

« DIGITAL TRANSFORMATION BARRIERS IN FRENCH SERVICE SMES – A RESEARCH TAX CREDIT PERSPECTIVE »

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DIGITAL TRANSFORMATION BARRIERS IN FRENCH SERVICE SMES – A RESEARCH TAX CREDIT PERSPECTIVE

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Abstract

This study investigates the barriers to Digital Transformation (DT) in French service SMEs. As literature on DT of service SMEs is scarce, this study uses a combination of a literature review analysis of barriers to DT in SMEs and a thematic analysis of the challenges to DT encountered by 26 service SMEs. The research identifies six main categories of barriers: technological barriers, business and strategic barriers, process and operational barriers, organizational barriers, human and talent barriers and security and compliance barriers. This paper highlights that service SMEs highly underestimate the barriers related to human and talent barriers and slightly underestimate organizational barriers while overestimating business and strategic barriers. This paper emphasizes the inadequacy of existing DT strategies designed for larger corporations and raises the need for research in the DT of service sector and particularly of service SMEs. The study also discusses the potential biases inherent in the data collection from reports intended for tax administration and the limitations of the sample size.

Key words: barrier, challenge, digital transformation, qualitative analysis, Small and Medium-sized Enterprises, thematic analysis

JEL codes: L8; L80 ; O3 ; O30

Introduction

Digital transformation (DT) is reshaping industries globally, yet as highlighted by Teichert (2023), the DT of the service sector is often overlooked in the literature. This gap underscores a broader issue: while DT in SMEs is frequently discussed in academic circles, the literature tends to focus less on the unique obstacles encountered by SMEs, particularly those linked to their smaller size, as noted by Williams et al. (2022) and Kääriäinen et al. (2021). Existing strategies, generally designed for larger organizations, do not adequately address the distinct needs of smaller service-oriented enterprises. Similarly, there is a lack of literature addressing the needs of companies in the service sector going through DT and even less regarding service SMEs. Many existing models are sector-oriented, tailored specifically to manufacturing industries, which limits their applicability to service industries (Aras & Büyüközkan, 2023).

Considering these challenges, this paper aims to address the research question: *"How do the distinctive characteristics of service SMEs influence the barriers they face in Digital Transformation, and how can these barriers be critically examined and categorized to inform more tailored and effective transformation strategies?"* This study starts with a narrative literature review focused on identifying key themes in the literature on DT barriers in SMEs and a classification of the barriers has been built. Then, an analysis of 26 French service SMEs challenges to DT has been conducted. Six categories of barriers have been identified: technological barriers, business and strategic barriers, process and operational barriers, organizational barriers, human and talent barriers and security and compliance barriers. The results of both analyses are compared in the results section to highlight the differences in barriers between SMEs and service SMEs. This study seeks to deepen the understanding of specific DT challenges faced by these firms. Our objective is to offer insights on challenges

encountered by service SMEs that could help refine their DT strategies, contributing to both academic research and practical applications in the field of DT.

1. DIGITAL TRANSFORMATION

1.1. Digital transformation definition

Researchers worked on defining what DT is and how it differs from other concepts such as digitization and digitalization. In this article, we will consider the definition designed in “Developing a unified definition of digital transformation” as “a fundamental change process enabled by digital technologies that aims to bring radical improvement and innovation to an entity [e.g., an organization, a business network, an industry, or society] to create value for its stakeholders by strategically leveraging its key resources and capabilities” (Gong & Ribiere, 2021). Building upon the existing literature, Verhoef et al. (2021) describe DT as the culmination of three progressive stages: digitization, digitalization, and then DT itself. Digitization is essentially the conversion of analog information into digital formats, a preliminary capability allowing firms to handle digital data (Ritter & Pedersen, 2020; Verhoef et al., 2021). It refers to the simple automation of tasks and routines (Verhoef et al., 2021). Digitalization goes beyond mere digitization, involving the integration of these digital capabilities within a business framework, for example in digital distribution and communication channels. The goal is not only to achieve cost savings (Gartner et al., 2022) but also enhance business processes and improve customer experiences through for example the use of robots (Ritter & Pedersen, 2020; Verhoef et al., 2021).

1.2. Digital transformation in Europe

DT has emerged as a key focus over the past decade, with European policymakers dedicating resources to meet specific benchmarks (European Commission, 2020). The EU’s

digital strategy is designed to facilitate this shift, ensuring it benefits both individuals and businesses while contributing to the ambitious goal of a climate-neutral Europe by 2050. Further guidance is provided by the Digital Decade policy program, which outlines detailed goals for 2030 to steer Europe's digital evolution (European Commission, 2023). These goals include increasing basic digital skills with at least 80% of the population proficient, enhancing the digital capabilities of businesses with 75% adoption of technologies such as Cloud, AI, or Big Data, and ensuring over 90% of SMEs achieve at least basic digital intensity. The strategy also prioritizes the development of secure and sustainable digital infrastructures and aims for the complete digitalization of public services.

1.3. Digital transformation in the literature

In this paper we will focus on DT. Research in this field highlights a comprehensive, data-driven approach as crucial for navigating the evolving business landscape. Verhoef et al. (2021) note that DT responds primarily to shifts in digital technologies, increasing competition in digital arenas, and changes in consumer behaviors shaped by digital interactions. This transformation is not just about adopting new technologies but also requires reconfiguring organizational structures and recalibrating performance metrics to accommodate these changes (Verhoef et al., 2021).

At the heart of these shifts is the critical role of data, which, as Santos & Martinho (2019) observe, is becoming ever more precise and available in real-time. This enhances decision-making processes, shifting them from intuition-based to data-driven. In the private sector, DT grants competitive advantages, streamlines business models, and facilitates adaptable, flexible, and tailored mass production (El Sawy et al., 2016).

However, the transition is not solely motivated by internal needs. Tangi et al. (2020) demonstrate that external drivers are the predominant motivators for organizational transformation, and in public administrations, it is often external pressures that catalyze the

overcoming of barriers to change. Similarly, managing organizational change is vital in DT, suggesting that adjustments within the company must be systematic and comprehensive, covering not only technology but also strategy, structure, and processes (Ney et al., 2022; Han et al., 2022; Teichert, 2019; Senna et al., 2023; Ochoa & Pena Reyes, 2021; Dobrinić, 2024; Berger et al., 2020). This integrated approach ensures that DT initiatives are aligned with the broader strategic goals of the organization, maximizing the benefits across all operational levels.

