3 - Age of Respondents

4.2.4) Industry Experience of Respondents

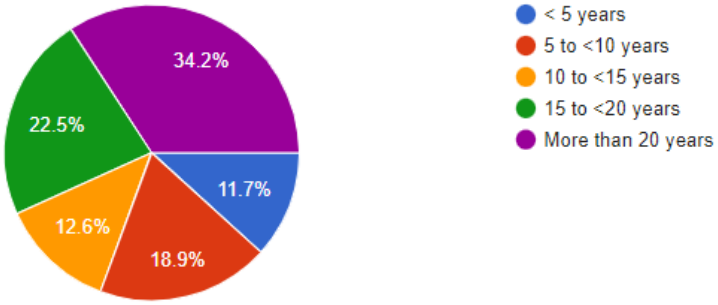


Figure 4.4 - Industry Experience of Respondents

The majority of the respondents in this survey have solid experience in the current or similar industries and the duration of experience in each is well distributed, therefore, their decision of innovation adoption should be representative of the high technology industries in Hong Kong as a whole.

4.2.5) Experience in Current and Similar Management Role

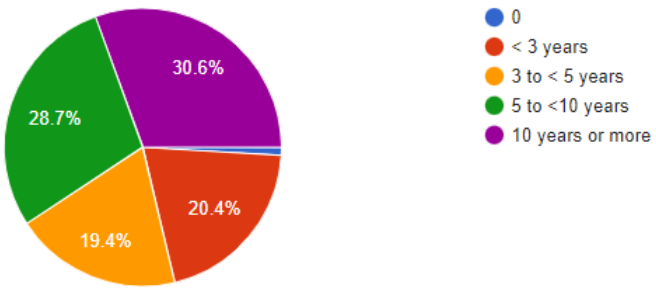


Figure 4.5 - Experience in Management Role of Respondents

Technological decision made by participants in this survey should be supported by professional judgment since 79% of the respondents have substantial experience (> 3 years) in their current management role.

4.2.6) Years of Company Establishment

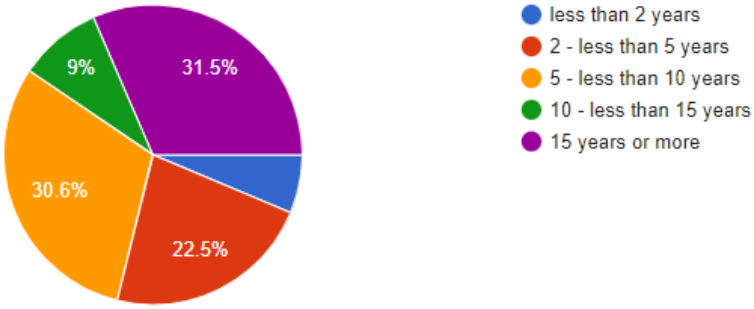


Figure 4.6 - Years of Company Establishment

More than 71% of the surveyed companies have been established for more than 5 years, indicating that they have moved beyond the turbulent startup stage and need to think and grow strategically.

Based on the composition of the respondents in this survey, it should provide us with a solid foundation for analyzing the attitude of Hong Kong high-tech entrepreneurs.

4.3) Validation of the Proposed Model

This section summarised the steps taken in validating the proposed model through the use of correlation matrix, cronbach alpha and primary factor analysis. Subsequently, inputs that may not be relevant contributors to the model development analysis of this research will be removed. This is critical because the model needs to meet with the various statistical requirements specified such as SRMR <=0.08, RMSR <=0.08 (acceptable) or <=0.05 (good), CFI= >0.95; IFI => 0.95; TLI => 0.95. In addition, GFI, which represents a measure of fit between the hypothesised model and the observed covariance matrix should contain a value of => 0.9 to ensure an acceptable model fit (Hu & Bentler, 1999). Jamovi v2.2.5 is the processing tool used for the analysis of this research.

4.3.1) Unreliable Data Identification and Removal

Initial feedback from respondents were screened without biases for integrity and results that consist of inconsistent data (e.g. industry experience > 15 years but age is <30) have been filtered as the first step of data validation.

4.3.2) Descriptive analysis

The descriptive analysis summary is shown below and the data distribution pattern does not exhibit any significant abnormalities. The measured mean value of Entrepreneurial Orientation, Transformational Leadership and Learning Orientation are all above average, meeting the entry requirement of holistic management f (H1∩H2 ∩H3) as defined within the 3H model. The company performance reported also showed an above average value, which is aligned with the ideal performance - management scenario suggested by 3H. More importantly, the level of inbound open innovation metrics was also higher than the average value, justifying the possibility that coherent existence among the three management elements can drive organisation performance within an inbound open innovation context.

Descriptives

	Optimism	Innovativeness	Insecurity-Inverted	Discomfave	InboundOilLevel	EOrientation	TFLeadership	LOrientation	Tenure	ExperienceInIndustry	Position	Age	CompanyPerformance
N	110	110	110	110	110	110	110	110	110	110	110	110	110
Missing	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean	4.26	3.87	2.85	2.92	3.95	3.66	3.95	3.89	3.65	3.50	4.35	3.13	3.63
Median	4.25	4.00	2.75	3.00	4.00	3.63	4.00	3.88	4.00	4.00	5.00	3.00	3.50
Standard deviation	0.651	0.702	0.802	0.619	0.544	0.466	0.581	0.574	1.15	1.43	0.915	1.02	0.669
Minimum	1.00	1.00	1.25	1.00	2.33	2.50	1.60	2.25	1	1	1	1	2.00
Maximum	5.00	5.00	5.00	4.75	5.00	5.00	5.00	5.00	5	5	5	5	5.00

Table 4.1 - Descriptive Analysis Summary

4.3.3) Independent Variables Reliability Verification through Cronbach Alpha Analysis

For elements that are composed of several questions, namely individual characteristics such as optimism, innovativeness and insecurity as measured by TRI, this study has confirmed that they are internally consistent (>0.7) while discomfort was found to be inconsistent (<0.7) so discomfort will be discarded from the model of this research. With a cronbach alpha of >0.7, the scale has shown it contains sufficient internal reliability (Nunnally, 1978). Discomfort may exhibit inconsistency due to the competitive and fast moving nature of the high technology industry where individual discomfort towards new technology is not a strong enough reason to reject new technology adoption by entrepreneurs due the survival need of their business. As such, discomfort will be removed from further analysis. Result of inbound open innovation adoption preference is also included in the analysis and the result was confirmed to be consistent.

Element	Optimism	Innovativeness	Insecurity	Discomfort	Inbound Open Innovation Adoption
Cronbach Alpha	0.82	0.83	0.73	0.61	0.73
Remark	Kept for further analysis	Kept for further analysis	Kept for further analysis	Removed from analysis	Kept for further analysis

Table 4.2 - Cronbach Alpha Analysis Summary for Independent Variables

Management and organisational elements such as entrepreneurial orientation, learning orientation and level of transformational leadership were also validated by Cronbach Alpha and the results showed the instrument used produced internally consistent results valid for further analysis.

Element	Entrepreneurial Orientation	Learning Orientation	Transformational Leadership
Cronbach Alpha	0.70	0.86	0.77
Remark	Kept for further analysis	Kept for further analysis	Kept for further analysis

Table 4.3 - Cronbach Alpha Analysis Summary for Management Variables

4.3.4) Correlation Matrix Result

As shown in the generated correlation matrix below, there is strong relationship between personal characteristics surveyed by the instrument used in this survey, such as Optimism, Innovativeness and Inbound Open Innovation adaptiveness, and the management elements, such as learning orientation, leadership, entrepreneurial orientation and organisational performance. The correlation between all factors was also significantly less than one, indicating support for discriminant validity. On the other hand, the correlation matrix results did not indicate any highly correlated variables, while evidence of common method bias usually results in extremely high correlations (>=0.90) (Bagozzi et al., 1991). Hence, the collected results suggest that common method bias is not a serious threat in this study. The derived results exhibit strong empirical support for the proposed relationship in the model of this research. Finally, as suggested by the correlation matrix, the only personal characteristic that is not significantly related to entrepreneurial orientation and transformational leadership under the context of inbound open innovation is personal feeling of insecurity towards new technology so it will not be included in the model of this research.

Company performance was found to be positively correlated to optimism and positively correlated to entrepreneurial orientation, learning orientation and transformational leadership in a significant manner. Inbound open innovation adoption was shown to be positively and significantly related to entrepreneurial orientation, learning orientation and transformational leadership while entrepreneurial orientation, learning orientation and transformational leadership were also positively and significantly correlated with each other.

Correlation Matrix

		Optimism	Innovativeness	Insecurity-Inverted	InboundOILevel	EOrientation	LOrientation	TFLeadership	Tenure	ExperienceInIndustry	Position	Age	CompanyPerformance
Optimism	Pearson's r	—											
	p-value	—											
Innovativeness	Pearson's r	0.434***	—										
	p-value	< .001	—										
Insecurity-Inverted	Pearson's r	0.326***	0.200*	—									
	p-value	< .001	0.036	—									
InboundOILevel	Pearson's r	0.204*	0.251**	0.065	—								
	p-value	0.033	0.006	0.500	—								
EOrientation	Pearson's r	0.233*	0.365***	0.163	0.445***	—							
	p-value	0.014	< .001	0.089	< .001	—							
LOrientation	Pearson's r	0.235*	0.417***	0.200*	0.376***	0.528***	—						
	p-value	0.013	< .001	0.036	< .001	< .001	—						
TFLeadership	Pearson's r	0.291**	0.384***	0.136	0.400***	0.497***	0.607***	—					
	p-value	0.002	< .001	0.158	< .001	< .001	< .001	—					
Tenure	Pearson's r	−0.073	−0.094	0.026	−0.229*	−0.029	−0.128	−0.186	—				
	p-value	0.448	0.329	0.791	0.016	0.762	0.182	0.052	—				
ExperienceInIndustry	Pearson's r	−0.130	−0.003	0.040	−0.187	−0.016	−0.122	−0.146	0.533***	—			
	p-value	0.177	0.972	0.677	0.050	0.865	0.205	0.127	< .001	—			
Position	Pearson's r	0.169	0.329***	0.127	0.271**	0.325***	0.247**	0.252**	0.320***	0.109	—		
	p-value	0.077	< .001	0.185	0.004	< .001	0.009	0.008	< .001	0.257	—		
Age	Pearson's r	0.040	0.020	0.182	−0.049	0.186	−0.050	0.082	0.419***	0.547***	0.206*	—	
	p-value	0.678	0.836	0.057	0.615	0.052	0.602	0.394	< .001	< .001	0.031	—	
CompanyPerformance	Pearson's r	0.214*	0.277**	0.065	0.184	0.287**	0.417***	0.344***	−0.001	−0.169*	0.182	−0.127	—
	p-value	0.025	0.003	0.499	0.054	0.002	< .001	< .001	0.988	0.048	0.057	0.165	—

Note. * p < .05, ** p < .01, *** p < .001

Table 4.4 - Correlation Matrix Analysis for Variables Collected

4.3.5) Validation via Principal Components and Confirmatory Factor Analysis

Subsequent analysis was conducted using principal components analysis and confirmatory factor analysis to ensure the data collected were significant for further analysis and the results are listed as below.

A) Confirmatory Factor Analysis (CFA)

Factor analysis is a possible means to suggest dimensions because it can be used to confirm if the number of dimensions conceptualised can be verified empirically (Churchill Jr, 1979). CFA was used in this study because Technology Readiness Index and the measurement of entrepreneurial orientation, learning orientation and transformational leadership are well established models. Since this research is trying to extend the coverage of these known hypotheses to overlap with each other under the 3H framework, the adoption of a CFA approach for model validation is reasonable.

One Factor CFA result from Jamovi is listed below when three TRI elements (Optimism, Innovativeness, Insecurity), Level of Inbound Open Innovation Adoption, three management characteristics (EO, LO, Transformational Leadership) and Organisational Performance are included. Model of fit obtained is $\chi2(110) = 26.7$; $p = 0.143$; SRMR = 0.056, RMSEA = 0.055; CFI = 0.965; TLI = 0.951 and the result helps to establish that the required convergent validity, discriminant validity, and reliability of the constructs reported by these traditional fit indexes were within the acceptable range.

Factor Loadings

				95% Confidence Interval			
Factor	Indicator	Estimate	SE	Lower	Upper	Z	p
Factor 1	Optimism	0.263	0.0655	0.1349	0.392	4.02	< .001
	Innovativeness	0.388	0.0673	0.2567	0.520	5.78	< .001
	InboundOILevel	0.280	0.0527	0.1769	0.383	5.32	< .001
	EOrientation	0.315	0.0425	0.2313	0.398	7.40	< .001
	LOrientation	0.446	0.0501	0.3478	0.544	8.90	< .001
	TFLeadership	0.431	0.0512	0.3310	0.532	8.42	< .001
	CompanyPerformance	0.315	0.0654	0.1870	0.443	4.82	< .001
	Insecurity-Inverted	0.199	0.0823	0.0379	0.361	2.42	0.016

Table 4.5 - One Factor Confirmatory Factor Loading

It is also worth noting that the SRMR, RMSEA, CFI and TLI all improved when Insecurity is removed from CFA, giving hints for subsequent analysis. Moreover, the significance of the results degraded when tenure in the company, age of entrepreneur and experience in industry were included in the CFA model, meaning these three parameters do not make a significantly positive contribution to this particular construct.

B) Principal Component Analysis

Three unique component groups appear when eigenvalues > 1 is used as filter. With the low level of correlations, these components were shown to be independent by Jamovi.

Inter-Component Correlations

	1	2	3
1	—	0.00	0.00
2		—	0.00
3			—

Table 4.6 - Inter-Component Correlations under Principal Component Analysis

Detailed component loading based on varimax rotation is captured and listed below. It is clear that Innovativeness and Level of Inbound Open innovation adoption attached strongly with organisational performance and the three management characteristics (EO, LO and Transformational Leadership). As expected, TRI elements and Tenure/Experience in Industry grouped nicely as separate component groups.

Component Loadings

	Component			
	1	2	3	Uniqueness
Optimism			0.778	0.333
Innovativeness	0.490		0.521	0.488
Insecurity-Inverted			0.778	0.387
InboundOILevel	0.625			0.544
TFLeadership	0.769			0.368
LOrientation	0.799			0.332
EOrientation	0.776			0.376
CompanyPerformance	0.564			0.671
ExperienceInIndustry		0.863		0.248
Tenure		0.860		0.253

Note. 'varimax' rotation was used

Table 4.7 - Principal Components Analysis Results Generated by Jamovi (Eigenvalues > 1)

4.3.6) Model Construction Using Path Analysis

After confirming the validity of the data collected, the researcher proceeded to model creation stage. The model construction technique used in this study is from the path analysis function under the structural equation modelling (SEM) analysis feature of Jamovi. SEM analysis is based on the principles of interpreting multiple regression econometric, path and factor analysis (Bollen & Long, 1993) and defined to accommodate models that include measurement errors in both dependent and independent variables, multiple indicators, reciprocal causation, simultaneity, interdependence and latent variables (Marcoulides & Schumacker, 2013). This study has gathered many academic suggestions from previous researches and the model used in this research is an extension of Russell and Russell (1992), which is already a systemic structure so SEM can be applied directly to test the theory of this research rather than going through exploratory analysis. SEM was also chosen over other approaches in the investigation of this research since it helps researchers to conduct simultaneous testing of the whole structure of relations with their relations and effects assessed (Kerlinger, 1986). Failure to model systematic measurement errors leads to biased and inconsistent estimates of the key parameters if they exist.

Goodness-of fit indices and significance tests provided this study a valuable way in finding a structural equation model that can be accepted in a preliminary sense. Maximum likelihood is also used in the data analysis of this research because it is the most popular fitting function for structural equation models as it caters for a formal statistical test of overall model fit for over identified models and its estimates are scale invariant and scale free in general (Schermelleh-Engel et al., 2003). Since path analysis, factor analysis, structural equation modeling, and related multivariate statistical methods are all based on maximum likelihood or generalised least squares estimation used for covariance structure modeling (Bentler & Bonett, 1980), the result analysis will also utilise all these elements in search of the relevant elements.

Based on the distribution of electronic surveys, the number of responses collected was able to achieve the minimum of 10 cases for every parameter that's

estimated in the model used in this research. As such, given strong correlations exist within the model and the total number of valid responses (110) is sufficient to produce a meaningful model according to Kline (Kline, 2015), the chi square test result will be a reasonable measure of fit, which also enables the use of path analysis as a valid modelling approach.

4.3.7) How Fitting is the Proposed Model

This research performs structural equation modeling (SEM) approach to test the hypotheses, using maximum likelihood estimation techniques to test the model. The measures from the dataset were refined by assessing their uni-dimensionality and reliability where Maximum Likelihood factor analysis was used. During the model optimisation process, insecurity and optimism were also dropped as part of the independent variables from the analysis as this improves the reliability and significance of the model used in this research. Instead, tenure of entrepreneur in the company and his/her experience in current and related industries were added to improve the overall reliability of the model in predicting organisational performance.

Parameters estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
TFLeadership	EOrientation	0.513	0.1071	0.30319	0.7230	0.412	4.79	< .001
TFLeadership	Innovativeness	0.193	0.0711	0.05395	0.3328	0.234	2.72	0.007
LOrientation	Innovativeness	0.132	0.0637	0.00714	0.2570	0.161	2.07	0.038
LOrientation	EOrientation	0.324	0.1021	0.12392	0.5241	0.263	3.17	0.002
LOrientation	TFLeadership	0.410	0.0827	0.24811	0.5722	0.415	4.96	< .001
EOrientation	Innovativeness	0.180	0.0560	0.06998	0.2896	0.271	3.21	0.001
EOrientation	InboundOILevel	0.323	0.0723	0.18177	0.4652	0.377	4.47	< .001
CompanyPerformance	LOrientation	0.374	0.1228	0.13371	0.6150	0.323	3.05	0.002
CompanyPerformance	TFLeadership	0.173	0.1214	−0.06509	0.4109	0.151	1.42	0.154
CompanyPerformance	Tenure	0.110	0.0575	−0.00291	0.2223	0.190	1.91	0.056
CompanyPerformance	ExperienceInIndustry	−0.107	0.0464	−0.19817	−0.0163	−0.230	−2.31	0.021

Table 4.8 - Parameters Weighting Details at 95% Confidence Intervals

Reliability of the model used in this research improves by 10 percent while other statistical indicators within the model remain significant and at highly acceptable value when both tenure and industrial experience are included as predictors of organisational performance. Age of entrepreneur and the position factor do not provide any enhancement to the validity of the model. Interestingly, industrial experience relates negatively to performance under an inbound open innovation context. One possible explanation is entrepreneurs may prefer finding

their own innovation method due to pride and persistence instead of conveniently adopting external technology and a delay due to this persistence has negatively impacted organisational performance. As such, continuous technological and psychological training may be required for high technology SMEs entrepreneurs to improve their willingness to adopt technology quickly.

