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Disruptive innovation in Small and Medium Enterprises: a key factors checklist

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Abstract

Small and Medium Enterprises (SMEs) operate in an environment where their existence are impacted by information technology – an attribute of Society 5.0, adoption of technologies and resource scarcity. As a key contributor to countries' economy, SMEs need to innovate, create social businesses, and develop new business models to stand the test of time. Hence, SMEs must focus on key aspects that will empower them to leap-frog the traditional pathways of development and innovate. The purpose of this study is to present SMEs with a disruptive innovation key factor checklist based on an investigation of key disruptive innovation factors from the literature. The disruptive innovation key factor checklist was developed by analyzing a corpus of 137 papers through an automated content analysis process. Ten themes and 38 concepts were identified that informed the categorization to the Technology-Organization-Environment framework and the creation of the disruptive innovation key factor checklist. To create an instantiation of the checklist, we mapped the key factors checklist to an SME case study. By considering the checklist, SMEs are guided to optimize their innovation strategy, stakeholder engagement, technology adoption and innovation impact.

Keywords: disruptive innovation, small and medium enterprises (SMEs), T-O-E framework, checklist

1 Introduction

Small and Medium Enterprises (SMEs) are considered as the backbone of an economy, directly influencing a nation's Gross Domestic Product (GDP) (Adeosun, Shittu, & Ugbede, 2021; Andalib, Azizan, Al Turi, Danilla, & Kaman, 2022; Safar, Sopko, Bednar, & Poklemba, 2018). The distinctive requirements of globalization, the information age and the incentive to capture value, enticed SMEs to effectively and timeously adapt their business models with new innovative capabilities to address opportunities and threats (Chakabva, Tengeh, & Dubihlela, 2020). This requirement of business model adaptation, especially applies to SMEs as the capturing of value from supplementary opportunities is an important capability towards increasing their resource pool and driving SME development (Abdullah, 2017; Allahar, 2019). The notion of business associations – a key opportunity brought about by the application of digital technologies - enable access to complementary value creation resources (Waldman-Brown, 2020). However, smaller organizations such as SMEs, require greater levels of business association involvement in order to capture value (Allahar, 2019; Chakabva et al., 2020; Moore & Manring, 2009).

SMEs operate in highly competitive markets competing with the digitalized business models of retail outlets and with customers' on-line shopping habits (Bollweg, Lackes, Siepermann, & Weber, 2020). Furthermore, SMEs experience new opportunities, insight into their customers and improved processes and efficiency when SMEs use information communication technology effectively (Alrawashdeh, Alsmadi, & Al-Gasaymeh, 2022; da Costa Nogami & Veloso, 2017; Gomber, Kauffman, Parker, & Weber, 2018). Resource scarcity prevents SMEs from implementing these new technologies such as an e-business solution even though e-business solutions is the dominant strategy for SMEs to interact with their customers (Escalfoni & Oliveira, 2021; Mashhour, 2022). Another factor that presents challenges to SMEs, is the competitiveness of the global market. One of the biggest challenges of the global market that SMEs face, is the highly competitive, technology driven and turbulent environment in which SMEs operate (Serumaga-Zake & van der Poll, 2021; Sombolayuk & Yusuf, 2019). If properly managed, the adoption and commercialization of these new technologies will empower SMEs to leap-frog the traditional pathways of development and innovate (Adegbite & Govender, 2021). Therefore, in order for SMEs to obtain a holistic view of adoption and commercialization factors, the purpose of this study is to investigate disruptive innovation factors in SMEs, by considering the following research question: "*What are the key disruptive innovation factors checklist SMEs should consider*?". We reflect on this research question by executing an analysis and categorization of disruptive innovation factors for SMEs, and then contextualizing the key factors within the technology-organization-environment (T-O-E) framework.

In this paper, we firstly provide an overview of literature in section 2, followed by the research approach in section 3. The discussion of the data analysis and findings are presented in Section 4, Section 5 details the contribution of the study and Section 6 concludes the paper.