Research on DT has predominantly focused on the manufacturing sector, often overlooking the unique challenges and needs of the service sector. This sector-specific focus has led to a significant underrepresentation of service industries in digital maturity models, highlighting a critical gap in the literature (Teichert, 2019; Teichert, 2023). Additionally, scholars indicate a lack of research addressing sectors other than manufacturing, with calls for a more inclusive approach that considers the diverse characteristics of different sectors (Berger et al., 2020; Karakaya et al., 2023; Han et al., 2022; Teichert, 2019). This oversight suggests a need for the development of new frameworks and models that better cater to the complexities and operational nuances of the service sector, ensuring that DT strategies are both comprehensive and relevant across all domains of industry.

2. DIGITAL TRANSFORMATION BARRIERS

2.1. Analysis of barriers to DT in SMEs in the literature

This section presents a narrative literature review focused on identifying key themes in the literature on DT barriers in SMEs. The selection process focused on identifying both empirical studies and recent literature reviews to capture a broad spectrum of current research and insights.

A search on Google Scholar database was conducted using keywords: (digital transformation* OR digital transition* OR digitalization* OR digitalization* OR digitisation* OR digitization*) AND (barrier* OR blockage* OR challenge* OR deterrent* OR hindrance* OR hurdle* OR impediment OR obstacle* OR problem*AND (SME* OR Small and medium-sized enterprise* OR Small to medium-sized enterprise*))). Three exclusion criteria have been used. First, literature prior to 2019 has been excluded. Secondly, based on titles, papers not focusing on SMEs or barriers to digital transformation (or equivalent keywords) have been excluded. Finally, papers which did not share a list, or a categorization of barriers have been excluded. The remaining twenty papers were studied.

All the barriers mentioned in each paper were extracted (table 5). Some authors created themes to categorize the barriers, but some did not. To harmonize the data, we selected the recurring themes and classified all barriers into these themes. Remaining barriers were classified in the “other” theme (*figure 1*).

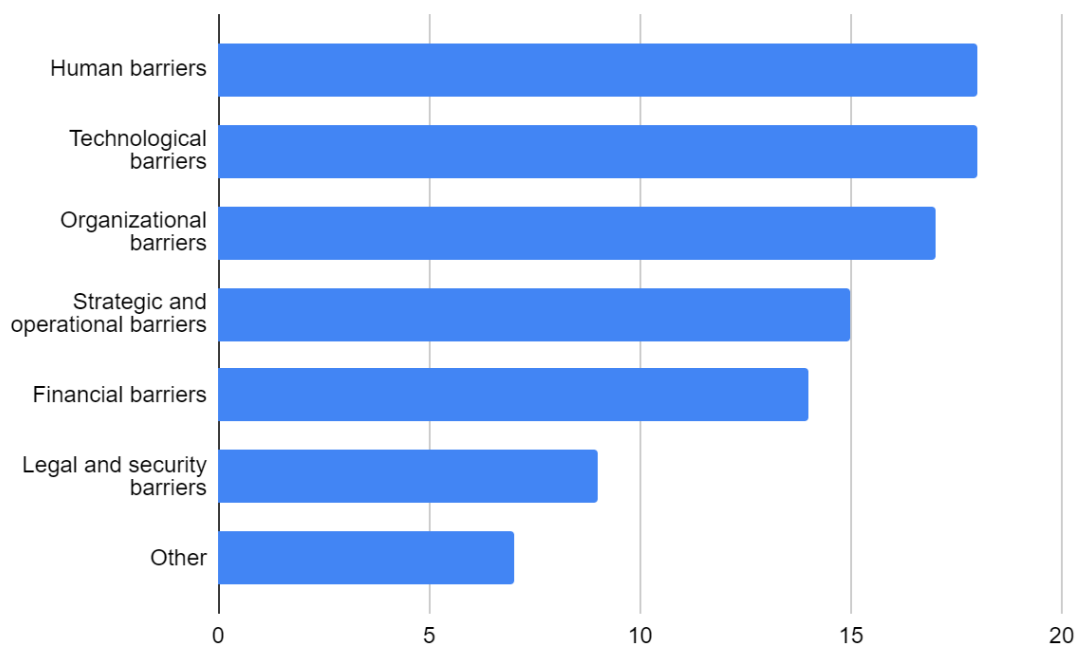


Figure 1 - Barriers occurrence in the literature

2.1. Digital transformation barriers in the literature

The landscape of DT barriers has evolved significantly, with organizational, cultural, and strategic challenges at the forefront. Kutnjak (2021) notes that the pandemic accelerated changes in business models and indirectly initiated DT projects across various sectors, each accompanied by unique challenges. A foundational step in the DT journey involves simplifying and standardizing processes, as emphasized by Cichosz et al. (2020), to mitigate complications during implementation.

Karakaya et al. (2023) and Nebati et al. (2023) highlight that a lack of structured strategy is often the downfall of successful DT initiatives, suggesting that digital maturity within organizations critically depends on the strategic planning of digital initiatives rather than intuitive management, a sentiment echoed by Berghaus (2016).

The discussion of barriers is predominantly centered around private sectors, with less attention to the cultural barriers that public organizations face (Rusu et al., 2020). This oversight of specific sectors to be studied extends to a general lack of existing structured approaches in the field, which Berger et al. (2020) argue could be ameliorated by adhering to best practices and established descriptive models (Malysheva & Kharlamova, 2021). Moreover, as Gkrimpizi et al. (2023) illustrate, while older DT barriers such as inadequate IT infrastructure have decreased, new challenges like data privacy and security concerns have arisen, yet resistance to change remains a persistent obstacle.

The evolving nature of these barriers coupled with the necessity for a holistic DT strategy and the importance of knowledge management in DT (Thornley et al., 2016) underscores the complexity of navigating DT in competitive and technologically advanced environments. This complexity suggests that future research should also consider exploring barriers in contexts with intense competition to fully understand the spectrum of challenges faced during DT.

2.2. SMEs specificities exacerbating barriers to digital transformation

In a study conducted by the Direction générale des Entreprises (DGE), published annually in the Baromètre France Num, several critical barriers to the DT of French SMEs have been identified. While a significant majority of SMEs have embraced digital platforms, approximately half remain skeptical about the financial benefits of digital investments and express concerns over data security risks, such as data loss or theft. Despite the high penetration of online presence, with around a quarter of SMEs engaging in e-commerce—rising to half in certain sectors—many still consider online sales irrelevant to their business models. The disparity in the adoption of management solutions is substantial and correlates with the size of the enterprise. Furthermore, there is a growing interest among these enterprises in leveraging data analytics and artificial intelligence. According to Europa’s 2023 survey on 12,909 European SMEs, 45% of them have difficulties finding the right skills which is preventing them from “adopting and/or using digital technologies” (European Union, 2023).

