

Understanding strategic response to Covid-19 crisis in manufacturing SMEs: A cluster analysis

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Abstract. Manufacturing small- and medium- sized enterprises (SMEs), which play a decisive role in the Spanish and European economy, have been particularly affected by the disruption generated by the COVID-19 crisis, being their strategic decisions key to maintain their competitiveness. This article explores the strategic priorities defined by managers of manufacturing SMEs to face COVID-19 related challenges. Data were collected from 167 manufacturing companies through an online questionnaire and exploited with factorial and cluster analysis. The results highlight the strategic importance of developing more advanced business models, boosting customer responsiveness and developing the innovative value propositions in developing a proactive response to the Covid-19 crisis. The value of this ongoing study lies in its contribution to quantitative research on the impact of the Covid-19 crisis on the strategic management of manufacturing SMEs.

Keywords: Cluster analysis; business model innovation; managerial practices; manufacturing companies; SMEs; Covid-19

1 Introduction

Small- and medium- sized enterprises (SMEs) play a key role in the European and Spanish economy. Moreover, in the case of companies in the Basque Country, many of these SMEs are manufacturing companies that respond to an economy related to the automotive, aeronautical and machine tool sectors, through the manufacture of components, assemblies, products and systems, and industrial services.

These companies were already experiencing a number of major changes in their competitiveness and challenges, arising from market and industry changes, digital transformation and Industry 4.0, when they were affected by the Covid-19 pandemic crisis. In this context, it is important to understand the strategies of manufacturing SMEs, as well as the role of business model innovation in this

context. As underlined by research, strategic decisions condition the organizational performance [1] and competitiveness of firms [2]. The research explores these strategic decisions from a managerial perspective [3].

The paper first presents the theoretical approach, as well as the research objectives and methodology. This is followed by the results and a final discussion, including conclusions, limitations and future research approaches.

2 Strategic response in SMEs

The theoretical underpinnings of this research are based on resource and capability theory [4], supported by research that emphasises the role of context in strategy setting [5].

This research takes as a reference different sets of capabilities that make up different strategic dimensions [6], with an impact on the competitiveness of companies. These capability sets are: Organisational culture [7]; Strategy formalization [8]; Customer orientation [9]; Value proposition development [10]; Value chain improvement and development [11]; People and talent management [12]; Resource efficiency and flexibility [13]; Open innovation practices [14]; Product and service innovation [15]; Business Model Innovation [16]; and Management maturity [17].

For some authors, the interaction of this set of capabilities can predict firm performance [18]. The prioritisation of these practices can also suggest patterns of strategy maturity, especially under conditions of major change [19].

3 Objectives and methodology

The aim of this study is twofold: (1) to distinguish groups of SMEs according to the elements of strategic orientation and (2) to analyse the characteristics of the different groups. This exploratory study uses data collected through a structured questionnaire completed by the managers of SMEs participating in a Covid-19 crisis response initiative launched by the Department for Economic Promotion of the Provincial Council of Gipuzkoa in 2020. The sample comprises 167 industrial SMEs.

Data were collected through an online survey based on a 36-item questionnaire (measuring the strategic relevance of practices on a 5-point Likert scale), and explored through cluster analysis. Before performing the cluster analysis, an exploratory factor analysis (EFA) was carried out using the maximum likelihood method. Calculations of different statistics were previously carried out in order to determine whether the application of the factor analysis was justified. For the clustering, the log-likelihood distance measure and the Schwarz clustering criterion (BIC) were used. For each case, a clustering variable was created in order

to develop the analyses shown in the following section. All these analyses were developed using SPSS statistical software, version 28.0.

4 Results

We used the two-steps cluster analysis [3], with a prior descriptive statistical analysis to check the necessary conditions. Before proceeding to the cluster analysis, we checked for multicollinearity by analysing the correlation between cluster variables. The rotation converged in 12 iterations, which allowed us to maintain the independence between the rotated factors to obtain a final structure of nine factors with eigenvalues > 1 , which together explain 62.76 % of the variance.

To investigate the heterogeneity among firms in identifying the strategic response, a two-stage cluster analysis was conducted based on the nine extracted factors:

