

Assessing Awareness and Innovation Challenges in SMEs: A Case Study in The Geoscience Sector

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Abstract

Innovation has become a topic of strong focus for different companies and institutions around the globe as the innovation capacity, or the lack of, can substantially influence the firm's position against its competitors and ultimately the survival of the business. In this context, a SME in the geoscience sector has embarked in the plan for increasing its innovation capacity. Nonetheless, different challenges are always present, including internal and external barriers. Therefore, the current study conducted a survey on 6 targeted groups (Directors, Managers, Business Support, Laboratories, Analysts, New Ventures & Business Development) to identify different trends in how innovation is perceived internally and what are the main concerns when it comes to implementing innovation. The survey was conducted focusing on 3 different segments: awareness of innovation, challenges and risks, and support and engagement. The data obtained revealed that the main limitations are related to financial and budgetary restrictions but also highlights challenges such as time allocation and company culture. The obtained information reflects what is typically reported in the literature as the main challenges SMEs face when implementing innovation. The results suggest that the company is heading in the right direction and could strengthen its position with the implementation additional processes and recommendations. Amongst those, this study provides different recommendations to help strengthen the innovation capacity within the company, including crowdsourcing campaigns, open innovation, informative digital boards for announcement and the implementation of the ISO 56000 series for innovation management.

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1. Introduction

Throughout history, innovation has been a defining force in the evolution of different civilisations. Undoubtedly, innovation can be traced back from the dawn of agriculture and birth of written languages millennia ago, to the most recent wave of industrial revolutions, including the latest developments in artificial intelligence and the technology associated to the fourth industrial revolution. Although, sometimes the industrial revolutions are portrayed as sudden leaps in technology, these innovations in fact correspond to a series of gradual processes that lead to breakthroughs, subsequently resulting in advances and inventions. These can then impact almost all aspects of society (Groumpos, 2021), including communication, transportation and increased efficiencies in manufacturing. Hence, nowadays businesses actively pursue innovation to benefit from technological developments. As well as benefit in efficiencies, innovation can also translate into new revenue streams. For instance, companies in the digital ecosystems have been pushing and leveraging from big data, machine learning, and cloud computing to enhance their business portfolio, including the use of social media to have a better understanding of their market (Subramanian et al., 2019).

According to the European Commission (EC, 2003), small and medium-sized enterprises (SMEs) defined as organisations with less than 250 employees with turnover of less than € 50 million (medium enterprises), and 50 employees with turnover of less than € 10 million (small enterprises). SMEs play a key role in the nations' economies including job creation in local communities, but can also play an important role in innovation, especially when interacting with other firms (Osano, 2023). However, SMEs also face different challenges when attempting to implement innovation. These challenges vary across different organisations, but typically extend from financial risks to negative perspective on innovation and changes (Müller & Voigst (2017).

Within the geosciences sector, numerous SMEs operating across the UK are pivotal in delivering essential services to larger multinational organisations. One notable example is the company used for the current research (hereafter the studied company). Said company corresponds to a SME based in Conwy, North Wales, and provides integrated services and geological solutions in the energy sector. With a workforce of approximately 120 employees, The studied company stands as the frontrunner in stratigraphic services worldwide. Nonetheless, as many other SMEs, the organisation is not exempt from encountering challenges when implementing innovation.

Hence, this study aims to investigate the current challenges faced by the company and also to aims to measure the perception of the workforce on innovation and innovative processes within the organisation by conducting an internal survey on

different aspects of innovation. The study also outlines the mechanisms that are being put in place and discusses potential recommendations for mitigating the challenge of bringing innovation to the company.

2. Research Objectives

The main research objectives of this study are:

- Evaluate how innovation is perceived by the workforce of an SME that operates in the geosciences sector.
- Identify challenges within an SME that operates in the geosciences sector.
- Explore the current processes implemented and assess their benefits.
- Recommend mechanisms to facilitate innovation within the company.

3. Justification

Businesses can be vulnerable to several factors that can shake their model and continuity. One that can be particularly disruptive, is technological advances. For this reason, innovation is one of the key elements for competitiveness, resilience, and business continuity (Niemimaa et al., 2019). Innovative businesses coupled with the development of new technologies clearly widen the companies opportunities and in fact constitute a threat to competitors that fail to adopt innovation as part of their business strategy (Niemimaa et al., 2019). Nonetheless, SMEs often face several challenges when bringing innovation into their businesses, including financial risks, limited resources and lack of facilitating mechanisms. To effectively address these challenges, it is fundamental to gain a deep understanding in the company's culture in relation to innovation as well as understanding and identifying the areas where weaknesses exist in this regard. Gaining a comprehensive understanding should provide the necessary mechanisms to elaborate a more strategic roadmap for implementing innovation in the company. This should serve as a cornerstone for facilitating bringing innovation and implementing innovative ways to deliver solutions to clients which in turn, would result in improved products as well as providing a competitive advantage to the organisation when it comes to attracting more customers. Innovation would also positively impact productivity and efficiency and ultimately long-term sustainability. In other words, without innovation, the company can become stagnant and could potentially jeopardise its survival.

4. Background and context

Recent technological advances in automation, Internet of Things, image recognition, machine learning, digitalisation and similar technologies, also known as technologies of Industry 4.0 (e.g. Darth and Horch, 2014; Zhou et al., 2015; Pereira and Romero, 2017; Ślusarczyk, 2018), have been creating a wave of changes in how different businesses operate, and arguably, it has also impacted the day-to-day aspects of life (Ślusarczyk, 2018). Numerous research and discussions related to these technological advances have been held over the past few years, to the extent that governments have started to introduce different legislations on this matter (e.g. European Parliament, 2023).

Although many businesses implement the culture of Continuous Improvement by adopting the guidelines provided by the ISO Standards, some industries tend to be more exposed and show more readiness to innovative technologies from Industry 4.0 and subsequently are more prone to see a substantial increase in productivity and effectiveness of processes. According to Hermann et al. (2016) adopting innovation generally impact:

- Interconnection; including standards, collaboration, and security.
- Decentralised decision-making.
- Information transparency; including data analytics and information provision.
- Technical assistance; including virtual and physical assistance.

As previously highlighted, the readiness for innovation varies across industries, with certain sectors adopting innovation more effectively than others. For instance, automotive, manufacturing, digital services, and urban planning among others, are nowadays seeing the benefits of bringing innovative processes to their workflows. This strategic adoption of innovation not only enhances their resilience but also enables them to grow more organically. However, when compared to other industries, the field of geosciences has seen a relatively slower pace in the adoption and implementation of new technologies. Specifically in the area of biostratigraphy, one of the core specialities of the studied company, the use of new technologies has been rather stagnant. Nonetheless, it is worth noting that image recognition and machine learning has recently become the focus of different biostratigraphy research groups around the globe (e.g. Pires de Lima et al., 2020; Garidel-Thoron et al., 2020) but their developments are still in their early stages and are far from widespread commercial implementation.

In the past few years, the studied company has embarked on a journey that aims at introducing innovation in the different areas of the business to strengthen their position in the market together with providing more and better solutions to their clients. Nonetheless, it is of vital importance to understand the challenges and obstacles the company can face when it comes to investing resources (financial and workforce) in implementation of innovative ways to operate. A complete and thorough

understanding of this should provide key insights for producing a clear and effective roadmap for innovation. In fact, systematic and formalised approaches for roadmap generation have been deeply studied and applied in different industries with positive results (e.g. Rinne, 2004; Kerr et al., 2012; Amati et al., 2020).

5. Significance of this study

The current study aims to provide insights on how innovation is perceived within the company and also elucidate on the ongoing challenges currently encountered when researching and developing innovation within the organisation. The results of this study should serve as a foundation for improving the current roadmap and will contribute with recommendations for implementing processes and mechanisms to enhance the innovation processes within the company and future strategic decision-making when implementing innovation.

6. Key Definitions, Context and Literature Review

The literature review in this manuscript aims to provide a context that focuses on the following:

- Aspects of Innovation and Industry 4.0
- Definition of SME
- Importance of innovation in SMEs
- Problems of SME face when bringing innovation

6.1. Aspects of Innovation and Industry 4.0

Innovation has been a fundamental part of humanity since the conception of society; since the agricultural revolution approximately 10,000 BCE and the innovations in science from Isaac Newton and Galileo Galilei to the most recent developments of the digital revolution. These technological advances have also had vital impact in how businesses operate and continue to shape the different models and processes applied within the organisations. Most recently, the ability of companies being innovative has become a key element of competitive advantage in different sectors (Bleicher and Stanley, 2016; Castelo-Blanco et al., 2019) with many using innovation to offer new

products and services from outside their former core business (Castelo-Blanco et al., 2019), and therefore becoming more profitable and versatile.

The current wave of innovation, also known as the fourth industrial revolution, or Industry 4.0 (e.g. Schuwab, 2016) is becoming a major disruptor on how every industry operates due to, amongst others, the unprecedented exponential speed of breakthroughs (Schuwab, 2016). Moreover, according to Slusarczyk (2018), the current industrial revolution will also have far-reaching effects on every aspect of our society given how technology facilitates the interconnectivity of everything. This integration and interconnection of digital technologies, also referred to as the Internet of Things (e.g. Xu et al., 2014; Witkowsky, 2017), encompasses the object interaction with other objects or the environment to provide detailed information such as physical conditions or parameters, available functions, locations etc. and can indeed correspond to a powerful tool in many fields, from manufacturing, to scientific processes (e.g. autonomous microscope collecting and providing information from rock samples). Other common technologies associated to Industry 4.0 encompass the use machine learning, artificial intelligence and in general the application of intelligent processes that enable interconnection between humans, machines and products using either autonomous or remotely controlled interfaces (Bleicher and Stanley, 2016).