SMEs play a pivotal role in the global economy, serving as major employers and economic drivers across various industries and nations (Thrassou et al., 2020). However, the diversity of barriers varies by organizational attributes such as size, revenue, and the autonomy to implement DT, as identified by Rupeika-Apoga & Petrovska (2022). Consequently, SMEs face significant challenges in their DT journeys. Key among these is the alignment of their current capabilities with the demands of future technological advancements, which is crucial for overcoming the inherent challenges of DT (Williams et al., 2022). These authors also highlight that SMEs often struggle to match the DT performance of larger organizations, primarily due to their limited resources. Kääriäinen et al. (2021) further emphasize that the limited know-how in SMEs exacerbates these challenges, making it difficult for them to effectively navigate the complexities of DT.

This combination of limited resources and a lack of structured digital strategy suggests a critical need for developing tailored DT models that cater specifically to the needs and constraints of SMEs.

2.3. Barriers to digital transformation in service SMEs

Research specific to the barriers to DT in service SMEs are nonexistent and as mentioned above, DT of service industry seem to be a blind spot in the literature. There is no systematic literature on digital transformation in the service industry (Rha & Lee, 2022). The barriers to DT of specific service industries are studied but without focusing on SMEs. They cover sectors such as maritime, education, logistic service providers, retail, tourism but particularly finance and healthcare (Rha & Lee, 2022). Nonetheless, Krajčík et al. (2023) focused on digital transformation in services and manufacturing SMEs and raised some differences regarding DT.

3. Research Methodology

3.1. Method

We seek to identify the different challenges encountered by service SMEs and categorize them into a typology of barriers. Our work is based on data collected from technical files on DT written by French service SMEs to enquire research tax credit. Using thematic analysis, we analyzed the “challenges” sections of these reports to identify themes.

3.1.1. Research tax credit

The Research Tax Credit (CIR) is a French tax incentive allowing industrial, commercial, and agricultural companies to offset research-related expenses—such as fundamental, applied, and experimental research—against their corporate income tax liability

(Direction générale des Finances publiques, 2024). This tool, with some variations, is available in other countries such as the UK, the USA, Canada, Australia and Germany. In France, in 2022, SMEs, which account for 91% of the beneficiaries of the Research Tax Credit, only represent 32% of the total tax credit amount (Paoli-Gagin, 2022).

A company can write a research program and submit it to the French tax administration as part of an advanced tax ruling (“rescrit” in French) to guarantee the validity of its research and development (R&D) operations. This research program contains different information such as the aim of the research, the gaps in the scientific literature, the challenges encountered by the company related to this topic, a planning of the activities that will be conducted over several years as well as the predicted theoretical contributions. Whether the company submitted an advanced tax ruling or not, once they receive the tax credit their R&D operations can be investigated to make sure that the company respects the legal requirements. That is when the company will need to produce technical files relating their R&D over the years for which they received the tax credit. This file contains similar information as the advanced tax ruling file but instead of being a projection of the activities it needs to relate the actual activities conducted by the company.

To conduct our analysis of the barriers to DT encountered by SMEs we collected the data from the section “challenges” of the technical files. These sections relate the difficulties encountered by companies in their R&D operations in digital transformation. The data collection methodology is detailed in the research methodology section.

3.1.2. Data collection

Starting from the data available of 66 companies, all companies working on a research program with technical files available have been selected, constructing an initial pool of 30 companies. (*Figure 2*). Then started an examination focused on verifying the number of employees and turnover to ensure all companies met the SME criteria. Only one company

failed the number of employee tests. The investigation then extended to the nature of the companies' activities; two companies have been excluded as they were not service companies. The final exclusion criteria relate to the quality of the data and excluded one company, leading to the final sample size of 26 companies to study. To uphold confidentiality and prevent the identification of the participating entities, all companies were anonymized. Lastly, the data initially collected in French has been translated into English before starting the data analysis process.

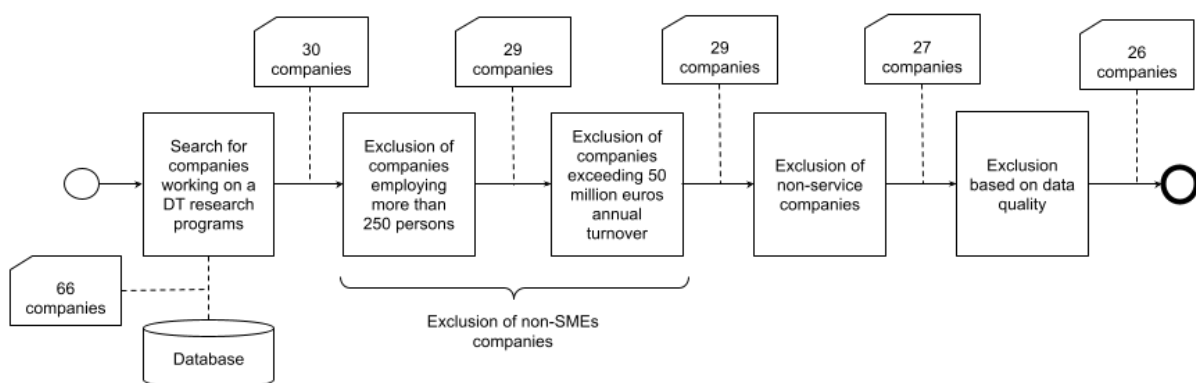


Figure 2 - Selection of the companies studied

3.1.3. Sample characteristics

The sample analysis involved a detailed review per type of activity and nature of digital transformation activity engaged by the companies. *Table 3* displays some of the main characteristics of five of the sampled companies obtained on *societe.com* and/or *pappers.fr*. For example, company number 1 is registered as a consulting firm in computer systems and software. Its main declared activity is the “management of IT infrastructure, integration, supply, training, expertise, and related equity investments”. We classified this company in the IT consulting category. This company was founded in 2009. In 2022, it had between 50 and 99 employees and generated a turnover between 15 and 20 million euros. 35% of the sample are companies in the sector of computer programming, 15% are consulting firms in computer systems and software, 12% are in the engineering and technical studies field and 8% are

advertising agencies and business and other management consultancy. The remaining 30% represents firms in various fields such as other IT activities, computer facilities management, data processing activities, internet portals, power generation, etc.

