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Innovation as recovery strategy for SMEs in emerging economies during the COVID-19 pandemic

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ARTICLE INFO

Keywords:
- COVID-19 economic crisis
- Innovation
- SMEs
- Strategic planning

ABSTRACT

The quarantine and disruption of non-essential activities as measure to contain the COVID-19 pandemic has negatively affected all economies around the World. This has had a deeper impact on small and medium enterprises (SMEs) in emerging economies because they have very limited resources and vulnerable supply chain and business-to-business/business-to-clients relationships. In this context, it is expected that after the pandemic many of these enterprises will disappear as the “new normality” will require changes in business and infrastructure management. To reduce this risk, innovation is identified as a key aspect of business recovery in the ongoing and post-COVID-19 pandemic period. This work presents a multidisciplinary methodological approach to guide these enterprises to innovate their products for new markets and making a better use of their limited available resources. As an example of this approach, the research-supported development of a new product for a family-owned SME was performed in a zone with high COVID-19 risk. The results provide insight regarding innovation as a survival tool for SMEs during and after the COVID-19 contingency, and the use of digital resources is identified as the main facilitator for networking and research-based design of innovative products within the “social distance” context.

1. Introduction

The COVID-19 outbreak, which started at the end of December 2019 in Wuhan, China, has already spread through the World by April 2020. This virus can cause severe respiratory, neurological, and cardiovascular complications (Ma et al., 2019; Klok et al., 2020). With an estimated mortality rate of 2.0% (Xu et al., 2020) and the need for specific infrastructure and equipment such as Intensive Care Units (ICUs) and respirators, this virus has caused great concern in the medical sector. Due to the lack of an effective treatment (as of October 2020) and the exponential growth of cases and fatalities, the governments have taken emergency actions to reduce the spread of the disease. By flattening the epidemic curve (Saez et al., 2020) it was expected to reduce the risk to break the capacity of the health care systems.

Among these actions, as of August 2020, the following are still in place in most parts of the World: social isolation, closure of public places, cancellation of events with more than 10 people, stop of non-essential activities (Saez et al., 2020; Nicola et al., 2020). Also, the following recommendations have been made: avoid public means of transport, continuously wash hands each hour, avoid interactions with people with symptoms such as sneezing, coughing, and breathing problems (Ali and Alharbi, 2020).

As consequence, these actions have reduced the economic flow through all kind of enterprises. Even for countries with a strong economy, such as the United Kingdom, the quarantine period is estimated to cause a decrease in their GDP of 3.0% (Nicola et al., 2020).
The quarantine has also led to increase the unemployment rate and the closure of businesses, making more evident the social inequality (Blustein et al., 2020; Nicola et al., 2020; O’Connor et al., 2020).

In emerging economies such as in Latin-America, these negative effects can be more significant due to additional problems: fragile health care systems, misinformation regarding the complications of COVID-19, limited access to clean water and sanitation services, high prevalence of people with pre-existing metabolic diseases such as diabetes and hypertension which already make use of the national health systems, poverty and vulnerable ethnic groups, precarious jobs, etc. (Burki, 2020; Díaz-de-León-Martínez et al., 2020). Particularly, small and medium enterprises (SMEs), which are largely family-owned, are dealing with a large economic burden and uncertainty. Although governments have developed loan schemes to help these enterprises to survive the pandemic, it is insufficient as they require more cash flows to retain workers, pay rent, and reinvest in their infrastructure.

Under this scenario, there is a crucial need to gather most of the knowledge regarding business management, strategic planning and innovation, to formulate alternatives for SMEs to reinforce their business models for different markets and restrictions. To address this need, the research community published discussions regarding the impact of the COVID-19 pandemic on businesses and reviews on previously published works which could provide recommendations for SMEs (He and Harris, 2020; Nah and Siau, 2020; Hamilton, 2020; Eggers, 2020; Kuckertz et al., 2020).