2 Background

Most SMEs tend to operate in the informal sector with limited funding and human and social capital (Masabo, 2021; Taljaard, 2020), and as such, are sometimes unaware of or lack the technical capabilities to implement the available technologies (Auerswald, Elmira, & Shroff, 2012; C.-L. Chen, Lin, Chen, Chao, & Pandia, 2021). In order to create social businesses, innovate and develop new business models, SMEs need to adopt web-based technologies and the Internet to market products and promote their brands (Adegbite & Govender, 2021; Omotosho, 2020). In this context, SMEs are key to stimulating economic growth, to innovate, and to create jobs (Adegbite & Govender, 2021).

2.1 Innovation capacity of SMEs

According to Csath (Csath, 2012:10) "innovation is an improvement anywhere in the business; not only in products, services, and processes, but also in … leadership, HR, communication, organization, marketing and any other activities". Consequently innovation capacity refers to an organization's ability to continuously improve its capabilities and resources to explore new prospects of product development to fulfil market expectations (Pierre & Fernandez, 2017). According to Pierre and Fernandez (Pierre & Fernandez, 2017) resources refer to the factors which organizations own, while capabilities refer to the organization's ability to implement the resources according to the processes and the activities embedded in these processes.

SMEs are responsible to drive innovation and competition in multiple economic sectors (Bayarçelik, Taşel, & Apak, 2014; Kaua, 2021). They need to be capable of innovation ahead of their competitors. However, they face several challenges which make it difficult for them to compete effectively. These challenge include limited resources in terms of finances, time, and people ; a lack of economies of scale; a lack of expertise; limited market knowledge; and a lack of networking opportunities (Lecerf, 2012; Taneja, Pryor, & Hayek, 2016). SMEs' capacity to innovate is seen as critical for them to overcome their challenges as Heimonen (Heimonen, 2012) reports that there is a positive correlation between SME innovativeness, competitiveness, and sustainable growth.

As SMEs compete in highly competitive markets, innovation is important to differentiate their products and services from those of larger organizations. It can assist them with agility, cost reduction, quality improvement, and the enhancement of customer satisfaction (Laforet, 2011). SMEs also need innovation to allow them to adapt to changes in their market environment, such as changing customer preferences, technological advances, and regulatory requirements. As they have limited capital and cash flow, they can hardly afford investment in Information Technology infrastructure (Taneja et al., 2016). Collaborative relationships and networks such as the offerings of cloud computing provide them with many benefits in this regard as it decreases large upfront costs, allows for monthly billing, and cuts expenditure on electricity (Azarnik, Shayan, Alizadeh, & Karamizadeh, 2012). SMEs need to adapt an innovation-friendly culture, establish partnerships, and embrace digital technologies to overcome their innovation barriers (Binte Rajah, de Fauconberg, & Woeffray, 2021).

2.2 Disruptive innovation

According to Thomond & Lettice (2002, p. 26) "a disruptive innovation is a successfully exploited product, service or business model that significantly transforms the demands and needs of a mainstream market and disrupts its former players." Christensen (2013; C. M. Christensen, 2013), who is well-known for his disruptive innovation theory, states that 'disruption' refers to a process where a company with a small number of resources challenges a well-known and reputable business successfully. This could be due to the company focusing on the needs of its most persistent customers. In doing so it disregards or overlooks the needs of others. Disruptive entities start off in low-end footholds or in new unestablished markets and pursue these overlooked needs. They typically succeed in offering lower prices, improved performance, or new functionalities in these markets and often also at lower costs. Reputable companies 'ignore' these new entrants to the market due to their focus on mainstream customers, which allows the disruptive entities to move upmarket and eventually succeed in offering what the mainstream customers need. This is when disruption occurs - when these customers start to adopt the disruptive entities' offerings in large volumes.

Disruptive innovations can create opportunities for SMEs who are more agile, flexible, and customer-focused than larger and established organizations (Bower & Christensen, 1995). Although they face several challenges in terms of their capacity to embrace innovation (as discussed in the previous section), they can adopt various strategies to leverage disruptive innovation. They can among

others focus on niche markets which are underserved or overlooked by larger organizations and offer tailored and differentiated solutions that address their specific needs and preferences (Akbar, Omar, Wadood, & Wan Yusoff, 2017); they can leverage digital technologies (Pan & Lee, 2020) and data analytics (Bianchini & Michalkova, 2019) to identify and target customer segments that are not effectively reached by traditional marketing and distribution channels; they can collaborate with other SMEs or larger firms, higher education institutions, or research institutes to access complementary resources, expertise and networks that can enhance their innovation competitiveness (Brink, 2017; Henttonen & Lehtimäki, 2017); and they can adopt agile and lean methodologies to enable them to iterate, test, and validate new ideas and products quick and efficiently (Leite, Baptista, & Ribeiro, 2016; Modransky, Jakabova, Hanak, & Olah, 2020).

