

Status Quo Research on Technology Knowledge in SMEs

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Abstract. *Small and Medium Enterprises (SMEs) which play substantial role in the development of any economy have been on the rise in the recent periods. Consequently, these enterprises are faced with a myriad of challenges which could potentially be solved through adoption of technology. Nonetheless, it has been observed that the new technological uptake among SMEs remains limited with the majority of them opting to maintain the status quo with regards to technology awareness and innovation strategies.*

In a literature review, this paper explores three major dynamics curtailing adoption of new technologies by SMEs in the manufacturing: Knowledge absorptive capacity and management factors, organisational structures as well as technological awareness. Firstly, with regards to knowledge absorptive capacity and management factors, this study shows how these factors drive innovation potentials in SMEs.

Secondly, with regards to technological awareness factors, this study documents how perceived usefulness, costs, network and infrastructure, education and skills, training and attitude as well as knowledge influence adoption of new technologies among SMEs in the world. Lastly, the study concludes by analysing how organisational structures drive innovation potentials of SMEs in the wake of swift and profound technological changes in the market.

Keywords. Digital transformation, technologies, digital skills, knowledge, SMEs

1 Introduction

While many SMEs aspire to adopt and adapt to the latest technologies, others appear to maintain a status quo with regards to technology awareness and innovation strategies mainly attributed to a number of factors. Firstly, SMEs without adequate and up-to-date technology capabilities are bound to suffer from low levels of innovation hence the inability to remain competitive in a globalised market (Gobin-Rahimbux et al., 2017). Explicitly, SMEs suffer from some challenges as far as technology uptake and innovation are concerned, ranging from limited resources,

inadequate capital, insufficient time, cultural, management, and organisational issues, among others. Nevertheless, adoption to new technologies may be curtailed by other factors that affect the firm either directly or indirectly including the firm's knowledge absorptive capacity, technological awareness, lack of integration or poor networking, managerial incompetency, organization structure, and capital. These are further explored in-depth in the study in order to answer the research questions: (a) What are the determining factors for the innovation potential in SMEs; and (b) What significance does the technology knowledge have in this consideration?

2 Innovation Potential in SMEs

Due to increased globalization in the world coupled with intense competition in the market, shorter product and technology lifecycle and rapid technological dynamics, significant number of firms especially SMEs are placing a lot of emphasis on innovation as a source of competitive edge (Bayearcelik, Tasel and Apak, 2014). However, innovation quests by SMEs are increasingly affected or determining by various factors including knowledge management capacity and absorptive factors, technological awareness and organizational structures as discussed in the proceeding sections of this study.

2.1 Knowledge Absorptive Capacity and Management Factor

A number of factors drive the innovation potential of SMEs, and one of them is the firm's knowledge absorptive capacity. Several previous studies have established that the absorptive knowledge capacity is a key determinant of the technological innovation capability of an enterprise (Yang, Zheng, and Peng, 2013).

Cumulative individual knowledge capacity impacts the overall knowledge capacity of the organisation. Individual capacity or capability can be explored from two major dimensions; internal and external function.

In regards to the latter function, individual employees have to assimilate up-to-date knowledge from outside the enterprise to improve the firm's knowledge absorptive capacity. This means or implies that employees need to have a higher level of similarity with external knowledge to make it easy when absorbing external knowledge.

On the other hand, former; internal function refers to the transfer of new knowledge from one employee to another. In the same way, the degree of similarity between various employees' knowledge base counts as well. The internal sharing environment shapes knowledge behaviours among employees. For instance, SME owners and managers mold different cultures, which may inhibit or promote knowledge dissemination, thus affecting individual knowledge behaviour. (Yang, Zheng, and Peng, 2013)

Nonetheless, despite its significance past researches on the same have majorly focused on large firms with strong research and development (R&D) backgrounds and multifaceted structures of operations with only limited research addressing the theory in manufacturing SMEs perspectives.