Those organizations are all conducting DT activities in their own companies and/or in their clients' companies. We categorized the 26 firms into three main categories depending on the nature of their DT activities. The first one, "information technology consulting", or *Entreprise de Services du Numérique (ESN)* in French, represents 50% of the sample. These companies "are part of the management consulting sector and focus primarily on information systems. Their mission is to advise their customers (public or private companies) on the IT solutions or architectures best suited to their functional needs, and/or to help them implement them." (Abid, 2022). Secondly, 38% of the sample group are categorized as "software editors". They are companies whose main activity might not necessarily be entirely linked to IT, but they develop software for their sector. Finally, 12% of the sample group are companies in a non-digital sector undergoing their own DT. For example, company #20 is a transportation company who developed its own TMS¹ and is deploying it among all its subsidiaries along with the restructuring of its organization and processes.

3.1.4. Analysis

A thematic analysis was used to analyze the data, to identify and determine patterns (themes). It is "a flexible and useful research tool, to provide potentially a rich and detailed, yet complex, account of data" (Braun & Clarke, 2006). The six steps of Braun and Clarke (2006) have been used to determine 73 codes, 15 subthemes and 6 themes (*Figure 3*). This process is iterative and nonlinear.

¹ Transport Management System

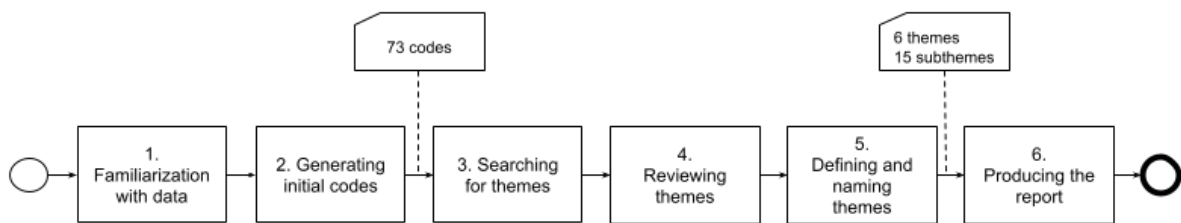


Figure 3 - Thematic analysis steps adapted from Braun and Clarke (2006)

Step 1. Familiarization with data

Data has been collected, as described in the data collection section, into 26 individual documents. They have been translated into English and anonymized. They have been read carefully and the initial ideas noted. The documents have then been uploaded into QDA Miner Lite, a qualitative data analysis tool.

Step 2. Generating initial codes

According to Braun et al. (2019), coding and theme development is a dynamic and adaptable process that often evolves along with the analysis. The data have been coded using inductive coding analysis into 73 codes. The main goal of the inductive approach is to enable research findings to arise from recurring, prominent, or important themes found within raw data, free from the limitations of structured methodologies (Thomas, 2003).

Step 3. Searching for themes

Once the data have been coded, the list has been reviewed to remove any duplicate, to refine the naming, to split codes that were not precise enough. Then the codes have been gathered into categories resembling themes. As defined by Braun and Clarke (2006), a theme identifies a key element of the data in relation to the research question and reflects a consistent pattern or meaning within the dataset.

Step 4. Reviewing themes

The themes have been examined to check that they match the codes but also the text extracts highlighted by the codes in QDA Miner Lite.

Step 5. Defining and naming themes

In line with Thomas (2003), who noted that most inductive studies report between three and eight main categories, the thematic analysis resulted in six themes.

Step 6. Producing the report

The results will be presented in the results section below.

4. Results

Six main themes and fifteen subthemes were identified through thematic analysis. *Table 1* summarizes in columns “themes count” (or “subthemes count”) the percentage of appearance of a theme (or a subtheme) in the analyzed data. Columns “theme case count” (or “subtheme case count”) show the percentage of companies having encountered a given theme (or subtheme).

Table 1 - Themes and subthemes count and cases appearance

Theme	Theme count	Theme case count	Subtheme	Subtheme count	Subtheme case count
Technological barriers	92%	33%	Standards and infrastructure	81%	14%
			Data management	58%	12%
			Integration and interoperability	62%	7%
Business and strategic barriers	92%	20%	Strategic alignment	73%	12%
			Market and competitiveness	58%	5%
			Business model innovation	42%	3%
Process and operational barriers	81%	16%	Collaboration and communication	77%	12%
			Process optimization	46%	4%
Organizational barriers	73%	13%	Operational efficiency	58%	7%
			Cultural adaptation	35%	3%
			Change management	31%	2%
Human and talent barriers	50%	12%	Workforce skills and training	46%	9%
			Employee engagement and wellbeing	27%	3%
Security and compliance barriers	58%	7%	Legal and regulatory compliance	42%	4%
			Cybersecurity	35%	3%

When analyzing qualitative data through thematic analysis, the dominance of a theme can only be determined through a high theme count and high case count (*Figure 3*). The most important barrier is the technological one. It has been mentioned by 92% of the companies and represents 33% of the codes. Then comes business and strategic barriers followed by process and operational barriers.