- Advanced business models (Advanced BM): Digital offer, revenue generation through new sources and channels, development of new business logics (pay-per-use, subscription, etc.), reinvention of business logic (customers, activities, suppliers, resources, revenue model).
- Customer responsiveness (CUSTOMER): Risk assessment and management, adaptation to new environments and challenges, customer segmentation, understanding customer needs, transformation of customer relationships, agile validation of value propositions, rapid adaptation to new environments and challenges, customer engagement.
- Value proposition innovation (Value INNO): Development of new value propositions, and ideation of new products or services.
- Value chain efficiency (EFFICIENCY): internal and external value chain transformation, new logistic approaches, changes in the value chain, cost efficiency.
- Roadmap (ROADMAP): Development of a roadmap for continuity, for transformation, to face future challenges, to have the resources, capabilities and key competences for the future.
- New channels (CHANNEL): Development of distribution channels that respond to the needs of each of our customer segments, and new integrated distribution channels.
- Innovation culture (CULTURE): Encourage experimentation, to seek out new opportunities and exploit them, to exchange knowledge and approaches among people, and to participate actively in the company.
- People (PEOPLE): People's skills development and training, polyvalence of people, retaining and attracting talent, promoting and facilitate a co-responsible work-life conciliation.
- Own products (Own PRODUCTS): Development of own products (good, services) and to market them directly.

The analysis suggests the creation of two different clusters (Cluster 1 with 95 firms - 56,9%, and Cluster 2 with 72 firms - 43,1%) with fair quality (Silhouette measure of cohesion and separation = 0,3), a value above 0.0, suggesting validity of the within and between cluster distances. T-test analysis confirmed the significance of the differences in the means of the nine factors between the two groups, with significantly higher values for all factors in the second group (Table 1).

Table 1. Mean differences for variables between clusters

Measures	Cluster 1	Cluster 2
	Means \pm SD	Means \pm SD
Advanced BM	2,00 \pm 0,86	3,34 \pm 0,74
CUSTOMER	3,76 \pm 0,60	4,55 \pm 0,29
Value INNO	3,47 \pm 1,02	4,61 \pm 0,47
EFFICIENCY	2,94 \pm 0,88	4,03 \pm 0,76
ROADMAP	3,45 \pm 0,90	4,26 \pm 0,48
CHANNELS	1,76 \pm 1,20	3,24 \pm 1,64
CULTURE	3,68 \pm 0,84	4,44 \pm 0,55
PEOPLE	3,85 \pm 1,05	4,55 \pm 0,48
Own PRODUCTS	1,69 \pm 1,43	4,44 \pm 0,55

The Advanced BM, followed by CUSTOMER and Value INNO factors, led the importance of the predictors for cluster creation (Fig. 1).

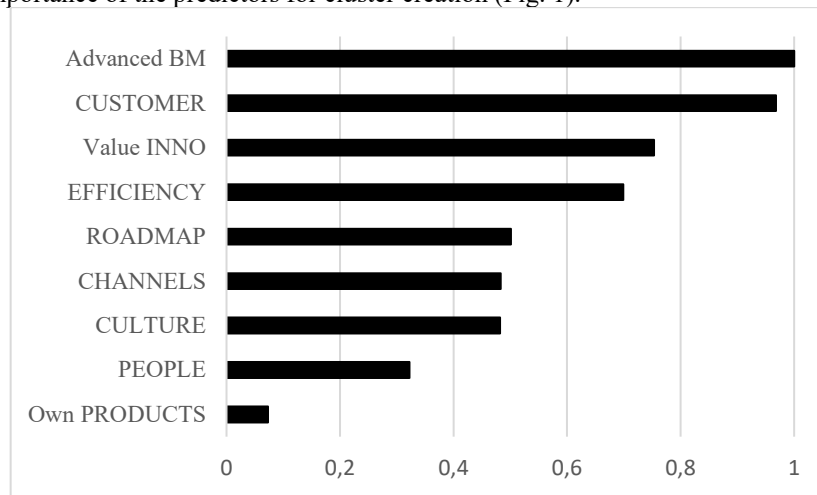


Fig. 1. Cluster formation predictor importance

Analysing the level of management in which the companies consider themselves to be situated (Management maturity). Table 2 shows the percentage distribution of all the companies according to this variable in the two clusters. Thus, companies that consider themselves “driver” or “advanced” are mainly located in cluster

2, while companies that consider themselves “reactive”, “initial” or “managed” are located in cluster 1.

Table 2. Distributions of companies by management maturity in each cluster

Management Maturity	Cluster 1	Cluster 2	Total
Driver	33,33%	66,67%	100,00%
Advanced	25,00%	75,00%	100,00%
Managed	69,41%	30,59%	100,00%
Reactive	94,44%	5,56%	100,00%
Initial	80,00%	20,00%	100,00%
Total	56,89%	43,11%	100,00%

5 Discussion, conclusions and further research

The research results obtained through the two-stage cluster analysis suggest the existence of two strategic response configurations for the Covid-19 crisis among the manufacturing SMEs analysed. Specifically, those that are strongly committed to a proactive and agile response in relation to their customers, the development of advanced business models and value proposition innovations; and those that adopt a more reactive stance in relation to these three strategic practices.