At present, it is therefore not unexpected to see a distinctive trend on different organisations actively seeking ways to leverage from the potential of these technological advances. This eagerness to explore and exploit these opportunities can also bring challenges and risks when a roadmap and a strategy is not clearly defined, with smaller companies being more vulnerable due to, for instance, budget restrictions. As such, many organisations are increasingly dedicating efforts to optimally adopt and adapt to innovation in a methodical manner, to minimise risks, capitalise from it, and ultimately secure business continuity.

6.2. Definition and importance of small-medium enterprises (SMEs)

According to the British government, SMEs are defined as businesses with less than 10 employees and an annual turnover of less than €2 million (micro), less than 50 employees and an annual turnover of less than €10 million (small), and medium-sized businesses with less than 250 employees and an annual turnover under €50 million (Department for International Trade, 2020).

SMEs play an extremely important role in the British economy. Statistics from 2022 show their significance, with 5.5 million businesses in the UK, equating to 99.9% of the business population corresponding to a SME (Federation of Small Businesses,

2022). Additional statistics shown by the Federation of Small Businesses (2022) showed that SMEs employed 16.4 million people during 2021 and generated an estimated turnover of £2.1 trillion. Hence, these numbers unequivocally demonstrate how SMEs are the backbone of the nation's economy. In addition to this, SMEs play a crucial role in providing employment to local communities. They can also nurture skilled talent and participate in providing services to the global market. These contributions undoubtedly fortify and enhance the overall strength of the nation's economy. Savlovschi and Robu (2011) also highlight how important SMEs are in competing with big corporations and therefore preventing them from controlling the market and potentially creating monopolies in different areas.

6.3. Importance of Innovation in SMEs

An increasing number of large companies have been shifting the way they operate by introducing technologies associated with Industry 4.0, leveraging from interconnectivity, automation and robotics. This has resulted in a substantial increase in efficiency and productivity (Mezentseva, 2021). The speed at how this new technology becomes available and accessible is also allowing smaller organisations to start incorporating it into their operations. This is therefore enabling an increase in the competition in the different industries at a global scale, but at the same time, in order to remain in business and competitive, SMEs must be able to respond quickly to the shifts in technology and become more dynamic in how they respond to changes in the customer requirements and playfield.

As mentioned previously, SMEs play a very important role within national economies. Implementing innovation within SMEs has the potential to bring a notable increase in profitability through the optimisation of processes and adoption of more efficient practices. Consequently, this can provide an advantage to the nation by positively impacting its economic growth. Petkovska, (2015) eludes that SMEs have an advantage compared to larger organisations in different factors, for example:

- Providing personalised service by creating a relationship with their customers.
- Good customer service as their relationship with their customers allow SMEs to understand their needs and provide tailored solutions.
- First-hand access to market information by dealing with a targeted audience and being able to identify new changes in the market.
- Flexibility to adapt to changes in the market by generally operating with a lean structure.
- Greater commitment and productivity in the workforce due to the size and simplicity of the organisational structure.

These advantages coupled with innovative processes and procedures can provide an ideal market environment for SMEs. However, as there are also many risks associated to implementing innovation, it is extremely important to execute a thoroughly calculated strategy to succeed, including a comprehensive market research to make sure the investments and workforce efforts are being directed towards the right developments. Mezentseva (2021) also eludes that it is necessary to carefully assess the specific needs of the specific SMEs and include appropriate guidelines as part of the strategy and roadmap. Four main fields defined by the Organisation of Economic Cooperation and Development (2005) should be clearly outlined and in the strategy and roadmap: product innovation, process innovation, organisational innovations and marketing innovations, with defined priorities for each one of these according to the needs and goals of each business.

6.4. Problems SMEs face when bringing innovation

Most SMEs find themselves in the conundrum of allocating resources to innovation versus billable work. This dilemma affects virtually all organisations as they require to accomplish daily tasks and products efficiently to be able to stay in business (Trott, 2017). On the other hand, the need of developing new ideas and products secures business continuity and competitiveness in the future (Trott, 2017). Figure 1 shows the fundamental problem companies face when trying to implement innovation, and clearly shows one of the biggest challenges at managing this type of process.

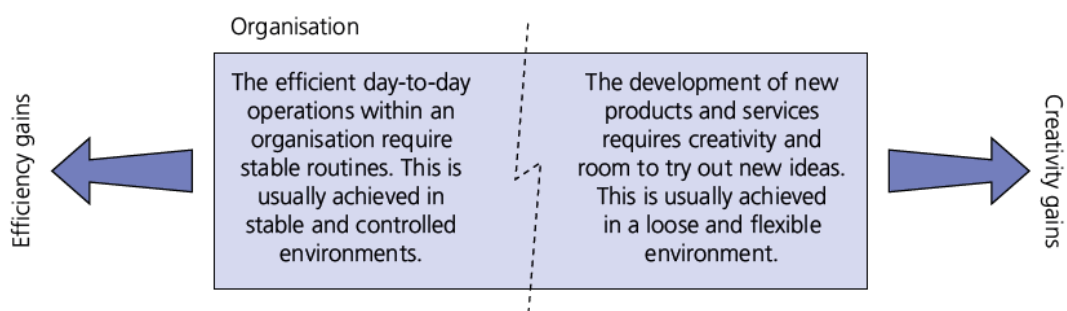


Figure 1: Tension between the need for creativity and efficiency. Taken from Trott (2017).

Trott (2017) also eludes that the long term growth of companies is highly dependent on the ability to make improvements and innovations to processes and products, but the lack of seeking innovation within the organisation will increase the likelihood of the business diminishing until collapsing itself. Therefore, it is crucial for organisations to provide a balanced amount of time and space for new product development and innovation. The dynamic approach of balancing between innovation activities and

regular operations highlights the fundamental role of senior management in providing a strategic plan that allows such culture. This dynamic capabilities approach was coined by Duncan (1976) as *business ambidexterity* or *organisational ambidexterity* and corresponds to a fundamental practice to apply innovation.

When it comes to SMEs, studies show that a lack of innovation culture and strategy can constitute one of the main challenges for innovation, particularly in the manufacturing sector (e.g. Terziovski, 2010; Kumar et al., 2014; Mittal et al., 2018). This in a way is the reflection of SMEs having to focus most, if not all their resources into daily tasks to be able to deliver products and remain in business. Hence, this also highlights that SMEs are financially constrained, and innovation can in cases become a financial risk. A negative intra-company perception on innovation can also be an obstacle for innovative practices.

Studies conducted by Mittal et al. (2018) indicate that SMEs typically lack cross-disciplinary collaboration with universities and/or institutions (national & international). This limits their access to new technologies and processes that could potentially benefit them and consequently restricting their technological progress to their specific domain.

A study on the main obstacles and barriers faced by SMEs when innovating conducted by Orzes et al. (2018) concluded that these can be broken into 6 areas:

- Financial Risk: including the high investments typically required for conducting innovation, restricted budgets, and lack of defined benefits.
- Cultural: lack of support from company managers and reluctance to change, restrictive mindset, unsupportive organisational structure
- Legal: including concerns in data security, bureaucracy, restrictions in regulations.
- Competencies/resources: deficit of skilled workforce and technical knowledge.
- Technical: including uncertainty about systems, lack of standards, compatibility issues with software/processes used, lack of knowledge and awareness of available technologies.
- Implementation process: lack of methodical approach and clear roadmap, changes in the business model, time allocation.

As previously eluded, one of the first steps towards implementing an adequate roadmap is understanding the level of awareness and the degree of innovation built in the organisation's operations. To measure this, Ganzarain and Errasti (2016) proposed a *Maturity Model* purposely tailored to SMEs to assess the level of development of innovation, specifically related to Industry 4.0, adopted by the organisations:

- 1) Initial: Company-specific Industry 4.0 vision is non-existent.
- 2) Managed: A roadmap for implementing Industry 4.0 is available.

- 3) Defined: Key resources, customer segments, and value proposition clearly defined.
- 4) Transform: strategy divided into concrete projects and tasks.
- 5) Detailed business model: The business model is transformed towards Industry 4.0

It is clear that innovation comes with many uncertainties and managing it involves trying to nurture and promote new ideas and develop the creative potential within the organisation. Managing this uncertainty is a fundamental feature in innovation and has been identified for many years. However, it is still a cause of concern in current organisations (Trott, 2017). Depending on the sector of operation, each company will have different types of challenges and different levels of uncertainty (e.g. manufacturing companies vs scientific companies). With the aim of assisting management in identifying and dealing with the different uncertainties, Pearson (1991) proposed a *uncertainty matrix*, or *uncertainty map* (Figure 2) and can show how uncertainty can evolve over time as understanding of output and processes get better understood.

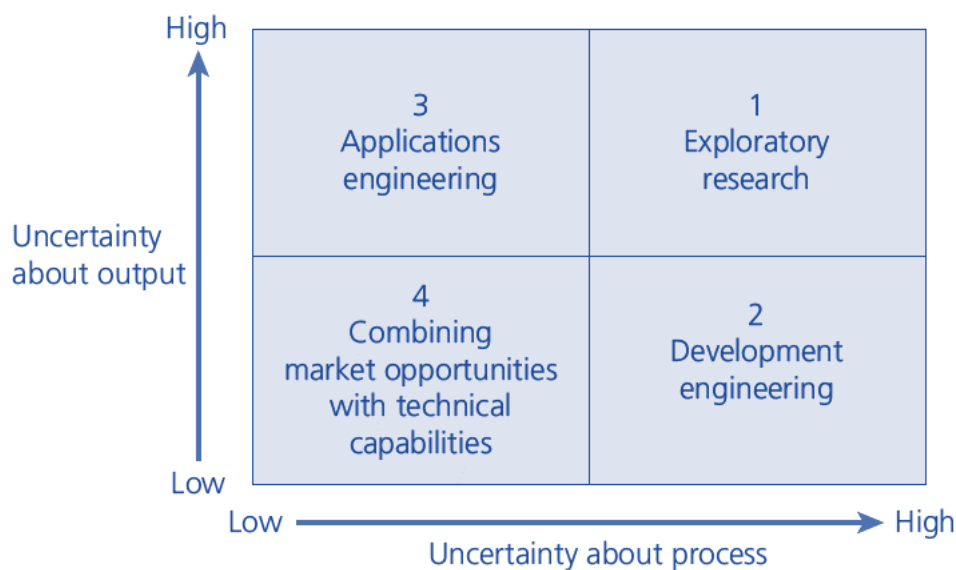


Figure 2: Pearson's uncertainty matrix. Modified from Trott (2017).