Yang et al. (2013) sought to investigate the context of knowledge dissemination and absorption and how the senior leadership's attitudes influence it. In their investigation, both senior and middle-level managers in the research and development departments of high-tech SMEs in Beijing were issued with survey questionnaires and the collected data analysed. The primary data collected from the investigation supported the study hypotheses (5 in number). Firstly, it supported the first hypothesis that the knowledge base of the staff was seen to affect the knowledge absorption capacity of the enterprises profoundly, so, enterprises can better the level of employees' knowledge and skills through training and consequently expand the knowledge base. Secondly, the study also supported the study hypothesis that the internal environment for sharing knowledge positively correlated with the enterprise knowledge absorption capacity. In this case, enterprises thus have a responsibility to strengthen interaction and integration between internal employees to build up knowledge flow; for instance, encouraging different departments to communicate in informal settings. The internal environment culture exhibited the biggest effect on firms' knowledge of absorptive capacity. For that reason, high-tech enterprises that engender a favourable internal environment are likely to experience improved efficiency in terms of knowledge absorption. Thirdly, the study supported the hypothesis that technology, as well as R&D, impacted the absorptive capacity of SMEs directly. This implies that enterprises that invested significantly in R&D and technology realised higher efficiency in knowledge production. Fourthly, the study further supported the hypothesis that collaboration through external communication with other firms or research institutions was positively related to the firms' capacity

for absorbing knowledge (Muscio, 2007). Evidently, the intensity with which enterprises undergo digital transformation pivots around the knowledge absorptive capacity of firms.

Lastly, the study also supports the hypothesis that the status of technological knowledge in firms can also be influenced by how capable they are able to work together. However, this greatly depends on the absorptive knowledge capacity of the partnering enterprises. For instance, when firms collaborate with external institutions, they expand their range of expertise, which fosters the development of new products. As further emphasized by Muscio (2007), to access and capitalise on the knowledge shared among collaborating institutions and firms, a strong foundation regarding the capabilities to "search, find, access, and interpret" that knowledge has to be laid. For instance, employees' training, skills, and experience form the foundation of the enterprise knowledge base and extensively determine the overall capability to absorb knowledge from the external sources (Muscio, 2007). Building on these observations, Muscio (2007) explored some of the factors that influence collaborations between entrepreneurial firms and external institutions in the Lombardy region in Italy. In his study, several elements of absorptive capacity were looked at to provide evidence of how they contribute to the capability of firms to team up with others. An estimated 276 sample population were interviewed comprising of R&D representatives and entrepreneurs with the focus of the interviews being on the following sectors; garments and textiles, plastics, machinery, plastics, metal products, pulp production, wood, carpentry, chemical, and electrical and electronic products.

Survey findings from the research study by Muscio (2007) underlined the positive correlation between various components that boost knowledge absorption capacity and the ability to join forces. Results from the regression analysis depicted a strong effect of absorptive capacity of firms on their wherewithal to establish networks. Explicitly, R&D deployment and employment recorded a positive coefficient meaning it fosters teaming up of firms. R&D and knowledge absorptive capacity are intertwined since enterprises have to invest in research and development to boost and concretise their knowledge base, which in turn improves the capacity to solicit knowledge from outside. In this way, it becomes easy to engage with external partners and establish strong networks with a view to accessing new knowledge. Other variables that were seen to deliver positive results when forming alliances with universities and research firms included employment of graduates (Laursen and Salter, 2004; Cassimen and Veugelers, 2002) and continuous training. There is a guarantee that firms that want to benefit from meaningful cooperation with external institutions should invest significantly in staff technical

training as this improves the enterprise knowledge absorptive capacity.

Such notions are supported by previous and original insights from Cohen and Levinthal (1990). Following from these findings, it can be deduced that the highlighted indicators of absorptive capacity induce a positive and significant marginal effect on firms' ability to establish effective networks. On a different tenet, Mohnen and Hoareau (2002) are more precise by stating that "in terms of the firm's cumulative capability to simultaneously establish different networks with different organisations, absorptive capacity is even more important". Muscio (2007) concludes his study by remarking that absorptive capacity empowers small firms by acting as a conduit for innovation capacity and activity because potential external sources of knowledge that are in line with the enterprises' future technology prospects can be monitored systematically (Fritsch and Lukas, 2001).

Other recent studies also explored the concept of absorptive capacity in the context of SMEs in Africa's construction industry. Bilau, Ajagbe, Bustani & Sholanke (2015), for instance, carried out a primary research study aimed at gaining insights into the absorptive capacity of SMEs in Nigeria's construction industry. In their findings, the authors single out various factors that are paramount for effective absorptive capacity in SMEs to be realised including the development of human resources, collaboration, and cooperation, attitude towards change, capabilities of the firm and knowledge management.

The study by Bilau, Ajagbe, Bustani & Sholanke (2015) adds to the existing absorptive capacity knowledge by identifying and analysing some essential SMEs' dimensions that are linked to new technology adoption and absorptive capacity concept from the perspectives of SMEs in Nigeria's construction industry.