The fit of the final model is satisfactory ($\chi 2(110) = 12.1$; SRMR=0.049, RMSEA = 0.031; CFI = 0.993; IFI = 0.993; TLI = 0.986; RNI = 0.993; NNFI = 0.986; NFI=0.933), suggesting that the nomological network of relations fits the data and the validity of the measurement scales (Churchill, 1979). Since SRMR is also less than .05, it indicates a good fit has been achieved by the model used in this research (Hu & Bentler, 1995). The goodness-of-fit statistics (GFI = 0.999; MFI 0.995) obtained also indicate a strong model and supported the hypothesised 8 factor structure (One TRI element - Innovativeness, 3H management elements, organisational performance, level of IOI, tenure and industry experience) model. As shown by the path analysis and structural equation model above, the elements identified in research question two can be fitted into a reliable model to predict the likelihood of organisational performance and is shown in the section below.

4.3.8) Final Model Configuration and Weighting

The final model configuration and the respective weighting is summarised in the figure below.

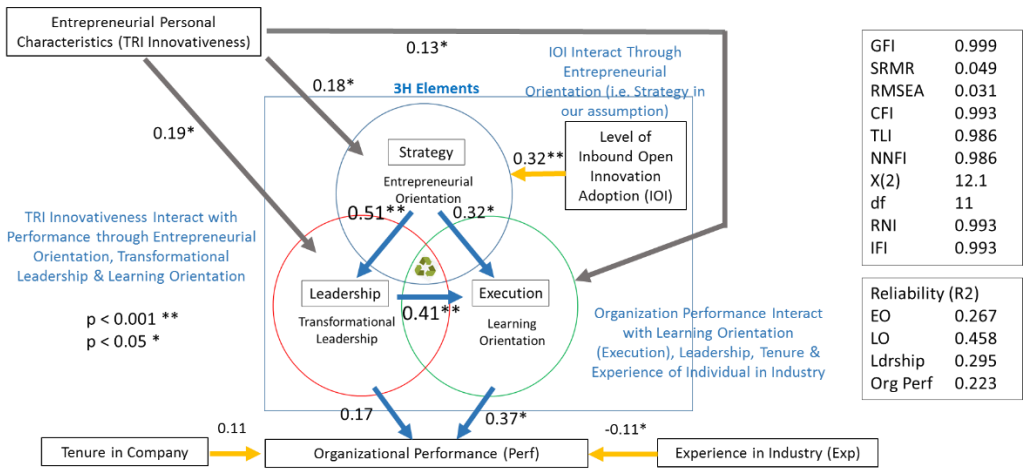


Figure 4.7 - Final Model with Configuration and Weighting

As the model used in this research exhibits good fit under a large number of validation indices, the addition of moderating variables was not necessary to

strengthen its reliability. This is consistent with the observation that moderator variables are introduced when there is an unexpectedly weak or inconsistent relation between a predictor and criterion variable (Baron & Kenny, 1986), which is not the case of this research.

4.3.9) Summary of Hypothesis Validity for High Tech SMEs in Hong Kong

Based on the new model created by embedding the 3H framework into Russell and Russell's model (1992), this study has obtained the empirical results as summarised in the table below.

	Managerial Characteristics of Organisation			Personal Characteristics of Top Management			
	EO (Entrepreneurial Orientation)	Leadership (Transformational Leadership)	LO (Learning Orientation)	Optimism	Innovativeness	Insecurity	Discomfort
Organisational Performance	H2a (S)	H2b (S)	H2c (S)	H4a (S)	H4b (S)	H4c (NS)	H4d (NS)
Inbound Open Innovation	H1a (S)	H1b (S)	H1c (S)				
Performance Impact due to Relationships between Management Elements	H3 (S)						

Table 4.9 – Hypotheses Validation Summary – (S = Supported, NS = Not Supported)

1) Hypothesis One - Inbound Open Innovation is positively related to three Core elements under 3H Management Framework

H1a –Entrepreneurial Orientation is positively related to the Level of Inbound Open Innovation

(Result: Supported by Correlation Matrix and shown as direct relationship in our model)

H1b –Transformational Leadership is positively related to the Level of Inbound Open Innovation

(Result: Supported by Correlation Matrix and shown as indirect relationship in the model used in this research)

H1c –Learning Orientation is positively related to the level of Inbound Open Innovation

(Result: Supported by Correlation Matrix and shown as indirect relationship in the model used in this research)

2) Hypothesis Two - Positive Correlation exists between EO, Transformational Leadership, LO and Organisational Performance

H2a – Entrepreneurial Orientation is positively related to Organisational Performance

(Result: Supported by Correlation Matrix and shown as indirect relationship in the model used in this research)

H2b – Transformational Leadership is positively related to Organisational Performance

(Result: Supported by Correlation Matrix)

H2c – Learning Orientation is positively related to Organisational Performance

(Result: Supported by Correlation Matrix and shown as direct relationship in the model used in this research)

3) Hypothesis Three – Positive Relationship between Management Elements can Enhance Organisation Performance under the context of Inbound Open Innovation

H3 – If Entrepreneurial Orientation, Transformational Leadership and Learning Orientation are all positive, organisational performance is also positive

(Result: Supported by Correlation Matrix and shown by relationship in the model used in this research)

4) Hypothesis Four – Personal Characteristics of Top Management is related to Organisational Performance

H4a - Managerial Optimism, as measured by TRI, has positive impact on Organisational Performance

(**Result: Supported by Correlation Matrix but not shown in our model)**

H4b - Managerial Innovativeness, as measured by TRI, has positive impact on Organisational Performance

(Result: Supported by Correlation Matrix and shown as indirect relationship in the model used in this research)

H4c - Managerial Insecurity, as measured by TRI, has negative impact on Organisational Performance

(Result: Not Supported)

H4d - Managerial Discomfort, as measured by TRI, has negative impact on Organisational Performance

(Result: Not Supported)

Other questions raised by Statement of Problems listed in Section 1.5.

a) Under an innovation environment, causal relationship exists between the framework elements and responsible for driving the outcomes of inbound open innovation implementation to deliver the firm's performance

(Result: Supported by validation against pre-requisite listed by Van de Ven and empirical shown by the result in the model used in this research)

b) How the framework can be applied to explain an inbound open innovation driven SME's performance?

(Result: Elements can be combined in the structure suggested by the result of the empirical model)

4.4) Chapter Summary

This study has empirically explained or proposed solutions to the research questions raised in Chapter two based on the collected data. More importantly, the findings of this study also extended the relationships identified by other researchers (Popa et al., 2017; Wang et al., 2015; Lichtenthaler, 2011; Dahlander & Gann, 2010; van de Vrande et al., 2009 and Singh et al. 2021) within the

inbound open innovation and organisational performance context. Findings of this study has revealed new understanding of inbound open innovation which will be discussed in the following chapter. Due to time constraints, data were collected from entrepreneurs operating within Hong Kong Science Park so the respondents are also benefited by the clustering effect as suggested by Porter.

Chapter Five – Discussion of Findings

The primary motivation for innovation in private sectors and SMEs is to maintain or increase profitability, improve market share, create new products or services to gain differentiation advantage, as well as cutting costs through innovation without stretching workload (Mulgan & Albury, 2003). Rapid advancement of technology in recent years are pushing companies to continuously work on creating new competitive advantages through innovation. Acceleration of technological progress is also becoming a major engine of dynamic competition. Management of technological innovation requires an understanding of both the broad industrial and business context so manager needs to know what drives innovation and the different approaches that may be required (Dodgson et al., 2008). In the following sections, the contributions towards developing a management framework for managing inbound open innovation in SMEs is summarised.

5.1) Identification of Key Elements for Effective Inbound Open Innovation Management

For each generation of industrial revolution to succeed, it must be accompanied by social innovations in areas of organisation, management and government regulations. Innovation involves overcoming obstacles, such as culture and trust, which are deeply rooted in a particular location (Hossain, 2015). The cross functional nature and complexity of technological innovation is presenting a major challenge to management of research and development based technology organisations. The long-term success of companies depends on the ability to manage streams of innovation instead of just a single event (Tushman, 1997). This happens because research activities are no longer restricted to a single area and need to be organised dynamically to interact with external actors found in external context, which may well be geographically distributed (Chiesa, 2001). Such environment is elevating the importance of inbound open innovation as a propellant of organisational success. Hence, a useful first step in the pursuit of entrepreneurial orientation effectiveness and performance is the establishment of a framework (Covin et al., 2006).

By using Van de Ven's factors of innovation (1986), this study has adopted the use of 3H framework as the theoretical reference of this research. Through incorporating 3H framework into the innovation model developed by Russell and Russell (1992), this research has proven the feasibility to incorporate different elements for the management of inbound open innovation in this model. For instance, entrepreneurship is defined as a management process (Stevenson, 1983) but management transformation from an entrepreneurial approach to a professionally structured organisation is always a challenge and a growth threshold (Dodgson et al., 2008). As shown by the findings below, the model adopted in this research has overcome such challenges by operationalising entrepreneurial orientation as the strategic head, learning orientation as execution hand and transformational leadership as heartful leadership within the 3H framework. This operationalisation is supported by the summary of previous research studies as listed in Chapter two, where there is a strong possibility of combining these three elements constructively to deliver coherent performance.

5.2) Establishment of Causal Relationships between Different Elements as Part of Inbound Open Innovation Management Implementation

The selected model has confirmed that management innovativeness has a positive influence on business performance (Hughes & Morgan, 2007) for Hong Kong high tech SMEs. The relevance of foundation factors within TRI 2.0 in explaining organisational performance as forecasted by Parasumara under an inbound open innovation environment (Parasumara & Colby, 2015) was confirmed. The addition of management attitude towards innovation is an important extension to existing methods of innovation audit because most of these audit tools only assess a firm's resources for innovation, innovation capabilities and innovation process (Dodgson et al., 2008). Hence, by including the assessment of management attitude, the selected model of this research has further expanded the scope and perspective of measurement. Through the instrument used in this research, a longitudinal analysis tool is made available to assess the effectiveness of inbound open innovation on a periodic basis to predict the likelihood of SMEs' future performance.

In providing a new framework that consolidates elements such as personal characteristics of entrepreneurs, managerial factors and external environment, this study offers a possible explanation of causal relationship for these key elements that are identified as part of innovation adoption (Dodgson et al., 2008). This study also contributes to the general understanding of innovation adoption by providing a simple yet conceptually sound model to cover many of the important integrative themes as identified by a study of 20 key adoption theoretical frameworks (Wisdom et al., 2014). These include external environment, absorptive capacity, which is part of learning orientation, leadership and readiness to change through innovation adoption.

By using entrepreneurial orientation, transformational leadership and learning orientation as strategic (head), leadership (heart) and execution (hands) elements based on the 3H framework, this study has successfully developed a model that is able to inductively describe and to deductively prescribe how entrepreneurial acts to drive inbound open innovation, leverage new technology, and execute flexible management approach to enhance organisational performance. The causal relationship shown by the selected model of this research offers broad implications to high technology SMEs organisational management because by expanding the comfort level of innovation adoption, organisations can attain the possibility of future performance improvement by applying the model to predict an innovation project/venture outcome. This research has also shown the attitude of entrepreneur towards inbound open innovation adoption and new technology is not directly responsible for organisational performance. Instead, as shown by the investigation of this research, the relationship between attitude and performance needs to be mediated by management framework as suggested by numerous scholars, such as Rogers (2003), who predicted intention and preferences will need to be converted to corporate action plans in form of strategy and executed through leadership guidance and other relevant behaviour.

The results also confirmed the existence of a causal chain in determining the effect of inbound open innovation on organisational performance (Zahra 1999), which can be enhanced by entrepreneurial innovativeness. This helps to

provide a longitudinal solution to investigate the causal relationships under inbound open innovation which was not yet available prior to this study (Brunswicker et al., 2015; Popa, et al., 2017). As shown by the selected model, it is possible to establish a causal relationship between the level of inbound open innovation adoption and entrepreneurship which can ultimately influence the level of transformational leadership and learning orientation to drive organisational performance. The important role of learning orientation as a mediator between transformational leadership and performance is also confirmed by this study. This is consistent with previous findings (Garcıa-Morales et al., 2008; Bass & Avolio, 2000) and this study also expanded the findings by Wang (2008) in two ways. Firstly, learning orientation mediates the relationship between entrepreneurial orientation and organisational performance within the Hong Kong high-tech SMEs context. Secondly, through applying the 3H framework, this study has added transformational leadership as a second mediator into Wang's model despite learning orientation remains the more dominant mediator over transformational leadership. This addition is supported by empirical data so future researchers can consider using both leadership and learning orientation as mediators for entrepreneurial orientation in forecasting high-tech SMEs performance.

The following sections will feature summaries of this study's findings of the different interactive and causal relationships between these key elements under the inbound open innovation management framework against theoretical observations.

5.2.1) Confirming the Causal Relationship between Inbound Open Innovation and Entrepreneurial Orientation

Throughout the journey of innovation management studies, scholars have developed various models in an attempt to group different antecedents together to explain innovation and organisational performance. These antecedents range from organisational learning and knowledge management, entrepreneurship and strategy, transformational leadership and organisational culture/behavior, external environmental factors to resources and organisational structure. They all

suggested innovation processes must align with the strategy of the organisation to overcome different challenges that arise during execution. However, most models fell short in explaining how to provide a holistic management approach in ensuring the continual success of innovation. Different aspects of organisational competencies that drive organisational innovation and performance must be addressed under a multi-dimensional structure and one sample approach is listed in figure below (Siguaw et al., 2006:562).

Figure 5.1 - Model of Innovation Orientation: Drivers, Actions and Outcomes (Siguaw et al., 2006:562)

Entrepreneurial orientation can strengthen the positive performance effects of inbound open innovation significantly more than resource orientation alone (Cheng & Huizingh, 2014). Based on the empirical finding of this study, the level of inbound open innovation adoption is indeed a causal driver of entrepreneurial orientation (0.32**) as suggested by Cheng and Huizingh. By replacing strategy with entrepreneurial orientation, this result can also be explained by Siguaw's suggestion because innovation orientation drives strategy, learning, and functional interaction of a firm collectively towards the goal of innovation (Siguaw et al., 2006:560).

Finally, according to Kim and Mauborgne, there are four major hurdles in an organisation that inhibit strategy execution. They are cognitive, resource-related, motivational, and political hurdles. These hurdles can be overcome by

“tipping point leadership” that is capable of bringing about fundamental changes very quickly through engaging the belief and energy of a critical mass of people so conversion to a new idea within an organisation will spread like an epidemic. This type of tipping point leadership, who makes unforgettable and unarguable calls for change, who concentrate their resources on what really matters, who mobilize the commitment of the organisation’s key players, and who succeed in silencing the most vocal naysayers (Kim & Mauborgne, 2014:110), is very similar to transformational leadership. Hence, as shown by the figure below, a transformative leadership approach supported by effective execution and a forward-looking strategy works well to motivate existing staff to adopt new innovation and ideas as suggested by Kim and Mauborgne.

Figure 5.2 - Blue Ocean - The Four Organisational Hurdles to Strategy Execution (Kim & Mauborgne, 2014:150)

Fortunately, as shown by the empirical model used in this research, leaders can achieve better results through a more entrepreneurially oriented strategy that is mediated by transformational leadership and a learning oriented organisation. In the following sections, how different relationships can be structured to contribute towards organisational success will be presented.

5.2.2) Enhancement of Entrepreneurial Orientation by Transformational Leadership

Entrepreneurial leaders' passion, creativity, and vision motivate others to experiment and learn for themselves. They set examples and encourage others to emulate their behavior and challenge status quo and such a leadership

characteristic is an integral part of organisations that seize and profit from new opportunities as they arise (Renko, et al., 2015). Entrepreneurial leaders establish conditions conducive to role performance and social exchange that include organisation trust, consensus on dominant logic, and appropriate organisational controls (Dess et al., 2003). This is done by linking different variables together through encouraging non-authoritarian structures that facilitate creativity, dialogue and collaboration (Alegre & Chiva, 2013).

Entrepreneurship and leadership converge in areas such as vision, influence on followers, motivating others, risk-taking, creativity or innovativeness (of the leader as well as followers), high tolerance for ambiguity and proactiveness (Renko et al., 2015:56). Entrepreneurial leadership is also more transformational than transactional (Chung-Wen, 2008:273) because entrepreneurship relates positively to inherent elements of transformational leadership. Leaders with these elements embrace empowerment, teamwork, an innovative and change supportive culture, more de-centralisation and less structural boundaries (Covin & Slevin, 1991; Zahra, 1993). By displaying innovative actions to achieve goals, transformational leaders are also more likely to become champions of entrepreneurship (Howell & Higgins, 1990).

To develop strategic flexibility and competitive advantages, leadership must encourage out-of-the-box thinking among all employees through communicating a long-term vision while also gaining their commitment to sail through continuous changes (Hitt et al., 1998). Organisations also need to have the flexibility to forecast changes and meet new demands as they occur and only transformational leadership can enable a firm to do so (Bass & Riggio, 2006). To maintain strategic flexibility, top leaders can also maintain entrepreneurial activities through the introduction of new managerial approaches and innovative administrative arrangements to facilitate the collaboration between entrepreneurial participants and the organisations in which they are active (Burgelman, 1983).

From the Hong Kong-based empirical results of this study, transformational leadership is positively and significantly correlated to

entrepreneurial orientation. As such, it supports the propositions from many scholars who claimed that entrepreneurship relates positively to transformational leadership (Covin & Slevin, 1991; Zahra, 1993; Eyal & Kark, 2004; Howell & Higgins, 1990). Coming in third in terms of correlation weighting, the strength of this relationship (0.497***) is only slightly lower in weighting than the relationships between learning orientation - transformational leadership, and learning orientation – entrepreneurial orientation. Furthermore, the structural equation model of this research has also confirmed that entrepreneurial orientation produces the best performance when transformational behaviour are at the highest (Chung-Wen, 2008; Engelen et al., 2015). For the development of relative advantages in inbound open innovation, transformational leadership with higher entrepreneurial orientation can contribute to higher business performance (Chung-Wen, 2008). This can be explained by the structural equation model in which transformational leadership is a mediator between entrepreneurial orientation and organisational performance. Entrepreneurial orientation is indeed a strong causal driver (0.51**) of transformational leadership in this study. This can be the direct result of transformational leadership promoting innovation within an organisation to create advantages. Hence, this study confirmed that entrepreneurial orientation of Hong Kong high tech SMEs management is casually enhanced by a transformational leadership approach. This enhancement to entrepreneurial orientation is important within the framework used in this research because transformational leadership was found to create the most favorable managerial circumstances for entrepreneurial activism in organisations (Eyal & Kark, 2004).

5.2.3) Entrepreneurial Orientation Interworking with Learning Orientation

Entrepreneurial orientation is an amalgamated construct composed of both strategies and actions (Hult et al., 2004; Naman & Slevin, 1993). It is also perceived behaviorally as the processes, practices, and activities that result in innovation (Slater & Narver, 1993; 1995). Hence, entrepreneurial orientation inherently includes execution as part of its characteristics. Since proactivity, a major characteristic of entrepreneurship, is also geared toward modifying the environment and not simply adapting to it, it favors generative learning (García-

Morales et al., 2006). The level of proactive perception on the surrounding environment by top managers also determines how organisations arrange innovation and learning to maintain their edge in the competitive environment (García-Morales et al., 2006).