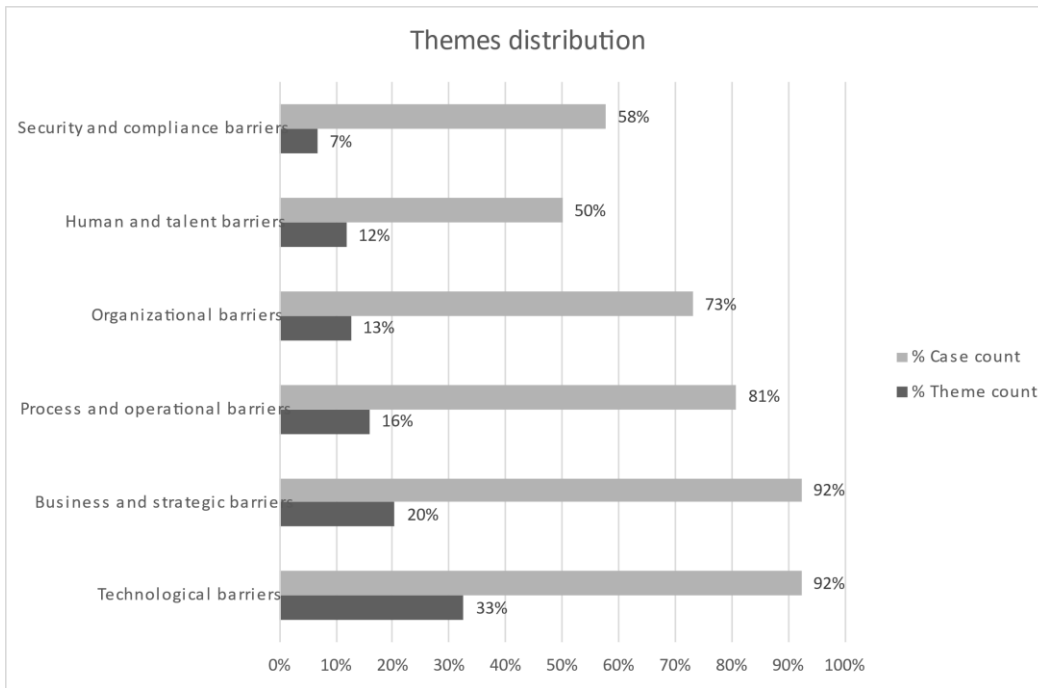


Figure 3 - Prevalence of barriers among companies

Regarding subthemes (*Figure 4*), the word cloud provided by QDA Miner Lite highlights in more detail the main concerns raised by companies which are linked to standards and infrastructure, strategic alignment, data management and collaboration and communication.



Figure 4 - Subthemes word cloud

Table 3 - Themes features and evidence

Theme	Subtheme	Empirical indicator
Technological barriers	Standards and infrastructure	<p>[a] <i>Company 2</i>: “How can we effectively implement existing standards and norms? What connection can we propose with standards that focus on strategy and governance, such as Cobit or CMMI?”</p> <p>[b] <i>Company 13</i>: “absence of an open IS making it possible to easily aggregate all of the community’s data into a common (virtual) data lake.”</p>
	Data management	<p>[c] <i>Company 6</i>: “Lots of data sent that is of no use to the consumer. Not only does this make their use more complex, but also increases network consumption.”</p> <p>[d] <i>Company 28</i>: “For the creation of dashboards with a transversal vision of the state of activity of a company, the main obstacle will be the translation of business elements into usable data on a technical level.”</p>
	Integration and interoperability	<p>[e] <i>Company 15</i>: “The design of a distributed, functionally rich software architecture (data models, processes, task types, data validation methods) guaranteeing perfect integrity of the data handled (in heterogeneous environments) capable of being exploited from synchronous / asynchronous or disconnected way represents a search lock that we will have to overcome.”</p> <p>[f] <i>Company 17</i>: “We want the solution to be easily integrated while meeting the requirements of efficiency, quality, ease of use and operation in the buyer’s environment without disrupting it.”</p>
Business and strategic barriers	Strategic alignment	<p>[g] <i>Company 25</i>: “How can we define a benchmark that will allow us to establish the RONI and the achievable ROI based on the context, the level of maturity and the level of financial implications and investments (+ other facilitators to be defined) of the target client?”</p> <p>[h] <i>Company 26</i>: “Be able to measure production losses in the event of under-optimization in order to improve regulation methods.”</p>
	Market and competitiveness	<p>[i] <i>Company 3</i>: “What developments will be necessary and factorable to meet the challenges of B2B e-commerce?”</p> <p>[j] <i>Company 25</i>: “What are the factors that significantly influence user satisfaction?”</p>
	Business model innovation	<p>[k] <i>Company 1</i>: “How can we define a matrix of service levels in coherent packages to satisfy all users?”</p> <p>[l] <i>Company 2</i>: “What solutions, tools or processes should be implemented to encourage the emergence of business models not based on Man-Days?”</p>
Process and operational barriers	Collaboration and communication	<p>[m] <i>Company 10</i>: “Absence of a systems engineering model integrating cooperative work, knowledge management and organizational impact.”</p> <p>[n] <i>Company 20</i>: “Design open and sustainable architectures with protocols allowing the exchange of data regardless of the terminal, object or repository used.”</p>
	Process optimization	<p>[o] <i>Company 10</i>: “Complexity in designing and adapting business process management (BPM) systems in the context of digitalization, taking into account the social aspects of business processes and the industry’s adoption of new techniques and standards.”</p> <p>[p] <i>Company 21</i>: “The obstacle that must be overcome is therefore to coordinate all existing and future solutions in order to have a fluid process from the beginning to the end of the process initiated by the consumer; and even beyond through monitoring and continuous improvement”</p>
Organizational barriers	Operational efficiency	<p>[q] <i>Company 10</i>: “Complexity of production-oriented design in industry (scaling up issue) taking into account the identification and management of dependencies, the improvement of communication and the balance between depth of modeling and necessary resources.”</p> <p>[r] <i>Company 7</i>: “The choice of one method or another will depend on the resources required for its implementation and use, especially as resources are increasingly limited. It is therefore also necessary to have the tools to measure and optimize the consumption of resources, which will make it possible to minimize costs and maximize the profitability of projects while offering sustainable solutions to market needs.”</p>
	Cultural adaptation	<p>[s] <i>Company 8</i>: “This concerns in particular the taking into account of the cultural dimensions of organizations, contingent on the otherness specific to each ecosystem.”</p> <p>[t] <i>Company 23</i>: “One of the obstacles identified during previous studies was that, for certain cases, the non-appropriation of the company’s ----- methodology by clients was reinforced, either by the use of other tools by the client (fear of change), either by a strong culture around the use of emails (large account such as -----), or by an absence of technical culture (MOA vs AMOA) despite potential integration into the customer information system”.</p>

