

Modelling Digital Maturity for SMEs

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Abstract: SMEs still suffer from a significant delay in digitalization compared to their larger counterparts. In order to develop effective public policies and digitization strategies, it is necessary to have tools that make it possible to assess the state of digitization of SMEs: digital maturity models. Literature review reveals a preponderance of tools developed for large firms or manufacturing SMEs. Applying multiple case study research, the present study models the behavior of the SMEs into a comprehensive maturity model. The contribution of this work is twofold. On one hand it confirms dimensions already considered as the subject of analysis by other researchers, strengthening their positions and completing them with some additional details. On the other hand, keeping in mind SMEs' inherent variety, the originality of this study lies in the quest for a tailor-made assessment of the digitalization of SMEs.

1 INTRODUCTION

In the last two years, small and medium-sized enterprises have had to face a situation of crisis. As highlighted by OECD (2020), the Coronavirus pandemic was a destabilizing element for SMEs.

The use of digital tools by SMEs was one of the factors that made it possible to reduce the negative impacts of Covid-19 (OECD 2020). In many cases it was the “lifeline” that allowed them to survive (Mandviwalla & Flanagan, 2021). However, SMEs are facing many challenges in their digitization path, conditioned by a scarcity of resources, skills, and know-how, and are unable to fully exploit the advantages offered by digital (Amaral & Peças, 2021; Soluk & Kammerlander, 2021)

Thus, it becomes paramount to develop digital maturity models. These models must serve in order to allow policymakers and actors operating in the ecosystem of SMEs to understand the real level of digitization of small and medium-sized enterprises and to develop the best strategies for fostering the digital transformation of small and medium-sized enterprises. However, as stated by Mittal, Khan, Romero and Wuest (2018), digital maturity models, more often designed for large companies, are unlikely to grasp the peculiarities of the economic and relational ecosystem of SMEs.

This research work aims to answer the gap in the literature by answering the following question: which elements should be considering in elaborating a digital maturity framework for SMEs?

The following sections, respectively, address the following contents: a) a theoretical contextualization of the importance of SMEs and the role of digital maturity models b) the research methodology c) the results deriving from the interviews conducted with SMEs d) the discussions and the proposal of a framework. Finally, the conclusions, limitations and future avenues of research are presented.

2 THEORETICAL FRAMEWORK

2.1 Why Should We Care About the Digital Maturity of SMEs?

Digitalization is seen as a basic requirement for companies to enter this new industrial revolution (Amaral & Peças, 2021). However, this digitalization process, which aims to “improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Mandviwalla & Flanagan, 2021) is less developed among SMEs because they are characterized by several constraints which lead them to face more

difficulties in implementing new technologies. (Amaral & Peças, 2021).

Thanks to readiness models and digital maturity models, entrepreneurs and consultants can develop a structured digital roadmap that considers resources and constraints of SMEs. Instead, researchers could benefit a better theoretical background of the different stages of the digitalization process, to acknowledge the heterogeneity among firms about their current state of digital adoption (Soluk & Kammerlander, 2021).

2.2 Maturity and Readiness Model

Due to the constraints that SMEs face, the digitization process is often developed following an incremental approach (Depaoli, Za & Scornavacca, 2020). For this reason, to gradually face the complexity of digitalization, a huge effort was spent in the last few decades to better qualify this phenomenon through or readiness assessments (Li, Su, Zhang & Mao, 2018).

Trotta & Garengo (2019) define consultancy firms as the “first movers” of this approach, those who introduced the concept of maturity model. Consultancies perceived the necessity of a tool which allowed for a comprehensive understanding of SMEs, not only to improve the governance of their projects but also to simplify the communication of a complex topic such as Digitalization (Trotta & Garengo, 2019). However, practitioners’ scales are often not suitable for SMEs because mostly geared towards large firms (North et al., 2020), and typically do not meet the standard in terms of replicability, generalizability, and transparency (North et al., 2020; Trotta & Garengo, 2019) – as it is required, instead, for scientific publications. Moreover, over the last year many of the maturity model that have developed have their focus transformation on Industry 4.0 (Klohs & Sandkuhl, 2020).