2.3 Technology-Organization-Environment (T-O-E) framework

Awa, Ojiabo Ukoha and Emecheta (Awa, Ukoha, & Emecheta, 2016) considered multiple frameworks and models for the study of technology impact namely, technology acceptance model (TAM), theory of reasoned action (TRA), theory of planned behavior (TPB), innovation diffusion theory (IDT), stage model (SM), technology-environment-organization (T-O-E) and resource-based view (RBV). They established that the T-O-E framework incorporates social and psychological parameters, and well as integrates the environment construct. Awa et. al. (Awa et al., 2016) concluded that the TOE framework is more holistic, and size and industry friendly, and is therefore well suited for application to SMEs.

Broader than just technology-driven change, disruptive innovation impacts SMEs, raising the requirement for innovation and of creativity of SMEs (Adegbite & Govender, 2021; Santosh, 2020). Innovation, whether it is disruptive or not, starts off as a small-scale experiment, eroding competitors' market share and profitability when they are successful and scale (C. M. Christensen, 2013; C. M. Christensen, Grossman, & Hwang, 2010). Tornatzky and Fleischer (Tornatzky, Fleischer, & Chakrabarti, 1990) present their T-O-E framework as the way in which organizational context influences the adoption and implementation of innovations. As the aim of our study was to investigate disruptive innovation factors in SMEs, we adopt the T-O-E framework for categorization of data following a similar process as Abed (2020) and Wessels and Jokonya (2022).

The T-O-E framework is an organization-level theory that explains that three different contexts i.e. technological, organizational, and environmental, influence technological innovation and adoption decisions (Baker, 2012). The *technological context*, consisting of equipment and processes, refers to the internal and external technologies that are relevant to the organization (Baker, 2012; Tornatzky et al., 1990). The *organizational context* includes the characteristics and resources of the organization such as the size of the organization, the degree of formalization and centralization, the workforce and the managerial structure (Baker, 2012; Tornatzky et al., 1990). The *environmental context* comprises of the organization's competitors, the size and structure of the industry, the macro-economic context, as well as the regulatory environment (Baker, 2012; Tornatzky et al., 1990).

These three contexts present "*both constraints and opportunities for technological innovation*", hence they influence the way in which an organization perceives the need for, searches for, and adopts new technology (Tornatzky et al., 1990:154).

3 Research approach

The aim of this research study was to establish the disruptive innovation factors that SMEs have to consider. In order to achieve the research objective, we followed a 2-step process. Firstly, a systematic literature review (SLR) was executed to identify the key factors of disruptive innovation in SMEs (Biolchini, Mian, Natali, & Travassos, 2005; B D Rouhani, Mahrina, Nikpay, Ahmad, & Nikfard, 2015)

through a process of gathering, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners (Okoli, 2015). Secondly, we categorized the findings from the SLR using the T-O-E framework described in Section 2.3 in order to create a checklist for SMEs.

A SLR is concluded according to a stand-alone, rigorous and systematic methodological approach (Aromataris & Pearson, 2014; Biolchini et al., 2005). Specifically, we followed the methodological approach suggested by Boland, Cherry and Dickson (Boland, Cherry, & Dickson, 2014) consisting of 3 main stages: planning, conducting and reporting the review. *Planning the review* refers to defining the research objectives and the review protocol, *conducting the review* includes selecting the primary studies and extracting the data, and *reporting the review* which refers to disseminating the results (Aromataris & Pearson, 2014; Babak Darvish Rouhani, Mahrin, Nikpay, Ahmad, & Nikfard, 2015). In terms of *planning the review*, we identified the search terms ("disruptive innovation“ and “small and medium enterprise”) to be executed in Google Scholar. We planned to execute automated content analysis by using a suite of algorithms that apply probabilistic models to discover the overarching themes in a body of literature and to categorize according to the presence and interrelationship of these themes (Blei, 2012; Nunez-Mir, Iannone III, Pijanowski, Kong, & Fei, 2016; Smith & Humphreys, 2006).