In this context, the present work contributes with a guideline model or methodology with established strategies and tools to support SMEs survival during this specific period. For this purpose, the proposed methodology considers the fundamentals of Porter’s 5 Forces and Blue Ocean Strategy with special emphasis on innovation which has been reported as a powerful trigger in times of crisis (Ucaktürk et al., 2011). A case study is discussed to support the suitability of the proposed methodology.

2. Methodological approach

Many SMEs fail in the short term due to already existing problems such as little or no investment in improvements and/or knowledge of the market, lack of formal planning and demand forecasting, lack of managerial and technical skills, and limited economical resources. These features make the SMEs more vulnerable to internal and external events such as: critical employee quitting his/her job, a decline of financing options, and reduction of demand due to a competitor entering the market (most of SMEs are within very competitive markets) (Eggers, 2020).

In the context of crisis, innovation has been identified as a powerful trigger for organizational resilience of small businesses and economic development in both, the manufacturing and service sectors (Forsman, 2011; Ucaktürk et al., 2011; Nah and Siau, 2020). Coincidentally, these are the most affected sectors during the COVID-19 pandemic (Fernandes, 2020; Hamilton, 2020).

Innovation in SMEs can be measured through three dimensions: product innovation, process innovation, and management systems innovation (Maldonado-Guzman et al., 2018). Specifically, product innovation has been identified as the most important to improve the enterprises’ performance (Hernandez-Espallardo and Delgado-Ballester, 2009). However, in practice, concerns regarding “when”, “where” and “how” to perform innovation are important when selecting and implementing the required managerial and technical strategies and tools. This is because the main dimensions of innovation can involve high costs and risks, and the current COVID-19 event has increased both, severely affecting the performance of SMEs.

An advantage to develop a suitable methodology to improve SMEs’ performance is that the small size of these enterprises also provide flexibility and closer relationships between their decision makers and their customers (Eggers, 2020). The proposed methodology explores on this advantage, and it is concise regarding the most suitable strategies and tools to minimize the associated costs and risks.

For this purpose, the proposed methodology is focused on the following two aspects:

- Optimization: to improve the SMEs processes and reduce waste and costs. As discussed in Nah and Siau (2020), cost optimization is important for business survival and continuity.
- Innovation: for the development of new products that meet new market needs. The achievement of innovation can be affected without prior optimization of the processes.

To achieve optimization and innovation, the proposed methodological approach integrates features of (i) Lean Manufacturing such as Six-Sigma (6σ) (Munro et al., 2015), (ii) Strategic Planning through Porter’s Five Forces and the Blue Ocean Strategy (Kim and Mauborgne, 2015) and (iii) Operations Research (OR) tools. In the following sections the characteristics and adaptations of these features are discussed.

2.1. Six-Sigma (6σ)

6σ is a Lean Manufacturing methodology used to control variability and continuously improve a process by detecting the causes that generate variability (i.e., errors, waste) and designing actions to reduce or eliminate them with a vision of continuous improvement. To achieve this, the methodology strategically integrates the use of diverse quantitative and qualitative tools, which are frequently used by other methodologies (hence, confusion is generated in its definition, even with some concepts such as lean which is focused on reducing activities that do not add value to a process and standardizing of processes) (Munro et al., 2015).

In this context, the DMAIC (Define, Measure, Analyze, Improve, Control) model is one of the most important strategies for the implementation of 6σ. In fact, some organizations consider DMAIC to be a synonymous of 6σ and it is also very similar to other iterative continuous improvement models such as PDSA (Plan, Do, Study, Act)/PDCA (Plan, Do, Check, Act/Adjust) of business/management.
fields. Table 1 presents an overall overview of each phase of the DMAIC model (Munro et al., 2015).

In practice, there is a wide portfolio of quantitative and qualitative strategies and tools to address these phases. As innovation is identified as the key factor for SMEs, the concept of \textit{value-added} which is associated to features added to a product for which the customer is prepared to pay an additional price, must be considered. This is directly associated to specific processes within the SMEs’ production system. Also, to identify the problem and formulate an appropriate solution, the \textit{cause and effects} of both, the problem and the solution, must be analyzed before standardization.