2.2 Technological Awareness

Adoption to new technologies may also be curtailed by technological awareness as illustrated in a quantitative study conducted by Gobin-Rohimbux et al. (2017) on technological awareness among SMEs specialized in handicraft in Mauritius. In their study, the authors surveyed a total of 42 entrepreneurs of different ages and education levels in addition to the age of the firms. Considering the competitive environment in which the small and medium enterprises in Mauritius operate, they have to embrace new technologies. Such assumption is based on the views of Mauritius's Small and Medium Enterprises Development Authority (SMEDA) which argued that despite the state agency offering basic training to local SMEs bearing in mind their low usage of technology, a significant percentage is yet to adopt new technologies in their daily operations due to a number of variables. In their study, Gobin-Rohimbux et al. (2017) reviewed a total of 10 studies and their findings showed the following

variables were associated with adoption or usage of technology among SMEs; cost, perceived usefulness, knowledge/awareness of ICT, network or infrastructure, and cost, education and skills, training, and attitude. The first research question in the study was to determine whether entrepreneurs were aware of present technologies to run their errands (the awareness, in this case, does not necessarily imply usage). Software and technology applications selected for the survey included Microsoft applications, social networking sites, Internet applications, and Websites. Surprisingly, only Facebook seemed to be a popular application with an awareness rate of more than 50 percent in the handicraft sector. On the other extreme, SMEs were least aware of Websites recording the least percentage of less than 20%. Technology awareness may probably lead to acceptance, especially if the technology is envisaged to be valuable in supporting business operations, as illustrated in Figure 1 below, showing survey responses on technology awareness from the entrepreneurs.

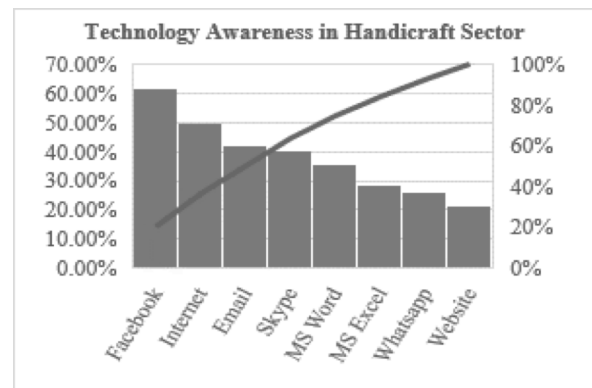


Figure 1: Awareness of technology among small and medium enterprises (Gobin-Rohimbux, 2017)

Interestingly, technology awareness did not automatically translate to acceptance and usage, as shown in figure 2 below.

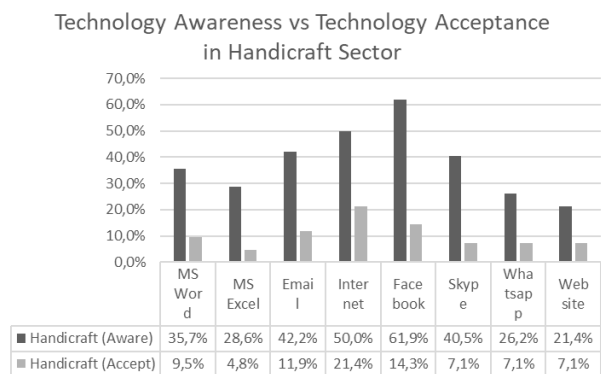


Figure 2: Awareness of technology among small and medium enterprises (Gobin-Rohimbux, 2017)

Looking at the graph, it is clear that many entrepreneurs or SMEs were aware of technological

applications or tools, but that did not imply their acceptance of the same. Based on the results of the statistical analysis, 35 out of 42 SMEs (83%) were considered low or non-users of technology when a total of 6 components were used to measure usage among SMEs. For that reason, it is necessary to look at some of the probable factors that led to the low acceptance and usage of technology.

Firstly, the cost of technology resources was considered a significant cause in the level of technology usage. Majority of respondents (about 77%) of the SMEs in the study stated that they would utilise technology if the associated resources were subsidised. Secondly, the entrepreneurs agreed that training is requisite to the adoption of new technologies. The training would be rolled out in the form of workshops, demonstrations, and seminars to equip SME owners with a range of skills. Concisely, training ranges from learning basic software applications like Microsoft applications to specialised and targeted courses such as Computer Aided Design (CAD), computer programming, software development, website building, and automatically-operated machines. Unfortunately, initiatives to acquire general and specialised skills require time; something that most SMEs felt would disorient their business activities. Unless there is clarity from relevant stakeholders on how training programs can benefit SMEs, the reluctance is bound to persist. Third, SMEs' perceived the usefulness of technology as a determinant of technology uptake because entrepreneurs want to know how technological innovations are going to support them in their daily business operations. For instance, if the developed technology contributed to efficient operations, SME owners are likely to embrace it. However, the study showed that most owners (81%) were not convinced that they needed technological resources in their daily business activities compared to a paltry 17% that believed technology is necessary for their operations. Approximately 30% of SMEs from the handicraft sector who took part in the study stated that they would utilise technology if it supported them in dealing with customers while 35% said they would use it if it assisted them in stock management. Putting into mind that age of SME owners is also a likely factor that influences awareness, acceptance, and utilisation of digital technology, survey findings showed that owners with an estimated average age of 34 years were in the class of moderate and high-level users.