It is well known that usually SMEs do not get the real meaning of digitalization or digital transformation (Pirola, Cimini & Pinto, 2019), and this lack of knowledge could strongly affect the business decisions of managers or entrepreneurs. Maturity models can potentially clarify their digital roadmap (Zapata, Berrah & Tabourot, 2020), exploiting the real potential of their technologies (Kääriäinen, Kuusisto, Pussinen, Saarela, Saari & Hänninen, 2020) and it allows a cross dimensional analysis linking the organizational needs with the operational knowledge (Trotta & Garengo, 2019). In this way, SMEs can improve their business performance using the maturity model’s systematic approach to digitalization (Depaoli et al., 2020).

For some authors such as Wendler (2012) maturity models are mostly construed as multi-dimensional framework. Some authors included in their model evaluations areas that could affect the digital maturity of a company, such as leadership, ambidexterity, or technology integration (González-Varona, Acebes, Poza & López-Paredes, 2020; Pirola et al., 2019). Some authors prefer a business process management approach, focusing on the six core elements of BPM – strategic alignment, governance, method, information technology, people and culture –, which are deemed to be a prerequisite of digital transformation; without them, SMEs would not be able to reshape their business models (Fischer et al., 2020). Other authors choose to completely deviate from the traditional perspective, deepening the relationship between the competences and the level of digitalization of a company; these maturity models are based on the theory of Digital Maturity Competences (DMC; Li et al., 2018).

From a careful analysis of the literature, it is possible to identify eight differences in dimensions that are normally taken into consideration in defining assessment models of digital maturity: digital strategy and roadmap (Pirola et al., 2019; Eller et al. 2020; Zangiacomini et al., 2020), employee skill and culture (Jeansson & Bredmar, 2019, Pirola et al., 2019; Eller et al. 2020; Zangiacomini et al., 2020), organizational flexibility and adaptability (Pirola et al., 2019; Eller et al., 2020; Del Giudice et al., 2021; Park et al., 2020; Zangiacomini et al., 2020), information technology (Pirola et al., 2019; Eller et al., 2020), integration (Jeansson & Bredmar, 2019; Pirola et al., 2019) customers (Jeansson & Bredmar, 2019; Pirola et al., 2019; Eller et al., 2020), external environment (Jeansson & Bredmar, 2019; Pirola et al., 2019; Del Giudice et al., 2021; Zangiacomini et al., 2020) and performance and benefits (Jeansson & Bredmar, 2019; Pirola et al., 2019; Eller et al., 2020; Zangiacomini et al., 2020).

3 METHODOLOGY

3.1 Case Study Research and Unit of Analysis

This research has been designed as a descriptive multiple case study (Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Yin, 2014). The case study methodology is suitable in case the research questions are open-ended and aim at analyzing complex phenomena (Yin, 2014), such as digitalization processes in SMEs.

Once defined the research questions, the next step of the case study methodology is the identification of the research purpose (Yin, 2014). The overall purpose of this study is to grasp which are the mechanisms and dynamics governing digitalization processes in SMEs. According to Yin (2014), a major step in designing and conducting a case-based research is the identification of the unit of analysis (i.e. the case itself), that is, the definition and the boundary of the case to be studied. Given the research questions and the purpose, the best fit is to adopt as a unit of analysis the single SME.

According to the European Union Commission (2014) the category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 people and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million. However, for the purpose of this work only the small and medium-sized category was considered as it would be difficult to enable meaningful comparisons with micro enterprises due to the significant differences in both structural and financial terms. Also, in order to avoid distortions and gain a better understanding of the real potential in terms of digitalization, the unit of analysis selected for this research will be an autonomous SME, as defined by the European Union Commission (2014).