	Change management	<p>[u] <i>Company 2</i>: “There are risks in transforming an organization too quickly: overload, demotivation and loss of control must be avoided.”</p> <p>[v] <i>Company 8</i>: “The search for a new organizational model will necessarily have to confront partners who are not necessarily evolving in the same direction. Differentiating structures can then be perceived as risks or disruptions, both internally and externally. External partners may be reluctant to work with, if not imitate, a differentiating organization. How can we therefore reduce the impacts of such a confrontation in the transformation? How can we minimize disruption and foster organizational resilience to create value for the entire value constellation?”</p>
Human and talent barriers	Workforce skills and training	<p>[w] <i>Company 15</i>: “The design of a software solution (web portal) allowing a non-IT audience to design, manipulate and continuously improve one or more digital processes (Processes, steps, Tasks, task validation mode) based on “low-cost” logic. code” and promoting user autonomy will also consist of overcoming barriers.”</p> <p>[x] <i>Company 2</i>: “What teaching strategy should be developed to promote the transmission of knowledge? What data format should be chosen to make this know-how as easy to assimilate as possible?”</p>
	Employee engagement and wellbeing	<p>[y] <i>Company 5</i>: “How can strategy be a driver of adoption and “happiness” at work (to be able to manage and contain operational constraints such as absenteeism, turnover, bad spirits)?”</p> <p>[z] <i>Company 23</i>: “How can we guarantee trust and implementation by users of the suggested corrective actions, even though they do not have the overall vision, and can be penalized individually by the proposed solutions? If governance is fully automated, how can conflicts and authority between users and the governance system be managed?”</p>
Security and compliance barriers	Legal and regulatory compliance	<p>[aa] <i>Company 2</i>: “How can we integrate the new standards of digital responsibility, represented in particular by the INR (Institut du Numérique Responsable) and the RGESN (Référentiel général d’écoconception de services numériques) into each global process?”</p> <p>[ab] <i>Company 8</i>: “Legal and regulatory structures, particularly in the context of public procurement, can limit flexibility and innovation and in particular contractualization outside of commitments to results. How can we maintain a public order while applying our organizational models?”</p>
	Cybersecurity	<p>[ac] <i>Company 1</i>: “How can we demonstrate that there are no flaws in the information system? Users, expecting security-related services to be produced, demand flawless security, which is not currently possible.”</p> <p>[ad] <i>Company 18</i>: “Absence of data science models to be able to analyze all the indicators enabling high levels of service to be ensured, particularly from a security perspective.”</p>

Theme 1 – Technological barriers

In the context of digital transformation, technological barriers are significant impediments that organizations must overcome to successfully integrate and utilize new technologies. This theme has been mentioned by 92% of the companies and represents 33% of the codes (*Table 1*). These barriers are categorized into three subthemes: standards and infrastructure, data management and integration and interoperability.

The subtheme *standards and infrastructure* highlight the need for standardized models and methods that include all relevant variables, suited architectures, and the development of complex tools. It also addresses issues such as the lack of transparency in new technologies, general technological difficulties, and the availability and rapid response time of IS as illustrated by quotes [a] and [b] (*Table 3*).

Effective *data management* is crucial for digital transformation. This subtheme focuses on the challenges of handling large volumes of data as shown in [c] (*Table 3*). But also, in maintaining data quality, ensuring data availability, and giving meaningful insights from the data as depicted in [d] (*Table 3*).

Integration and interoperability address the challenges related to incorporating new technologies into existing systems. Key issues include the integration of new technologies, managing the complexity of system architectures, ensuring data interoperability, maximizing native integration into legacy Information Systems (IS), decentralizing IS, and enhancing IS transparency as presented in quotes [e] and [f] (*Table 3*).

Theme 2 - Business and strategic barriers

In the realm of digital transformation, business and strategic barriers represent significant hurdles that organizations need to address to ensure successful transition and innovation. This theme has been mentioned by 92% of the companies and represents 20% of the codes (*Table 1*). These barriers can be categorized into three subthemes: strategic alignment, market and competitiveness and business model innovation.

Strategic alignment focuses on ensuring that all digital transformation initiatives are in harmony with the broader business objectives. This involves clear role definition and addressing poorly defined strategy aligned with DT. But also identify how to integrate new subsidiaries and corporate social responsibility (CSR) initiatives into the overall strategy. Additionally, it includes the definition of relevant Key Performance Indicators (KPIs) to develop a data-oriented strategy as evidenced by quotes [g] and [h] (*Table 3*).

Market and competitiveness highlight the need to address issues related to profitability, the creation of added value for stakeholders, and the application of suitable models and methods to public organizations. But also understanding the specificities of the sector and customer's field of work as well as measuring customer satisfaction are also critical as shown in quotes [i] and [j] (*Table 3*).

Business model innovation addresses the challenges associated with evolving and adapting business models to fit new digital realities. Key issues include evaluating costs and invoicing within new business models and defining new service packages that align with these innovative models as illustrated by quotes [k] and [l] (*Table 3*).

Theme 3 - Process and operational barriers

In the context of digital transformation, process and operational barriers represent significant challenges that organizations must overcome to optimize their operations and improve collaboration. This theme has been mentioned by 81% of the companies and represents 16% of the codes (*Table 1*). These barriers are categorized into two subthemes: collaboration and communication and process optimization.

The subtheme *collaboration and communication* focus on improving internal and external collaboration within new business models, integrating human-AI collaboration, ensuring the ability to switch between tools and applications, adopting agile methodologies, customizing solutions based on existing tools, and ensuring new methodologies are adopted by all stakeholders as reflected in quotes [m] and [n] (*Table 3*).

Process optimization addresses the challenges associated with enhancing and automating business processes. Key issues include the automation of processes, the implementation of Business Process Management (BPM), improving the efficiency of business processes, developing new decision-making methods, addressing the lack of decision-making tools, and overcoming the lack of an experimental field for testing new processes as indicated by quotes [o] and [p] (*Table 3*).

Theme 4 - Organizational barriers

In the context of digital transformation, organizational barriers represent significant challenges that can hinder the successful implementation and integration of new technologies and processes within an organization. This theme has been mentioned by 73% of the

companies and represents 13% of the codes (*Table 1*). These barriers are categorized into three subthemes: operational efficiency, cultural adaptation and change management.

The subtheme *operational efficiency* highlights the need to optimize resource management and reduce costs, automate support processes such as finance, manage third-party relationships effectively, and minimize the loss of time as detailed in quotes [q] and [r] (*Table 3*).

Cultural adaptation focuses on the challenges related to aligning the organization's culture with new digital processes and technologies. This includes adapting to the company's culture, dealing with uncertainty and a changing environment, and managing the emergence of new professions as reported in quotes [s] and [t] (*Table 3*).

Change management addresses the difficulties associated with managing organizational change. Key issues include resistance to change, the risk of transforming an organization too quickly, and the potential disconnect between the Research and Development (R&D) team and the rest of the organization as highlighted by quotes [u] and [v] (*Table 3*).

Theme 5 - Human and talent barriers

In the context of digital transformation, human and talent barriers represent significant challenges related to the workforce and their engagement with new digital processes and technologies. This theme has been mentioned by 50% of the companies and represents 12% of the codes (*Table 1*). These barriers are categorized into two subthemes: workforce skills and training, and employee engagement and wellbeing.