Conversely, non-IT users were seen to have an average age of about 54 years. Further, the perceived ease of use is associated with the ease with which the entrepreneurs make use of technology. Survey results indicated that training improved the perceived ease of use among SMEs. Thus, SMEs with employees that are trained in special programmes find it easy to develop, implement, and use high-tech applications like CAD, statistical analysis software, programming languages, and cloud computing to mention a few.

2.3 Organisational Structure

The organisation structure is also seen as a significant driver for innovation potential of SMEs; however, from a different perspective, as shown by Lindner and Leyh (2018). Enterprises continue to face a complex environment because of swift and profound changes, and one of the main catalysts causing this is the exponential technological evolutions which are associated with buzzwords like 'digital change' or 'digital transformation' (Bajer, 2017). Such advanced and dynamic technological opportunities impact almost every enterprise irrespective of the size denoting a fundamental paradigm shift (Viehland, 2013; Bley, Leyh and Schaffer, 2016). Traditionally, small and medium-sized firms are organised and optimised for control and controllability, and so it contradicts fundamental and high-velocity variations that feature in digital evolution.

On the other hand, the majority of classical SMEs have a hierarchical structure with clear communication channels. For that reason, they are suited for coordination, control, and monitoring. Firms poised for technological transformation need to break from this form of organisation to a more networked and Project-Oriented System (SPOS) (Arbussa, Bikfalvi, and Marques, 2017; Branicki and Taylor, 2017).

Lindner and Leyh (2018) decided to explore the concept of agility in the context of digital transformation. Agility, as utilised in this case, is defined as the ability of an organisation to "be prepared for and respond to" shifting capacity demands and functional needs in a very quick manner. Also, the IT applied in addressing changes is expected to extend the firm's capacity. Two viewpoints are shared in Lindner and Leyh (2018) study; (1) increased agility in a firm's structure enables and enforces digitalisation; and (2) implementation of new digital platforms lead to increased agility in a firm. The bottom line is that agility is a key component embedded in the digital transformation process. Though SMEs operate with smaller budgets, they are more agile given their succinct decision-making process. To address the set research questions, the study was modelled in three stages involving a systematic analysis of literature, focus groups, and reference modelling. In the first stage, 18 articles were selected for review in line with the research focus. Thereafter, issues identified in the first stage were evaluated in the second stage with the help of focus group interviews where possible actions to be taken by firms were recommended.

Two studies dejected the proposition that digitalisation is a precursor to heightened agility as proposed by Lindner and Leyh (2018) and Bley et al., (2016). Moreover, another study by Martensen et al. (2016) revealed that mobile hardware and software contributed significantly to the flexibility of organisations. Majority of the identified articles supported the notion that increased digitization led to more agility in organisation structures. A further set of a study conducted by Gastadi et al. (2014) contradicted

the view that agility is a precursor to digital transformation. In their study, Gastadi et al. (2014), for instance, believed that new technologies could not be easily implemented in a classical organisational structure hence the need to adopt a more agile structure. They added that IT reorganisation is disruptive; therefore, it brings about disruptive changes in the way firms are organised. A similar opinion was also given by Lindner et al. (2018) who noted that essential organisational restructuring which guarantees more agility needs to be undertaken prior to the introduction of new technology because this creates an ideal environment for implementation. On their part, Lindner et al. (2018) posited that the potential offered by new technologies could not be realised adequately unless the organisational structures are appropriately agile. In the context of SMEs, digitalisation is seen to increase networking and flexibility, but this depended on the utilisation of new software applications such as tools for data analysis. Regrettably, the IT landscape found in many SMEs is flawed because it is centralised and not flexible, which means less innovative practices. In addition to that, small budgets for SMEs inhibit quick implementation, thus a long time to develop the IT systems (Essers and Vaneker, 2016). What makes SMEs to be considered agile and flexible compared to larger firms, are the processes of making decisions which are seen to be short (Arbussa, Bikfalvi, and Marques, 2017). At the same time, SMEs operate in a very dynamic environment, and they are subjected to both rapid and constant growth, which calls for increased agility in the organisation structure. The literature review pointed out that SMEs still suffer from low levels of digitalisation, and a gradual increase is requisite; to achieve this, less centralised IT is also needed. Views from the focus group consisting of SME managers and owners affirmed that improved agility is a precursor for successful digitalisation. Such a notion was, for instance, depicted by the consensus in regards to the pilot projects presented in the course of the study that, agility is necessary for thriving digitalisation.