Trott (2017) highlights that the company culture is undoubtedly a crucial component in innovation as this can affect engagement from different departments or groups. Reluctancy to share ideas and unwillingness to work and implement innovation can lead to innovative projects being left incomplete and abandoned due to lack of progress. In addition, SMEs typically lack space for creativity due to the focus on efficiencies as previously mentioned. However, the reviewed literature highlights the need to adopt a willingness to accept risky, yet informed, decisions to increase focus

in innovation, including providing individuals the space to develop ideas and experiment (e.g. Birdi et al.,2012; Trott, 2017).

7. Case study: SME operating in the geoscience sector – North Wales

7.1. Overview

The studied company constitutes one of the leading SMEs service provider in the geoscience sector. With satellite offices in Cheshire, St Albans and North America, its main headquarters are located in Conwy, UK. The company operates with approximately 120 staff members and has been actively growing since founded, in 1995.

Over the past few years, the company has embarked in a mission to implement innovative processes and procedures as well as ways of delivering products to its client base. As part of this process, it is important to gather a detailed picture of how innovation is perceived within the organisation to be able to identify areas of weaknesses and challenges faced in order to create more effective strategies and clearer roadmaps to innovation. Hence, the research here conducted provides internal insights in the different aspects of innovation and innovative processes on the different departments of the company. The conducted survey also provides an opportunity to the participants to provide suggestions and/or feedback on how the internal processes and procedures related to innovation can be improved. Additional observations are provided by the author of this research.

7.2. Methodology

In order to measure the degree of awareness in innovation within the company, and to aim to identify weak points and potential improvements, an intra-company survey has been conducted. In general, surveys correspond to an effective way of collecting information and insights on specific areas and are widely used from scientific research to governmental institutions. By engaging with staff members, it is expected to obtain a baseline for measuring innovation awareness and also provide a reference point for tracking the changes in the company in areas such as company culture and

acceptance. It should also provide indication on how different departments of the company stand in terms of trends and engagement. The results should also provide indications on gaps in the awareness and understanding of innovation on each department and discerning views on factors such as the risks associated to innovation implementation. This should also provide essential information for delivering effective awareness sessions and training initiatives and improve how innovation strategies are communicated across the organisation. In addition, gauging the state of innovation within the company should allow a more strategic investing in innovation initiatives as opposed to a broad approach on different fronts resulting in efforts and resources being misused.

7.2.1. Research Design and Data Collection Method

Is commonly seen that certain people are more prone to complete surveys than others. In intra-company analyses, this can be seen as some departments or branches engaging more than others in such process. Therefore, company-wide surveys tend to only capture information from specific areas of the business and therefore showing skewed data to some extent. Hence, with the aim of providing a standardised measurement and avoidance of skewed data towards one specific area of the business, specific targeted individuals were requested to participate in the survey. The participants were grouped as follows, with each group having the same number of participants for consistency:

Group 1: Directors

Group 2: Department Managers

Group 3: Business support

Group 4: Laboratories

Group 5: Analysts

Group 6: New Ventures and Business Development

In addition, similar proportion of junior and senior employees were selected on each group to aim to provide a general picture that equally captures the perspectives from all the different ranks in the organisation.

The survey was carried out during October of 2023 using Microsoft Forms as survey tool. The approach taken was designed to assess three principal sections, with a total of 16 questions:

Survey sections:

- Section 1: Awareness of Innovation
- Section 2: Challenges and Risks
- Section 3: Support and Engagement

The complete set of questions of the survey is included in Appendix 1.

7.3. Results

A total of 42 individuals were selected to participate in the survey and although the implementation of a targeted approach in the research design was aimed to mitigate lack of engagement, only 54.7% of the selected candidates provided responses to the survey.

An interesting trend is seen in the variance of the response rate from the different groups surveyed, with the lowest rate obtained in Group 4 (Laboratories) with only 14.2% of responses received (see Table 1). It is important to highlight that at the time of the survey, workloads in the company were extremely high, specifically with overseas deployment of laboratory technicians. This could have to some extent affected the engagement from this group. In a marked contrast, a 100% response rate was obtained in Groups 2 and 5 (Department Managers and Analysts respectively).

Group	Response Rate	Sample Size	Realised Sample
1. Directors	28.5%	6	2
2. Managers	100%	6	6
3. Business Support	57.1%	6	4
4. Laboratories	14.2%	6	1
5. Analysts	100%	6	6
6. New Ventures and Business Development	28.5%	6	2

Table 1: Response Rate, Sample Size, and Realised sample values per group surveyed.

The main results obtained in the survey are outlined below in the form of graphs and general comments.

7.3.1. Section 1: Awareness of Innovation:

One of the key aspects of innovation, is the ability to discern and identify potential actions or ideas that, if developed, could transform into a new innovative product or process. Hence it is vital to identify the degree of engagement and also which departments are more actively coming across processes or scenarios where innovation could be implemented.

The findings show that 48% of the surveyed group indicate occasional engagement in ideas that could become commercial innovations and only 1% indicating no engagement in such process (Figure 3). Overall, all the different departments have at least occasionally identified potential opportunities for innovation highlighting the high degree of potential opportunities for innovation.

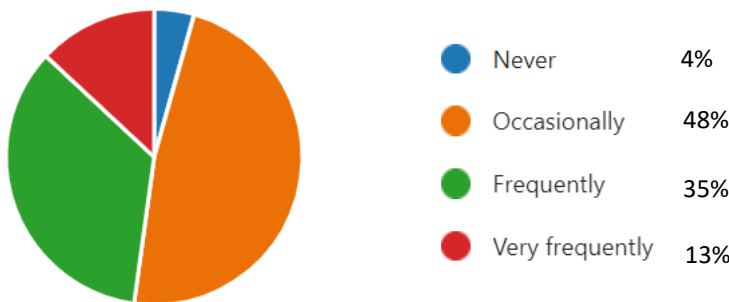


Figure 3: Percentage people becoming aware of ideas that could transform into innovative processes.

When asking the respondents on how important investing in innovation (time, people, resources), a general consensus is that they perceive innovation investment as an important factor for the benefit and continuity of the business. In other words, the results show an almost unanimous result acknowledging that innovation is a pivotal factor in the business and requires continuous attention. Also, a common agreement across most of the surveyed individuals is that budgetary restraints is the main obstacle for bringing innovation with time allocation or focus in billable work being the second most frequent answer. Figure 4 shows the results obtained on how the importance of investing in innovation is rated.

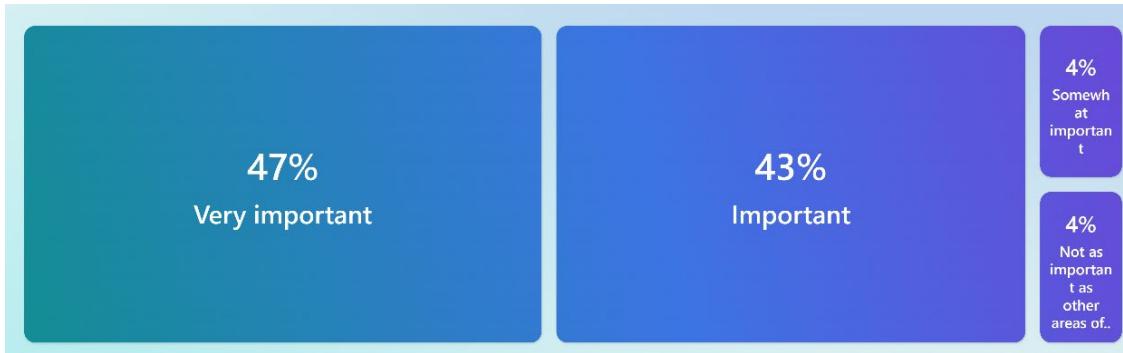


Figure 4: Importance of investing in innovation (time, resources, people). 47% *Very Important*; 43% *Important*; 4% *Somewhat important*; 4% *Not as important as other areas of the business*.

87% of the surveyed people indicate that the company has been actively pursuing innovation activities over the past 3 years, with the main area being digitalisation (Figure 5). This is in line with the current internal campaign of focusing in innovation practices, and with the current roadmap having digitalisation as one of the first areas to tackle. However, it also reflects that somehow a 13% of the surveyed people is not fully aware of the ongoing innovation practices.

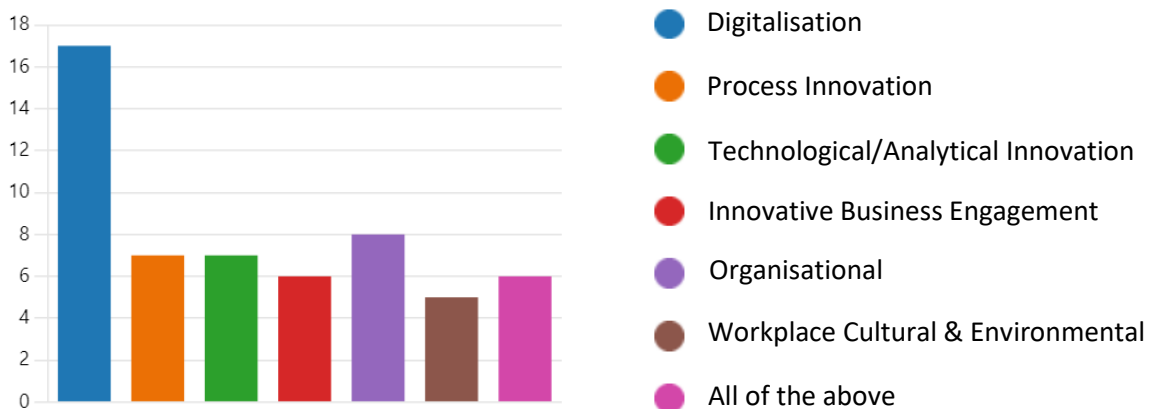


Figure 5. Types of innovation being implemented in the company.