Furthermore, organisations that promote entrepreneurship learn and innovate, encouraged by the presence of key pre-existing internal or external attributes that enable it to change, renew and reinvent themselves (García-Morales et al., 2006). This happens as entrepreneurial orientation enables flexibility and facilitates firms to reconfigure their skills and talents (Wang, 2008:649). Learning orientation must also be in place to maximise the effect of entrepreneurial orientation on performance especially in more entrepreneurial firms (Wang, 2008) because organisational learning is a principal means of achieving the strategic renewal of an enterprise. Corporate entrepreneurial activities are very important for promoting organisational learning and developing new knowledge that generates advantages (Dess et al., 2003). The existence of entrepreneurial orientation within an organisation can create significant opportunities for multi-dimensional organisational learning (Pinchot, 1985). This happens because organisation is influenced by industry, markets, competitors, external environment, internal operations and processes while scouting for opportunities (Zahra, 1991).

On the other hand, learning and its management plays a crucial role under inbound open innovation context especially during the opportunity sensing and seizing stages (Teece, 2007). Simply having entrepreneurial orientations as a corporate strategy does not automatically lead to better performance because deeply rooted values and beliefs that bring about certain behaviors can affect firm performance (Zhou et al., 2005:54). Firms that want to engage continuously in innovation should first build learning mechanisms in their organisations to enhance their ability to accumulate, assimilate, and apply both internal and external knowledge (Zhao et al., 2011).

Organisational learning itself needs to encompass the entire enterprise instead of only at the individual or group level because organisation operates in an open system (Crossan et al., 1999). Knowledge creation within the

organisation should be at the center of company human resources strategy supported by organisational design, business practices and managerial responsibilities so personal knowledge becomes readily available to others (Nonaka et al., 1995).

Through either formal or informal entrepreneurial activities within an organisation, company performance can be enhanced as the creation of new knowledge becomes a foundation for building new competencies or revitalizing existing ones (Zahra et al., 1999: 169). Entrepreneurial orientation can enhance the positive relationship between knowledge-based resources and performance because it helps to focus the organisational structure. This structural alignment can facilitate the utilisation of the firm's knowledge-based resources to discover and exploit opportunities (Wiklund & Shepherd, 2003). The utilisation of unique competence driven by entrepreneurial activities contribute to the exploitation of resources in a better way (Madsen, E.L., 2007). As a result, such improved usage of resources will lead to better organisational performance.

To provide additional insights to the findings of this research, causal relationships between entrepreneurial orientation and organisational learning is shown below. This competence-based approach suggests organisational performance and competitive advantage can be enhanced by corporate entrepreneurship as it drives organisational learning to achieve organisational performance (Zahra et al., 1999).

Figure 5.3 - Corporate Entrepreneurship, Knowledge, & Organisational Competence Development (Zahra et al., 1999:172)

As shown by the empirical results of this research, the positively and significantly correlated relationship between entrepreneurial orientation and learning orientation proves the existence of entrepreneurial orientation within an organisation can create significant opportunities for learning orientation (Dess et al., 2003; Pinchot, 1985; García-Morales et al., 2006). Coming in second in terms of correlation weighting, the strength of this relationship (0.528***) indicates the presence of entrepreneurial orientation work favorably with a learning culture to produce innovation effectively (Slater & Narver, 1993; 1995). The structural equation model generated by the empirical data also confirms learning orientation should be in place and act as a mediator between the entrepreneurial orientation and organisation performance relationship so the effect of entrepreneurial orientation on performance can be maximised (Madsen, E.L., 2007; Wang, 2008; Wiklund & Shepherd, 2003; Zahra et al., 1999)

The findings also indicate entrepreneurial orientation is beneficial to firms with organisational learning capability because their strategies support deep integration of external sources into a company's innovation activities. However, after gaining broader access to knowledge and expertise, as in the case of inbound open innovation, organisations must revise their strategy-making processes to cope with more challenging environment (Miller & Friesen, 1983). At the same time, top management needs to have the vision and commitment of resources to develop and assemble the requisite human assets to cultivate the innovation capabilities necessary for success (Rothaermel & Hess, 2007). This is because development of competitive advantages requires building dynamic core competence with the focus on developing human capital. Besides, the possession of an organic structure, the ability to respond quickly to changing market conditions, and pursuing planned, well-crafted strategies are critical intervening mechanisms in the entrepreneurially orientated strategic learning capability relationship (Anderson et al., 2009).

In addition, a model which suggests how strategy, knowledge and organisation specific elements are responsible for delivering business performance is shown in the figure below (De Long, 1997:3). These suggestions from Zahra and De Long are also proven by this study as entrepreneurial

orientation is a causal driver (0.32*) of learning orientation in delivering organisational performance under an inbound open innovation environment.

Figure 5.4 - An Overview of Knowledge Management Elements (De Long, 1997:3)

5.2.4) Bringing Learning Orientation and Transformational Leadership to Work Collectively

Culture and climate are reflections of leaders' attitude and behavior while effectiveness of organisational learning also depend on leadership style. Trust and support, which are major features of transformational leadership, were also identified as some of the primary dimensions of organisational context to influence the levels of individual initiative, mutual cooperation and collective learning within companies (Ghoshal & Bartlett, 1994). Positive relationship between learning orientation and transformational leadership was found when leadership behavior for a learning organisation is transformational and a learning orientation is one of the follower behaviors (Coad & Berry, 1998).

Leaders act as a coach in helping individuals in an organisation to surface assumptions, understand patterns and relationships among people, organisations, and events. Leaders also facilitate new learning and innovation for members so they can be proficient in continually improve their learning and performance in understanding and adapting to work-related environment (Bass, 1998). In addition, synergistic relationship exists among the elements of culture and climate that maximise learning and its benefits (Slater & Narver, 1995). To create

an organisation that is capable of continuous learning, its chief executive officer and his/her immediate sub-ordinates hold the key to success, because the best way to generate such learning is for the top to do it (Argyris, 1977).

Supported by appropriate training, individuals could possess the information, skills, incentives, and responsibility to make decisions essential for innovation, quality improvement, and rapid response to change (Cascio, 1995). On the contrary, misalignment of communication flows, systems, structures, and procedures support between departments in the organisational learning system is negatively associated with business performance (Bontis et al., 2002). In addition, creating a social environment that encourages knowledge sharing is important. Such social environment includes climate of openness, commitment to education and development, demonstrating involved leadership, increasing organisational commitment, communicating the benefits of knowledge exchange, and redesigning work processes and jobs (Cabrera & Cabrera, 2002).

From a performance delivery perspective, learning orientation and transformational leadership were found to be positively related to employee creativity, which in turn positively related to employee performance (Gong et al., 2009). Through training and goal-setting programmes, positive relationship between transformational leadership and organisational performance as well as positive relationship between organisational innovation and organisational performance are reinforced in higher learning organisation (García-Morales et al., 2008).

Transformational leadership acts as the motor and transmitter of innovative culture and dissemination of knowledge while also enhances organisational learning and innovation. This positively drives organisational performance because organisational learning positively influences organisational performance as shown in the figure below (García-Morales et al., 2012).

Figure 5.5 - Relationship between Transformational Leadership, Organisational Innovation, Learning and Performance (García-Morales et al., 2012)

Under transformational leadership, employees are likely to be more creative and leaders can leverage learning orientation to positively moderate the level of creativity by promoting an open environment for learning that encourages innovation and creative problem-solving (Jyoti & Dev, 2015). The organisational commitment of subordinates was significantly improved after managers received transformational leadership training. Better financial outcomes were reported by branches in which managers followed the training sessions (Barling et al., 1996).

According to empirical data, learning orientation, which is the base for execution, has exhibited the strongest positive and significant correlation (0.606***) with transformational leadership. This corresponds well to suggestions that leadership behavior for a learning organisation is transformational and follower behavior should include a learning orientation (Coad & Berry, 1998). This is because a learning organisation can become a platform for developing better transformational leaders as behaviors can be changed in the expected direction through these programmes (Barling et al., 1996). Learning organisations also cultivate creativity among employees (Gong et al., 2009). The result from the structural equation model also supports claims

that transformational leadership drives organisational performance through organisational learning (García-Morales et al., 2008; García-Morales et al., 2012) because transformational leadership is a strong causal driver of learning orientation (0.41**) according to the result.

Finally, business performance is also a combination of organisation factors such as culture, behaviors, knowledge management as well as structural elements, including process and infrastructure. Failure in any of these elements, especially the creation, transfer and use of knowledge will lead to degradation in business performance. Subsequently, a management framework that can balance various elements is needed. Nonetheless, leadership during organisational knowledge creation for innovation is complex. Leadership should consist of a core layer to create local knowledge, a conditional layer that provides the resources and context for knowledge creation, and a structural layer that forms the overall framework and direction for knowledge creation in the organisation (Von Krogh et al., 2012). Hence, the selected framework meets this requirement by incorporating leadership and learning simultaneously.

5.2.5) Enhancing Understanding of Causal Relationships between Management Factors

The empirical result has firmly established the causal relationships between the three core management factors by showing readers how they should interact in the previous chapter. First of all, entrepreneurship is complemented by transformational leadership during the creation of a learning organisation. Transformational leaders act as mediators because they have high quality vision and good implementation techniques. Possession of high quality vision is complementary to entrepreneurial orientation because once opportunities are identified by entrepreneurs, they can be effectively converted into quality vision by transformational leaders. Transformational leaders also give better task cues and clarity through their communication skills so followers are able to complete their tasks with quality. Therefore, leaders can positively enhance the task satisfaction of followers while achieving better organisation performance (Kirkpatrick & Locke, 1996). This causal relationship is also empirically represented by our model. To complete the task delivery process,

transformational leaders also possess the ability to encourage staff to execute. Such ability is crucial for sustaining organisational performance and is also reflected by the causal relationship shown in the model used in this research because learning orientation is also influenced by transformational leadership.

Moreover, entrepreneurs deliver firm performance by drawing upon various resources. The role of entrepreneurship is positively related to firms' ability to perform under hostile and dynamic condition via strategies and competitive tactics (Covin & Slevin, 1991). As many of these resources are related to strategy, leadership, organisational competences, and resources development, the selected model is also adding valuable insights to Covin & Slevin's model on how these resources should interact from another perspective.

Figure 5.6 - Relationship and Interaction between Organisational Factors (Covin, & Slevin, 1991)

Teece (2014) offered another suggestion on how these three elements should interact through his dynamic capabilities theory. Dynamic capabilities start with the identification and assessment of opportunities, which is entrepreneurial in nature. It also involves enabling firms to maintain competitive advantage through developing ability that is hard to replicate. The ability to seize opportunities through resource allocation, guided learning, and continuous

renewal through transformation requires leadership support (Teece, 2014:18). This dynamic capabilities framework builds upon the resource-based approach and is also entrepreneurial by nature in recognising the importance of critical resources. Resources in turn are developed through learning, and good strategy that leverages internal and external partners for resource development is part of the business processes (Teece, 2014:15). Supported by good strategy, dynamic capabilities can sustain superior enterprise performance for organisations as they are better equipped to benefit in a fast-moving global environment (Teece, 2014:23). As such, the method suggested by Teece to deliver performance is equivalent to leveraging entrepreneurial orientation to drive transformational leadership and learning orientation. Teece's emphasis of using external partners also highlighted that inbound open innovation adoption by SMEs can play a key role in organisational success under the fast moving environment created by Industry 4.0.

Finally, entrepreneurs and transformational leaders are more likely to succeed in fast changing environment because they support the building of learning organisations that can be easily reconfigured. By advocating an entrepreneurial spirit that favors change, firms can streamline business processes, promote autonomous decision-making, and tap into individuals' creative power to bring a higher order generative learning environment (Wang, 2008). This in turn supports entrepreneurs to identify and respond to emerging opportunities or threats more promptly, leading to more transformation and knowledge acquisition.

Leaders with higher flexibility can reallocate resources more effectively to develop new knowledge in the form of resource and capability development. In a learning organisation that has more proficient knowledge, leaders will be more willing to take risks, allowing it to seize new opportunities in a more entrepreneurial manner (Büschgens et al., 2013). This in turn increases the need for more knowledge acquisition. The positive reinforcement cycle between learning and adaptive capability driven by external changes (Lane et al., 2006) is an example to show the benefit of management factors working coherently under an inbound open innovation context. Hence, by including management elements,

personality, and inbound open innovation adoption, the model of this research may offer one possible solution to address the need of continuous improvement in dynamic environment as predicted by the evolutionary process (Winter & Nelson, 1982).

5.3) Establishment of Causal Relationships between Personal Characteristics and Inbound Open Innovation Management

Organisational innovation can be viewed as a five-dimensional construct including creativity, openness, future orientation, risk-taking, and proactiveness. These dimensions also represent organisation's ability to generate ideas and innovate continually over time (Ruvio et al., 2014). Openness towards customers, suppliers and universities has a significantly positive impact on the different innovation performance measures (Inauen & Schenker-Wicki, 2011). Creativity is highly related to innovativeness. Optimism is a future-oriented thinking (Parker et al., 2010). Optimism and proactiveness are also compatible as they combine positively to define personality as a single factor (Van der Zwan et al. 2016:287). Since there are strong similarities between TRI elements and Ruvio's dimensional factors, TRI appears to be an attractive instrument for ongoing personal characteristics measurement. Hence, elements from TRI were used to empirically examine the relationship between inbound open innovation and organisational ability to innovate in the following sections.

5.3.1) Innovativeness and Inbound Open Innovation

Innovativeness is the awareness of the need to innovate, or a positive attitude toward change (Hurt et al., 1977:59). Innovativeness indicates how early an individual can adopt innovations with respect to others in the social system (Rogers & Shoemaker 1971), so it is a person specific variable. Innovativeness of SMEs is also enhanced by having a strong innovation climate, which contributes to both inbound and outbound open innovation (Popa et al., 2017). Hence, measurement of innovativeness should reflect the level of entrepreneurial orientation as well as openness towards change via inbound open innovation.

This proposition is supported by the empirical data of this research which confirmed innovativeness as a positive and significant factor for causally driving

transformational leadership and learning orientation. Innovativeness also emerges as one of the components selected by this research's structural equation model. Furthermore, innovativeness works in conjunction with inbound open innovation adoption level in predicting the level of entrepreneurial orientation. This is because innovativeness is also positively and significantly correlated to inbound open innovation adoption. Innovativeness is also well aligned with the three key management elements (entrepreneurial orientation, transformational leadership, learning orientation), organisational performance, and the level of inbound open innovation as suggested by principal components analysis. Hence, for SMEs, innovativeness is an important predictor of organisational innovation since a small business firm is simply an extension of the individual who is in charge (Lumpkin & Dess, 1996).

5.3.2) Optimism and Inbound Open Innovation

For a company to remain successful under turbulent and disruptive environment characterised by economic uncertainty, it is essential for the leader of it to have an optimistic belief that he/she is capable of initiating and maintaining difficult courses of action, which is clearly a kind of proactiveness (Schwarzer & Taubert, 2002:10). Proactive and positive organisational behavior is more open to learning development and change. In addition, if management can achieve a good balance between personal ability and job requirements, it will lead to better motivation, optimism and performance (Burke & Litwin, 1992). As learning orientation affects the degree of proactive learning in an organisation as a whole (Sinkula et al., 1997), learning orientation can also help to bridge the gap between personal ability and job requirements. Hence, through the development of training programmes in workplace, management can encourage learning through external knowledge adoption as a way to overcome challenging environment (Luthans, 2002).

According to the empirical results of this study, optimism is positively and significantly correlated to the level of inbound open innovation adoption. However, the correlation between optimism and inbound open innovation is not as strong as the correlation between innovativeness and inbound open innovation.

Nevertheless, by measuring leaders' optimism level, it is possible to get insights into their inbound open innovation preference. This is because holding an optimistic belief in one's capacity to initiate and sustain challenging actions is pivotal for entrepreneurial success, especially in volatile environments.

5.3.3) Risk Taking and Discomfort towards Inbound Open Innovation

Innovation management is about managing risks because innovativeness may also be deciphered as the proportional amount of risk-taking involved in the deployment of resources in an uncertain situation (Hurt et al., 1977:58). Disruptive organisations knowingly take risks in their pursuit of innovation (Dyer et al., 2011:234) because they have confidence and do not feel insecure. Management familiarity with a new technology, their degree of confidence that the team can succeed in a new technical area, and attitude to risks are all important factors composing the comfort level of management (Tidd & Bessant, 2020:328). Management is also accepting a certain level of risks by allowing exploration, adaptive learning, and experimentation to exist alongside the development of existing ideas (Wang, 2008:650). Since exploration, experimentation and adaptive learning are highly relevant to learning development and external knowledge adoption, measuring the level of insecurity and discomfort of management against a new technology should be reflective of risk tolerance of leaders in the inbound open innovation process.

However, as the data for discomfort was shown to be unreliable by a low Cronbach Alpha value, no further analysis was conducted for this TRI element. The low Cronbach Alpha value could be the result of innovation being measured from a customer service perspective in the TRI survey. On the other hand, correlation between insecurity and the level of inbound open innovation adoption was also found to be insignificant. This insignificant correlation may be the result of respondents being asked for their opinion about the general public rather than their own preference. In fact, discomfort and insecurity are complex and more challenging to measure and could be due to the slightly different themes each item captures that are not part of the core construct they share (Parasuraman &

Colby, 2015:9). Hence, both insecurity and discomfort will be classified as non-relevant to inbound open innovation adoption in the analysis of this research.

5.4) Relationships between TRI Elements and Key Management Components

Entrepreneurship is an approach to management (Stevenson, 1983) and even though entrepreneurial style offers useful insight into management willingness to take on risks through changes and innovations, it is just one of the three major components that relates positively to company success under the "Concept of Fit" model (Naman & Slevin, 1993). Hence, it is difficult to use a single element to measure entrepreneurship because it is not an all or none trait. Instead, it should be viewed as a range of behaviors which are cohesive (Stevenson & Gumpert, 1985:86). The search for a single psychological profile of the entrepreneur is bound to fail as for each traditional definitions of the entrepreneurial type, there are numerous counter-examples that disprove the theory (Stevenson, 1983). To meet this multi-dimensional challenge, TRI is used to assist readers by linking organisational ability to innovate and management elements together. The correlations and relevancies between different TRI elements and key management components are examined below.

5.4.1) Characteristics of Entrepreneurial Orientation

Entrepreneurial orientation is defined to have five dimensions which include innovativeness, risk taking, pro-activeness, competitive aggressiveness and autonomy (Lumpkin & Dess, 1996). Since proactiveness, risk taking and innovativeness are also focus areas of entrepreneurial orientation (Lumpkin & Dess, 1996), they correspond well to the elements of optimism, insecurity, and innovativeness as measured by TRI. Insecurity is negatively correlated to risk taking while optimism is associated with taking proactive steps (Carver et al., 2010:879). Relationship between TRI elements and entrepreneurial orientation was examined and summarised as below.