It was therefore hypothesised that knowledge absorptive capacity, organisational structure and management factor and technological awareness would have an high impact on the adoption of new technologies in manufacturing SMEs either directly or indirectly.

3 Methodology of Literature Review

The study mainly adopted quantitative methods and entailed collection of data from a wide range of primary materials. The first step in the literature search entailed justifying the need for the review itself. This was achieved by, for instance, identifying the research hypotheses, exploring the gaps in existing and past research.

The next step entailed searching the extant literature by making informed decisions about the most

suitable literature materials to be utilized in the study from various sources. Literature was captured from (a) Google Scholar; (b) Elsevier and (c) SpringerLink since these databases provided the most relevant results during an initial explorative search phase. The underlying method of literature research, as shown in Figure 3 below, was adapted from Webster and Watson (2002). Search and analysis were conducted in February 2019 using the following search keywords: Digital transformation, technologies, digital skills, knowledge, SMEs.

The next step in literature search as shown in Figure 3 entailed filtering results and removing duplicates. Whenever possible, filter criteria restricting results specifically to scientific papers were applied. Due to the large amount of results, the search had to be narrowed down considering titles only. However, during the process, a lot of objectivity was exercised to avoid mistakes and biasness from the researcher and to ensure inclusivity and this was achieved by using three reviewers who were independent to the study involved in either the screening process or solving disagreements with regards to deciding on the most appropriate literature to be used. Moreover, the independent coders were also tasked with analyzing and examining the quality of the primary literatures by appraising both research methodologies used and rigor of the studies' design to assist the independent reviewers in making informed decisions with regards to the best literatures to be included in the study (Pare and Kitsiou, 2016).

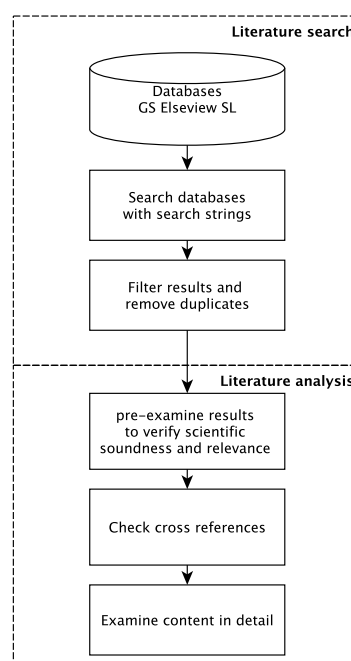


Figure 3: Process of literature research (Adapted from Webster and Watson, 2002).

Further, after removing duplicates from the respective search results, a first content-related evaluation based on the documents' titles and abstracts was carried out.

Results without any relevance to the object of this research had to be excluded from further analysis, as well as results which lacked scientific standards. The remaining results were analyzed in full detail. Finally, the bibliographies of highly relevant results were examined to determine further literature contributing to answering the raised research questions. During this process, 84 relevant results were identified.

4 Conclusion

Even though the majority of SMEs aspire to adopt and adapt to the latest technology, a few others appear to maintain a status quo with regards to technology awareness and innovation strategies mainly attributed to a number of factors as shown by the findings of this research.

Employing quantitative method, the findings of the study reveal that a few more SMEs that tend to maintain the status quo regarding technology awareness and innovation strategies may be curtailed by a number of factors that affect the firm either indirectly or directly including organisational structure, knowledge absorptive capacity, and management factor and technological awareness.

Technology knowledge is considered to have a great impact on acceptance, especially if the technology is envisaged to be valuable in supporting business operations. Interestingly though, technology awareness did not automatically translate to acceptance and usage.

Nonetheless, the study was also subject to a number of limitations with its major limitation being on its reliance on quantitative methods. Such past studies might not be accurately representing the actual situations in SMEs to-date. Thus, the study suggests that future researches should try using qualitative methods such as interviews and questionnaire surveys which represents the current data and information to confirm the findings in this current study.

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