Summary on Section 1:

Overall the findings obtained seem to show alignment between the surveyed groups on how important innovation is to the business and also shows how a great percentage of individuals are actively aiming at identifying opportunities for innovation on their daily tasks. This displays interest in innovation from different individuals and also potential from the workforce for engaging and participating in such activities.

The received responses also indicate that digitalisation is the main innovation activity with the highest awareness amongst participants. This is in line with the current innovation strategy where digitalisation has been one of the first areas being developed.

7.3.2. Section 2: Challenges and Risks

As mentioned previously, most individuals agree that the budgetary restraints correspond to the main obstacle for bringing innovation to the organisation. However, other obstacles or challenges eluded for bringing innovation to the company according to the obtained responses are:

- High workloads preventing staff from looking and developing innovative ideas.
- Resistance to change from all levels of the organisation, including personnel at Management and Director level.
- Lack of creating and nurturing creative environment and spaces and fostering collaboration in innovative ideas.
- Lack of time allocated to innovative activities.
- Lack of a clear strategy including procedures and protocols to follow for research and development and slow decision making.
- Not enough autonomy given to Departments for innovation.

When it comes to perceiving innovation as a potential risk to the company, the outcome reveals great disagreement, with 39% expressing agreement of a potential risk, 34% agreeing that there is no risk associated with innovation, and 26% suggesting uncertainty on the stance of the potential risks associated with innovation (Figure 6).

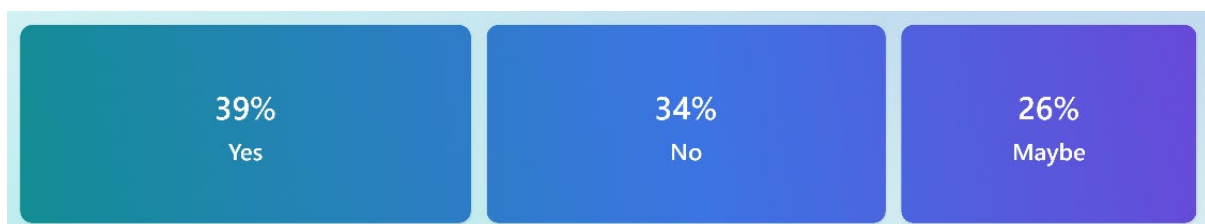


Figure 6: Percentages on the view of implementing innovation represents a risk to the company.

The main areas or factors that could represent a risk to the business according to the responses obtained in the survey are:

- Wasting resources (budget and staff) in innovative activities that ultimately would not materialise into a commercial product or process or would not get implemented.
- Overinvesting in one specific area without carrying out an appropriate market research or client requirements would jeopardise budget allocation to innovation in subsequent years. Also, poor market research could end up in developing a product with price tags that the clients are not willing to pay.
- Focusing too much in innovation and losing focus on the core business that generates the revenue.
- Overall financial risk and uncertainty around the return of investment.
- Poor project and resource management in innovation activities
- Acceptance of innovation from staff and/or clients
- Innovation into new areas could represent diverting away from the company's *forte* resulting in traditional work going to competitors or staff leaving due to lack of interest in the new fields.

Figure 7 shows that according to the 82.6% of the surveyed people, the effectiveness in the ongoing innovative initiatives needs to improve, with only a 17.4% indicating that it's the right balance. None of the respondents consider that the effectiveness of the current innovation is high (too much/too high in Figure 7). In addition, 78.3% of the respondents indicate that time allocated to innovation needs to increase and 65.2% suggest that the personnel allocated to innovation needs to increase. 21.7% and 34.8% consider that the time and personnel allocated to innovation is the right balance accordingly. This seems to be in agreement with the statements above listing the obstacles and risks.

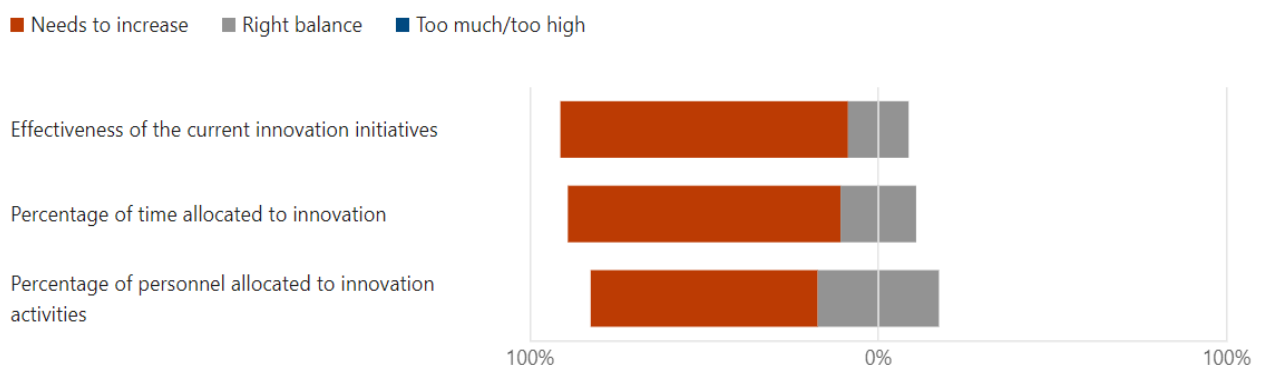


Figure 7: Bars indicating the effectiveness of innovation initiatives and percentage of time and personnel allocated to innovation within the studied company.

The information obtained also mentioned that the company could also be affected by the presence of internal barriers, including the limitation of only a reduced group of individuals working in innovative activities, and frequently at closed door. This could prevent or difficult input and participation at a broader scale. Other internal barriers such as company culture, resistance to change and unclear budgets have also been mentioned by the respondents. These tend to be quite common, and most SMEs experience them to a certain degree as suggested by the study conducted by Cordeiro and Vieira (2012).

Finding the right balance on giving priority to routine work versus innovation activities is the perhaps one of the fundamentals conundrums faced by SMEs. Nonetheless, a general consensus across the company on where innovation stands in terms of priorities could have a positive impact in the process of implementing innovation. Following from that, the results obtained on how much priority should the company give to innovation indicate an overall agreement towards innovation needing to be one of the highest priorities to the company; 21.7% strongly agrees on the statement that innovation should be one of the highest priorities in the company, with 52.2% agreeing on this statement. 17.4% is neutral and only 8.7% disagrees with the statement (Figure 8).

Although budget for innovation has been commonly mentioned as one of the internal barriers experienced in the studied company, the data also shows a general view that there should be a balance between expenditure against innovation and other activities. 52.2% indicates neutrality towards a high percentage of the budget being spent in innovation whereas 30.4% agrees on the statement of high expenditure (Figure 8). Nonetheless, increasing expenditure in innovation can have implications in the company's cash flow meaning that the financial risks will also increase accordingly.

The survey reflects that the current channels or procedures to propose innovation ideas within the company are ineffective or inefficient with 8.7% of the respondents strongly disagreeing with the statement of the company having clear mechanisms for proposing innovation. An additional 47.8% indicate they disagree with the statement but a 21.7% consider the current mechanisms are effective (Figure 8). This could potentially be highlighting certain groups being more aware of the channels in place than others. Nonetheless, establishing clear channels across the organisation is key for nurturing a culture of creativity and innovation.

34.8% of the respondents have a neutral view on the statement "the size of the company impacts the implementation of innovation", whereas 34.8% and 8.7% agree and strongly agree respectively (Figure 8). The literature review shows that the size of the organisation is indeed amongst the main factors that could affect implementing innovation as the size of the company can have implications in lacking the relevant skill force and having limited access to funding financing amongst others. This has been clearly documented in different studies (e.g. Gomes et al., 2009; Kumar et al., 2014; Mittal et al., 2018; Mezentseva, 2021).

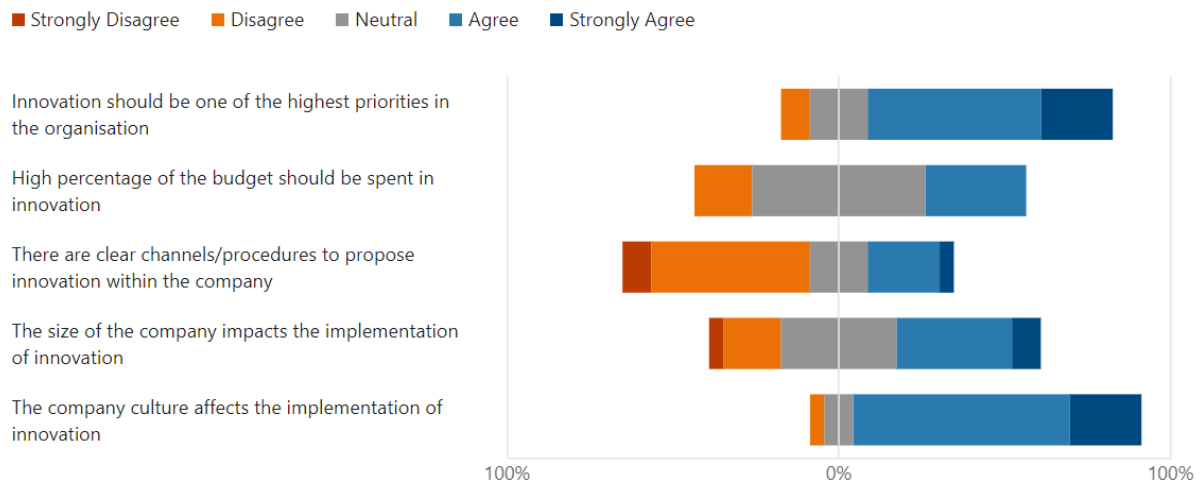


Figure 8: Degree of agreement vs disagreement on the different statements provided in the survey.