A) Entrepreneurial Orientation is Positively Related to Optimism

Optimism positively affects goal aspirations and attainment, strategy formulation, and how entrepreneurial start-ups manage very difficult situations (Luthans, 2002). It is highly relevant to corporate entrepreneurship which includes risk taking, pro-activeness, and radical product innovations (Miller, 1983). Through the process of corporate entrepreneurship, organisations can achieve their goals through the renewal of key ideas in which organisations are built upon. This often emerges in the form of entrepreneurial orientation because entrepreneurial orientation encourages strategies that drive the creation of new ideas and facilitate proactive and competitively aggressive positioning (Cooper et al., 1989).

Innovation also consists of an attitude towards taking risks with individual ambitions, personal objectives and certain levels of self-confidence along with having access to resources such as social and family support (GERA 2021). However, during innovation and the pursuit of opportunity, a cost may be imposed and many executives resist innovation as they will find it is easier to stay at the administrative or routine end of the organisational spectrum than moving towards the entrepreneurial end (Stevenson & Gumpert, 1985). So if a company wishes to stay entrepreneurial, it must convince everyone that change is the company's overriding goal (Guth & Ginsberg, 1990).

This is where optimism is relevant because it is a form of future-oriented thinking. Employees, who are high in consideration of future consequences, reported greater proactivity (Parker et al., 2010:843). Management must have the vision, optimism and commitment to overcome any resistance brought by the de facto operation plan of the organisation to embrace entrepreneurship. This proposition is supported by the empirical data of this research, which indicates entrepreneurial orientation is positively and significantly related to optimism of top management.

B) Entrepreneurial Orientation is Positively Related to Innovativeness

Entrepreneurship can be characterised as innovative, creative, dynamic, risk-tolerant, flexible and growth-oriented (Kayne, 1999). Entrepreneur is characterised principally by innovative behavior and will employ strategic

management practices in the business (Carland et al., 1984). This is because entrepreneurs are not just opportunistic but also creative and innovative (Stevenson & Gumpert, 1985). In fact, innovativeness is highly related to differentiation strategy and offers the opportunity for radical product creation. Innovativeness was determined to be part of the conceptual competencies which are reflected in the behaviors of an entrepreneur (Man et al., 2002). The rate of new product innovation is a direct reflection of how entrepreneurial a firm is (Drucker, 2014). Hence, the use of innovativeness as a measurement key for entrepreneurial orientation is highly relevant and this proposition is strongly supported by the empirical data, which indicates entrepreneurial orientation is positively and significantly related to innovativeness of top management. Furthermore, innovativeness is the only personal characteristic that is included in the final model based on structural equation modelling. In fact, innovativeness is found to be a causal driver of all three management elements including entrepreneurial orientation (0.18*).

C) Entrepreneurial Orientation is Negatively Related to Insecurity towards New Technologies

The function of entrepreneurs is to reform or revolutionise the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way (Schumpeter, 2010). Good performance is achieved by pioneering the development of new products, processes, and services over competitors (Zahra et al., 1999). Through new product variations, companies can adopt differentiation and cost leadership strategies which are positively related to performance (Lechner & Gudmundsson, 2014).

A successful firm is either capable of responding rapidly to changes that are beyond its control or so innovative that it contributes to change in the environment. Entrepreneurship is an approach that offers these benefits (Stevenson, 1983). During technology disruptions, entrepreneurship has flourished because independently minded people elected to take the risk in leaving secure positions to promote novel ideas or venture into new markets

rather than allowing organisational superiors and processes to inhibit them (Lumpkin & Dess, 1996). Hence, entrepreneurs are likely to feel self-secured to take risks. Unfortunately, from the empirical results of this research, correlation between insecurity and entrepreneurial orientation was found to be insignificant so insecurity will be classified as non-relevant to entrepreneurial orientation here.

D) Entrepreneurial Orientation is Negatively Related to Discomfort towards New Technologies

As SMEs and startup organisations grow, they will need to keep up with the pace of changes to seize ongoing and new opportunities that emerge in the market. This is made possible by adopting new technologies and act faster than competitors. As focus on control will standardise outputs and does not encourage innovation (Mintzberg, 1993) so incorporating organisational flexibility is a key factor for entrepreneurship. It is critical to encourage entrepreneurial behavior by making those involved feeling comfortable towards change and new innovation adoption. This is because entrepreneurial activities can improve the rate of organisational growth and profitability depending on the company's competitive environment (Zahra et al., 1999; Zahra & Covin, 1995). Hence, entrepreneurs should feel comfortable towards new technologies. Unfortunately, the data for discomfort was shown to be unreliable due to a low Cronbach Alpha value, so no further analysis was conducted for this TRI element.

5.4.2) Characteristics of Transformational Leadership

Organisations operating under an inbound open innovation model is more likely to be transformational rather than transactional (Howell & Avolio, 1993; Bass, 1985). The relationships between TRI elements and transformational leadership are examined and summarised as below.

A) Transformational Leadership is Positively Related to Optimism

Transformational leaders can identify core values of firms while unifying the purposes of the organisation and its members to encourage the liberation of human potential (Bass & Steidlmeier, 1999). They are also likely to be confident with high self-esteem, positive, optimistic, emotionally balanced, and able to cope with stressful and complex environments (Bass & Riggio, 2006:168). This

optimistic attitude is essential because it creates confidence, which is the best fit capacity element of positive organisational behavior. CEOs with bright side personality such as being optimistic, self-confident and determined are positively related to transformational leadership (Resick et al., 2009:1365). Hence, optimism is a key element of transformational leadership and this is supported by the empirical data of this research, which confirmed transformational leadership related positively and highly significantly to optimism of top management.

B) Transformational Leadership is Positively Related to Innovativeness

Transformational leadership is defined as the extent to which a manager is seen as intellectually stimulating (Bass et al., 1987). Transformational leaders also initiate more attempts to articulate their compelling vision of an innovation's potential to the rest of the organisation (Howell & Higgins, 1990). To implement their visions, leaders is likely to bring in changes to organisations as innovativeness focuses on the willingness of organisation to change (Calantone et al., 2002). Such change normally leads to some level of transformation either in terms of operation process or structure of the organisation.

Transformational leadership co-exists with increased motivation, effectiveness, innovation, and the ability to cope with changes (Antonakis, 2001). Transformational leaders try to stimulate creativity and innovativeness by encouraging staff. They often get involved in the analysis process to address problems with new approaches to make things become compatible with the existing organisation processes. Authentic transformational leaders also provide followers with identity images of trustworthiness, credibility, moral worth, innovativeness, esteem, and power (Bass & Steidlmeier, 1999). Although changes due to innovation would normally create conflict within the organisation, transformational leaders can find ways to align those seemingly conflicting interests and improve understanding of group dynamics. This is possible because under transformational leadership, followers are more open to shifts in their world view (Boal & Bryson, 1985), which in turn is a precursor to actual changes (Boal & Hooijberg, 2000).

Since organisational structure is part of the variables which moderate the project outcome based on the innovativeness and other personal traits of the leaders (Creasy & Anantatmula, 2013), the level of organisational innovativeness should reflect the level of transformational leadership. This proposition is strongly supported by the empirical data, which indicates transformational leadership is positively and significantly related to innovativeness of top management. In fact, innovativeness is found to be a causal driver of all three management elements including transformational leadership (0.19*).

C) Transformational Leadership is Negatively Related to Insecurity towards New Technology

To implement radical innovation strategies, top management should establish a developmental culture in their organisation which emphasises an external and flexible orientation (Büschgens et al., 2013). Hence, disruptive innovation most likely comes from transformational leadership operating under an inbound open innovation environment that enables flexibility, risk taking and adoption of new technology. Trust created by transformation leadership implies that coworkers can accept mistakes as learning experiences. Individuals are also encouraged to enhance their self-efficacy and try things beyond core tasks (Parker et al., 2006). Transformational leaders also resolve the compatibility challenge by emphasising interpersonal processes between leader and followers (Boal & Hooijberg, 2000:525). Finally, in organisational development during innovation, transformational leaders normally play important roles by emphasising universal principles of justice and the interests of all stakeholders in the organisation (Bass & Steidlmeier, 1999). Hence, transformational leaders are likely to bring moral feeling into an organisation and act as a model to maintain trust simultaneously so members feel secure and comfortable under the changing environment brought by innovation. However, correlation between insecurity and transformational leadership was found to be insignificant in this study so insecurity is classified as non-relevant.

D) Transformational Leadership is Negatively Related to Discomfort towards New Technologies

During the early stages of innovation, the presence of a powerful leader can lead to high levels of cohesion among workers, stronger dedication to the organisation's ideology, and a sense of unity among the employees (Quinn & Cameron, 1983). This is complemented by leaders' ability to increase follower's commitment to organisational target by communicating a compelling vision of the future supported by inbound open innovation. Better communication with other executives and staff also offers an opportunity to reduce different types of internal disagreement. With their commitment towards moral excellence, transformational leaders can form a platform of common values within the organisation to stimulate alignment and congruence of interests rather than producing a blueprint for others to follow (Bass & Steidlmeier, 1999:211). Hence, transformational leaders help to reduce discomfort towards changes and new technologies through their ability to align members of the organisation. Unfortunately, the data for discomfort showed a low Cronbach Alpha value and irrelevant. Therefore, no further analysis was conducted for this TRI element.

5.4.3) Characteristics of Learning Organisation

Experimentation, risk taking, dialogue, interaction with external environment, and participative decision making are five elements which combine to form the foundations of organisational learning capabilities (Chiva & Alegre, 2009). Source of organisational innovation may come from continuous interactive learning within the organisation through the process of design, development, production and marketing. It can also emerge from a wide variety of external sources such as customers, suppliers, contractors as well as from other organisations such as universities, government laboratories and agencies, consultants, licensors, licensees and others (Freeman, 1994).

A learning oriented organisation will ultimately produce sustainable competitive advantage through self-reinforcement because the desire of learning is driven by an inherent awareness of the need to innovate, or a positive attitude toward change under an innovative management (Hurt et al., 1977). As attitudes

and beliefs are core elements in a learning-innovation cycle as shown below (Senge, 2014), the idea of using TRI as a tool to measure potential capability to innovate and execute is also warranted.

Figure 5.7 - The Essence of the Learning Organisation (Senge, 2014)

In the following sections, the relationships between TRI elements and learning orientation are examined.

A) Learning Orientation is Positively Related to Optimism

Optimism helps to drive the efficiency of entrepreneurs from learning through their own experience in the context of new venture (Hmieleski & Baron, 2009:483). The ability of entrepreneurs to create new knowledge also depends on committing to access the tacit insights and intuitions of individual employees and make them available for the entire organisation (Nonaka et al., 1995:96). This can be achieved through the development of learning orientation which influences the degree to which proactive learning occurs in an organisation (Sinkula et al., 1997:309). As a result, organisation will deliver positive outcomes in the form of proactive and innovative behaviors such as rapid, deep and broad learning of new technologies and skills (Dess et al., 2003:372). A significant proportion of organisational information acquisition through searching becomes a consequence of proactive managerial initiatives from higher management levels (Huber, 1991:99).

On the other hand, business disruption will lead entrepreneurs to rethink about the objectives of failed or disrupted tasks. In this case, the use of transformative learning may be particularly relevant for entrepreneurs of SMEs due to the amount of personal investment, resources and exposure that they spent on starting and managing a small venture. An optimistic character provides positive support for transformative learning and prepares entrepreneurs to stay

ahead of change in order to execute innovation. Hence, optimism is essential for driving learning orientation and this proposition is supported by the empirical data which indicates learning orientation is positively and significantly related to optimism of top management.

B) Learning Orientation is Positively Related to Innovativeness

Firm's innovativeness is the output of learning orientation and learning is central to innovation (Calantone et al., 2002). Organisational learning also needs to incorporate creativity and radical innovation as part of the strategic orientation to sustain competitive advantage (Wang & Ahmed, 2003). This can be achieved by the creation and maintenance of a learning culture which is one of the primary way to attain and maintain competitive advantage (Sinkula et al., 1997). In fact, higher level of innovativeness in firm is associated with cultures that emphasise learning, development, and participative decision making (Hurley & Hult, 1998). For instance, technology standards are driven not only by external drivers but also by a firm's learning orientation (Schilling, 2002).

Hence, if innovativeness exists in organisational cognition, it can be a driving force towards the development of knowledge and execution within an organisation. This proposition is strongly supported by the empirical data which indicates learning orientation is positively and significantly correlated to innovativeness of top management. In fact, innovativeness is found to be a causal driver of all three management elements including learning orientation (0.13*). As such, innovativeness of top management is confirmed as a key driver for successful execution through learning and knowledge renewal under an inbound open innovation environment.

C) Learning Orientation is Negatively Related to Insecurity

A learning orientation enables more rapid learning and the creation of new and situation-specific knowledge. Learning orientation also encourages the engagement of experiential actions, repeated practice and codification of experience into technology and formal procedures (Eisenhardt & Martin, 2000). By such definition, learning involves interaction within the organisation and contact with the external environment. Hence, development of learning in an

organisation must cover both absorptive and adaptive capacities. Absorptive capacity requires constant experimentation, double loop learning and willingness to tolerate small failures. It is important to have an organisational context that encourages plausible judgment, active listening, periodic information exchange, and working consensus (Boal & Hooijberg, 2000). Such context can help staff and management to reduce anxiety of being criticised when undertake new endeavours.

This is in contrast to organisational climate where defensive reasoning thrives as members often concern about the existence of error. It is dangerous to organisational performance and effectiveness by putting the organisation in an ultra-stable systems that are anti-corrective and inhibits learning (Argyris, 2004). Fortunately, the adoption of new ideas through inbound open innovation will encourage continuous learning and break the negative cycle of defensive reasoning. However, taking this step to grow beyond insecurity and defensive reasoning requires courage and belief from top management. This proposition is indeed supported by the empirical data as learning orientation is negatively and significantly correlated to the feeling of insecurity among top management. In fact, learning orientation is the only management element (out of the three elements) that feeling of insecurity can correlate to. Hence, learning orientation can help an organisation to grow out of a negative cycle of defensive reasoning if top management is confident enough to adopt new technology.

D) Learning Orientation is Negatively Related to Discomfort towards New Technologies

Learning orientation comes with a set of organisational values including commitment to learning, open-mindedness, and shared vision which combine to influence the propensity of the firm to create and use knowledge (Sinkula et al., 1997). Open-mindedness represents the willingness of an organisation to review its operational routine and to accept new ideas (Calantone et al., 2002). In addition, company can use existing and new knowledge to promote generative learning as a long lasting core competency, supporting them to foresee environment and market changes to make adjustments (Calantone et al., 2002). Under such circumstances, the continuation of innovation in SMEs requires the

existence of learning orientation to source new ideas. Unfortunately, the data for discomfort was shown to be unreliable by a low Cronbach Alpha value, so no further analysis was conducted for this TRI element.

5.4.4) Mapping TRI Elements against Key Management Factors for Inbound Open Innovation

As explained above, two TRI elements, namely innovativeness and optimism are shown to be highly relevant to the three components of the inbound open innovation management framework and the relationship is summarised in the table below. Data for discomfort could not be used for further analysis as it was proven to be unreliable. Insecurity also provided a mixed result. Nevertheless, by leveraging TRI, this study has captured a multi-dimensional snapshot of the attitudinal mind map from each respondent instead of searching for a specific persona to achieve the same result. In addition, assessment can now be done on a regular basis to provide a longitudinal view on how each of the TRI factors and the corresponding management elements is traversing. Through the instrument, top managers can obtain a multi-dimensional and longitudinal view so various components can be balanced in a structured manner in the inbound open innovation process.

TRI Assessment Factors	Innovativeness	Optimism/Proactive	Insecurity	Discomfort
Entrepreneurial Orientation	✓	✓	✗	Data not use as it has failed reliability test
Transformational Leadership	Visionary/Creative ✓	Caring ✓	✗	
Learning Orientation	Learn New Knowledge ✓	Commit to Learn ✓	✓ Open-Mindedness	

Table 5.1 - TRI Elements Mapping Against Entrepreneurial Orientation, Transformational Leadership & Learning Orientation Based on Empirical Result

5.4.5) Innovativeness is the Dominant Personal Characteristics in Driving Management Approach

The result has clearly demonstrated personal characteristics of high tech SME entrepreneurs, namely innovativeness and optimism, are highly related to the success of organisational management as suggested by Paramasura and Colby (2015). This also echoes the result found by an Irish technology SME study in which entrepreneurial founder/CEO played a principal role in the decision to

leverage inbound open innovation and the underlying dynamics (Barrett, et al., 2021). The empirical model has also successfully confirmed both innovativeness and the level of preference towards innovation adoption as independent antecedents of innovation management. As organisational performance is mediated by the three major management elements identified, prediction of organisational performance operating under an inbound open innovation environment is now possible by auditing the status of each of the management elements as suggested by 3H framework (Yu, 2022).

As innovation is an attribute of an organisation, any ideology from the management would influence the type of innovation selected because the chief variable related to innovative change at an individual level is the attitude of an individual toward change (Mohr, 1963). In addition, innovativeness drives the capacity to innovate within an organisation so firms that have greater capacity to innovate can develop competitive advantages and achieve higher levels of performance (Hurley & Hult, 1998).

Figure 5.8 - Organisation and Market Driven Innovation (Hurley & Hult, 1998:45)

Hence, as shown by the empirical result, innovativeness is the dominant personal characteristic that also acts as an antecedent in influencing organisational performance through the framework. Innovativeness, as a causal element that drives entrepreneurial orientation, is playing an important role in the cognitive mapping and formation of management perception in the model. Its presence is also giving us a better understanding of management perception

which provides a greater understanding of the causal links in models of entrepreneurial orientation (Lyon et al., 2000:1081).

To a lesser extent, optimism is another characteristic that is relevant to organisational performance but it only appears as a factor in the correlation matrix analysis instead of appearing in the final empirical model. One possible explanation is optimism is a future oriented attitude (Aspinwall, 2005) so it may have been already embedded within entrepreneurial orientation which has a strong link with proactiveness and optimism (Parker et al., 2010). The significant correlation between innovativeness and optimism may also have embedded the role of optimism within innovativeness. This is because even though optimism potentially enhances an organisation's propensity for proactive learning and change, it is infused within the organisational behavior and drives the organisation to be more receptive to learning, development, and change. As a result, only innovativeness exists as the dominant personality in the final model. However, future survey instruments may need adjustment to review more about the role of optimism in inbound open innovation.

5.5) A Management Framework that can Predict Organisational Performance under Inbound Open Innovation Environment

Building upon the four basic factors of innovation and the four challenges of innovation management suggested by Van de Ven (1986), this study has compared the potential merits and advantages of the seven different management models under the context of inbound open innovation. As a result, three models, namely 3H, 3P and 7S have met the requirements. To reduce complexity as seen in 7S and remove any risk of surreality perceived in 3P, 3H is chosen as the core reference model.

The empirical results based on proposition from Van de Ven was substantiated by the structured relationships shown by the 3H-based model which provided solid correlation between management elements with the delivery of organisational performance. Furthermore, the three key management elements (entrepreneurial orientation, transformational leadership, learning orientation), organisation performance, level of inbound open innovation and innovativeness

of management fit well together under the principal components analysis. As such, this study has successfully identified a suitable model that can measure and forecast organisational performance as suggested by previous research literature.