3.2 Cases Selection

The selection of the cases represents a critical issue in the field of building theory from cases (Eisenhardt, 1989). In order to enhance the external validity of the research, the adoption of multiple case studies is preferred to the single case study (Yin, 2014), since the generalization purpose of the study requires more cases to be examined

A structured approach to the sampling process has been adopted with the intention of maximizing the collection of valuable insights. Three dimensions were identified:

- Industry: manufacturing vs services.
- Size: small ($10 < AWU < 50$) vs medium ($50 < AWU < 250$).
- Geographical location: Northern Italy, Central Italy, Southern Italy.

This selection process led to the identification of a heterogeneous sample of 18 cases conveniently anonymized to safeguard the identity of the SMEs involved.

3.3 Data Analysis

After having transcribed verbatim each interview, a coding procedure was initiated, following the Gioia Methodology (Gioia et al., 2012). The procedure started with a within-case analysis and then moved to a cross-case synthesis to aggregate the findings and build a more robust basis for the development of a theoretical framework. In the first-order analysis both in-vivo and constructed codes have been adopted to label salient points of the collected empirical evidence. Then, in the second-order analysis labels were grouped together and categorized according to the corresponding sphere of pertinence. In this phase a process of triangulation between the evidence collected in the field and the theoretical realms related to SMEs digitalization was carried out, questioning each time whether the concepts developed were both consistent with the literature and able to explain the phenomena observed in reality (Gioia et al., 2012). Once the categories were formed, the process of abstraction went on with their further aggregation into themes. In this phase the focus was on two fronts: on one side themes validating extant theories and propositions emerged, while on the other side novel concepts for enriching the scientific framework “leaped out”.

4 FINDINGS

4.1 The Internal Perspective

From our interviews, skills, culture, adaptability, flexibility, shared best practices are positively correlated with digital maturity and play a central role in SMEs. However, these dimensions cannot be considered in isolation, due to the pervasiveness of digitalization. In fact, a correct commitment and people mindset allows the roadmap to be implemented with less effort.

“The most critical and most important asset is the people, because they are the ones who create the most value for any company. So, this is the first step, that is, having a team, having a company focused on the same goal and convinced to do so.” (S5, Governance and privacy manager). Technologies allow a better information sharing, and they strongly influence organization working methods and therefore the People & Culture dimension. “We must, so to speak, facilitate integration between people. So, if this integration already exists within the supplier, that's fine, otherwise if this technology or need is not inherent to the suppliers we have, we try to find

market-wide solutions that allow us to provide a solution. to this thing, compatibly with what are the investments." (M6, CEO)

4.2 The External Perspective

At this point we adopt an external point of view, describing the environment in which SMEs operate.

Our evidence suggests that the role that customers and suppliers play to shape digital maturity is basically the same. Thus, it is possible to confirm that customers' and suppliers' behavior positively influence the adoption of technologies (Jeansson & Bredmar, 2019). However, from some interviews it emerges also the negative impact that these actors could have on digital maturity. In this case emerge the mediating role of the size: If the SME is smaller than its customer base or smaller than its suppliers, the SME's digital implementation could be imposed or hindered with more simplicity by these external actors. On the other hand, if the SMEs is greater than its customers and suppliers, the firm can stimulate the adoption of technologies along the supply chain. This element influences drastically the evaluation of the digital maturity because some companies, due to external constraint, cannot digitalize processes and improve their digital maturity.

Also, other stakeholders include entities such as competitors, consultants, universities and research entities, public agencies are responsible for digital maturity improvement. However, SMEs convey that some of these stakeholders, such consultants and universities, could contribute better to enhance their digitalization. "The facilitators of this, including the universities, competence centers, the digital innovation hubs, all these people here, including you, it's a bit of a mess." (M3, CEO)

A particular influence is brought by competitors: "Sometimes we thought this was a waste of money, always like I told you from our parents. However, we gradually led them, through competitors, to change their mindset by telling them things like, "Did you see? They did this, they have the website, they have...". Let's say that we pushed them and this desire to excel led them to listen to us allowing us to catch up with the times." (S3, CEO). In fact, several projects are introduced thanks to the competitiveness of the market. The contribution of competitors is relevant also for all SMEs' scales.