2.2. Porter’s Five Forces and the Blue Ocean Strategy

Within the SMEs context, the \textit{competitive environment} has been identified as a moderator of product innovation and performance (Hernandez-Espallardo and Delgado-Ballester, 2009). This environment is described based on Porter’s Five Forces: threat of entry, intensity of competition, power relative to buyers, power relative to suppliers, and threat of substitutes (Porter, 2008; Hernandez-Espallardo and Delgado-Ballester, 2009). This model helps to identify five aspects which drive competition and threaten the enterprise’s ability to make profit, and make the enterprise to “stake out a position in its industry that is less vulnerable to attack” (Dalken, 2014). Table 2 presents an overall overview of Porter’s Five Forces (Porter, 2008; Dalken, 2014; Hernandez-Espallardo and Delgado-Ballester, 2009).

Here it is important to mention that all forces influence the intensity of competition of all enterprises within a considered industry (Porter, 2008). Also, most SMEs are competitors within industries that produce substitutes. This adds challenges to SMEs survival in case of crisis, and the Five Forces model can support the assessment of the industry to develop the most appropriate strategy. As high competition is likely to be observed, it is necessary to identify strategies to change the market and reduce the number of competitors. A strategy used for this purpose has been known as the Blue Ocean Strategy (Nah and Siau, 2020). Its name comes from the analogy to a blue ocean which is seen in the absence of sharks (market with few competitors), and a red ocean which is seen in the presence of a high number of sharks devouring its prey (market with many competitors). This strategy focuses on “creating a new market space by capturing new demands in the market” (Kim and Mauborgne, 2004). As examples of enterprises which successfully performed a Blue Ocean strategy the following can be mentioned: Cirque du Soleil, Apple, iTunes and Canon. Table 3 presents an overall overview of the characteristics of enterprises within red and blue oceans.

2.3. Integrated Methodology

To integrate the previously discussed strategies into a functional methodology, the first step consists on identifying the main aspects or recommendations for SMEs survival during the COVID-19 pandemic. Based on Kuckertz et al. (2020) the following survival measures were considered:

(a) Create solutions to new problems by creatively combining existing technology and human capital.
(b) Activate network resources such as flexible staff rotation and payment options.
(c) Focus on channeling resources to viable and value generating activities.
(d) Temporarily downsize non-essential activities.
(e) Analyze new opportunities which may arise at the ending of the crisis.

In this context, in April 2020 the International Labour Organization (ILO) also issued a six-step COVID-19 business continuity plan (BCP) for SMEs (ILO, 2020):

(f) Identify the key products or services.
(g) Establish the objective of the BCP.
(h) Evaluate the potential impact of disruptions in the enterprise and workers.
(i) Identify the actions to protect the enterprise’s assets (people, processes, profits, partnerships).
(j) Establish contact lists.
(k) Maintain, review and continuously update the enterprise’s BCP.

Thus, the integrated methodology should guide SMEs for the implementation of their BCP and survival measures. Fig. 1 presents the general structure of the proposed methodology which integrates the DMAIC model and specific tasks/tools for each phase. To address

| Table 1 |
|---------------------------------|---------------------------------|
| Phase              | Description                                      |
| Define             | Identify the event that negatively affects the process. |
| Measure            | Collect information regarding the process.       |
| Analyze            | Analyze the process and the information collected to know what is happening. |
| Improve            | Formulate actions/solutions based on the analysis of information to change the process and improve it. |
| Control            | Monitor the system to sustain savings/improvements. |

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Table 2
Michael Porter’s Five Forces.