The second step was to *conduct the review* in which we executed the search words in Google Scholar returning a result of 378 papers (we excluded patents and citations in Google Scholar). We excluded duplicates, papers written in languages other than English, papers not accessible and screened papers based on relevance to our research focus and in particular SMEs, resulting in 137 papers identified for automated content analysis. Figure 1 shows the number of papers extracted for automated content analysis by year.

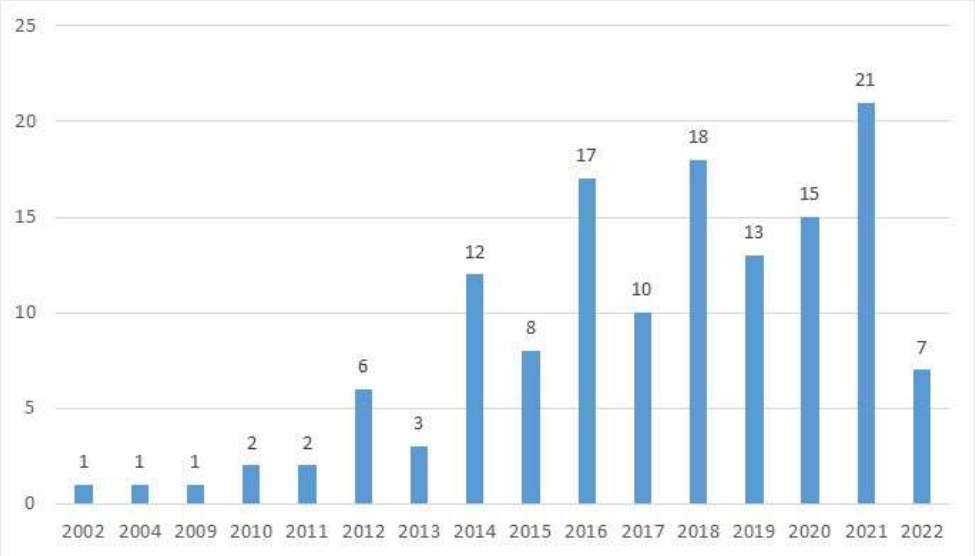

Figure 1: Papers extracted for detailed analysis, N = 137

Automated content analysis which is based on different software programs and is increasingly used in the scientific literature, was then applied to analyze the 137 papers identified (Kuckartz, 2019; Smith & Humphreys, 2006). We used Leximancer version 5.00.140 2021/08/25 following the methodological procedure applied by Brochado, Lobo, Pacheco, and Maldonado (2020) and Khan, Rana, and Goel (2022). Leximancer is advanced natural language processing software utilizing Bayesian theory (Leximancer, 2021). We uploaded the corpus of 137 papers to Leximancer, extracted the concepts seeds, generated Thesaurus and finally generated the results (Leximancer control panel). The software

determined the frequency of concepts and their relationships, without any prejudice about the data, through an unsupervised iterative process, automatically inferring concepts, themes and report patterns from the data (Leximancer, 2021).

The output from the Leximancer analysis is discussed in the next section of the paper.

4 Data analysis and findings

The objective of this research study was to investigate the key disruptive innovation factors relevant to SMEs. Figure 2 shows the Leximancer visualization and legend of clustered concepts consisting of 10 themes and 38 concepts. The visualization groups concepts in themes through allocating different colours to each theme.