Workforce skills and training addresses the challenges associated with equipping the workforce with the necessary skills and knowledge to adopt and effectively use new technologies. Key issues include user adoption, staff training and skills development, integration and retention of employees, attracting new talents, knowledge management, knowledge retention as illustrated by quotes [w] and [x] (*Table 3*).

Employee engagement and wellbeing focuses on the impact of digital transformation on employee engagement and wellbeing. Key issues include the impact of human emotions and wellbeing, lack of trust among employees, and adapting to new ways of working and shifts in the employee/employer relationship as shown in quotes [y] and [z] (*Table 3*).

Theme 6 - Security and compliance barriers

In the context of digital transformation, security and compliance barriers represent critical challenges that organizations must address to protect their digital assets and ensure conformity to legal and regulatory standards. This theme has been mentioned by 58% of the companies and represents 7% of the codes (*Table 1*). These barriers are categorized into two subthemes: legal and regulatory compliance and cybersecurity.

Legal and regulatory compliance focuses on the challenges related to complying with legal and regulatory requirements. Key issues include adhering to legal requirements, managing local and geographic differences in regulations (GDPR²), protecting intellectual property, aligning with existing standards, and implementing effective risk management practices as outlined in quotes [aa] and [ab] (*Table 3*).

Cybersecurity addresses the challenges associated with protecting digital assets from cyber threats. Key issues include cybersecurity concerns, balancing cybersecurity measures with costs, and ensuring robust protection mechanisms are in place as presented in quotes [ac] and [ad] (*Table 3*).

5. Discussion

This study has explored the diverse barriers to DT that service-oriented SMEs in France face. This led to the identification of critical impediments across six categories: technological barriers, business and strategic barriers, process and operational barriers, organizational barriers, human and talent barriers and security and compliance barriers. Each of these

² General Data Protection Regulation

categories presents unique challenges that must be addressed to ensure successful digital transformation.

Technological barriers are among the most fundamental challenges that service SMEs face in their digital transformation journey. Establishing robust standards and IT infrastructure is crucial for supporting the deployment and scaling of digital solutions. Bouncken & Schmitt (2022) consider “inadequate and insufficient investments in IT infrastructure in case firms as key inhibitors of digital transformation” in SMEs. Proper data management practices are also essential for informed decision-making and leveraging data as a strategic asset. Omrani et al. (2024) highlight the importance of IT infrastructure and digital tools as key factors for digital technology adoption, noting that many SMEs are unprepared to implement new technologies. Limited infrastructures and access to financing exacerbate this barrier in SMEs (Raji et al., 2024). In addition to impacting the IS landscape this can lead to unexpected IT costs (Amarilli et al., 2023), especially as the complexities and resource constraints that SMEs encounter during digitization often lead to a need for external support (Kääriäinen et al., 2021). In the literature analysis, technological barriers appeared as the second barrier, it can be assumed that the research findings are aligned with the literature.

Addressing *business and strategic barriers* allows organizations to enhance their competitive edge, ensuring that their digital transformation efforts are both market-relevant and customer-focused. Effective strategic alignment is critical to ensuring that digital initiatives support and enhance the organization’s goals. Business models must evolve through “business model innovation unique to the digital context” (Böttcher et al., 2022). This is even more relevant for the service sector as DT can lead to new business models (Rha & Lee, 2022). SMEs tend to leap into digital transformation due to external pressure and end up using technology to adapt to the changing environment instead of aligning technology with business and defining a strategy accordingly (Canhoto et al., 2021). Therefore, developing organizational competence for digital transformation (Varona et al., 2021) and strategic

planning as well as decision-making capabilities are essential for navigating digital transformation, noting that misalignment can significantly hinder progress (Williams et al., 2022). Also, Sepehr et al. (2022) stresses the need for careful planning and execution of strategic components to ensure successful digital transformation. The business barriers, as observed in 21 of the companies studied, align with insights from the Direction générale des Entreprises (2023) that highlight SMEs skepticism about the financial benefits of digital investments. However, in the SME literature analysis, business and strategic barriers appear as the fourth out of seven barriers. This can be explained by the fact that service SMEs' business models are more susceptible to disruptions from digital transformation since, unlike manufacturing or product-based businesses, they typically depend on intangible assets (knowledge, client relationships, etc.). Given the direct influence of digitization on customer relations and service delivery, SMEs may perceive strategic difficulties as more pressing and crucial.

Regarding *process and operational barriers*, enhancing collaboration and communication is essential for fostering innovation, flexibility, and responsiveness in digital transformation initiatives. Effective process optimization is crucial for increasing productivity and operational efficiency. Kääriäinen et al. (2021) identify the operational challenges SMEs face, such as the need for automation and the integration of new digital tools into existing processes. Ulas (2019) underscores the inconsistent Information and Communications Technology (ICT) investment behaviors of SMEs, advocating for structured approaches to digital transformation. Similarly to the second barrier, process and operational barriers appear in fourth position in the SME literature analysis. Compared to industries like manufacturing or retail, service SMEs may have more customized and flexible processes, which might make standardizing and automating operations more challenging. Since their business models are closely linked with their customer-facing operations, the introduction of digital tools may have a substantial impact on service delivery and increase operational difficulties.

Organizational barriers can significantly impede digital transformation. Enhancing operational efficiency is vital for improving productivity and ensuring that organizations can fully leverage digital transformation's benefits. Brink & Packmohr (2023) highlight how organizational culture and technical issues can impact digital transformation success. Moreover, organizational barriers are considered a key factor influencing digital transformation, especially regarding strategic issues like business model innovation (Judijanto et al., 2024). In addition, Le-Dain et al. (2023) emphasize how organizational barriers can hinder digital servitization, emphasizing the need for internal organizational adjustments. This barrier seems to be slightly less mentioned in service SMEs than in the literature analysis. Service SMEs may prioritize addressing operational challenges related to digitizing customer-facing processes, which may shift focus away from organizational barriers compared to global SMEs.

The success of digital transformation heavily relies on the skills and engagement of the workforce. Overcoming *human and talent barriers* through effective training and development are crucial to ensuring that employees can adapt to and thrive in a digitally transformed environment. Williams et al. (2022) stress the importance of human capital capabilities, noting that limited skills and talent within SMEs pose a significant barrier to digital transformation. Yezhebay et al. (2021) include skill acquisition and cross-collaboration as essential elements in overcoming human-related barriers. Meanwhile, Dörr et al. (2023) also highlight the struggle SMEs face with limited resources and capabilities, which are critical for managing digital transformation effectively. In the literature analysis of the barrier, the human barrier is the most important one. In our analysis, the data have been collected from technical files used to justify the good use of a research tax credit on digital transformation. Research tax credits do not cover challenges related to training employees. This may explain why the human and talent barriers are underrepresented in this analysis.