The model from Burke & Litwin (1992) bears major similarities to the suggested model. Firstly, external environment, which is represented by inbound open innovation adoption in the model, is not interacting directly with organisational performance. Instead, this relationship is mediated by three management elements, namely leadership, strategy and organisational culture. Secondly, there are causal relationships between management elements, organisational performance, and external environment. By including innovativeness of entrepreneurs in the model, this research provides an encouraging extension to the model from Burke & Litwin (1992). Thirdly, by including learning orientation as an execution tool, the model also provides an explanation of how organisation can deliver transformational performance when influenced by external environment.

Figure 5.9 - A Model of Organisational Performance & Change – The Transformational Factors (Burke & Litwin, 1992)

However, the 3H based model has also produced multiple enhancements to Burke and Litwin model. Firstly, the model has established causal relationships between management elements. By understanding the consequences of their action, management can selectively allocate resources and monitor specific area when certain outcome is desired. For instance, if more effective leadership is required in the organisation, the firm should look at its

current strategy also. Secondly, instead of only generalising external environment as any outside condition or situation that influences organisational performance (Burke & Litwin, 1992:531), the enhanced definition is focusing on the level of inbound open innovation adoption, which is acting as an agent in driving organisational performance. This level of adoption is the reaction of the management team to the changes happening in the external environment based on their professional judgment. Hence, the model is responding to a more focused assessment of the relevant factors in the external environment.

Thirdly, the inclusion of personal characteristics in the framework supports the observations made by many scholars that the characteristics of an organisation is an extension of the characteristics of the CEO and top management (Barrett, et al., 2021; Kitchell, 1997; Thong & Yap, 1995; Miller & Droge, 1986; Miller & Toulouse, 1986; Barker & Mueller, 2002; O'Reilly et al., 2014). Lastly, the framework also brings industrial experience (Mischel, 1977; Kimberly & Evanisko, 1981) and tenure in the firm (Finkelstein & Hambrick, 1990; Wang, 2008; Murphy, 1996; Boeker, 1997-B) of the top management into consideration. Both are missing in Burke and Litwin's model.

The framework has also provided support to Ellinger, suggesting a positive causal relationship between learning orientation and organisational performance. According to Ellinger, there is positive association between the learning organisation practices and firms' financial performance (Ellinger et al., 2002). In addition, the framework also offers a much simpler representation of relationships between learning management (learning orientation), strategy, firm members' creativity (innovativeness), external environment, and output/performance compared with the model proposed by Lane (2006).

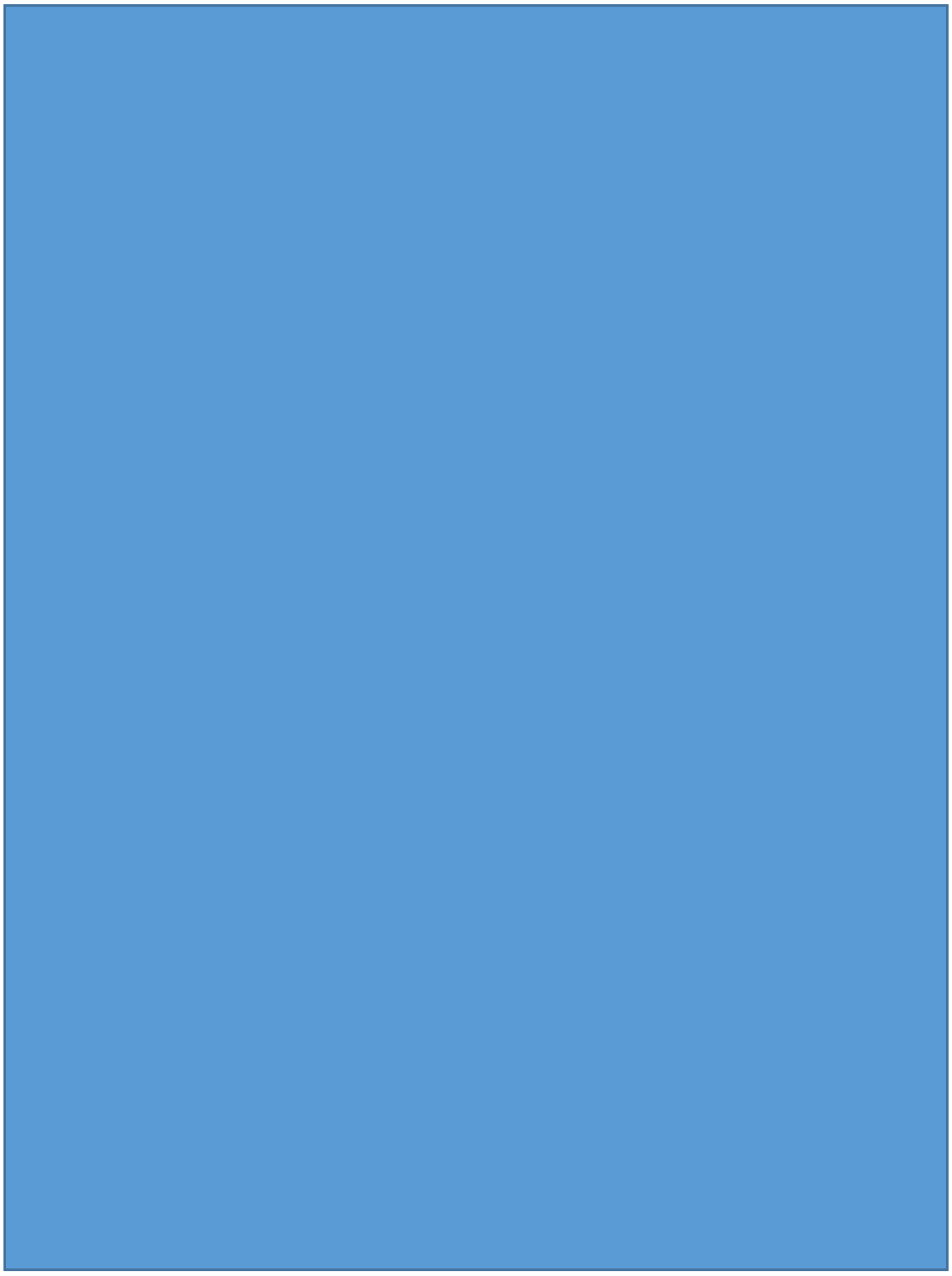


Figure 5.10 - A Process Model of Absorptive Capacity, Its Antecedents, and Its Outcomes (Lane et al., 2006)

Nevertheless, one key difference between the framework and Burke & Litwin's model is the existence of a bi-directional causal relationship between various elements. Although it has not been empirically confirmed, the theoretical analysis in Chapter Two also supports the possibility of bi-directional causal relationship. The investigation of this difference should be left to future study. Hence, this study has not only contributed towards the extension of various

models (Ellinger, 2002; Burke & Litwin, 1992), it has also provided an alternate suggestion of how a management framework can help to predict organisational performance under inbound open innovation.

5.6) Empirically Reveal the Benefit of Inbound Open Innovation Implementation

The framework has provided important guidelines on how to link management characteristics with economic factor in the form of organisational performance. As such, this research may have produced an answer to Chesbrough's request (Chesbrough, 2003) and visualised how inbound open innovation should be implemented as part of the organisational work process. Furthermore, this study has also strengthened how conceptual factors such as innovation norms and attitudes, as outlined in Russell and Russell's model (1992), can be collected and optimised. This was achieved by using Technology Readiness Index 2.0 as the reference instrument to measure entrepreneurial attitudes and cognitive norms towards new technology and innovation.

As the model also included the assessment of innovation adoption to expand the overall coverage of Russell and Russell's innovation norms, it was heartening to see such enhancement yielding positive results. In addition, the model has also shown that the level of entrepreneurship can be increased by adopting a higher level of inbound open innovation. As such, programmes that can increase the level of inbound open innovation adoption can provide potential ingredients towards improving company performance. Nonetheless, such achievement is only possible if checkpoints are put in place to ensure elements covered by the models and entrepreneurial attitudes are adjusted according to the level of increase in inbound open innovation adoption.

By linking strategy, leadership and execution in the same model, the result of this study has also provided a possible extension to models of Neo-Schumpeterian, who have not succeeded in developing a behavioral theory associating firm strategy with operation routines on the whole (Freeman, 1994). In addition, by introducing transformational leadership alongside entrepreneurial orientation and learning orientation, the model is extending the common

understanding of evolutionary economists who normally only consider knowledge acquisition and entrepreneurship as core elements. This extension supports Nelson's request because evolutionary economics has open frontiers to work with other disciplines such as social science (Nelson & Winter, 2002:42).

Finally, few companies have been able to develop technological innovation in a strategic manner (Christensen, 2013). The findings of this framework can help this management community to adopt a simple, yet holistic approach to sail through their organisational transition journey smoothly. The proposed model and instruments of this research can also be an important tool for companies operating at planning and implementation stages by identifying the missing or underperforming components. Hence, our model is giving R&D ecosystem an opportunity to succeed in Industry 4.0 by enlightening both entrepreneurs and policy makers with a new concept to plan and adjust their approaches for new technology adoption. As such, the model has also provided scholars and evolutionary economists an alternate vision to manage innovation from a new perspective.

5.7) Demonstrate How Causal Relationships under Inbound Open Innovation Drive Firm's Performance

This study is the first empirical attempt to address the missing link between entrepreneurial characteristics and organisational performance by studying relevant characteristics of Hong Kong high-tech SMEs under the inbound open innovation environment. As multiple factors exhibit partial rather than full mediation or organisational performance, the data supports the idea that multiple elements are involved in determining corporate performance. This phenomenon fits nicely into the 3H framework because 3H assumes effective organisational performance hinges on a synergistic integration of a set of key elements specific to the firm. These elements are derived from three H domains, metaphorically named as Heart, Head and Hand. The findings also extended the scope and the effectiveness of previous inbound open innovation concept (Chesbrough, H. 2003) which failed to elaborate on how inbound open innovation can be incorporated to improve organisational performance.

The empirical model has also shown causal relationship exists between organisational performance and entrepreneurial innovativeness and it is mediated by the 3H management framework. Likewise, the relationship between organisational performance and level of inbound open innovation adoption is mediated first by entrepreneurial orientation and subsequently by transformational leadership and learning orientation. This clearly suggests that 3H could be extended to include consideration towards contextual factors that may influence the 3H framework elements. In the model, this fourth factor, as suggested by Damanpour (2017:46), is related to the attributes and characteristics of innovation. In fact, the fourth factor in the framework is the innovativeness of the entrepreneurs and their preferred level of inbound open innovation. Nevertheless, the fourth contextual factor in other application will be different and should be investigated by future studies.

In addition, the extensive review of previous studies has also revealed exciting evidence to support the proposed concept of a self-sustaining innovation system. The benefit of understanding and acknowledging the existence of such cyclical relationship can be substantial as business model development in SMEs can be a never ending process. This is because organisations in the twenty-first century are seen as learning systems and the management process is viewed as a process of learning in order to create a sustainable organisation in the long run (Kolb & Kolb, 2009:42). The existence of strategic flexibility in local organisations enables them to enhance current performance by taking advantage of future opportunities (Boal & Hooijberg, 2000).

5.7.1) Organisational Performance is Enhanced by Inbound Open Innovation

Organisational environment is central to all management aspects (Boyd et al., 1993) and its perception is related to organisational structure, processes, technology and decision making. Hence, inbound open innovation, which corresponds to organisational environment, is an important driver of strategy and the model has provided empirical evidence to support the claim that an increased level of inbound open innovation is positively related to organisational performance of high tech SMEs (Parida et al., 2012; Freeman, 1994). As part of

the value chain, a firm has the opportunity to capture value through inbound open innovation to assure its viability during the joint value creation process (Christensen et al., 2005). Companies with a higher level of absorptive capacity also produce better results in areas related to innovation and performance (Adams et al., 2006). This is because a higher level of innovation performance in SMEs is achieved as organisations are increasingly drawing on external knowledge in their innovative activities (Laursen & Salter, 2006). The average level of inbound open innovation in SMEs will increase as they become more inclined or forced to collaborate with other organisations due to the lack of in-house resources to develop and commercialise new products (Van de Vrande et al., 2009).

Based on findings from Gartner, inbound open innovation, which is reflected by the composability scores, and business performance is positively related and this notion was also confirmed by the model. This is because innovation performance could be improved through the appropriation of financial value from new products and services (Brunswicker & Vanhaverbeke, 2015).

Figure 5.11 - Comparison of Business Performance (Costello & Rimol, 2021)

Furthermore, it was shown that external knowledge resource acquisition and technology scouting has positively influences the innovation deployment as well as performance of the organisation (Wang et al. 2015). In addition, it is encouraging to see from another empirical analysis which showed higher investment in in-licensing and more extensive in-licensing experience lead to superior volumes of technology out licensing (Sikimic et al., 2016). This is consistent with the prediction of self-sustainability and clearly supports the idea

of using inbound open innovation as a tool to drive learning orientation so new innovation can be developed and sold to other organisations.

Finally, strategic management researchers also suggested that inbound open innovation could play a mediating role in enhancing organisational performance. This is possible as top management values knowledge indirectly and influences open innovation through knowledge sharing practices which enhances their organisational performance and benefits SMEs (Singh, et al., 2021). Singh's proposition is indeed supported by the significant correlation between learning orientation and inbound open innovation adoption in the result. According to the model, learning orientation and entrepreneurial orientation are important mediators between level of inbound open innovation and organisational performance. Hence, this study has shown how higher level of innovation adoption can be converted into higher level of organisational performance.

5.7.2) Organisational Performance as the Causal Outcome of Key Elements

Organisational performance is often a source of persistent uncertainty but fostering of innovation orientation has a positive effect on the performance of SMEs (Rosenbusch et al., 2011). According to Andy Grove, ex-CEO of Intel, inbound open innovation is an instrument to increase performance. Performance and output of teams within the organisation can increase if internal and external information can be gathered and disseminated to the people who needs it. In addition, by providing appropriate training, motivation and feedback to the team, the overall performance will be increased (Grove, 2015). Hence, Grove highlighted the importance of leadership and execution ability to innovative companies as they try to bring disruption to the market.

However, innovation is multi-faceted and complicated so it is always difficult for management to visualise the variation and deviation happening in an objective manner. Entrepreneur must recognise inbound open innovation is not only impacting a particular aspect of innovation performance but will positively influence a wide range of innovation performance indicators (Cheng & Huizingh, 2014). Hence, leaders need to evaluate how to balance the positive impact of

inbound open innovation on financial performance against increasing cost, e.g. due to alliance, on a continuous basis (Faems et al., 2010). Organisational performance is also positively related to the innovativeness component of entrepreneurial orientation, market orientation, and learning orientation (Kropp et al., 2006). Unfortunately, many evolutionary economics scholars, including Veblen, Schumpeter, Nelson, Winter and Freeman, have not included leadership as part of their consideration because leadership is just embedded in lesser function such as coordinating and structure (Nelson & Winter, 2002). To fill in this knowledge gap, the causal relationship identified between performance and key elements in the framework is examined theoretically and empirically in detail below.

A) The Role of Entrepreneurial Orientation in Driving Organisational Performance

Entrepreneurship is a type of strategic orientation since it dictates how a firm intends to compete through the methods, practices, and decision-making styles that managers use to act entrepreneurially (Lumpkin & Dess, 1996). Under major paradigm shift, such as Industry 4.0, organisations are forced to change by embracing innovation as a strategic direction component and this complements the entrepreneurial orientation construct (Naman & Slevin, 1993). In dynamic market environments that demand aggressive product development and highly adaptable product processes, implementing a strong entrepreneurial orientation may be essential to success (Slater & Narver 1995). This is because entrepreneurial orientation has positive effects within an organisation and drives organisational performance (Alegre & Chiva, 2013). It enables organisation to provide faster response to market needs by becoming more risk tolerant. It is forward-looking and critical in reducing the frequency and magnitude of major shock (Slater & Narver, 1995).

Entrepreneurial orientation also represents how the organisation is structured to discover and exploit opportunities to enhance the positive relationship between resources and firm performance (Wiklund & Shepherd, 2003). For businesses that are 10 years or below, only entrepreneurial orientation was a significant predictor of performance because the strength of the owner's

entrepreneurial orientation continue to dominate the younger small businesses during its drive for positive performance (Runyan et al., 2008). This observation is particularly relevant to high technology SMEs surveyed in this study as entrepreneur plays an influential role in affecting the performance of the firm, particularly when an firm remains small (Man et al., 2002).

Management ability to respond and coordinate depends on their entrepreneurial competencies, which are considered as a higher-level characteristic encompassing personality traits, skills and knowledge, and, therefore, can be seen as the total ability of the entrepreneur to perform a job role successfully (Man et al., 2002). Moreover, the pro-activeness and innovativeness elements of entrepreneurial orientation were found to have a positive influence on business performance (Hughes & Morgan, 2007). Such outcome may be the result of entrepreneurship being positively related to a firms' ability to perform under dynamic environment during the early stage of product life cycle (Zahra 1993). Hence, for SMEs, an entrepreneurial orientation strategy is an antecedent of innovation performance and a useful parameter to explain why firms perform differently (Nelson, 1991). This is because entrepreneurial orientation will enable organisation to identify new and disruptive opportunities which lead to future success. In the long run, as the level of entrepreneurial orientation increases over time, it will also lead to better performance over competitors (Madsen, 2007).

Based on the theoretical suggestions outlined above, this research has examined entrepreneurial orientation as the strategic element in the framework. The finding supports claims that implementing a strong entrepreneurial orientation under a dynamic market environment may be essential to success (Slater & Narver 1995) because entrepreneurial orientation has positive effects within the organisation and drive organisational performance (Alegre & Chiva, 2013). Finally, as more than 68% of the respondents are from companies that were established for 10 years or below, the empirical results also support the theoretical claim that entrepreneurial orientation can be a significant predictor of performance of younger firms (Runyan et al., 2008).

In the empirical results, entrepreneurial orientation is positively and significantly correlated to the performance of an organisation. Entrepreneurial

orientation is also the third highest weighted factor when correlated to organisational performance, ranked behind learning orientation and transformational leadership. Based on the final model produced by structural equation modelling, entrepreneurial orientation – organisational performance relationship is omni-directional and mediated by learning orientation and transformational leadership. The causal relationship between entrepreneurial orientation and performance echoes suggestions that entrepreneurial orientation can be a significant predictor of performance of younger firms (Runyan et al., 2008). Furthermore, such causal arrangement is expected as entrepreneurial orientation is the key driver of an innovative organisation because it dictates leadership and execution practices according to Lumpkin & Dess (1996). The result also confirmed that entrepreneurial orientation was also a prime strategic driver of innovation capability development, one of the determinants of organisational survival and success (Wang & Ahmed, 2004).