| Force                  | Description                                                                                                                                                                                                 |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Threat of Entry        | The existence of entry barriers for new enterprises within a specific industry. There are effects on the competitive advantages, profits, and rivalry between competitors by the entry of new enterprises to existing markets. There are six significant barriers to enter the market: Economic of Scale, Product Differentiation, Capital Requirements, Cost Disadvantages, Access to Distribution Channels, and Government Policy. |
| Intensity of Competition | The existence of different forms of competition (e.g., price discounting, new products, advertising, service improvements). The profitability of an industry can be affected by the level of rivalry between existing competitors. |
| Power Relative to Buyers | The existence of buyers with a high market power which can push prices downward, or request higher quality/extended services. In general, the power relative to buyers is high if they are large and few, and they can easily select another supplier. |
| Power Relative to Suppliers | The existence of suppliers which the power to threaten enterprises with increasing prices for goods or services. Thus, the power relative to suppliers is high if they are large and few, and many kind of customers are eager for their goods or services. |
| Threat of Substitutes  | Substitutes are products or services which can fulfill the same function as others within the considered industry. The existence of many substitutes affect the overall profitability between all competitors within an industry. |

Table 3
Characteristics of Red Oceans (many competitors) and Blue Oceans (none or few competitors).

| Red Ocean                                      | Blue Ocean                                      |
|------------------------------------------------|------------------------------------------------|
| Existing Businesses                            | New Business Ideas                              |
| Compete in the existing market where there is high competition. | Create spaces with little or no competition (make the competition irrelevant). |
| Exploit existing demand.                       | Create and take advantage of new demand.        |
| Give in the value-price relationship.           | Break the value-price relationship.             |
| Low cost or product differentiation.           | Significant profit and product differentiation. |
the recommendations (a)–(k) for survival of SMEs during the COVID-19 pandemic the following implementation tools were considered (Munro et al., 2015):

- **Value Adding Processes**: This is a process, or sub-process, which can transform raw materials or services into more valuable ones. For innovation purposes, it is important to identify the processes which can support the development of new or improved goods with higher value or new markets.

- **Root Cause Analysis**: This is an analysis aimed to determine the core issue (root cause) which, when present, can lead to negative effects on the enterprise. This is associated to identify the potential problems which can compromise the innovation or optimization efforts.

- **Cause–Effect Analysis**: This analysis is focused on identifying root causes and support the formulation of solution. As examples of tools to perform Cause-Effect Analysis the following can be mentioned: Fishbone Diagrams, Ishikawa Diagrams, Herringbone Diagrams, Effect Analysis Relational Matrix X-Y, Failure Mode and Effects Analysis (FMEA).

These analyses must be performed considering the current vulnerability of the SME. Thus, the BCP RISK MATRIX (ILO, 2020) must be performed in this initial stage. This can also support the identification of problems directly associated to the COVID-19 pandemic. Then, the use of specific quantitative tools such as Design of Experiments (Factorial Design) and Descriptive Statistics (i.e., average/standard deviation of demand data and production rate, coefficients of variability, stock-out probability, hypothesis testing, etc.) is recommended to analyze and validate the data obtained at each stage.

Innovation and optimization are performed once the problems have been correctly identified. The Cause–Effect Analysis is suitable to propose solutions while protecting the enterprise’s assets (people, processes, profits, partnerships). Identifying the value-adding processes can provide insights for new product development. This is also supported by the Blue Ocean Strategy. In accordance to temporarily downsize non-essential activities, Elimination of Waste involves reducing or eliminating any resource or process which does not add value to the system or product.

The use of digital resources (mobile communication, online tutorials) is recommended to improve on the creation of solutions collaboratively, to know flexible ways to increase cash flow inside the SME and channel resources for value generating activities. This is important for innovation through re-engineering and new product development. Disruptive solutions are recommended under the Blue Ocean Strategy to identify opportunities from problems and explore different markets. Finally, among the techniques to implement optimization and innovation, Sustain, Safety, and overSight from the 7S technique takes more relevance under the COVID-19 scenario to keep safe spaces and procedures in the work place.