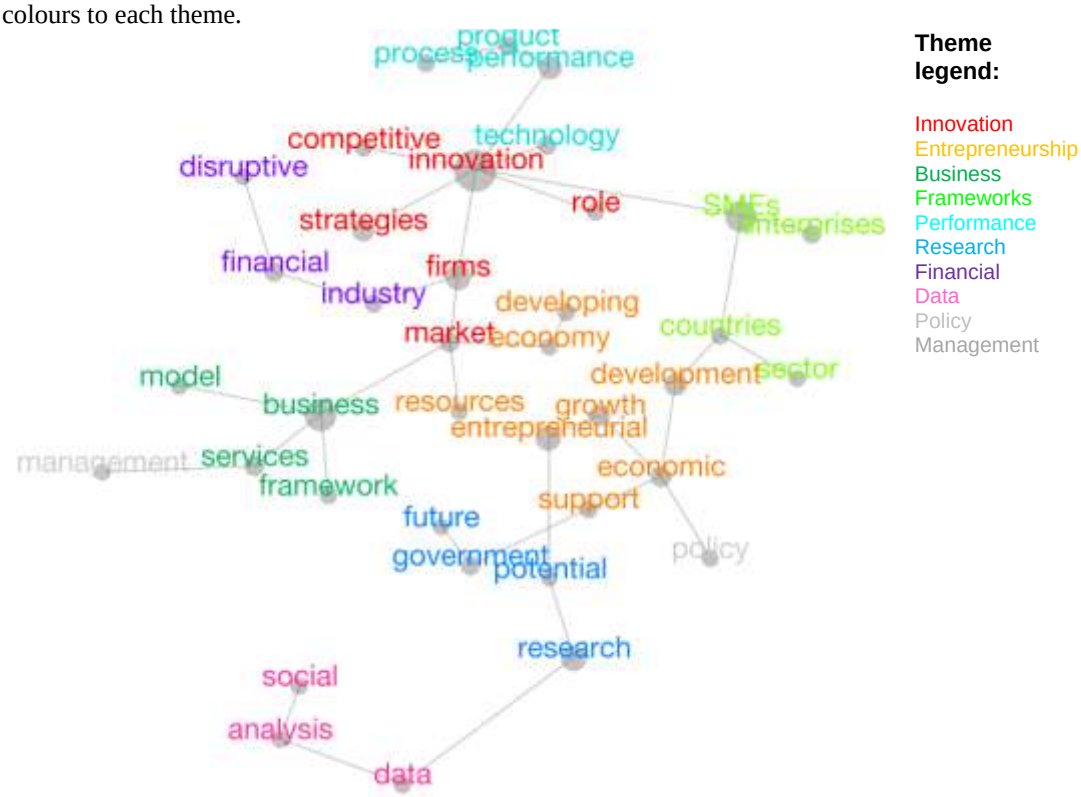

Figure 2: Clusters of concepts (Leximancer visualization and legend)

We extracted the themes, concepts and brief description from Leximancer shown in Table 1. The number in square brackets after each theme represents the number of hits. “Hits” refer to the number of text blocks in the corpus associated with the theme (Leximancer, 2021). “Key concept description” reflects an abbreviated phrase of the concept identified during the automated content analysis.

The theme *innovation* focuses on the adoption of innovation and optimizing market opportunities, such as markets where large enterprises are less successful. The identification of such opportunities relates to the analysis of consumer behaviour trends, enabled through relevant and fit-for-purpose employee training programs and sustainability strategy incentives. *Entrepreneurship* refers to the identification of competitive pressures and addressing the competitive pressures through the effective strategic alliance with other participants in the market. As SMEs provide employment opportunities as

discussed earlier in the paper, government policies and programs intended to support entrepreneurs must be accessed and utilized. An entrepreneurial mindset must be fostered through the promotion of an internal community of stakeholders. The *business* theme relates to the application of digital transformation in order to enable and realize business model and value chain innovation. As such, a digital transformation process may pose significant risk to the organization (e.g., system failures, data breaches, cyber-attacks, lack of adoption), risks must be identified and mitigated, and risk experience support structure must be consulted in support of moderating risk impact. From a business perspective and where relevant, the promotion of the internationalization of SME products presents an opportunity and digital transformation may mobilize future jobs. *Frameworks* theme highlights the services, frameworks and models that may be applied by SMEs to ensure the delivery of service, an aspect that is critical for the development of SMEs. This theme also reflects the potential of SMEs to stimulate economic growth and to contribute considerably to the GDP of nations. A key concept highlighted in this theme relates to empirical evidence that confirms the link between the absence of training and support to the failure of SMEs, amplifying the requirement for multi-pronged training interventions.