The last cardinal point is composed by Digital Service Providers (DSPs). For SMEs they are the reference point for all digital projects. Moreover, their contribution is not only related to the provision of technologies, but they are also guide of the digital

journey, they are the digital trainer and digital consultant of SMEs. Over time, the service level expected from these providers is increasing, and SMEs are becoming more and more aware of their relevance for a successful implementation of digital projects.

4.3 Internal-External Perspective

The element that contributes drastically to the definition of digital maturity is the Applicability dimension. This is represented as a layer between SMEs and external actors; however, it should be considered as a background dimension which influence all the other dimensions of the framework. Sometimes, internal processes are not digitalized because the analogic version is more effective. "I don't know, the kanban with tags, maybe tomorrow we will also do the digital kanban, it already exists, and we can do it, but if the green, yellow and red card works perfectly, as has been done for thirty years in Toyota and twenty in Italy, it works well and its point of strength is also this stuff, why digitalize it?" (M3, CEO) It happens also for the external point of view. Applicability influences the relationship between SMEs and customer and suppliers, it influences the contribution of DSPs to digitalization and the relationship between exogenous factor, other stakeholder, and SMEs.

4.4 The Context

During our interviews, we found lot of references to Covid 19 pandemic, as an example of exogenous factor which influences digital transformation. For this reason, it is possible to confirm that SMEs digital maturity is strongly affected by socio economical condition which could change organization and the works methods (Mandviwalla & Flanagan, 2021).

A concrete example: "In the period of Covid we could not go around and since we had to present the new collection, like so many of our competitors but we were the first, we created a virtual showroom to present the collection made using CAD, therefore the digitalization of the fabrics, not the fabric photographed. Useful or not useful? At that moment it was required. [...] However, at that moment, during the three-and-a-half-month lockdown, we created a virtual showroom". (M2, Marketing and communication manager)

More in general, the overall degree of technological know-how in the economy – i.e., the availability of a technology, together with the availability on the market of the competencies needed

to integrate such technologies – strongly influences digital maturity. In this context we refer to the advancement of technologies in a particular context. It is possible that in a different period technology could be not implemented because immature, but over the time they will enable new processes and new innovations.

“In my opinion sooner or later we will also think of the metaverse, perhaps better sooner than later because maybe after it's late. It's true, no one knows it now, few know it, but everyone talks about it. [...] And if the metaverse will help to create new job opportunities, to increase the business for realities already present today, so be it, I am the first, rather, I would like to face this discussion. ” (M2, Marketing and communication manager)

This kind of evaluation is useful also because “Now the technology has a short life cycle.” (S5, Governance and privacy manager). This means that a maturity model should be re-calibrated frequently in order to assess SMEs in a correct way. This allows an innovative evolution in terms of readiness model, because it gives the possibility to assess companies in different time period and obtain different result. “Some technologies you marry, some you lose, you have to be able to make the right choices. You have to make some choices because you can't keep up with everything obviously, there is so much out there that how can you stay up to date and keep up with everything?” (S2, CEO)

Also, the Legal Framework contributes to the adoption of technologies. Several authors states that public institutions have an impact upon SMEs’ digitalization, and it is possible to confirm these results with our interviews. “These are years of exceptional investments for us, because the various opportunities and tax advantages linked to 4.0 combined with Sabatini have given us crazy leverage”. (M5, CEO). “Some things are also required by law, if you are asked for the PEC you have to adapt”. (M4, Administrative manager)

Lastly, also the geographical and socio-economic context should be considered. In some cases, this external factor is perceived as the main driver of digitalization.

“The digitalization come from, I would say 70 (external factor) and 30 (internal factor)”(S9, CEO)

However, some difficulties could derive from context that bind companies and force them to slow down their growth.

"In Italy, personnel management is enough ... we don't focus so much on people, that is, in Italy there are the lowest salaries in Europe." (S9, CEO)

For these reasons, considering also these dimensions in the evaluation of digital maturity is crucial because it allows a benchmarking between companies that operate in different environments.

5 DISCUSSION

The main objective of this framework is to provide a guideline for the fair evaluation of the digital maturity, highlighting different perspectives for the evaluation of small and medium enterprises. For this reason, the framework in Figure 1 represents a compass indicating what are the main dimensions that improve the SME’s digitalization, without forgetting the essential nature of an enterprise.