B) How Transformational Leadership Delivers Performance

Organisational innovation often involved transformation which is the process of developing and implementing major change programmes. Transformation is closely relevant to high tech companies because high managerial discretion occurs in industries with high level of R&D activities, resulting in high differentiation in high market growth, level of long-term planning and product differentiation (Hambrick & Abrahamson, 1995: 1435). Transformation may also involve radical changes to the structure, culture and processes of an organisation since significant and far-reaching developments are planned and implemented as a transformational change in both corporate structures and organisation-wide processes (Armstrong, 2006).

In driving organisational performance, transformational leadership provides visions that lead to a positive and direct impact on innovation, growth and profitability (Matzler et al., 2008). This is because CEO driven transformational leadership was found to be positively related to alignment of within-team goal, which in turn was positively related to organisational performance (Colbert et al., 2008). Transformational leadership also provides

higher project quality due to the ability to inspire a sense of mission, stimulate team members intellectually with new ways of problem solving and learning, as well as encourage members to do more than normal (Keller, 1992).

Transformational leaders are competent in leading a corporation towards reducing perceived complexity and segmental thinking from the corporate culture to take advantage of innovations when they occur (Kanter, 1984). This is because transformational leaders are better communicators so they can share their intention of cultural adjustment and expected behavioral outcome more thoroughly with members of the organisation. This ability is critical because culture is an integral part of the general function of an organisation and a strong culture ensures everyone is on the same track (Martins & Terblanche, 2003). As culture is created by dynamically interactions between groups within an organisation as shaped by leadership, the organisational structure, norms and rules (Schein, 2010), transformational leaders that are competent play a crucial role in developing an inbound open innovation friendly culture to deliver superior performance.

Based on the empirical results, transformational leadership of high tech SME was confirmed to be positively and significantly correlated to the performance of an organisation. It is the second highest weighted factor when correlated to organisational performance, ranked only behind learning orientation. This is because transformational leadership leads to a positive and direct impact on innovation, growth and profitability (Matzler et al., 2008). As the respondents of the survey is mainly top management, this research has also confirmed that CEO driven transformational leadership was positively related to organisational performance (Colbert et al., 2008). Such causal relationship between transformational leadership and organisational performance is represented in the final model and is omni-directional. Interestingly, based on the structural equation model, transformational leadership is not impacting organisational performance in a statistically significant manner. Instead, its influence on organisation performance has to be mediated by learning orientation. This may happen as transformation is perceived as a long term processes (Armstrong, 2006; Hambrick & Abrahamson, 1995). In addition, as most transformational leaders

try to accomplish major changes through cultural change and staff stimulation (Keller, 1992; Kanter 1984), their contribution towards organisation performance may be seen as an indirect component as shown by the model.

C) How Learning Orientation Delivers Performance

In an economy driven by technological changes, such as Industry 4.0, behavioral foundation is built upon on the development of capabilities. This competence development process is cumulative and learning-based (Nelson & Winter, 2002). Knowledge and capability renewal through learning is fundamental to sustaining competitiveness of business because performance is in large part derived from intangible assets such as organisational-level knowledge (Liebskind, 1996). User-product relationships, managerial and technical skills, and accumulated tacit knowledge are all important sources of diversity and of comparative advantage (Freeman, 1995). Based on such knowledge-based view, it was shown that external knowledge acquisition and technology resource scouting have positively influences on innovation deployment as well as performance of the organisation (Wang et al. 2015). This is because organisational learning is the capability to enable firms to create knowledge as the source of improved performance (Dess et al., 2003).

Learning organisations enjoy competitive advantages as they are competent learners, which are skilled at creating, acquiring, and transferring knowledge, with the ability to modify its behavior to reflect new knowledge and insight (Sinkula et al., 1997). A climate that encourages proactive learning, also known as learning orientation, should be positively related to team performance (Edmondson, 1999; Bunderson & Sutcliffe, 2003). Through experimentation and experience, learning improves the execution performance of innovation process, and becomes a critical factor in creating innovation capability. During such innovation or technological disruption, knowledge adaptation will enable competitiveness by efficiency improvement (Dodgson et al., 2008).

Learning orientation should also be applied as a cultural norm throughout the organisation to drive the creation and adoption of new knowledge so the competitive advantages of organisation can be sustained by learning faster than

its competition (Senge, 2014). Under a learning oriented culture, adaptive capabilities can continuously evolve and strengthen within an organisation because adaptive capabilities and learning are often described as co-evolving and mutually reinforcing (Barkema & Vermeulen, 1998; Simonin, 1999; Autio et al., 2000; Lewin et al., 2011). The ability to sustain significant improvements over a long period of time rests on the capability, resources and desire to learn from experience. It is important also to possess the ability to understand the root causes of problems (Wheelwright & Clark, 1992). This is especially relevant to technology organisations that are research and development based as organisational knowledge is a key strategic resource. It is also an intangible asset that is unique and hard to imitate or substitute (Cabrera & Cabrera, 2002).

Similarly, an increase in absorptive capacity can change existing in-house knowledge which in turn increases the absorptive capacity (Van den Bosch et al., 1999). Through the development of absorptive capacity, knowledge is transformed and used to contribute towards the creation of new competitive advantages (Zahra & George, 2002). Hence, learning from both internal and external sources drives the firm's absorptive capacity, which in turn influences the final organisational performance (Lane et al., 2006). As a result, the enhancement of absorptive and adaptive capacity in tandem drives the final organisational performance outcome in a sustainable manner.

Finally, a firm's competitive advantage is derived from scarce, valuable and durable resources, competencies, and capabilities (Barney, 1991). As capabilities ultimately impact execution, resource-based theory can be used to identify capabilities that are specifically affecting firm performance (Verona, 1999). This is because successful firms are those that can strategically use its available resources to the greatest extent and support the execution of critical task for management (Peteraf, 1993). Hence, sustainable advantages to support effective execution in a high-tech company can be attained by adopting a strategy which focuses on utilising resources to support knowledge development as shown below (Grant, 1991:115).

Figure 5.12 - A Resource-Based Approach to Strategy Analysis (Grant, 1991:115)

Based on the empirical data, a strong and positive relationship between learning orientation and organisation performance was recorded. The empirical result has also confirmed a strong causal relationship between learning orientation and performance in the organisations surveyed because organisational learning enables firms to create knowledge to support improved performance (Dess et al., 2003). This corresponds to suggestions that learning orientation should be positively related to team performance (Edmondson, 1999; Bunderson & Sutcliffe, 2003). With this relationship, this study has also statistically proven business performance should increase as the stock of organisational level learning increases (Bontis et al., 2002). In addition, there is a strong and positive correlation between learning orientation and the level of inbound open innovation preference. In summary, the model confirmed that learning orientation plays an important role in enabling the development of critical resources to support execution. During this development process, organisational learning becomes a fundamental and strategic factor from a resource-based approach perspective (Real et al., 2014; Lado et al., 1992). Hence, learning orientation is an essential element of performance delivery under inbound open innovation.

5.7.3) Possibility of Different Management Factors Working Causally to Support Inbound Open Innovation

Another major contribution of the model adopted in this research is the identification of causal relationships between different paths of management and innovation elements. For instance, the model has shown by increasing the acceptance level of external knowledge through inbound open innovation, the impact of innovativeness in driving the performance of organisation is enhanced. This is consistent with the findings where improved business knowledge, practices and revenues were recorded when training were given regularly to entrepreneurs over a period of one to two years (Karlan & Valdivia, 2011). The model has also shown by encouraging entrepreneurs to think more innovatively about technology, the strength of entrepreneurship and the learning orientation of company will increase, and leader is likely to be more transformative. Such finding echoes Dibrell's suggestion that positive innovativeness exists when formal strategic planning processes and planning flexibility are positively associated (Dibrell et al., 2014). By confirming the positive correlation between inbound open innovation adoption level and entrepreneurial orientation, the model also supports Vanhaverbeke's suggestion that innovation activities can only be understood in a meaningful way if it is placed within the overall SME's strategy or business model (Vanhaverbeke et al., 2012)

By leveraging the 3H management framework as the core, this study was able to empirically establish the relationship shown in the final model (Figure 4.7) for entrepreneurs leverage to achieve the best organisational performance outcome. For example, the model visualises how strategy making styles (entrepreneurial orientation) and decision making biases (transformational leadership) function as important elements that help to establish clear links with absorptive capacity (execution and learning orientation), capacity to change, and managerial wisdom (Boal & Hooijberg, 2000). In addition, the model also confirmed organisational learning partially mediates the relationship between entrepreneurial orientation and performance as suggested (Real et al., 2014).

The model has also expanded the understanding of how innovativeness interacts with different management aspects, such as learning and leadership. It

also explained how likely performance can be impacted or altered through different combinations. For instance, the model suggests transformational leadership is directly and positively related to organisational performance which is consistent with finding by Howell & Avolio (1993). It also supports claim by Ensley that the choice of leader behaviour, which is transformational rather than transactional in this study, is critical to the performance and survival of new ventures (Ensley et al., 2006). In addition, the model supports claim that transformational leadership was found to be directly and positively related to the predicted performance of the business surveyed (Howell & Avolio, 1993)

More importantly, as both entrepreneurial orientation and transformational leadership correlated significantly with optimism and innovativeness in the empirical results, this study has confirmed suggestion that entrepreneurship and leadership converge in areas such as innovativeness and proactiveness (Renko et al., 2015:56). This is because optimism and proactiveness is interchangeable (Van der Zwan et al. 2016:287). This convergence also supports the idea that key management elements can work coherently to produce positive impact on organisational performance.

5.7.4) Demonstrate how Key Management Elements can be Structured Causally to Predict Future Organisational Success

By replacing external environment uncertainty with top management attitude towards inbound open innovation adoption, the model has made one possible suggestion of how external environment can impact SME strategy as suggested by Russell (1992). As shown by the model, external environment uncertainty, represented by attitude towards inbound open innovation, does not impact performance directly. Instead, inbound open innovation causally impact entrepreneurial orientation, which is responsible for strategic planning, and this echoes the model developed by Boyd et al. (1993:212).

The framework also echoes findings of a Turkish study that good organisational performance was achieved when the right level of resources support, being open minded and support for collaboration are in place through the promotion of entrepreneurial activity (Bayarçelik et al., 2014). Furthermore,

this study has successfully enhanced the model developed by Russell and Russell (1992) through data collected from Hong Kong SMEs under an inbound open innovation context. Supported by the empirical findings, a structure that establishes causal relationships between entrepreneurial orientation, learning orientation and transformational leadership has emerged. This structure corresponds with many theories and hypotheses published over previous decades and listed in Chapter 2. For instance, the model has confirmed organisational learning and innovation are positively and causally related to organisational performance because organisational innovation and organisational learning work jointly to promote organisational entrepreneurship to increase competitive advantages (García-Morales et al., 2006). A few other examples were highlighted in the figure below, including those proposed by various scholars such as Zahra (1999), Wang (2008), Zhou (2005), Teece (1997, 2004) and Garcia-Morales (2008).

By measuring the perceived level of inbound open innovation adoption, innovativeness and entrepreneurial orientation of SMEs management, this study has shown assumptions, vision and goals of decision makers can be incorporated together as part of the conceptual framework of organisational beliefs and goals as suggested (Porter et al., 1991:295). The reliability of performance prediction also improves when entrepreneurial tenure and experience in industry are included into the model. This is because decisions made by executives who are under significant job demands closely reflect their backgrounds (Mischel, 1977), including their functional backgrounds (Kimberly & Evanisko, 1981) and tenure (Finkelstein & Hambrick, 1990).

According to the model, predictability of organisational performance under an inbound open innovation context increases when top management has longer tenure but decreases with more experience in the industry. One possible explanation is longer tenure means entrepreneur is likely to be more successful in knowing how to navigate in the industry through better understanding of the company strengths and weaknesses. On the other hand, organisational performance is negatively correlated to industry experience of the entrepreneur operating under an inbound open innovation environment. This may be the result

of different experience in top management teams, which acts as a key source of innovation especially in transforming resources, notably managerial resources, and fosters organisational growth (Penrose & Penrose, 2009). Another explanation of negative correlation between performance and experience in the industry is entrepreneurial belief in using his own ability to resolve problems rather than making changes by adopting external ideas under inbound open innovation. Detailed investigations should be left to future studies.

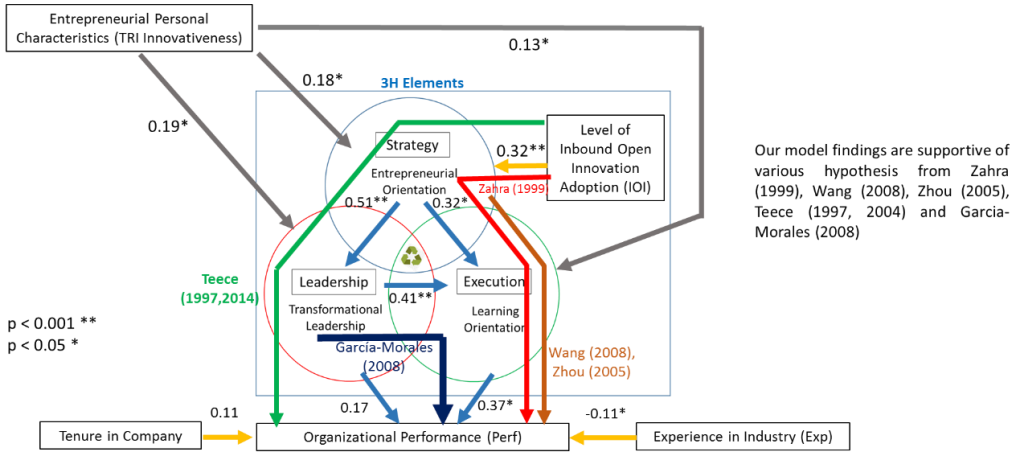


Figure 5.13 - 3H Based Management Model & Other Proposed Relationship

Finally, by including entrepreneurial orientation, learning orientation and transformational leadership as part of the management framework as suggested by 3H, the model helps to explain the role of management approach in mediating the relationship between external environments, personal attitude of entrepreneur towards new technology, and organisational performance. In fact, the statistically significant relationship between entrepreneurial orientation, learning orientation and transformational leadership under the model makes 3H a credible framework in addressing the management requirement to support inbound open innovation.

5.7.5) Application Examples

The ability to adjust business model quickly enables the creation of products that can meet customer requirements. This adjustment ability is critical because inbound open innovation intensity or inbound open innovation activities per employee is higher in SMEs than large organisations. Moreover, inbound open innovation is a major path for SMEs to search for changes in business model to seize new business opportunities and should be part of the business strategy

(Vanhaverbeke et al., 2012). As an example, the high rate of organisational success in the United States and more recently in mainland China is the result of having companies with higher strategic flexibility (Hitt et al., 1998).

For instance, before becoming an artificial intelligence technology giant, Nvidia had to continuously evolve its product design to address market opportunities quickly. By shifting its target market from computer graphics and video games for personal computing to artificial intelligence serving corporate markets, CEO Jensen Huang had to continuously adopt and acquire new technologies, such as acquisition of intellectual property rights of 3dfx, to meet with Nvidia's market need during such adjustments (Britannica, 2024). Another example is the adoption of external artificial intelligence engines by a local high tech glass wear company located in Hong Kong Science and Technology Park. Such technology adoption enables the company to enter new areas like enterprise support, education, and industrial maintenance to achieve higher sales and brand recognition (Wilson, 2024). In both examples, the founders first identified the opportunities in new markets before strategically assigning resources to learn and develop solutions to address these markets. Through execution driven by these transformative leaders, additional market sales and awareness were achieved.

5.8) Optimisation of Organisational Performance Outcome (OP) Using the 3H Approach

To ensure the continuation of corporate success through the adoption of innovation, organisational change is more likely to happen so change management becomes an important ingredient to success (Damanpour 2017). Under inbound open innovation environment, management needs to have the ability and vision to adjust the organisation structure and strategy at different stages of the organisation journey. Sustainability of inbound open innovation is achieved through the balancing of value capture and value creation (Chesbrough & Appleyard, 2007). Hence, organisational lifecycle adjustment undoubtedly involves some level of management intervention. Such adjustment is based on the understanding and choice of interaction with external environment by management. If management is equipped with the appropriate framework to exercise effective control, they can effectively address the change management

challenge to adopt new technology, employ valuable strategies, and implement new organisation structures to foster learning and innovation.

This challenge is met by our model, which is based on the 3H framework, and enhanced by introducing transformational leadership to traditional evolutionary economic model. The 3H based framework can become the core of an effective instrument to increase organisational innovativeness. This is achieved by leveraging transformational leadership, entrepreneurial orientation and learning orientation as effective intervention elements. The question as to how the 3H enabled framework supports top management through its flexibility to exercise strategic leadership, building dynamic core competences, focusing and developing human capital is explained below.

5.8.1) How 3H Sustains Coherence through a Balanced Approach

Key core competencies of a network organisation, as shown below, include the ability to design, manage, and control strategic partnerships with customers, vendors, distributors, and other (Webster, 1992). Hence, how these elements are balanced to create sustainable coherence and competitive advantages through a management framework is critical for the organisation. This study has confirmed the existence of significant relationship between entrepreneurial orientation, transformational leadership, learning orientation, and organisational performance. The possibility of using 3H framework to balance these three factors to create competitive advantages is supported.

Figure 5.14 - Network Organisation – (Webster, 1992)

Through the use of the 3H based model, internal and external organisational skills, resources, functional competences, and dynamic capabilities can be developed to fill the resource gap in the organisation. Innovation in organisation can become sustainable if it is supported by a continuous learning culture and the availability of creative people (Martins & Terblanche, 2003) so knowledge as a resource can be continuously upgraded. This is because the essence of organisation is their ability to maintain their competitive position through innovation and continuous learning (García-Morales et al., 2006). This is accomplished by a balanced integration and reconfiguration of knowledge as learning is fundamental and central in a national innovation systems approach but often overlooked in a business system approach (Lundvall, 1999). To sustain continuous coherence, strategic direction should aim at continuously upgrading the company resources and capabilities to maintain competitive advantages of a company. The use of the 3H based model is indeed offering a solution to address this challenge.

5.8.2) Understanding the Application of 3H under Different Context

By offering management the ability to adopt a balanced approach, the framework can be used to constrain the speculative element in human decision making process, which was raised as a requirement under the Austrian theory (Kirzner, 2009). This is important as variations in the speed of learning, different degree of asset specialisation, breadth of path dependencies, and environmental factors can all contribute to the competitiveness of an organisation. Furthermore, the introduction of knowledge about entrepreneurship can enhance the final impact of inbound open innovation (Karlan & Valdivia, 2011). Subsequently, companies more exposed to entrepreneurship knowledge are likely to become more learning oriented and adopt a more transformative approach in leadership. In addition, instead of just guiding entrepreneurs to be more learning oriented, their learning inclination can also be improved by increasing their knowledge and interest in entrepreneurial orientation and transformational leadership. This holistic management approach is made possible because it echoes the fundamental theory suggested by the 3H framework when all 3H domains intersect effectively.

In comparison, evolutionary economic models always remain in a constant state of flux as it lacks sufficient understanding of some of the key relationships, such as innovation and their diffusion, due to the diversity of agents, industries and national circumstances. The existence of such dynamic elements clearly calls for continuous optimisation of models through empirical research to strengthen their validity and scope of application (Freeman, 1994:491).