Testing of the methodology was performed with a textile SME in the city of Puebla, Mexico, which was under strict quarantine between April and July of 2020. By the time of this revision, although some non-essential businesses started to operate since July 2020, as of October 2020, the main customer sector of this SME which consists of sport teams and schools, are not allowed to operate. Thus, demand has been minimum for this SME. In Mexico, 98.0% of all economic entities are SMEs and they contribute to 50.0% the GDP (Lozano-Yécora et al., 2013). Even though most of the economic entities are SMEs, they have a very high failure rate, and up to 90.0% do not survive beyond two years (Salas et al., 2012). The COVID-19 pandemic has already added more challenges and difficulties to these SMEs and the proposed methodology is aimed to provide tools for this period and the post-COVID period. The details of this case study are presented in the following section.

### 3. Case study

As the COVID-19 pandemic spread to Mexico and quarantine started on March 23, 90% of local SMEs shot-down operations. As of October 21st, Puebla is the 7th state with more COVID-19 confirmed cases (34,174) and 4,558 deaths, which leads to an estimated mortality rate of 13.0%. Also, its geographical proximity to the state and city of Mexico (2.0 h trip), which holds the largest number of confirmed cases (146,167 + 91,271 = 237,438) and deaths (14,368 + 10,214 = 24,582) (as of October 21st) leads to additional risks to control the pandemic (Gobierno de Mexico, 2020).

In this social context, a family-owned SME in the field of sock production was considered for implementation of the methodology. The market for this product is highly competitive given the presence of larger companies, both domestic and foreign, which are capable

| Aspect               | Description                                                                 |
|----------------------|-----------------------------------------------------------------------------|
| Year of Creation     | 1983                                                                        |
| Pre-COVID-19 challenges |                                                                                     |
| (i) Production       | Empirical production practices, non-standardized production shifts, variable production times. |
| (ii) Suppliers       | Production is subject to the available raw material which is provided by a single supplier which is located 4.0 hours away from the SME. |
| (iii) Customers      | Two clients, which generally use credit to purchase the products (i.e., orders are not paid in full, these are partially paid, or these are paid only when the customer itself sells the product to other customers). |
| (iv) Management      | Empirical management practices, cash-only operations (no electronic payments are considered). |
| (v) Competitors      | More than 100 competitors within the regions, from other SMEs to large companies. Many products from China are imported in the region at a lower cost. Thus, the SME is within a “Red Ocean”. |
of producing on a large scale with better technology and lower sale prices. Thus, the SME has survived by producing small orders of customized sport socks for local SMEs and end-customers. Considering the previously discussed information, Table 4 presents the profile of the SME.

This has severely affected the considered SME. As sport sock sales depend of football and school events, both suspended indefinitely, this product is not considered as essential for the general population (in contrast to take-away food services and water distribution). While the government has established the end of the strict quarantine by May 31 with the eventual return to a “new normality” (use of face-masks, avoidance of public places, restrictions on automobile use, etc.) the recovery of businesses is uncertain. Fig. 2 presents the information of the SME associated to the first steps of the methodology.

As advantages, the SME has the appropriate machines for production. Also, the owner can modify these machines to customize the product, which is a value-adding feature. As disadvantages, the supply process is inefficient in both aspects: capacity and time. Also its two clients are out of the business and there is fear to look for other clients due to the social isolation and contagion risks. As presented in Table 4, previously to the COVID-19 event, these two clients were also not reliable as payment was not immediately received from them.

The BCP Risk Matrix score of 39 classified the SME as borderline between the medium (20–40 score) and high vulnerability (40–60 score) group. Under the high vulnerability group the ILO states that the enterprise is likely to be severely impacted by the COVID-19 event with long-term disruption or deterioration of the situation, hence a plan of action should be focused on (1) identifying whether the SME is most vulnerable to internal or external threats, and (2) taking measures to reduce risk and vulnerability to COVID-19 (ILO, 2020).