We improve the understanding of the main dimensions identified by researchers (as in section 2.2) so far with the aim of covering all SMEs with their characteristics and differences. The eight dimensions of reference play a fundamental role for the model proposal, leading our research from the theoretical point of view.

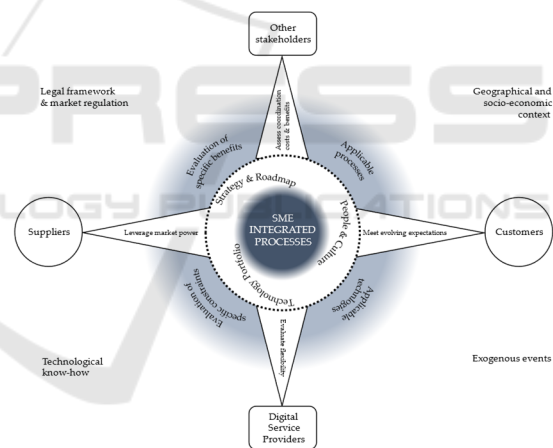


Figure 1: SMEs Digital Maturity Framework.

However, the framework dimensions do not correspond exactly to those listed in the literature review, but it groups some of them in a single theme. This happens for the dimension People & Culture, which groups together Employee skill and culture and Organizational flexibility and adaptability; and it is also true for the dimension Technology Portfolio, which aggregates Integration and Information Technology.

5.1 The Core of the Framework

People & Culture, Technology Portfolio, and Strategy & Roadmap are the essence of SMEs; all of them converge into the Integrated Processes dimension, that plays the role of connector.

From our interviews, People & Culture is a fundamental driver of digitalization, thus confirming the contribution of all the reference studies (Eller et al., 2020; Jeansson & Bredmar, 2019; Pirola et al., 2019; Zangiacomini et al., 2020).

The second dimension is Technology Portfolio. Its contribution to digital maturity is straightforward: digital technologies are the tools which enable the transformation. Previous research underlines that technology integration is a requirement of digital maturity.

The third dimension is Strategy & Roadmap which it is considered a crucial dimension for digital maturity by most of the authors (Eller et al., 2020; Jeansson & Bredmar, 2019; Pirola et al., 2019; Zangiacomini et al., 2020). It is well established that Strategy & Roadmap represents the capability of the company to implement, evaluate, and define digital goals. However, it is necessary to further stress its importance, because none of the seminal papers addresses the Strategy & Roadmap dimension from the service SMEs' perspective.

The Strategy & Roadmap dimension allows into account the different nature of SMEs (manufacturing or service), thus enabling an evaluation tailored to the firm.

The above-mentioned dimensions influence drastically the Integrated Processes dimension. Nevertheless, when authors define models and assessment tools, looking at production processes, they refer to categories strictly related to manufacturing machines, sensors, and products.

5.2 Relationships

Processes allow to go beyond the perimeter of the SMEs and create connection with the other entities of the model. Within the SMEs network, four are the key relationship on which SMEs should focus, represented with the four cardinal points: Customers, Suppliers, Digital Service Providers, and Other Stakeholders.

Customers have great importance also in other studies (Eller et al., 2020; Jeansson & Bredmar, 2019; Pirola et al., 2019), while the influence that suppliers have on SMEs is less mentioned. Our evidence suggests that the role that customers and suppliers play to shape digital maturity is basically the same.

Thus, it is possible to confirm that customers' and suppliers' behavior positively influence the adoption of technologies (Jeansson & Bredmar, 2019).

Looking at the seminal papers, some of them highlight the role that DSPs play in digital transformation; however, none of them strongly emphasize the great contribution that these actors give to SMEs. In our research, we witness how DSPs positively influence digitalization and, moreover, how they strongly influence the heart of the company – Strategy & Roadmap, People & Culture, Technology Portfolio.