The trend seen in the bottom bar of Figure 8, shows that a vast majority of the surveyed individuals agree that the company culture affects the implementation of innovation, with 21.7% strongly agreeing and 65.2% agreeing with the statement provided and only a mere 4.3% disagreeing.

It is to some extent difficult to clearly define what encapsulates the concept of company culture in terms of innovation as they can sometimes be conditioned by different factors such as the concept being reflected, the respondent's approach, and the emphasis given (Szczepanska-Woszczyna, 2014). However, in general terms, an organisation with a positive culture towards innovation should have a buy-in behaviour across the company, and arguably more specifically on the key stakeholders as they will likely have a stronger influence in the innovative character of the business.

In the concluding segment of Section 2 of the survey, the respondents were requested to rank a series of options from highest to lowest (Figure 9). The options were tailored based on the most common challenges faced by SMEs according to the literature (e.g. Cordeiro and Vieira, 2012, Mezentseva, 2021). During the design of the survey, this segment was strategically placed at the end of Section 2 (Risk and Challenges) to avoid the respondents opinions in the preceding sections from any potential bias derived from literature. Placing options based on literature at the end of the section also allowed comparing similitudes between the commonly stated risks and challenges mentioned by the different groups and the ones typically faced by SMEs according to the literature. In other words, this enables to validate the experimental insights of participants with observations from different research studies.

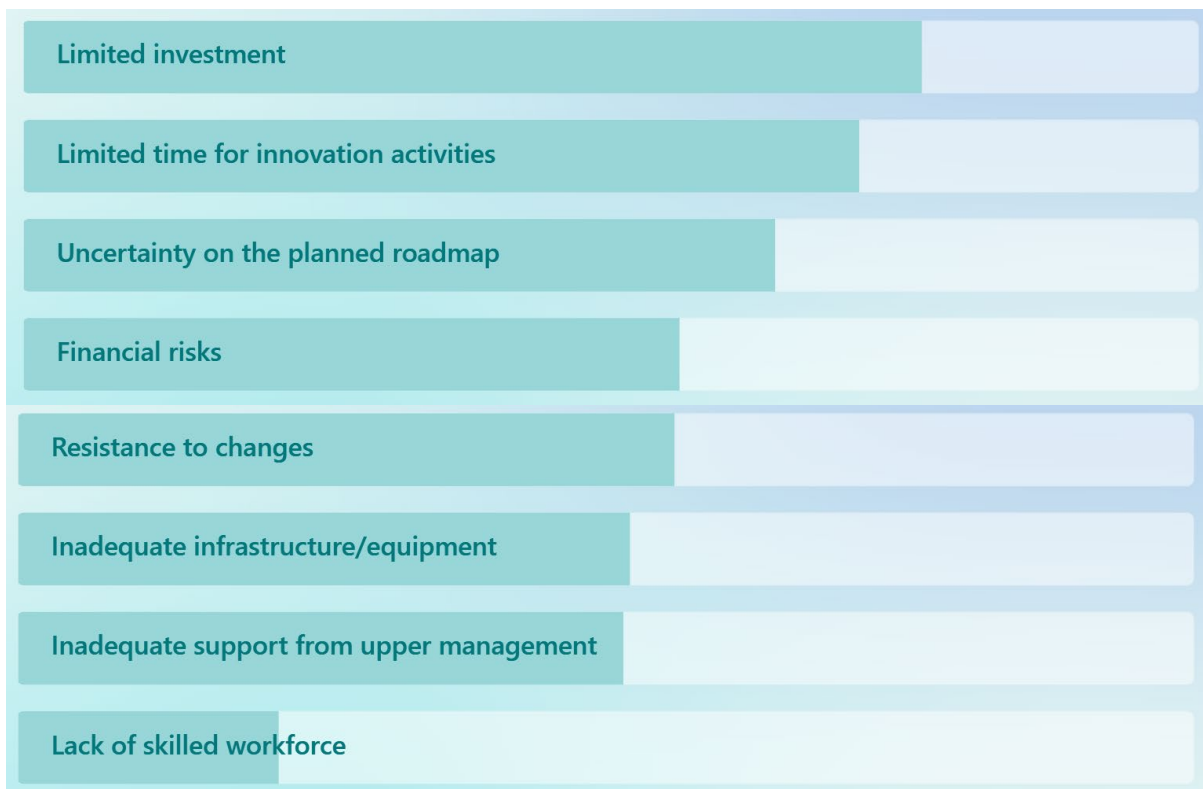


Figure 9: Ranked options on the major challenges for implementing innovation in the company according to the surveyed groups.

According to the results obtained, limited investment in innovation emerges as the top challenge for bringing innovation to the company, with a significant 30% of the surveyed staff placing it as the primary concern. Closer examination of the results show that Group 2 (Managers) corresponds to the group where this option was more frequently considered as being the top challenging factor for innovation. The fact that most of this group consistently placed limited investment as the main challenge potentially signals their limitations to develop activities related to innovation due to budgetary constraints and highlights the importance of how budget considerations can play an important role in shaping the innovation and innovative culture within the teams.

Limited time for innovation activities corresponds to the second highest option in Figure 9. However, only 9% of the respondents assigned this as the top option, but interestingly this was observed exclusively in Group 5 (analysts). 30% of the surveyed people placed this as a second option without any trends on a specific group but rather spread across evenly.

Figure 9 shows the challenge of uncertainty on the planned road as being ranked as third highest ranked concern with 17% of the surveyed people placing it as the first choice, with half of them being from Group 3 (Business Support), potentially

highlighting common perspectives by the individuals within this part of the business. Possibly the nature of their roles could mean that their exposure to the ongoing innovation process is smaller compared to other groups of the business. A deeper analysis would be required to find out if this is the case.

Financial risk corresponds to the fourth highest challenge for implementing innovation according to the data displayed in Figure 9. 22% of the surveyed personnel placed this as their highest concern. Particularly, no specific trends have been noted when dissecting the results, meaning that all groups are equally aware and concerned of the financial risks associated to the implementation of innovation. The absence of any clear trends potentially implies that employees at different levels share a common understanding on the financial risks associated to innovation and innovative activities as opposed to only a specific group people with specific roles.

13% of the surveyed people selected resistance to changes, which go hand to hand with company culture, as the major challenge for implementing innovation. The individuals placing this as their main concern derive from Group 2 (Managers), Group 5 (analysts) and Group 6 (New Ventures and Business Development), suggesting a degree of concern on the cultural factors from a proportion of individuals from these group that could influence the development of innovation internally.

Inadequate infrastructure and/or equipment and inadequate support from upper management are placed closely as the sixth and seventh challenges respectively in Figure 9, with a mere 4% placing these options as their highest concern. This suggests a favourable scenario in the company indicating that the existing equipment and infrastructure required for exploring innovative ideas is considered to be somewhat sufficient. There are, however, scenarios or circumstances where specific equipment would be required for developing innovative ideas (e.g. autonomous machinery) but has yet to be identified due to the infancy of the different innovation projects that are currently planned. Nonetheless, this requirement could fall into the *limited investment* option if such scenario would arise. In addition, according to the results obtained, the company seems to benefit from support from the upper management for innovation activities as this has been placed as the second to last challenge in Figure 9.

Finally, the lack of skilled workforce is positioned as the least concerning challenge in Figure 9 according to the surveyed groups. Notably, none of the individuals who participated in the survey identified this challenge among their top 3 highest challenge for innovation in the company. Only a small 9% of the respondents placed it in fourth position and 4% in the fifth position. In contrast, 65% of the surveyed individuals placed it as the least concerning factor for implementing innovation. This highlights a consensus amongst the surveyed groups that the existing workforce in the company possess the relevant knowledge and skillsets needed to conduct innovation activities that could develop into new products or processes.

Summary on section 2:

Section 2 of the survey provided valuable information on the risks, challenges and internal barriers within the company. The predominant challenge identified internally corresponds to limited investment, particularly echoed within Group 2 (Managers). This goes in line with the general theme of budgetary constraints as being the most predominant obstacle. Time constraints for innovation activities arises as one of the main concerns for Group 5 (Analysts), with financial risks associated to innovation being recognised across the different groups. Existing infrastructure, support from upper management, and skilled workforce constitute a generally favourable asset in the company for nurturing innovation if well managed.

7.3.3. Section 3: Support and Engagement

To evaluate what factors would influence participation of staff in innovation at work, the respondents were asked to provide insights on which factors they considered play an important role in such matters. The more frequently provided aspects were:

- Formally defined time allocation for innovation activities across the entire company, ideally, including specific expected time allocated to these activities in the timesheets.
- Workload reduction: the constantly heavy workloads prevent any thinking and developing of innovative ideas. – This would to some extent goes hand to hand with the previous point.
- Clear support from the board as sometimes there are mixed messages due to some members of the board being more engaging in innovative activities than others.
- Clear direction and roadmap. This would provide more motivation on personnel to engage in activities that would likely result in products and/or processes that would be implemented or adopted. This includes projects with defined goals and outcomes.
- More transparency in the ongoing processes. – This should be implemented in conjunction with the previous point.
- Dedicated workshops to get people involved in innovation activities irrespective of whether or not people would eventually get involved. This would increase the sense of involvement in staff members and would also provide different views that would benefit the process.
- More delegation of authority and autonomy from upper management to staff for developing and implementing innovation.

Furthermore, when asked about any reservations in getting involved in innovation-related activities, 78% indicated that they have no concerns. A common theme developed in the 22% of people that indicated having a degree of concern in participating in innovation activities was related to time and deadlines; getting involved in innovation activities would leave participants with reduced time to fulfil the routine activities associated to their roles. It is worth highlighting that an adequate structure that defines a set time to be allocated to innovation would have to consider the impact in turnaround times on the current business deliverables. Hence, modification in the projects life cycles would be required to extend their duration and, in this way, allow staff to participate in innovation practices alongside billable work without increasing the pressure due to deadlines etc.