Moreover, in the light of this research, the group of companies that are more proactive in strategic transformations towards the response to the Covid-19 crisis are those that are more mature in their management, as opposed to those that are more reactive or have weakly initiated their transformational reflections. Despite the limitations of this research, the results obtained provide important input for managers and policy makers.

Some limitations arise in this study due to the nature of the work. One of them refers to the size of the sample, and the other to the lack of a control group of similar companies that did not participate in the initiative.

We believe that this research contributes to the generation of knowledge on strategy in manufacturing companies in crisis. Future research could increase the sample size, develop a research based on control groups integrating similar companies that did not participate in this initiative, and develop comparisons in relation to other business sectors and regions.

References

1. George B, Walker RM, Monster J (2019) Does Strategic Planning Improve Organizational Performance? A Meta-Analysis. *Public Adm Rev* 79:810–819. <https://doi.org/10.1111/puar.13104>
2. Mueller GC, Mone MA, Barker III VL (2007) Formal strategic analyses and

- organizational performance: Decomposing the rational model. *Organ Stud* 28:853–883. <https://doi.org/10.1177/0170840607075262>
3. Lorentz H, Hilmola O-P, Malmsten J, Srari JS (2016) Cluster analysis application for understanding SME manufacturing strategies. *Expert Syst Appl* 66:176–188. <https://doi.org/10.1016/j.eswa.2016.09.016>
 4. Gebauer C. J. H. S (2014) Business model innovation in the water sector in developing countries. *Sci Total Environ* 488–489:512–520. <https://doi.org/10.1016/j.scitotenv.2014.02.046>
 5. Barney JB (2001) Is the resource-based “view” a useful perspective for strategic management research? Yes. *Acad Manag Rev* 26:41–56. <https://doi.org/10.5465/AMR.2001.4011938>
 6. Anand G, Ward PT (2004) Fit, flexibility and performance in manufacturing: Coping with dynamic environments. *Prod Oper Manag* 13:369–385. <https://doi.org/10.1111/j.1937-5956.2004.tb00224.x>
 7. Jardioui M, Garengo P, El Alami S (2020) How organizational culture influences performance measurement systems in SMEs. *Int J Product Perform Manag* 69:217–235. <https://doi.org/10.1108/IJPPM-10-2018-0363>
 8. Fréchet M, Goy H (2017) Does strategy formalization foster innovation? Evidence from a French sample of small to medium-sized enterprises. *Manag* 20:266–286. <https://doi.org/10.3917/mana.203.0266>
 9. Peillon S, Dubruc N, Mansour M (2018) Service and customer orientation of corporate culture in a French manufacturing SME. In: *Procedia CIRP*. pp 91–95
 10. Neuhüttler J, Woyke IC, Ganz W (2018) Applying value proposition design for developing smart service business models in manufacturing firms
 11. Noke H, Hughes M (2010) Climbing the value chain: Strategies to create a new product development capability in mature SMEs. *Int J Oper Prod Manag* 30:132–154. <https://doi.org/10.1108/01443571011018680>
 12. Shipton H, West MA, Dawson J, et al (2006) HRM as a predictor of innovation. *Hum Resour Manag J* 16:3–27. <https://doi.org/10.1111/j.1748-8583.2006.00002.x>
 13. Leitner K-H, Guldenberg S (2010) Generic strategies and firm performance in SMEs: A longitudinal study of Austrian SMEs. *Small Bus Econ* 35:169–189. <https://doi.org/10.1007/s11187-009-9239-x>
 14. Hossain M, Kauranen I (2016) Open innovation in SMEs: a systematic literature review. *J Strateg Manag* 9:58–73. <https://doi.org/10.1108/JSMA-08-2014-0072>
 15. Visnjic I, Wiengarten F, Neely A (2016) Only the Brave: Product Innovation, Service Business Model Innovation, and Their Impact on Performance. *J Prod Innov Manag* 33:36–52. <https://doi.org/10.1111/jpim.12254>
 16. Foss NJ, Saebi T (2017) Fifteen Years of Research on Business Model Innovation: How Far Have We Come, and Where Should We Go? *J Manage* 43:200–227. <https://doi.org/10.1177/0149206316675927>
 17. Ongena G, Ravesteyn P (2020) Business process management maturity and performance: A multi group analysis of sectors and organization sizes. *Bus Process Manag J* 26:132–149. <https://doi.org/10.1108/BPMJ-08-2018-0224>
 18. Christiansen T, Berry WL, Bruun P, Ward P (2003) A mapping of competitive priorities, manufacturing practices, and operational performance in groups of Danish manufacturing companies. *Int J Oper Prod Manag* 23:. <https://doi.org/10.1108/01443570310496616>
 19. Ibarra D, Ganzarain J, Igartua JI (2018) Business model innovation through Industry 4.0: A review. *Procedia Manuf* 22:4–10