Applicability influences the relationship between SMEs and customer and suppliers, it influences the contribution of DSPs to digitalization and the relationship between exogenous factor, other stakeholder, and SMEs.

For this reason, applicability should be a considered as a filter that allows all the entities described by the framework to interact among each other following the benefit that SMEs are trying to gain.

5.3 Context

Finally, based on the evidence from the interviews, the context should be evaluated according to the endowments in terms of technological knowhow, exogenous events, legal framework, and geographical and socioeconomic context.

According to the findings of our interview, thus, digital maturity should be assessed using an evolutive approach: in this way a SMEs could be considered digital mature for a particular context, but digital immature in the moment in which this context changes. This gives a huge feature to our model, which consider the possibility to be demoted to a lower level of digital maturity.

Moreover, the four elements that are part of the external layer of our framework should be considered as interrelated elements.

6 MANAGERIAL CONCLUSIONS

This research evidence that for SMEs, core and support processes are the main elements to be considered in terms of digitalization. However, we show that these are not the only dimensions that are involved in the digital maturity evaluation, “the winner is the one who has the widest possible approach, who tries to see the interconnections” (M3, CEO). With this research, entrepreneurs can extend their digital vision through the environment in which

operate, focusing on what is significant for their companies.

We highlight that developing digitalization with external actors is crucial to exploit advantages, “to promote and convey messages and values” (M7, Marketing and sales manager). For example, our research underlines the importance of a well-established relationship with digital vendors. “Supplier choice is even more important than today's technology” (M3, CEO) because a digital partner could fill knowledge gaps and allows companies to define the correct activities and solutions to implement digitalization, as happened to M7: “we have several partners, not directly an eCommerce, but several partners who convey our products through digital channels”. Benefits derived from the network are several. Another example could be related to the easier access to financial resources, thanks to regions' digital subsidy or on-again, a collaboration with suppliers in terms of digital integration could reduce order errors, misunderstanding, and so on.

7 CONCLUSION, LIMITATION AND FUTURE RESEARCH

This research work manages to achieve a double goal: it confirms some of the dimensions highlighted by other researchers, enriching them, however, with additional details and by, distancing itself from the contributions exclusively dedicated to large companies or only to manufacturing companies, proposes a vision of the digital maturity models to cut out on SMEs.

As presented in the discussion of the model, our advice is to follow an adaptable evaluative perspective that starting from the object of analysis – the single SME with its processes – can then rescale the results obtained on the basis of the other components which, depending on the context in which the company operates, will enable a more truthful assessment of its digital maturity.

However, this work is not without limitations. The first limitation concerns the “high-level” perspective of the phenomenon. Only C-level managers and executives were interviewed. A wider set of informants not coming from the firm's chain of command, could also be involved in future research. The second limitation relates to the shortage of different points of view from other actors of the ecosystem. It would be interesting to look at the phenomenon from a different angle, for example by adopting the vendor's standpoint as a complementary

means to refine the understanding of the digitalization processes of SMEs. The third limitation concerns the adoption of the model to effectively assess the digital maturity of an SME. Future research should focus on identifying the scales and evaluation criteria by which to evaluate the different variables that make up the framework presented in this paper. Finally, a limitation common to the whole research regards the relatively low generalizability of the findings in terms of both numerosity and heterogeneity, coming from the qualitative nature of the research methodology adopted. According to the purpose of the research, it does not represent a real drawback because a more in-depth inquiry was essential to establish a theoretical basis for understanding the rationales behind SMEs' digitalization. However, given these characteristics, future research could improve the generalizability of this work by addressing the emergence of “idiosyncratic phenomena” (Eisenhardt, 1989) according to two alternative pathways:

1. Quantitative support: complementing the interpretative-oriented approach adopted during the interviews with a more statistical-oriented set of research.
2. Further improving heterogeneity: this research does not intend to claim exhaustiveness, so two possible ways glimpse of enhancing heterogeneity within the sample are: a) enlargement of the geographical scope b) inclusion of additional sectors.

Given the limitations listed above, the framework presented does not represent a finish line but rather it is intended as a preliminary starting point that settles the stage to new avenues of research.

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