Additional concerns expressed in the survey relate to the absence of well-defined processes for submitting or reporting and following up on innovation initiatives. This indicates the need to create some kind of portal ideas and tracking which will offer transparency to the ongoing processes.

To conclude, the surveyed groups were requested to provide, if any, suggestions or initiatives to encourage innovation in the company. The suggestions included:

- Relevant company-wide training and awareness sessions on what new technology is being implemented or explored.
- Improve communication specially on encouraging innovative ideas.
- Push for innovation on internal processes as equal as the current campaign for developing new products for the company's clients. This would have a positive impact across the organisation and will benefit the overall company culture around innovation.
- Define time allocation for innovation activities.
- A procedure where employees can submit ideas and provide budget towards preliminary market research to evaluate feasibility. Small 'innovation project' teams could subsequently be formed after to ensure the continuous progress and ultimately the development of a new product, process or procedure.
- Feedback mechanisms or surveys in current innovation activities to facilitate input which could lead to new ideas or ways of resolving specific drawbacks.

Summary on Section 3:

Section 3 of the survey showed that most of the surveyed personnel do not have any concerns in participating in innovation. Important insights on which factors influence staff participation in innovation activities was also acquired, with formally defined time allocation and workload reduction being the most frequently developed theme in the feedback obtained. Interesting suggestions were obtained such as strategic changes in the project lifecycles to accommodate for innovation and well defined processes for

submitting and tracking innovation ideas. These ideas and feedback should be taken into consideration as they could end up being paramount in cultivating a culture of innovation within the company.

7.4. Discussion

7.4.1. Is the data obtained in the survey reflecting what the literature reports in terms of challenges?

As documented in the literature review, SMEs typically find themselves trying to find the right balance between enough investment in innovation without compromising their financial stability but also not falling behind and ultimately succumbing on their competitors with better technologies. In fact, according to Mezentseva (2021), the smaller the company, the higher the risk of not benefiting from the current industrial revolution due to lack of financial strength to bring innovation to the company. The limited investment and budgetary constraints mentioned in the survey as the main challenges for bringing innovation within the studied company, are arguably a consequence of the financial constraints an SME typically experiences. This is in line with what is frequently reported in the literature as one of the main challenges for SMEs (e.g. Madrid-Guijarro et al., 2009; Cordeiro and Vieira, 2012; Mittal, 2018; Mezentseva, 2021), with Madrid-Guijarro et al. (2009) also concluding that the financial burden of innovation is more significant in smaller organisations. Nonetheless, it is important to recognise that the financial risks that come with increasing budget towards innovation could be paid off by the potential development of new capabilities and products that will in turn benefit and strengthen the company's financial health in the long term. Innovation can also provide the means for entering new sectors and industries allowing business diversification (Kamien and Schwartz, 1975). The same rationale would apply to personnel allocation to innovation activities; the prospect of personnel developing new products and processes could allow an organic growth of the organisation, strengthening the branding and leveraging from having a strong foundation of innovative staff.

7.4.2. What are the most frequently reported internal barriers and how to mitigate them:

Time allocation

Certain barriers, such as budgetary constraints and limited investment in innovation, are generally controlled by financial factors that are to some degree conditioned by

external factors such as volatility in the market (e.g. oil price) that could lead to conservative budgets, or external funding sources that could limit the amount of funds available for innovation. This reflects the overall vulnerability of SMEs to financial risks when attempting to increase innovation. However, there are internal obstacles that companies can remove or reduce to facilitate innovation. Time allocation for innovation activities is amongst the most frequently mentioned obstacle in the data obtained in the survey. Although staff allocating more time to innovation has financial implications internally, a better-defined system could also help monitoring and controlling the percentage of time being used towards these practices. For instance, the data obtained in Section 2 of the survey, indicates that Group 5 (analysts) is the group that expressed more concern regarding the amount of time spent in innovation (or the lack of). All the analysts of the company have either at MSc or PhD level, and with a strong scientific background. This, together with the obtained information suggesting that the current infrastructure and equipment is somewhat adequate for innovation activities, could imply a potentially beneficial opportunity to increase innovation that could lead to new products and/or processes if specific time management strategies for innovation were put in place. On the other hand, these findings could also signal the question of whether this trend seen in Group 5 responds to the nature of their roles as their responsibilities are heavily linked to the health of the cashflow.

Different studies identify time pressure as being detrimental to creativity and therefore innovation (e.g. Amabile et al., 1996; Darini et al., 2011). Hence, the leaders of the organisations require to have a conscious awareness on time allocation to specific activities to achieve specific targets set within the company (Reunanen, 2015). Strategic time management mechanisms are therefore needed to be implemented in the workplace to mitigate the negative impacts to creativity due to time allocation. For instance, Darini et al. (2011) suggests that tailored time management practices, such as daily planning, long-range planning or clear targets can work as strategies towards the achievement of innovative ideas and creativity. A defined monthly percentage of time allocated to innovation activities and research by specific staff members, with defined goals would likely benefit innovation in the organisation as this would provide the freedom for experimenting and testing new ideas in specific time blocks without the time pressure for billable work. Moreover, the fact that only 4% of the respondents indicating no engagement in ideas that could become commercially viable (Figure 3), shows potential and drive for innovation amongst most of the surveyed people.

Clear roadmap

The obtained feedback from the survey suggests a somewhat unclear understanding of the current roadmap for innovation within the company. The need for designing and communicating a clear path with medium and long-term goals is pivotal to ensure cohesiveness in the efforts made on innovative practices. Also, identifying the market needs is essential when developing an innovation roadmap as this will ensure the focus aligns with the current needs. It is therefore recommended that the roadmap follows established innovation management models such as the stage-gate model

(e.g. Cooper, 2003 & 2008; Schultz et al., 2019), which in summary defines each innovation process as stages such as idea generation, idea scoping, business case, developing stage, testing and validation, launch stage, and post-launch review; each with a go or kill decision gate (Amati et al., 2020). Additional research should be conducted in other so-called *technology roadmapping* to identify the most beneficial and suitable one for the company. Nonetheless, the focus should be in establishing a continuous support in facilitating creativity and coordinating and delivering the different efforts conducted in innovation activities (e.g. Phaal et al., 2004; Radnor and Probert; 2004; Amati et al., 2020).

Moreover, the results obtained in this research show that 13% of the surveyed staff are unaware of any efforts currently being made with regards to innovation (see Results - Section 1: Awareness of Innovation). As communication and transparency should help bringing this percentage to 0%, and also for all stakeholders to be on the same page, an easily accessible diagram with the current roadmap is recommended to be made available in the company's intranet, with the use of dashboards as a potential tool for visualising progress in the different fronts of the innovation campaigns.

Company culture and resistance to change

Incentivising creativity is key for organisations competitiveness and survival (Büschgens et al., 2013; Shafi et al., 2020). And as described in this manuscript, innovation comes with risks and uncertainties. However, companies need to be willing to tolerate this if they want to develop effective innovation (Büschgens et al., 2013). However, resistance to change can frequently be present within companies for different reasons such as the establishment of comfort zones in the daily tasks. Introducing changes in procedures and processes can destabilise such zones and therefore producing a potential push back from certain staff members on these changes. Including people in the process of change and innovation should to some extent increase the acceptance of such changes. However, it is important that the acceptance of changes is seen across higher management as this would demonstrate a 'lead by example' scenario to the organisation that could promote a dynamic company culture that is willing to take in new and innovative ways of operating.

The concept of *Strategic Fit*, defined as "the degree of consistency between the needs, demands, goals and objectives between different components of the business" (e.g. Nadler and Tushman, 1980; Hannan and Freeman, 1989; Sigglekow, 2002), corresponds to a valuable practice as it provides means to the organisations' ability to change and adapt to adapt and succeed (Carmeli et al, 2010). To mitigate the resistance to change within the studied company, the development of an strategic fit should be explored in the company. This investigates the relationships developed with clients and other external stakeholders, known as *external* strategic fit (e.g. Carmeli et al, 2010) and provides insights on how the current strategy of the company aligns with customer needs, market trends etc. This should highlight needs for adapting to external changes. To secure a successful 'fit', an *internal* strategic fit is also required

to be implemented to make sure the company culture and the internal goals of the organisation are aligned, including active support and involvement from upper management to strengthen a cultural change, specifically as literature shows the requirement of senior management to be actively committed to changes and flexibility (e.g. Hammer & Champy, 1994). Both external and internal strategic fit are required to secure its implementation provides value to the company in terms of adaptability and competitiveness (Carmeli et al., 2010).

The importance of company culture and how it influences innovation has been well documented by different studies. For instance, research conducted by Büschgens et al. (2013) show how the development of a company culture based on flexibility and willingness to accept uncertainties can influence the level of innovation within the firm. On the other hand, an approach fully focused on stability in the systems and a continuous use of the methods adopted historically may decrease the ability to innovate in a company (Dougherty and Heller, 1994). Szczepańska-Woszczyna (2014) highlights that companies wanting to be innovative need to transform their culture, so it involves a more pro-innovative approach, including the continuous interest and support from upper management to cultivate innovation activities even if they correspond to minor innovation in processes or procedures. The studies of Szczepańska-Woszczyna (2014) also conclude that companies tend to focus on resources but give less attention to the company culture which is a key element to the development of innovation. Moreover, Loewe & Dominiquini (2006) identify culture and values as being one of the four pillars for innovation effectiveness (Figure 10). This therefore shows that company culture is a factor that must be worked on actively.