In this study, since all three management elements are rated as above-average by the surveyed responses, the entry condition of holistic management f(H1∩H2 ∩H3), as defined by the 3H model, has been met (Yu, 2022). In addition, both organisational performance and inbound open innovation show their positive presence, being graded as above average by the survey participants. This result is encouraging as it indicates holistic management can exist when both organisational performance and inbound open innovation level are satisfactory. Furthermore, the new model can be used by high technology entrepreneurs to continuously audit and improve the delivery of organisational performance under an inbound open innovation driven environment. More importantly, deviations from the recommended orientation can also be identified at an early stage so remedial actions, such as tailored training and personal coaching of top management, can be proposed and implemented to address the root cause during the preliminary stage of deviation.

The various optimisation approach offered by the framework is listed below where H1 is defined as transformational leadership, H2 entrepreneurial orientation and H3 learning orientation of the organisation.

1. $f\ (H^1 \cap H^2 \cap H^3)$ Adequacy of all 3H domain factors and effective intersection of all 3H domains – Ideal case of holistic management as both necessary and sufficient conditions are fulfilled.
2. $f\ (H^1 \cap H^2 \cap \sout{H^3})$ Deficiency of Hand domain factors
3. $f\ (H^1 \cap \sout{H^2} \cap \sout{H^3})$ Deficiencies of Head and Hand domain factors
4. $f\ (\sout{H^1} \cap H^2 \cap H^3)$ Deficiency of Heart domain factors
5. $f\ (\sout{H^1} \cap \sout{H^2} \cap H^3)$ Deficiencies of Heart and Head domain factors
6. $f\ (H^1 \cap H^3 \cap \sout{H^2})$ Deficiency of Head domain factors
7. $f\ (\sout{H^1} \cap H^2 \cap \sout{H^3})$ Deficiencies of Heart and Hand domain factors

8. $f(H^1 \cap H^2 \cap H^3)$ Have all necessary but insufficient condition due to weak intersection of H1 and H2
9. $f(H^1 \cap H^2 \cap H^3)$ Have all necessary but insufficient condition due to weak intersection of H2 and H3
10. $f(H^1 \cap H^3 \cap H^2)$ Deficiency of Hand domain factors and weak intersection between H1 and H3
11. $f(H^1 \cap H^2 \cap H^3)$ Have all necessary but insufficient condition due to weak intersection of all 3H

$f(H^1 \cap H^2 \cap H^3)$ Deficiency in all three H factors and weak intersection among all three H domains

In summary, overcoming complexities in innovation implicitly support the use of a multi-dimensional framework like 3H to analyse and monitor company performance. This study has shown the use of the 3H based framework can help management to maintain equilibrium amongst many factors so innovation can be successfully navigated in an organisation.

5.8.3) Application Example

To succeed in innovation, one practical approach for organisation is to exploit underutilised resources by entering into new activities. During such endeavours, new competences will also be created through learning in a parallel and balanced manner. Under such situation, the 3H based model can be used as a framework to assist as firms need to expand their understanding of resources beyond the traditional resource based approach. This is because resource based view is seen recently as lacking thorough ability to explain how and why certain firms can create competitive advantage under a business environment of rapid and unpredictable change (Eisenhardt & Martin, 2000). Furthermore, the static nature of resource based view (Arend & Bromiley, 2009) is becoming a shortcoming from a wider, even national system perspective since entrepreneurship is a dynamic and institutionally embedded interaction between entrepreneurial attitudes, ability, and aspirations where individuals drive the allocation of resources through the creation and operation of new ventures (Acs et al., 2014). As such, resource based view requires modification to become a

long term strategy especially for firms operating under a dynamic market environment (Eisenhardt & Martin, 2000; Wang & Ahmed, 2007).

One application example occurred for an Internet of Things company residing in HKSTP. The founder of the company made a strategic decision to establish an associate company that focuses on software integration. This was driven by his recurring needs to search for, and negotiate with various system integration partners to secure business opportunities for his products. As the skillset required for software platform services is different from the existing hardware product, the founder invited an external investor as new joint venture partner due to his extensive contact with end clients needing platform services. New expertise on platform development was also established through recruitment and collaboration with new partners that are associated with the new investor. In this example, the founder has identified the strategic need and shortcoming of capabilities within the company, and tackled the deficiency due to weak intersection of strategy and execution skill by transforming the company through new skill adoption and development. Moreover, the company was also strengthened by acquiring the external knowledge offered by the new partners through inbound open innovation. Through such adjustment, the customer base and revenue generated has been growing rapidly in the past two years.

5.9) Enable Longitudinal Benchmarking of Inbound Open Innovation Performance

Through the establishment of a new instrument based on previous studies, the analysis now offers researchers the opportunities to repeat measurements of management characteristics against organisational performance over a pre-defined period of time (3 to 5 years). Such repetition of measurements enable discrete and cross sectional snapshots of organisational metrics to be longitudinally mapped against management characteristics. This matching solution was not yet available prior to this study (Brunswicker et al., 2015; Popa, et al., 2017). Hence, the proposed instrument has made it possible to benchmark organisational performance against various aspects of management characteristics while operating under inbound open innovation.

In addition, by including analysis of how personal characteristics interact with innovation, this study has partially fulfilled the suggestion made by scholars to explore how micro level variables (for example, trust, personality characteristics and employee engagement) operate in the workplace as supporting or obstructing factors under an inbound open innovation environment in SMEs (Singh et al. 2021). Since the instrument enables longitudinal analysis to be conducted based on consistent approach, changes in micro level variables related to inbound open innovation can also be captured by future researches.

From a practical organisational management perspective, this study has shown it is possible to enhance different elements within the management structure, namely strategy, leadership, and execution, in a holistic rather than individual manner. Hence, by conducting the survey periodically, management can capture the instantaneous status of an organisation and benchmark it against information collected at different times. Management can then select the appropriate methodologies provided by 3H and adjusts individual management or input elements accordingly to ensure continuous organisational success. Moreover, since this study has confirmed that personal characteristics of SMEs' top management do not directly translate into organisational performance, management must pay attention to the mediating role of elements residing in the management framework. For example, as innovativeness is affecting all three management elements as identified by 3H under an inbound open innovation environment, it is more effective to encourage entrepreneurs to think more innovatively about technology in order to increase the strength of entrepreneurship. Fortunately, longitudinal tracking of these factors are now made possible by the benchmarking instrument.

5.10) Chapter Summary

This study has shown that SMEs can increase their chances of success if a flexible yet comprehensive management framework like 3H is leveraged for inbound open innovation management. 3H also enables the visualisation of how these three core domains interact in the organisation so it offers top management the ability to understand the impact on the organisation due to the different levels in each domain. Such ability can assist top management to address different

situations by tracking the status of each domain so barriers and limits can be overcome. The model also confirmed Nelson's suggestion that entrepreneurial orientation could be regarded as an antecedent of innovation performance, which helps to explain why firms perform differently (Nelson, 1991). Moreover, the result also supports the claim that entrepreneurial orientation is the main predictor of performance as it leads to better performance over time (Madsen, 2007).

The model has also confirmed management innovativeness has a positive influence on business performance (Hughes & Morgan, 2007) for Hong Kong high tech SMEs. This study also shows foundation factors in TRI 2.0 can explain organisational performance as forecasted by Parasumara under an inbound open innovation environment (Parasumara & Colby, 2015). The inclusion of management attitude towards innovation is an important extension to existing methods of innovation audit because most audit tools only assess a firm's resources for innovation, innovation capabilities and innovation process (Dodgson et al., 2008). Hence, by including the assessment of management attitudes, the model has further expanded the scope and perspective of measurement. Through the instrument, a longitudinal analysis tool is now available to assess the effectiveness of inbound open innovation on a periodic basis, which can also help to predict the likelihood of SMEs' future performance. However, more data can be collected by future studies to confirm whether similar relationships exist in an outbound innovation environment.

Chapter Six – Conclusions

6.1) Contribution towards Management Framework Development

6.1.1) Expand Management Understanding of How Inbound Open Innovation Influences SME Performance

As most SMEs face financial, technological and managerial resource constraints due to their small size, operation model identified by this study is likely to improve SME competitiveness and address both external and internal challenges facing small businesses on an ongoing basis. This study has improved management's understanding of interaction between inbound open innovation and various elements within an organisation. Such understanding is important because the wide range of technology available today is not only stretching the resources and knowledge of large corporation, it is also forcing smaller organisations to constantly strive for innovation through internal and external knowledge scouting.

It was widely recognised that inbound open innovation is an important element to enhance organisational performance (Chesbrough & Appleyard, 2007:57). In addition, inbound open innovation acts as a set of practices for profiting from innovation and a cognitive model for creating, interpreting and researching those practices (West et al., 2006). Hence, the adoption of new ideas and innovation through an inbound open innovation strategy becomes an important method to maintain and renew competitive advantages of companies. Moreover, apprehending how the extent of inbound open innovation adoption acts as an antecedent in impacting company performance is an important area for management. Therefore, the model generated by the result of this study is particularly important because even though entrepreneurs from high-tech companies are widely assumed to be innovative, the relationship between their innovativeness and organisational performance has not been structurally analysed within the Hong Kong high-tech SMEs landscape.

Finally, how inbound open innovation interacts with different management elements was not well established before this study. In fact, inbound open innovation and the related business models are constantly changing

organisational practices, creating strategic positions that had not been clearly articulated and can differ across technologies and industries (Dahlander & Gann, 2010). As such, the model developed by this study can assist management to visualise how adoption of external knowledge through inbound open innovation can interact with other existing organisational elements in a simple yet holistic manner. Moreover, the empirically derived result is consistent with earlier study that innovation is significantly and positively related to superior performance (Vincent et al., 2004). Hence, this study provides management a new vision towards enhancing organisational performance and competitive advantages through inbound open innovation.

6.1.2) Potential Behavioral Model Enhancement Based on Evolutionary Economic Theories

To boost organisational innovation, the creative behavior of top management and how they value innovation play a critical role in the effectiveness of utilising innovative capacity for that organisation (Pierce & Delbecq, 1977). To neo-Schumpeterian economists, innovation varies enormously and is highly complex since the degree of variation is significant, depending on the industry, technology, type of system and process as well as the cost involved (Freeman, 1994). Hence, neo-Schumpeterian have not been successful in developing a behavioral theory relating firm strategy to routines and rules of thumb because business studies theorists and economists have remained too far apart (Freeman, 1994: 486).

However, even under the existing lens of evolutionary economics, the question how entrepreneurs, their orientation, knowledge accumulation and development can work together to create sustainable competitive advantages for the organisation remains unanswered. Nevertheless, evolutionary economics has enhanced management appreciation of how technological progress and economic growth is driven by advancement in technology (Nelson & Winter, 2002). This was done by providing a macro lens which links entrepreneurial orientation and learning orientation as shown in the figure below. Unfortunately, economic system is not in equilibrium most of the time so explanation of observed configurations and their changes based on simple orthodox statistics, would be at

best incomplete and probably misleading (Nelson & Winter, 1982). Managers should not try to create a one-size-fit-all solutions or routines for their operations. Instead, they should continually reconfigure or revise the capabilities they have developed when operating under an environment governed by evolutionary theory.

In order to execute such a vision, the ability to create an organic structure that responds swiftly to changing market conditions is required. The adoption of well-crafted and planned strategies can also function as critical intervening mechanisms to enhance the entrepreneurial orientation-strategic learning capability relationship (Anderson et al., 2009) as suggested by evolutionary economics. Such structural change needs transformational leadership from top management who should be innovative enough to execute through behavior changes within an organisation. In addition, economic models of evolutionary economists also focus on organisational learning, structure and co-ordination at an organisational level (Nelson & Winter, 2002:41). This is because even though organisational learning is part of the infrastructure that is conducive to innovation (Van de Ven, 1986), the process of knowledge discovery is also likely to result in external knowledge adoption similar to those demonstrated by inbound open innovation activities.

Hence, by proposing a framework that combines entrepreneurial orientation, execution through learning and led by transformational leadership, the enhanced model is providing a new alternative for evolutionary economists. This enhancement was also supported by empirical results. With its ability to analyse transformational leadership, execution and strategy, this 3H based framework, shown under the new model below, supports the optimisation of interaction within an organisation while operating under the context of inbound open innovation. It also offers the possibility to drive behavioral changes within an inbound open innovation environment due to its simplicity and flexibility.

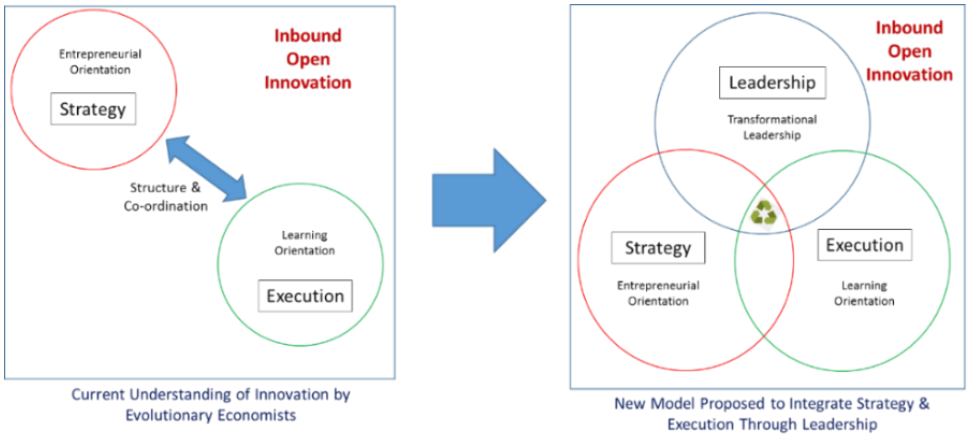


Figure 6.1 - Potential Extension of Existing Model Used by Evolutionary Economics

6.1.3) Highlighted the Possibility of Self Reinforcement

The 3H based model has shown the potential of self-reinforcement where learning and leadership are driven by strong entrepreneurial orientation. The structured model not only offers formal but also flexible approach so organisations can rework and amend plans incrementally to deliver organisational performance as part of the implementation process under an unstable environment (Brews & Hunt, 1999). The finding is also supportive of and supported by findings from the double loop learning model (Argyris, 1977 & 2003) when organisations correct the errors by changing its managing approach as mismatch emerges. This double loop analogy happens if entrepreneurs can recognise the need for strategy adjustment due to changes in the external environment or alterations in entrepreneurial preference during the adoption of inbound open innovation.

Finally, the model has also demonstrated when all three core management elements within the 3H structure are correlated positively, the organisational performance is also positive. This indicates the structure of the management framework is sound and supports the possible existence of self-reinforcement. Nevertheless, possibility of self-reinforcement calls for management awareness towards including inbound open innovation adoption as a key consideration of company strategy adjustment. Ideally, the causal relationship between elements can also be used as a beacon for forward planning during the periodic adjustment of strategy. Conversely, it is also possible that outbound open innovation will

enable learning orientation and leadership to drive entrepreneurship because knowledge and education level of company top management remains an important driver for entrepreneurial orientation for those in China (Chow, 2006). However, this statement is beyond the scope of this study and needs to be examined by future studies.

6.1.4) Successfully Addressed Knowledge Gaps in Innovation Management

This study has successfully answered the request raised by Siguaw (2006) by developing a model that supports and fosters innovation based on strategic implementation to drive the management and development of competencies. Through the causal structure proposed by the model, this research also has to overcome the management challenge highlighted by West & Bogers (2014:27) of how different elements within the inbound open innovation model should be integrated. With this model, the knowledge gap concern on management innovation raised by Damanpour (2017:14) has been addressed. In addition, by including measurement of preference towards inbound open innovation and personal characteristics of the entrepreneurs, this study has also provided a more complete picture of which are the exact antecedents, mediators, and moderators in the inbound open innovation processes and demonstrated how they would improve performance as envisioned by West and Bogers (2017:46).

Finally, the new model can help reader to better understand how organisational performance is influenced by the complex combination of context and actions over time as requested by Richard (Richard et al., 2009:745). It also offers insights into the some of the limits in leveraging external sources of innovation as suggested by West and Bogers (2014:31). Future researchers and managers can also utilise the framework as a tool to effectively adjust the way that organisations are managed contingently as requested by Christensen (Christensen, 2016).

6.2) Recommendations

Under turbulent environment like Industry 4.0, SMEs can maximise the benefit of inbound open innovation by endorsing a more networked, distributed

and collaborative organisational context due to their limited resources. Competitive advantages can be established by adopting the composable based approach for innovation adoption. This is because successful organisation can absorb innovation into its culture and management process (Martins & Terblanche, 2003). Through the collaborative platform provided by inbound open innovation, participating firms should reap the benefit of success by unlocking a significantly greater set of resources available to all parties involved instead of doing it alone (Chesbrough, 2007).

Through sufficient and effective preparation, the model based on 3H framework should provide top managers a credible platform for implementing inbound open innovation by using the entrepreneurial orientation, transformational leadership and learning orientation as its core elements. As this study suggests tenure and experience did not impact directly in strategy, transformational leadership and learning orientation, such findings make continuous training and introduction of inbound open innovation to entrepreneur an important topic to counter the negative impact of industrial experience. The overall speed of organisational evolution can also be improved by keeping entrepreneurs afresh of changes and new innovation happening externally rather than only focusing in-house and past experience.

6.3) Practical Implications for Management

To succeed in a changing environment, management need to understand the behavior of firms, their capabilities and limits for adaptation so the right transformation can take place. Many innovations have to overcome adoption hurdles such as strong resistance from stakeholders both inside and outside the company. Adoption hurdles can make or break the commercial viability of even the most powerful innovative ideas if they are overlooked in the planning process (Kim & Mauborgne, 2014:73). By utilising the causal relationship identified in this study, continuous optimisation of critical management elements is no longer a myth and can be done with carefully crafted strategy and execution. For example, using the framework developed in this study, top management can

systematically balance different management factors to achieve equilibrium necessary for desired company outcomes.

To enable growth in the company, firms should have entrepreneurial strategy in place and leverage transformational leadership to drive learning within organisations since existing knowledge of firms can rapidly become obsolete in dynamic environments (Teece, 2007). A living example would be the adoption of artificial intelligence as its pace of change is staggering, with new breakthroughs in algorithmic machine learning and autonomous decision-making, engendering new opportunities for continued innovation. As outlined in the AI workshop held on 13th June 2019 at the School of Management, Swansea University UK, history tells us that as industry and society changes, humans generally adapt to the new ways of working and learning of new skills. For instance, studies have articulated the extensive reach of many forms of AI within the medical and legal professions and well as manufacturing (Dwivedi et al., 2021:40). Hence, any technology SMEs that fail to embrace artificial intelligence are likely to miss out on new ways to conduct business more efficiently.