Table 1. Key disruptive innovation aspects extracted from SLR corpus

Source [Hits]	Key concept	Key concept description	Reference
Innovation [556]	innovation	adoption of innovation	(Kaua, 2021; Mansour, 2015; Mills, 2016; Moore & Manring, 2009; Mukundan & Thomas, 2015; Mung'ora & Kiiru, 2019; Nguyen, 2015; Owuor, 2018)
	firms	employee training programs	
	strategies	sustainability strategy incentives	
	market	consumer behaviour trends	
	role	market spaces where large enterprises are less successful	
Entrepreneurship [348]	competitive	identified competitive pressures	(Auerswald et al., 2012; Dasher, Harada, Hoshi, Kushida, & Okazaki, 2015; Elmansor & Arthur, 2015; Escalfoni & Oliveira, 2021; Mwatsika, 2021; Srinuan, 2014)
	entrepreneurial	effective strategic alliance with other participants in the market	
	development	promote internal community of stakeholders	
	growth	government policies and programs intended to support entrepreneurs	
	economic	provide employment opportunities	
Business [332]	support	risk experience support	(Allahar, 2019; Auerswald et al., 2012; C.-L. Chen et al., 2021; Fairooz & Wickramasinghe, 2019; Joseph et al., 2016; Mansour, 2015; Nyamboli, 2021; Pietersen, 2018; Serumaga-Zake & van der Poll, 2021; Yusuf, Lopez-Cordova, & Gregory, 2021)
	developing	support digital transformation	
	economy	promote the internationalization of SME products	
	resources	mobilize future jobs	
	business	business model and value chain innovation	
Frameworks [312]	services	delivery of service critical	(Abbad, Magboul, & AlQeisi, 2022; Abdullah, 2017; Anwar, 2018; Irvine & Moore, 2018; Kaua, 2021; Le Roux & Bengesi, 2014; Marima, 2018; Moore & Manring, 2009; Pallapothu, 2012; Yun, 2017)
	framework	encourage more inclusive development	
	model	stimulate economic growth	
	SMEs	contribute considerably to the GDP	
	enterprises	multi-pronged training interventions	
Performance [248]	countries	increase employment opportunities	(Hungund, 2020; Mohammed, 2021; Mukundan & Thomas, 2015;

Source [Hits]	Key concept	Key concept description	Reference
	sector	large share of the economy	Mung'ora & Kiiru, 2019; Owuor, 2018; Tajeddini, 2016)
	performance	improved operational performance	
	product technology	product and process innovation technology capability	
Research [252]	process	organizational dialogue	(C.-L. Chen et al., 2021; Kurniati & Suryanto, 2022; Marima, 2018; Pallapothu, 2012; Pietersen, 2018; Saguy & Sirotinskaya, 2016; R. Weerasinghe, Jayawardane, & Ramlogan, 2014; RN Weerasinghe, Jayawardene, & Ramlogan, 2013)
	research	research and development in business incubators	
	government	support tax compliance	
	future	manage current demand, create a space for the future	
	potential	commercialization of new technologies	
Financial [131]	financial	streamline production and increase efficiency	(Anwar, 2018; Chakabva et al., 2020; Gomber et al., 2018; Kaua, 2021; Mung'ora & Kiiru, 2019; Pallapothu, 2012; Sombolayuk & Yusuf, 2019; Tajeddini, 2016)
	industry	revitalize industries	
	disruptive	disruptive innovation opportunities (Fintech)	
Data [172]	data	draw data that engender innovativeness	(Gomber et al., 2018; Jain, Jaiswal, & Prasad, 2014; Kurniati & Suryanto, 2022; Mills, 2016; Srinuan, 2014; Waldman-Brown, 2020; RN Weerasinghe et al., 2013)
	analysis	define new measurement of innovation	
	social	participative decision-making practices	
Policy [42]	policy	policy makers to learn from real world case studies to improve policy efficacy	(Dasher et al., 2015; Jain et al., 2014; Lee, Yang, & Pham, 2017; Salisu, Julienti, & Bakar, 2018; Shetty & Panda, 2021; Thorsteinsdóttir, Bell, & Bandyopadhyay, 2021; R. Weerasinghe et al., 2014; RN Weerasinghe et al., 2013)
Management [50]	management	tactical management and external networking	(Arora & Jain, 2019; Edwards, 2017; Escalfoni & Oliveira, 2021; Gunawardana, 2018; Irvine & Moore, 2018; Kaua, 2021; Marima, 2018; Pallapothu, 2012; Tajeddini, 2016; Thomas, 2016)