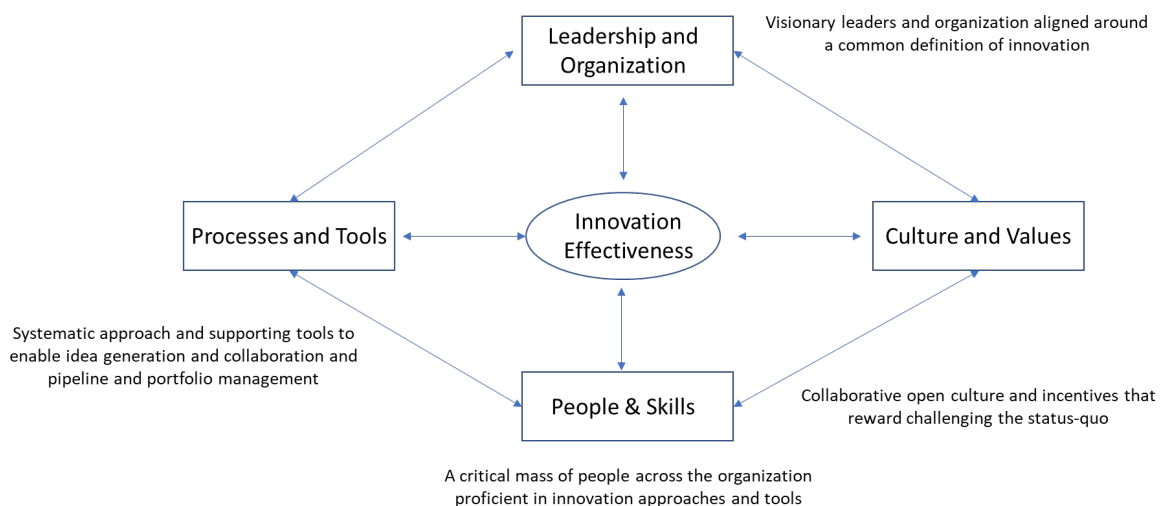


Figure 10. Key areas for innovation effectiveness. Modified from Loewe & Dominiquini (2006).

There are of course, more many more factors reported in the literature that can hamper innovation in the different companies, with some being affected more than others on specific areas. Table 2, taken from the Oslo Manual (OECD/Eurostat, 2005) shows a comprehensive list of the typical recurrent factors that hamper product innovation, process innovation, organisational innovation and marketing innovation.

Relevant for:	Product innovations	Process innovations	Organisational innovations	Marketing innovations
Cost factors:				
Excessive perceived risks	*	*	*	*
Cost too high	*	*	*	*
Lack of funds within the enterprise	*	*	*	*
Lack of finance from sources outside the enterprise:				
Venture capital	*	*	*	*
Public sources of funding	*	*	*	*
Knowledge factors:				
Innovation potential (R&D, design, etc.) insufficient	*	*		*
Lack of qualified personnel:				
Within the enterprise	*	*		*
In the labour market	*	*		*
Lack of information on technology	*	*		
Lack of information on markets	*			*
Deficiencies in the availability of external services	*	*	*	*
Difficulty in finding co-operation partners for:				
Product or process development	*	*		
Marketing partnerships				*
Organisational rigidities within the enterprise:				
Attitude of personnel towards change	*	*	*	*
Attitude of managers towards change	*	*	*	*
Managerial structure of enterprise	*	*	*	*
Inability to devote staff to innovation activity due to production requirements	*	*		
Market factors:				
Uncertain demand for innovative goods or services	*			*
Potential market dominated by established enterprises	*			*
Institutional factors:				
Lack of infrastructure	*	*		*
Weakness of property rights	*			*
Legislation, regulations, standards, taxation	*	*		*
Other reasons for not innovating:				
No need to innovate due to earlier innovations	*	*	*	*
No need because of lack of demand for innovations	*			*

Table 2: Factors hampering innovation activities. Taken from the Oslo Manual (OECD/Eurostat, 2005)

7.4.3. Is the studied company currently moving in the right direction in terms of innovation?

It is clear that, as most SMEs, the studied company is currently experiencing the tension between efficiencies and creativity gains which lines up with the concept theorised by Trott (2017) (*refer to* Figure 1). The data obtained in the survey shows high pressure to focus on billable work, likely due to heavy workloads, with overall little to no time being budgeted for innovation activities. This to some extent pulls in the opposite direction of the current push for innovation within the company and reflects the very essence of the conundrum between maintaining cashflow and investing in the development of new products and processes. Nonetheless, it is clear that the company is currently embarking in a mission of creating an innovative culture, with clear advances in the area of digitalisation, as eluded in the results obtained in the survey (Figure 5). In addition, ongoing internal '*lunch and learn*' sessions have provided a valuable space for sharing the planned roadmap and the progress on the current innovation projects being conducted. Training sessions have also recently focused on broadcasting the ongoing processes and providing basic training on the new technologies being implemented. A systematic measuring of the improvement and success of new processes and products would be beneficial for securing that the efforts are on track and relevant for the market needs. A more clearly defined system for budget and resource allocation from upper management would also have a positive impact on innovation, including autonomy of stakeholders on how these get used.

It is important to highlight the importance of differentiating between R&D activities that are essential to the business and innovation activities. For example, activities such as market research can indeed benefit innovation but is also needed to be conducted for the company to understand and react to trends and market needs. Regardless of innovation, the company could face risks if this type of information is not obtained. In fact, the Oslo Manual (OECD/Eurostat, 2005) mentions the difficulty in differentiating between R&D expenditure and budget for innovation.

Overall, the efforts and plans carried out in the company seem to be in line with the good practice for innovation. Different goals and objectives have been set for the short to medium term. Strong emphasis is currently being made in digitalisation, which according to Bleicher & Stanley (2016) can act as a catalyst for growth and innovation within the companies. Nonetheless, the current internal processes and systems in place are still evolving and there is therefore room for improvement. The implementation of the different practices and methods mentioned above should help boosting these and positively impact innovation in the company. It is important to conduct thorough research and make sure an appropriate implementation, suitable for the company, is put in place to secure the right outcomes and obtain the best results in the quest for innovation. In addition, according to the data obtained in the survey, 13% of respondents indicated unawareness of the current areas being worked on in terms of innovation, including digitalisation (*see* Results section). This somehow

reflects the need for improving communication and having a “open door” approach to improve the awareness of the current efforts being made.

7.5. Recommendations

7.5.1. Crowdsourcing campaigns

Various recommendations have been suggested in the Discussion section, including exploring the implementation of a *strategic fit*, clear definition of time allocation for innovation, technology roadmapping and others. Nonetheless, additional factors can help boosting innovation in the company. For instance, *Crowdsourcing* campaigns can increase engagement from staff and also could provide valuable ideas that could translate into new innovative products and/or processes. This method also constitutes an effective way to provide opportunities to the workforce to suggest potential upskilling associated to ideas. For example, studies conducted in collaboration between Cornell University and Ernst & Young (Ernst & Young, 2023) shows how crowdsourcing can accelerate ideation and therefore more rapid product and solution development. The study also concludes that these campaigns can provide a meaningful experience to staff and helps promoting fulfilment as employees feel engage and valued, not to mention the positive financial aspect for the firm in obtaining ideas from crowdsourcing campaigns as mentioned by different authors (e.g. Jeppesen and Lakhani, 2010; Pollok et al., 2019). Something worth mentioning, is the potential challenges a crowdsource campaign can bring. For example, Pollok et al. (2019) highlights the main challenges being increased time pressure, modification and adaptation of the processes in place, and unrealistic expectations. Hence, top management needs to design these campaigns adequately so avoid or mitigate these challenges.

Periodic crowdsourcing campaigns could be implemented in the firm with the purpose of boosting innovation. The frequency of these campaigns should be discussed in upper management, but at least one per year is recommended to be carried out. A financial incentive could be offered via gift cards, similar to the internal system currently in place for health and safety reports. Ernst & Young (2023) also propose the use of company’s merchandise as another form of incentive. The same author highlights that financial incentives stimulates motivation for participation and also a healthy competitiveness across the company.

Ernst & Young (2013) eludes that within the different methods for intra-company crowdsourcing available, the two most effective ones are strategic campaigns and skill-based support tasks, with the former targeting specific groups with defined expertise and relevant interests and the latter being a narrower one, such as testing products or identifying solutions to well-defined challenges. Due to the nature of the studied company, it is expected that this approach should yield positive results

providing the crowdsourcing campaigns are well designed and clear and defined support from upper management is in place.

A study conducted by Hossfeld et al. (2014) highlights different aspects to consider for running an effective crowdsourcing campaign. Although the study is focused on multimedia applications and the quality of experience, some points are valid for general campaigns, including:

- Simplified questions
- Feedback channels
- Lessons learned

Ernst & Young (2013) also defines best practices for crowdsourcing campaigns, including:

- Clear definition of the challenge
- Implementation of streamlined platforms
- Succinct and open-ended questions to leverage from a broader input
- Leverage from collaboration of existing groups with similar interests
- Provide incentives
- Facilitate interactivity and encouragement of continuous exchange of ideas

At present, the studied company uses a designated portal to report issues or suggestions related to the Quality Standards. An additional segment in this portal could be implemented for crowdsourcing ideas for innovation. This would provide a platform that staff is already familiarised with and would also keep innovation and continuous improvement centralised into one single portal.

7.5.2. Open innovation

The term open innovation refers to the use and collaboration of external sources for developing innovation (Oxford Review, 2021). This collaboration proves beneficial for all the stakeholders involved. For example, mutual collaborations with clients can positively impact the internal capabilities of the company and at the same time benefit the client with better and more innovative products or services received. The use of open innovation allows companies to access a more diverse pool of knowledge and therefore identify solutions more easily. This practice also increases the efficiency in innovation activities and compensates from intra-company deficiencies (Zhang et al., 2023). The use of open innovation can also act as a stepping stone for providing access to new markets (Figure 11) and can provide means for the company to become efficient in the daily operations and adaptable to the changing market. This is also known as organisational ambidexterity.

In addition to clients, organisations can benefit from establishing collaboration with universities and research institutions. For example, sponsoring MSc or PhD degrees for conducting research on specific areas needed by the company is a common

practice. Hence, it is recommended that the studied company establishes this type of open innovation with universities. Due to the niche field in which it operates, and the lack (but need) of further developments in computer science, sponsoring a research project in areas such as image recognition and automation would be beneficial. Exploring the avenue of a joint partnership with a client for sponsoring and establishing open innovation with an university is also suggested.