Finally, by continuously adjusting management factors listed in this study, entrepreneurs can introduce market disruptions through innovation without destabilising the organisation. For instance, to retain end customers, product innovation can come from a firm's own R & D while process innovations can come from the R & D done by suppliers and are embodied in their products (Nelson & Winter, 1977). Ultimately, entrepreneurs can leverage the model to deliver knowledge renewal (learning orientation) as part of the firm's formal strategy (entrepreneurial orientation), changing the existing market order and achieve wealth creation in the society through technological innovation.

6.4) Limitations

Although this study of inbound open innovation started from the lens of an evolutionary economist and expanded it through the 3H management framework to make it more balanced, further improvement of the new approach should be possible if neighboring disciplines, such as psychological research, are included to conduct further assessment. For instance, non-economic or

management background expert could provide a more objective and certainly more independent view on some fundamental issues because the process of innovation adoption is dynamic so longitudinal data collection using observation and interviews in addition to questionnaires would provide a richer understanding of the process (Damanpour & Schneider, 2006).

In addition, even though this study has successfully identified the interaction between learning orientation, transformational leadership and entrepreneurial orientation, it is yet to confirm the possibility of learning orientation driving transformational leadership and entrepreneurial orientation as well as transformational leadership driving entrepreneurial orientation to achieve organisational performance enhancement as suggested by the coherent inbound open innovation cycle. This could be the result of using inbound open innovation as a context where knowledge becomes an execution focus function instead of a wealth and strategy creation element as in the case of out bound open innovation. Furthermore, since only a cross-sectional study was conducted in this research, a truly longitudinal picture cannot be established for surveyed companies so further studies should include longitudinal methodologies and data envelopment to provide a view on performance relationship (Morgan & Strong, 2003). Moreover, bidirectional relationships envisioned in the self-sustaining cycle cannot be tested as longitudinal data is absent. In addition, under outbound innovation, knowledge is creating new selling opportunities so entrepreneurial strategy may be subsequently adjusted to acquire new market opportunities but this should be left for future studies to investigate.

Due to the scoping of this research, no investigation into the challenges facing the actual implementation of 3H under an inbound open innovation context is conducted. Due to time and resource limitation, this study is only able to contribute towards some of the additional input required by a holistic framework. This is because a true holistic approach will also need to address more specialised managerial processes such as entrepreneurial learning, strategy formulation, creativity, problem solving and decision making and leadership research (Kolb & Kolb, 2009), which is clearly beyond the scope of this study.

Finally, as this research focused on Hong Kong high tech SMEs, future researches can be conducted in different countries and/or different industries to provide a wider picture of how different context can impact the model.

6.5) Suggestions for Future Research

By successfully showing the existence of new dimensions in innovation management, this study also suggests that additional factors may emerge if future researchers follow the approach of this research by conducting investigation that extend the breadth or depth of elements residing in the selected model. For instance, even though this study has identified innovativeness and optimism as highly relevant to organisational performance under an inbound open innovation environment, there may be other individual characteristics that can bring similar impact but yet to be discovered.

In addition, although one would expect input and feedback from business operation will expedite innovation models optimisation, the exact type of input or feedback is yet to be determined as it is out of the research scope of this study. Hence, future scholars can investigate which are the critical elements, and what is the triggering threshold so management can commence process optimisation. Such knowledge and understanding is important because innovation models will continue to evolve so other networking structures will emerge to become the next generation of innovation model (Rothwell, 1992). By insightfully forecasting how future innovation model will emerge, companies can create new competitive advantage before others, thereby achieving better performance than their peers.

Acting as a longitudinal instrument, the framework offers researchers the ability to conduct regular and consistent company assessment. By detecting deviations from a balanced structure, the framework can assist management to identify the existence of potential risks surrounding their business. This includes the risk of technological obsolescence, the need for continuous skill development, and the challenges of integrating new technologies into existing business models. Furthermore, as themes capture by discomfort an insecurity may not align with the core construct in this study due to their complexity, future researchers can consider modifying the survey questions for discomfort and insecurity

(Parasuraman & Colby, 2015:9). By improving the survey questions, future researches can collect new responses to enhance the robustness of this framework.

Finally, the key informant method was used for data collection so the data reflects the opinions of only one person in our surveyed SMEs. Future studies could consider including a research designs that support data collection from multiple participants within an organisation and also covering the contribution of inbound open innovation for larger organisations.

6.6) Summary

This study aimed at identifying factors that are essential for the creation of successful and sustainable companies in Hong Kong high technology industries under the inbound innovation context. Due the size of Hong Kong's economy, performance of technology companies in Hong Kong are mainly driven by inbound open innovation as most of the technology products designed and sold by local SMEs utilise and adopt external technology. As this study has shown, learning orientation and inbound open innovation adoption are positively and significantly correlated, the ability of a company to execute can be benefited by inbound open innovation.

It was evident from previous research that company performance is not a direct result of individual innovativeness or entrepreneurship. Instead, entrepreneurship and innovativeness will be mediated by some framework in order to deliver organisational performance. Fortunately, based on the empirical data collected from Hong Kong entrepreneurs located in Hong Kong Science and Technology Park, this study was able to identify the core elements of this framework by leveraging both 3H suggested by Yu (Yu, 2021) and the initial model of corporate entrepreneurial strategy proposed by Russell (Russell & Russell, 1992:645).

By proposing and visualising the causal relationships between different elements through a new framework, this study has expanded the understanding of how to drive inbound innovation management more effectively to deliver SME performance. Through the proposition of this new framework, this study has also provided an explanation of the causal relationships between personal

characteristics and different management elements and extended previous findings by Anh (Ahn et al., 2017). For instance, innovativeness and entrepreneurial orientation are mediated by transformational leadership and learning orientation before affecting the final organisational performance.

Finally, through the causal framework proposed, this study has successfully addressed the knowledge gaps in innovation management as requested by Siguaw (2006) and Damanpour (2017) by overcoming the management challenge highlighted by West & Bogers (2014:27) of how different elements within the inbound open innovation model should be integrated. Furthermore, the inclusion of leadership has provided additional behavioral insights to the neo-Schumpeterian model proposed according to the Evolutionary Economic Theories. Findings from this study should enhance the understanding of how innovation should be managed and assist in the creation of successful and sustainable companies in Hong Kong high technology industries under the inbound innovation context.

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Appendix One - Detail of Questions used in Survey

i) Introduction Statement

We would like to invite your kind participation to take part in a survey for a management research study which is part of a doctoral research project. This survey will only take around 10 - 15 minutes. The aim of this study is to develop a Hong Kong specific entrepreneurial profile for people managing technology companies in Hong Kong. Your valuable feedback will be important for this project so that we can recommend enhancement programmes for future entrepreneurs. All answers collected will remain anonymous and confidential at all times and only be used for this research.

By submitting your feedback, you are consenting to be a participant of my study where all data will remain anonymous and confidential as we will not identify you individually from your answers in accordance to the guideline approved by the ethics review committee of the University of Wales TSD. As this survey is completely voluntary, should you feel uncomfortable and do not want to respond, you are also free to do so. Thank you for your time and please feel free to leave any further comment here. (我們誠邀閣下參與一個管理研究項目的調查.這項調查只需要大約 10-15 分鐘。本研究的目的是對香港科技公司的管理人員進行剖析調查,為未來新一代的香港企業家提供更好的指導。所有收集的答案將會保持匿名和保密,並且僅用於本研究。通過提交您的回應，閣下同意成為我們研究的參與者。所有數據將根據 University of Wales TSD 的道德審查委員會批准的指引下保持匿名和保密. 如果您不想回答，您也可以選擇不提交和離開。謝謝你的寶貴參與和回應。)

ii) Level of Inbound Open Innovation

In our firm, for our new product development, we (five-point scale: 1="strongly disagree" and 5="strongly agree") (Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013) & (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021) (likert 7) (IOI)

1. We constantly scan the external environment for inputs such as technology, information, ideas, knowledge, etc.* (IOI – 1)

2. Our firm actively seek out external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) of knowledge and technology when developing new products. (IOI – 2)

3. We believe it is good to use external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) to complement our own R&D.* - one question is removed

4. Our company often bring in externally developed knowledge and technology to use in conjunction with our own R&D. (IOI – 1)

ii) Performance Metrics of Innovation (five-point scale: 1="strongly disagree" and 5="strongly agree") (PMI)

1) Our new product introduction has increased over the last 5 years (Calantone, R.J., Cavusgil, S.T. and Zhao, Y., 2002) (likert 7) (PMI - 1)

2) Our company meets our sales performance and return on investment targets. (Venkatraman, N. and Ramanujam, V., 1986) & (Bontis, N., Crossan, M.M. and Hulland, J., 2002) (likert 7) (PMI - 2)

3) The organization has obtained high sales growth in the main products/services and markets. (García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006) (likert 7) (PMI - 3)

4) We have been able to expand our existing customer base this year. (Hughes, M. and Morgan, R.E., 2007) (likert 7) (PMI - 4)

iii) General Background Information

(1) Age of respondent – (Dawes, J., 2008) [598] (2) Age of Firm – (Pérez-Luño, A., Wiklund, J. and Cabrera, R.V., 2011) (3) Size of Firm (4) Education Level (5) Position of respondent in Company (6) Year of Experience in the industry

iv) In the area of entrepreneurial orientation

For entrepreneurial and learning orientation, the following questions will be used. (Wang, C.L., 2008) (likert 7)

Market proactiveness

1) In general, the top managers of our organisation favor a strong emphasis on Research & Development, technological leadership, and innovations.

2) In the past 5 years, our organisation has marketed a large variety of new lines of products or services. (also related to performance) – so removed

2) In the past 5 years, changes in our products or service lines have been mostly of a minor nature. (Reverse coded)

Firm risk taking

1) In general, the top managers of my organisation have a strong propensity for high-risk projects (with chances of very high return).

2) The top managers believe, owing to the nature of the environment, that bold, wide-ranging acts are necessary to achieve our organisation objectives.

3) When there is uncertainty, our organisation typically adopts a "wait-and-see" posture in order to minimize the probability of making costly decisions. (Reverse coded)

Firm innovativeness

1) Management actively responds to the adoption of "new ways of doing things" by main competitors.

2) We are willing to try new ways of doing things and seek unusual, novel solutions.

3) We encourage people to think and behave in original and novel ways

v) From a learning orientation perspective (wang C.L 2008 – 7 points, Baker, W.E. and Sinkula, J.M., 1999 – 5 points for LO)

Commitment to learning

1) The basic values of this organisation include learning as a key to improvement.

2) The sense around here is that employee learning is an investment, not an expense.

3) Learning in my organisation is seen as a key commodity necessary to guarantee organisational survival and generate our competitive advantage (combined with original question one)

Shared vision

1) There is a commonality of purpose in my organisation.

2) All employees are committed to the goals of this organisation.

3) Employees view themselves as partners in charting the direction of the organisation.

Open-mindedness

1) We are not afraid to reflect critically on the shared assumptions we have made about our customers.

2) Personnel in this organisation realize that the very way they perceive the marketplace must be continually questioned.

3) We rarely collectively question our own business about the way we interpret customer information. (Reverse coded)

vi) Transformational leadership

1) I transmit the organisation's mission, reason for being, and purpose to all of the employees. (García-Morales, V.J., Jiménez-Barrionuevo, M.M. and Gutiérrez-Gutiérrez, L., 2012) (Likert 7) (Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000)

2) I consider the moral and ethical values before I take action. - (Behaviors Charm) (Page 450 Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung)[529] (Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung 1999) - a five-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree) to each of the MLQ5X items (Mind garden) MLQ 5x : 1 (not at all) 2 (Once in a while) 3 (Sometimes) 4 (Fairly Often) 5 (Frequently, if not always)

3) I talk optimistically about the future and articulate/communicate a vision. (Inspirational Motivation) (Page 450 Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung), (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)

4) I re-examine critical assumptions to question whether they are appropriate. (Intellectual Stimulation): (Page 450 Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung), (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)

5) I treat staff as individuals, supports and encourages their development. (Individualized Consideration/Staff Development – labelled as “encouraging the heart” by Carless (Page 394 & Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000), (Kouzes & Posner, 1990)

These are chosen because regardless of national setting, four transformational behaviors—articulating a vision, providing an appropriate model, having high performance expectations, and showing supportive leader behavior—positively affect the relationship between EO and firm performance. (Engelen, A., Gupta, V., Strenger, L. and Brettel, M., 2015)

Technology Readiness Index

Optimism

1) New technologies contribute to a better quality of life
2) Technology gives me more freedom of mobility
3) Technology gives people more control over their daily lives
4) Technology me more makes productive in my personal life

Innovativeness

1) Other people come to me for advice on new technologies
2) In general, I am among the first in my circle of friends to acquire new technology when it appears
3) I can usually figure out new high-tech products and services without help from others
4) keep up with the latest technological developments in my areas of interest

Discomfort

1) When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do
2) Technical support lines are not helpful because they don't explain things in terms I understand
3) Sometimes, I think that technology systems are not designed for use by ordinary people
4) There is no such thing as a manual for a high-tech product or service that's written in plain language

Insecurity

1) People are too dependent on technology to do things for them
2) Too much technology distracts people to a point that is harmful
3) Technology lowers the quality of relationships by reducing personal interaction
4) I do not feel confident doing business with a place that can only be reached online

Survey Question	Area Studied	Scale	Ref Source	Remark
Age of Respondent	General Background	(<30, 30-<40, 40-<50, 50-<60, 60+)		
Years of Company Establishment	General Background	(<2, 2-<5, 5-<10, 10-<15, 15+)	Pérez-Luño, A., Wiklund, J. and Cabrera, R.V., 2011	
Total Number of Employees	General Background	(<5, 5-<10, 10-<25, 25-<50,		
Role of Respondent in Company	General Background	(Founder/CEO, Top Management, Middle Management, Expert/Individual Contributor, General Staff)		
Highest Education Level Attained by Respondent	General Background	(High School, Higher Diploma, Bachelor, Master, Doctorate)		Reversed Coded
Years of Experience in Current or Same Industry	General Background	<5, 5-<10, 10-<15, 15-<20, 20+		
New technologies contribute to a better quality of life	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology gives me more freedom of mobility	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology gives people more control over their daily lives	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology me more makes productive in my personal life	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Other people come to me for advice on new technologies	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point

In general, I am among the first in my circle of friends to acquire new technology when it appears	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
I can usually figure out new high-tech products and services without help from others	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Keep up with the latest technological developments (e.g. Blockchain, Crypto) in my areas of interest	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technical support lines are not helpful because they don't explain things in terms I understand	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Sometimes, I think that technology systems are not designed for use by ordinary people	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
There is no such thing as a manual for a high-tech product or service that's written in plain language	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
People are too dependent on technology to do things for them	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Too much technology distracts people to a point that is harmful	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology lowers the quality of relationships by reducing personal interaction	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point

I do not feel confident doing business with a place that can only be reached online	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
I transmit the organisation's mission, reason for being, and purpose to all of the employees	Transformational Leadership - Vision	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(García-Morales, V.J., Jiménez-Barrionuevo, M.M. and Gutiérrez-Gutiérrez, L., 2012) (Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000)	Garcia Morales (Likert 7), GTL Carless (likert 5)
I consider the moral and ethical values before I take action	Transformational Leadership - Behaviors Charm	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung 1999)	Likert 5
I talk optimistically about the future and articulate/communicate a vision.	Transformational Leadership - Inspirational Motivation	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung) (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)	Likert 5
I re-examine critical assumptions to question whether they are appropriate.	Transformational Leadership - Intellectual Stimulation	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung) (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)	Likert 5
I treat staff as individuals, supports and encourages their development. ("encouraging the heart" by Carless Page 394)	Transformational Leadership - Individualized Consideration/Staff Development	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Page 394 & Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000)[472] (Kouzes & Posner, 1990)	Likert 5
The basic values of this organisation include learning as a key to improvement.	Learning Orientation – Commitment to Learning	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5

The sense around here is that employee learning is an investment, not an expense.	Learning Orientation – Commitment to Learning	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
Learning in my organisation is seen as a key commodity necessary to guarantee organisational survival and generate our competitive advantage	Learning Orientation – Commitment to Learning	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5 (combined with original question one)
There is a commonality of purpose in my organisation.	Learning Orientation – shared vision	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
All employees are committed to the goals of this organisation.	Learning Orientation – shared vision	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
Employees view themselves as partners in charting the direction of the organisation.	Learning Orientation – shared vision	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
We are not afraid to reflect critically on the shared assumptions we have made about our customers.	Learning Orientation – Open mindedness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
Personnel in this organisation realize that the very way they perceive the marketplace must be continually questioned.	Learning Orientation – Open mindedness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
We rarely collectively question our own business about the way we interpret customer information.	Learning Orientation – Open mindedness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5

				(Reverse coded)
In general, the top managers of our organisation favor a strong emphasis on Research & Development, technological leadership, and innovations.	Entrepreneurial Orientation – Market Proactiveness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
In the past 5 years, changes in our products or service lines have been mostly of a minor nature.	Entrepreneurial Orientation – Market Proactiveness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5 (Reverse coded)
In general, the top managers of my organisation have a strong propensity for high-risk projects (with chances of very high return).	Entrepreneurial Orientation – Firm Risk Taking	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
The top managers believe, owing to the nature of the environment, that bold, wide-ranging acts are necessary to achieve our organisation objectives.	Entrepreneurial Orientation – Firm Risk Taking	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
When there is uncertainty, our organisation typically adopts a "wait-and-see" posture in order to minimize the probability of making costly decisions.	Entrepreneurial Orientation – Firm Risk Taking	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5 (Reverse coded)
Management actively responds to the adoption of "new ways of doing things" by main competitors.	Entrepreneurial Orientation – Firm Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
We are willing to try new ways of doing things and seek unusual, novel solutions.	Entrepreneurial Orientation – Firm Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
We encourage people to think and behave in original and novel ways.	Entrepreneurial Orientation – Firm Innovativeness	Strongly Disagree, Disagree,	Wang, C.L., 2008	Original Likert 7 – survey Likert 5

		Neutral, Agree, Strongly Agree		
Our firm constantly scan the external environment for inputs such as technology, information, ideas, knowledge, etc.	Extent of Inbound Open Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013) & (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021)	Original Likert 7 – survey Likert 5
Our company actively seek out external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) of knowledge and technology when developing new products.	Extent of Inbound Open Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013), (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021) & (Cheng, C.C. and Shiu, E.C., 2015)	Original Likert 7 – survey Likert 5
Our organisation believes it is good to use external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) to complement our own R&D.	Extent of Inbound Open Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013), (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021) & (Cheng, C.C. and Shiu, E.C., 2015)	Original Likert 7 – survey Likert 5
Our new product introduction has increased over the last 3 - 5 years	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Calantone, R.J., Cavusgil, S.T. and Zhao, Y., 2002) (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5
Our company meets our sales performance and return on investment targets during the last 3 – 5 years.	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Venkatraman, N. and Ramanujam, V., 1986) & (Bontis, N., Crossan, M.M. and Hulland, J., 2002) (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5

Our organisation has obtained high sales growth in the main products/services and markets during the last 3 – 5 years.	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006) (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5
Our company have been able to expand our existing customer base during the last 3 – 5 years.	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Hughes, M. and Morgan, R.E., 2007) & (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5

Table A1 – Summary of Survey Question, Area of Studied and Reference