The theme *performance* highlights key considerations to improve operational performance and contribute on a large scale to a nation's economy. Key focus areas in this context include product and process innovation enabled by technology capability. With increased business performance, employment opportunities may increase further. *Research* refers to research and development opportunities in business incubators towards e.g., commercialization of new technologies and creating future opportunity while managing current business demand. Two enablers highlighted in this theme relates to fostering organizational dialogue and to utilize compliance support structure e.g., tax. *Financial* in the context of disruptive innovation indicates considerations to streamline production and increase efficiency. Organizational efficacy in the context of SMEs may revitalize industries and lead to disruptive innovation opportunities, especially in the Fintech sector. The theme *data* points to applying the power of data to define new measurement parameters for innovation and to stimulate innovativeness. Applying data in decision-making processes enable participative decision-making

practices. *Management* and *policy* both consisted of one concept only and encompasses a focus on tactical management and external networking as management practices in support of disruptive innovation. In order to improve policy efficacy, policy makers should learn from real world case studies to find the effective policies. Furthermore, required policy adjustments in foreign trade, investments, and foreign employment should be made for the development of SMEs.

5 Discussion of findings

A list of key factors related to disruptive innovation of SMEs have been identified. In order to provide a checklist for SMEs of the key factors to consider, we categorized the key factors identified into the contexts included in the T-O-E framework namely technology context, organizational context and environmental context. The categorization and its application are discussed in the next two sections.

5.1 Categorization of concepts to T-O-E framework

Six key aspects were categorized to the technology context, 11 key aspects to the organizational context and 15 to the environmental context as shown in Table 2. Six key aspects could not be allocated explicitly to the T-O-E framework contexts, and we enriched the T-O-E contexts with an additional context, i.e., socio-technical. Socio-technical theory is based on the notion that the design and performance of any organizational system can only be understood and improved if both *social* and *technical* aspects are considered and treated as interdependent parts of a complex system (Erickson, Claussen, Leydens, Johnson, & Tsai, 2020). Furthermore, socio-technical contexts must be considered as Society 5.0 aims to take advantage of technological advances to develop the foundations for a better world for all people (Rojas, Alomía, Loaiza, & Romero, 2021).

Table 2. Key disruptive innovations aspects mapped to enriched T-O-E framework

Contexts	Key aspects
Technology	1. promote the internationalization of SME products
	2. technology capability
	3. commercialization of new technologies
	4. streamline production and increase efficiency
	5. disruptive innovation opportunities (Fintech)
	6. draw data that engender innovativeness
Organizational	1. employee training programs
	2. promote internal community of stakeholders
	3. risk experience support
	4. business model and value chain innovation
	5. delivery of service critical
	6. encourage more inclusive development
	7. multi-pronged training interventions
	8. improved operational performance
	9. organizational dialogue
	10. support tax compliance
	11. participative decision-making practices
Environmental	1. sustainability strategy incentives
	2. consumer behaviour trends
	3. market spaces where large enterprises are less successful
	4. identified competitive pressures
	5. effective strategic alliance with other participants in the market
	6. government policies and programs intended to support entrepreneurs
	7. provide employment opportunities

	8.	stimulate economic growth
	9.	contribute considerably to the GDP
	10.	increase employment opportunities
	11.	large share of the economy
	12.	manage current demand, create a space for the future
	13.	revitalize industries
	14.	policy makers to learn from real world case studies to improve policy efficacy
	15.	tactical management and external networking
Socio-technical	1.	adoption of innovation
	2.	support digital transformation
	3.	mobilize future jobs
	4.	product and process innovation
	5.	research and development in business incubators
	6.	define new measurement of innovation

Society 5.0 seeks modern technology application methods in order to identify the best strategies and tools to use in a manner that guarantees sustainability within the framework of a new society that demands constant renovations (Rojas et al., 2021).

5.2 Exemplary study as an "instantiation" of the T-O-E categorization and checklist

In order to provide application opportunities of the key factors identified for disruptive innovation in SMEs, we present an exemplary case study that can be interpreted as an "instantiation" of categorized checklist.