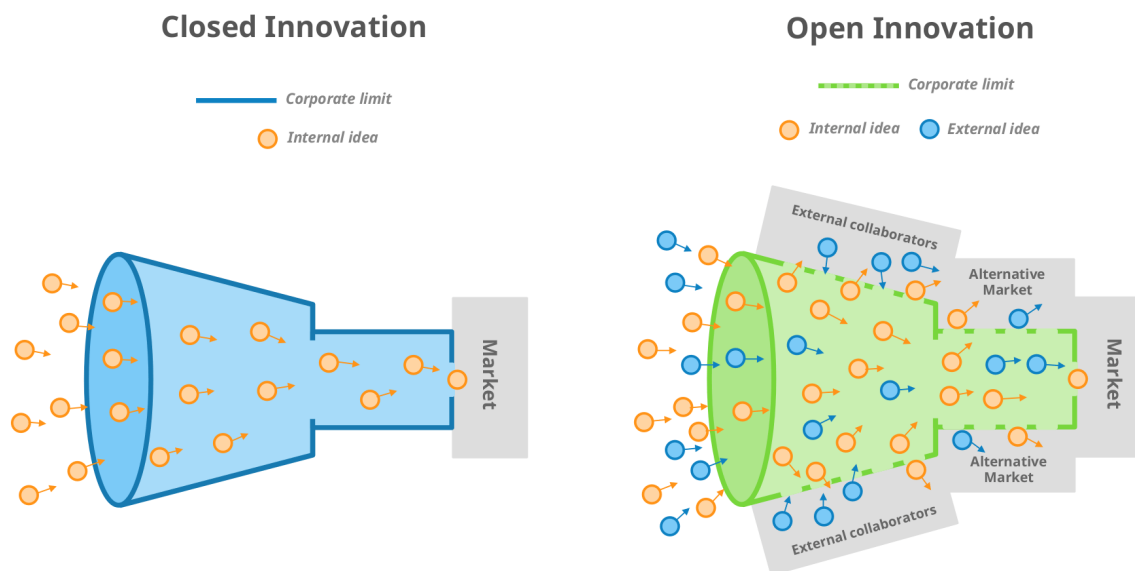


Figure 11. Closed innovation vs open innovation. Taken from Isomäki, 2018.

7.5.3. Digital board for innovation announcements

One of the common themes seen in the survey was the need for improving communications in the ongoing innovation activities and a clearer overview on the roadmap and different targets and objectives moving forward. Although there is a defined roadmap, it lacks visibility and therefore not many people are aware of it. Hence, a designated announcements board for innovation would be substantially useful. Specifically, an allocated space in the company's intranet, which everybody has access to, would significantly increase visibility and transparency. This space would be extremely useful for keeping the entire organisation informed on progress and the different objectives being pursued and the roadmap for innovation. This space can also be useful for upper management and directors to clearly communicate strategies and priorities. A summary of the initiatives and results from the crowdsourcing campaigns can also be placed here in the form of announcements in addition to recognition to those actively participating in innovation activities and providing ideas. This could also provide a positive impact and an incentive for more staff to get involved in contributing to innovation and creativity. In addition, continuous

announcements on the ongoing innovation activities can spark new ideas from people who are not currently involved in. This could lead to finding solutions previously not considered and increasing the pace on specific projects, not to mention improving the company culture when it comes to innovation.

7.5.4. Implementation of ISO 56000

A recommendation to implement ISO 56000 is also suggested by the current study. ISO 56000 constitutes a series of guidelines and standards that provides “guidance for organisations to establish, implement maintain and continually improve an innovation management system” (International Organization for Standardization, 2020). The adoption of ISO 56000 should also provide guidelines on the right terminology for innovation. This should also help in providing tools for consistent communications in innovation activities (Naden, 2020).

As eluded in this study and the different references cited, implementing innovation can be extremely challenging, especially in SMEs. The ISO 56000 should provide systematic processes and procedures that should help mitigating said challenges and reduce uncertainties.

The studied company currently adheres to different Standards, including ISO 9001, ISO 14001, ISO 45001 and ISO 27001. The 56000 series follows the same level of structure for ISO management systems, with some common terminology with the ISO 9001 (Gueorguiev, 2023). This similarities should therefore facilitate the implementation of the ISO 56000 as the studied company is already familiarised with this type of structure and would be compatible with the existing accreditations.

To summarise the 56000 series provides the following:

- Fundamentals and Vocabulary (ISO 56000)
- Innovation management system (ISO 56002)
- Tools and methods for innovation partnership (ISO 56003)
- Innovation management assessment (ISO 56004)
- Tools and methods for intellectual property management (ISO 56005)
- Tools and methods for strategic intelligence management (ISO 56006)
- Tools and methods for mapping opportunities and ideas (ISO 56007)
- Tools and methods for innovation operation measurements (ISO 56008)

It is worth highlighting that these are guidelines, with the Standards (ISO 56001) currently being developed. Nonetheless, the early implementation of this guidelines would pave the road for this certification once it becomes available. This would also have a positive impact to the reputation of the company, in addition to the other benefits previously mentioned.

The adoption of ISO 56000 would in theory increase the innovation capacity of the firm, which according to Lawson and Samson (2001), corresponds to the ability to continuously create new products processes and systems that benefit the company

based on transforming knowledge. Different studies conclude that this capacity is extremely important for the firm's survival and evolution (e.g. Wang and Ahmed, 2007; Silva, 2021). Hence, critical focus must be given to this aspect by the studied company using the guidelines from the ISO 56000 series as a vehicle to increase the probabilities of a healthy innovation capacity. Moreover, Other authors have shown that the implementation of ISO 56000 does indeed help increasing the innovation capacity (e.g. Silva, 2021), with even universities and institutions adhering to this system (e.g. Gueorguiev et al., 2020; Gueorguiev, 2023).

7.6. Limitations and future studies

The conducted survey in this study showed interesting trends and important information for the business. The targeted approach aimed to provide full representativeness to the different sectors of the studied company. However, there are limitations regarding the obtained data, mainly being the sample size of the conducted survey. A very small percentage of realised samples was obtained in 3 of the 6 groups studied (see Table 1). This very likely skews the obtained data for those groups to the knowledge and opinion of a small number of individuals. In other words, this could have generated over-representation but may not accurately represent the overall data for each of those groups. Although the obtained information in the survey shows clear trends across the surveyed individuals, the small number of realised sample in some groups could have limited statistical meaning.

The period when the survey was conducted coincided with high number of staff members being deployed overseas and offshore as part of the business services. This could have potentially affected the engagement from individuals of certain groups (e.g. laboratory technicians), and due to time constrains for the present study, the survey remained open only for a limited time. A similar survey, open to the entire company and with a less constraint timeframe is therefore suggested to mitigate the limitations highlighted above.

A thorough internal and external strategic fit should be conducted to make sure the adequate resources required for obtaining the innovation desired are present. This analysis would also help identifying potential gaps on skills needed for the organisation's goals and objectives and would allow the firm to put a process to remove this gap, either via training or recruitment.

7.7. Conclusions

The obtained information in this study allowed to identify different trends and weaknesses in terms of innovation within the studied company. Overall, innovation is internally perceived as a very important aspect for the business, with no major concerns regarding its implementation and, in fact, with different people already engaging in innovation and innovative ideas. The data obtained indicates that the main challenges for implementing innovation correspond to limited budget allocation and investment. This goes in line with the information reported in the literature, which mentions that finding the right balance for investing in innovation vs maintaining cashflow is one of the main challenges in SMEs. Based on the data obtained, other of frequently reported challenges for innovation are lack of time allocation and company culture amongst others.

The different processes currently in place for innovation are proving useful and is aligning the company in the right direction. The additional recommendations provided in this study, including crowdsourcing campaigns, collaboration with external institutions and the implementation of ISO 56000 should help strengthening the innovation culture and facilitate innovation within the company.

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Appendix 1: Complete set of questions of the survey

Section 1: Awareness of Innovation:

Q1: Provide your job title.

Q2: Based on your current understanding, what do you think is/are the main challenge(s)/obstacle(s) for bringing innovation to the company (please justify)

Q3: In your regular work activities and professional interests, how often do you become aware of ideas and potential actions that, if managed well, could become operational and commercially viable innovations for the company or our clients?

Q4: Rate how important you think investing on more resources, innovative activities and/or research should be for the company.

Q5: Based on your experience, has the company actively pursued innovation activities in the past 3 years?

Q6: If yes, what types of innovation has the company implemented (multiple choice – digitalisation, process innovation, technological/analytical innovation, business engagement and marketing strategies, organisational, workplace cultural and environment, other)

Section 2: Challenges and Risks

Q7: Do you think implementing innovation represents a risk to the company?

Q8: Please rank: Effectiveness of the current innovation initiatives, percentage of time allocated to innovation, percentage of personnel allocated to innovation activities.

Q9: Are you aware of any internal barriers to sharing and implementing innovative ideas within the company?

Q10: Rank the following: Innovation should be one of the highest priorities in the organisation, high percentage of the budget should be allocated to innovation, there are clear channels/procedures to propose innovation within the company, the size of the company impacts the implementation of innovation, the company culture affects the implementation of innovation,

Q11: Please order the option from the major challenges to the lowest when implementing innovation in the company: uncertainty on the planned roadmap, limited investment, lack of skilled workforce, resistance to changes, limited time for innovation activities, inadequate infrastructure/equipment, inadequate support from upper management, financial risks.

Section 3: Support and Engagement

Q12: Name a factor, if any, that would encourage you to get involved in innovation at work.

Q13: Do you have any concerns in participating in innovation-related activities? If yes, specify.

Q14: Do you have any suggestions on initiatives or strategies that can be implemented to encourage innovation in the workplace?