With this initial diagnosis, Fig. 3 presents the steps of the methodology focused on formulating solutions for the identified problems. Currently, the main problem is the absence of sales which was aggravated by the high number of competitors and lack of reliable clients. To improve the change of market of the SME from the “Red Ocean” to the “Blue Ocean” to get more reliable clients and higher demand of products, the development of a new product which was defined as sock for people with diabetes was considered. The population with this metabolic disease is increasing in Mexico, and as of 2020 it is estimated that 37.0% of Mexican adults have undiagnosed diabetes (Félix-Martínez and Godínez-Fernández, 2020). Under this scenario, ulcerations on the feet are the main cause of complications leading to amputation. Appropriate footwear (socks, shoes) are required to control sweating and pressure which are contributing factors to these complications (Bennett, 2015; Chand et al., 2012; Ameersing et al., 2015).

Currently there are many private doctors and clinics which provide counseling to people with diabetes and are in need of
appropriate products. This represents a viable market for the SME in the absence of the traditional market (sport socks). Instead of just copying a commercial sock model for people with diabetes, the advantage of the SME regarding the ability to modify machines was explored. This was performed through design based on specialized research about the characteristics and needs of the so-called “diabetic foot” (Chand et al., 2012; Ameersing et al., 2015). This led to updated knowledge about the vulnerable zones of the feet due to sweating and pressure (Smith et al., 2013).

Then, the development of the new product was integrated within the supply chain in accordance to keep the strategic balance between the supplier, the SME and the clients. The actions for each relationship are presented in Fig. 4. Optimization of the manufacturing process was performed between the supplier and the SME through appropriate planning of raw material (RM) by inventory control methods such as the Periodic Review Model. The characteristics of the new product are crucial for the relationship
between the SME and the clients as it must comply with their requirements. This was achieved by the specialized care research for the vulnerable zones of the diabetic foot (Bennett, 2015; Chand et al., 2012; Smith et al., 2013; Ameersing et al., 2015) and the most appropriate materials such as bamboo, tencel and cotton (Arafa, 2018; Woolley and Fogoros, 2018). The relationship between the supplier and the clients is regulated through the possibility of the supplier to provide the RM to produce the new product. Note that to keep the supply chain working, health-keeping actions must be performed. Very affordable cleaning and protective gear were obtained through direct contact with suppliers via Internet and mobile platforms (i.e., WhatsApp, Skype).

While the modification of the knitting machines and the optimization of the operations do not require economic investment, the RM and the cleaning and protective gear requires an investment which is not available. Thus, the required procedures to acquire one of the COVID-19 loans of the government (approximately 1000 USD) for SMEs were obtained through research on the Internet. Finally, potential clients were contacted by direct communication (WhatsApp, Skype, ZOOM) with doctors and clinics in the near area. Also, networking with former family doctors was performed to “spread the word” and obtain recommendations regarding the new product.

By the end of June the SME could receive a loan and two suppliers confirmed their capability to provide the required RM including its delivery. Regarding the potential clients, two out of five confirmed orders for the new product, which as October 2020 have sustained frequent orders (60–100 USD per week) which have kept the SME operational. The knitting machines were modified to produce the new product with the knitting characteristics required to reduce the risks of sweating and pressure. The appropriate application of the Periodic Review Model and standardization of production has kept the generation of waste at a minimum with a fluent production of the new product.

4. Conclusions

In this work an integrated methodology was presented to support the recovery efforts of SMEs during and after the COVID-19 contingency. Taking advantage of digital resources such as Internet and communication platforms (WhatsApp, ZOOM, Skype), knowledge about specific techniques and contacts (suppliers, clients) can be performed to make better use of the limited resources of SMEs. As discussed, innovation can be the main resource for survival during this event. In order to implement it, optimization of the production processes must be performed. More than ever, the multidisciplinary approach is crucial for innovation and optimization. As presented, tools of Lean Manufacturing, Strategic Planning, Industrial Engineering and Ergonomics were required to address the needs of the considered SME.

Although the case study is limited to the manufacturing sector, the methodology can be applied on the service sector. The COVID-19 has represented a real challenge not only within the health sector, but to all sectors including education, manufacturing, service, tourism, entertainment, etc. Thus, more research is needed to improve the resilience of enterprises during this period.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this paper.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ribaf.2021.101396.

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