This case study reports on a SME with a high-end disruptive innovation success: SF, a Chinese SME who engages in broadband products (J. Chen, Zhu, & Zhang, 2017). SF was founded in 2000 and became the largest most innovative network equipment supplier in several areas in 2017. When applying the proposed checklist of key factors related to disruptive innovations which SMEs need to consider, the following is established. SF applied 4 of the 6 possible key aspect under the **technology** context. There was proof of their *technical capability* as they provided/sold high-end disruptive technologies (innovative network equipment). In terms of *commercialization of new technologies*, they became the largest and most innovative network equipment supplier, with lead technology and products offered in several areas. SF conformed to the aspect of *streamlined production and efficiency increase* as they were allowed to use workplaces made available for public service platforms to obtain information and to expand their sales channels. Lastly, they made use of *disruptive innovation opportunities* as they launched a disruptive breakthrough network product every 1 to 2 years of which 75% became Chinese market leaders within 3 years, and they paid attention to gaps in the market and niches which were ignored by their competitors, to expand their competitive advantage. The case study does not report on the aspects of *promoting the internalization of SME products* or whether the company *drew on data to engender their innovativeness*.

Under the **organizational** context, SF applied 4 of the 12 key aspects listed. These include *employee training programs* as they had active programmes to promote co-operational learning in the form of tutor learning and team learning. The next key aspect they complied with is the *promotion of internal community of stakeholders*. SF deployed various programmes to promote internal learning such as hero assembly and learning from the open-source community they belong to. With regards to *risk experience support* they had an effective incentive system in place to encourage innovation. The *organizational dialogue* aspect was considered as SF was reported to have valid internal communication channels. The last key aspect they complied with was *strategic support for innovation*. In this regard, SF established a clear long-term strategic objective to capture the domestic market with innovative products and services through their independent research and development.

Of the 15 possible **environmental** key aspects, SF complied with 8. There was proof that they kept up with *consumer behaviour trends*, as managers accessed consumers knowledgeable about their product domain. They targeted *market spaces where large enterprises are less succes*sful and entered the market through lower price of homogenized products when they started off; they have since then paid attention to market gaps and niches which were ignored by competitors to expand their competitive advantage. SF formed *effective strategic alliance with other participants in the market* as they used industry associations, competitors, and other external sources of knowledge, and they welcomed suggestions for improvement from their users. They benefited from *government policies and programs intended to support entrepreneurs* as they received government funding and cash district government rewards and preferential tax rates. As SME SF *contributed considerably to the GDP* as it is reported that they became the largest and most innovative network equipment supplier in the market with lead technology and products in several areas. They had a *large share of the economy* as they were ranked in the top 500 high-tech, high-growth firms in the Asia Pacific region for 8 consecutive years. They were able to *manage the current demand and create a space for the future* due to their initial innovative idea of gateway acceleration which was derived from technical feedback and potential demand of a single user. Lastly, SF made use of *tactical management and external networking* as they cooperated with China UnionPay data centre and learned together to bring about successful innovation.

In the last context of **socio-technical**, SF considered 1 of the 6 key aspects. They made use of *research and development in business incubators* as the strategic significance of their research and development reflects in the 15% of their annual income which they invested in research and development; and the fact that 40% of their total staff, who were selected from the top 2% graduates from famous Chinese universities, were employed to do research and development work.

During the process of analyzing the case study, we added a key aspect to the organizational context as SF specifically raised *strategic support for innovation*.

6 Conclusion

The contribution of SMEs to the economy of countries is established and in order for SMEs to survive and thrive, they need to innovate, make sense of the ubiquitous computing world, create social businesses, and develop new business models to stand the test of time. The objective of this study was to investigate and present a key disruptive innovation factors checklist for SMEs that may guide their consideration of their innovation strategies through a comprehensive approach.

Through an automated content analysis process using Leximancer Software, a corpus of 137 papers were assessed and 10 themes and 38 concepts were identified. The 38 concepts were categorized by applying the T-O-E framework and we established that 6 concepts could not be categorized, resulting in the addition of a context i.e. socio-technical context to the T-O-E framework. The categorization across the 4 contexts (technology, organization, environment and socio-technical) provided the based for the design of the checklist. In order to illustrate the checklist application, we mapped a SME case study to the key aspects of the checklist.

The next step following the findings of this research study, is to collect data from SMEs via a questionnaire based on the checklist in order to establish the applicability of the checklist in a real world context. In addition, future research may include the implementation of a disruptive innovation pilot with an identified SME and practitioner to investigate and enrich the checklist as a utility and its practical worth for optimizing disruptive innovation strategies.

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