Security and compliance barriers are critical in ensuring the legal and regulatory integrity of digital transformation initiatives. Ensuring compliance with legal standards is essential for avoiding penalties and maintaining a trustworthy reputation, while robust cybersecurity measures are necessary for safeguarding sensitive data. Regulatory compliance needs to be integrated into the company's digital transformation strategic approach (Omrani et al., 2024) especially for SMEs (Thrassou et al., 2020). Sepehr et al. (2022) emphasize that navigating rules and regulations is a crucial part of the innovation strategy framework for SMEs. SMEs are more vulnerable to cybersecurity threats due to less proactive data protection and lack of resources, putting them at a disadvantage compared to larger companies that can leverage their scale to access and protect larger volumes of data (Kergroach, 2020). The results of this study align with the literature analysis on SMEs barriers.

In the analysis of the barriers to DT in SMEs' literature, the fifth barrier is the financial barriers. Aspects linked to this barrier such as cost reduction, productivity and efficiency have been integrated into the process and operational barriers. Nonetheless, the lack of financial resources preventing DT does not appear. This can be explained by the fact that this barrier is implied by the need for the companies to request a research tax credit on DT.

The nuanced understanding of barriers developed through this study suggests that existing DT strategies, typically designed for larger corporations and non-service sectors, are inadequate for service SMEs. This discrepancy highlights the need for more tailored transformation strategies that consider the unique challenges and resource constraints of smaller firms in the service sector.

6. CONCLUSION

This study has first conducted an analysis of the barriers to digital transformation in the SMEs literature regardless of the industry as service SMEs are understudied. The barriers have been classified into seven categories, in order of appearance; human, technological,

organizational, strategic and operational, financial, legal and security and others. Then, the study has identified and categorized the main barriers to DT encountered by service SMEs in France. Those barriers have been collected from research tax credit reports on DT and critically analyzed and compared to the barriers to DT in the SMEs literature. Our findings reveal that the most significant challenges are related to technological and business and strategic barriers, closely followed by process and operational barriers, organizational barriers, human and talent barriers and security and compliance barriers.

The result of this analysis shows that service SMEs seem to highly underestimate the barriers related to human and talent barriers and slightly underestimate organizational barriers. Whereas they seem to overestimate the barriers linked to business and strategy. This insight underscores the need for DT strategies specifically tailored to the unique characteristics and constraints of service SMEs, rather than adopting frameworks designed for larger organizations or for non-service companies.

Several limitations must be acknowledged. First, the data for this study were sourced from reports issued by companies to the tax administration for obtaining tax credits. This may introduce biases as these reports are designed to meet specific regulatory requirements. Additionally, all studied companies have been coached by the same consulting firm during the design of their research program and tax administration report. Moreover, the sample size of 26 companies, while insightful, is also limited and may not represent the full diversity of experiences among French service SMEs. Finally, regarding the analysis of the barriers in the literature, research papers have been searched on Google Scholar only. Even if this is a really comprehensive database it can be seen as a limitation of this paper.

Despite some limitations, this study contributes valuable insights into the digital transformation barriers faced by service SMEs. By identifying and categorizing these barriers, we provide a foundation for developing more nuanced and effective DT strategies tailored to the unique needs of SMEs, thereby enhancing both their competitive edge and compliance in

a rapidly evolving digital landscape. This aligns with the broader academic and practical pursuit of equipping SMEs to better navigate the complexities of digital transformation, fostering a more inclusive and technologically skilled business ecosystem. Future research should address the shortcomings of current models by developing tailored frameworks that better accommodate the unique challenges and resources of service SMEs. Additionally, expanding the sample size and incorporating quantitative data could provide deeper insights into each barrier's context and impact. Engaging with policymakers and industry leaders to translate these findings into actionable strategies will also be crucial in advancing the practical applications of digital transformation for service SMEs.

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8. APPENDIX

Table 4 - Characteristics of a sample of 26 French SMEs' studied

Company	Activity (societe.com)	Main business activity (societe.com)	Nature of DT activity	Creation date (societe.com)	Nbr of employee (societe.com)	Revenue 2022 (societe.com) (pappers.fr)
1	Consulting in computer systems and software	Infrastructure outsourcing, IT integrator, suppliers of IT goods and services, as well as IT training and expertise, and equity interests in all legal entities.	IT consulting	2009	50 - 99	15 - 20 M€
3	Business and other management consultancy	Services, consulting, training and expertise in the fields of management and technology	IT consulting	2002	20 - 49	1 - 1.99 M€
6	Computer programming	Design, production, distribution, and maintenance of online advertising, sales, and website services	Software editor	2009	6 - 9	500 - 999 k€

18	Other IT activities (6209Z)	Software publishing and maintenance, IT services, training and consulting in IT and e-business	IT consulting	2010	10 - 19	20 - 50 M€
26	Engineering, technical studies	Energy, storage, operation, financing and development in the energy sector, particularly in photovoltaic and battery products.	Non-digital sector	2019	10 - 19	500 - 999 k€

Table 5 – Literature review barriers analysis in SMEs

Research papers	Barrier 1	Barrier 2	Barrier 3	Barrier 4	Barrier 5	Barrier 6	Barrier 7	Barrier 8
Rupeika-Apoga et al. (2022)	Human	Technological	Financial	Organizational	Legal	Environmental		
Yusuf et al. (2024)	Organizational	Technical and Infrastructural	Financial	Market Constraints	Regulatory Concern	Sustainability	Strategic	
OECD (2021)	Human Resources and Skills	Financial	Technological	Regulatory and Legal	Security			
European SME Survey (2019)	Technological	Human Resource and Skills	Financial	Organizational				
Schmitz and Wimmer (2024)	Technological	Data Management and Governance	Policy and Compliance	Operational and Process	Integration and Interoperability			
Palade and Møller (2023)	Human Resource and Skills	Technological	Financial	Organizational	External	Governance and Compliance		
Nnenna et al. (2024)	Financial	Organizational	Technological	Knowledge and Skills				
Peillon and Dubruc (2019)	Technical/Technological	Organizational	Human Resources Related	Customer-Related				
Omrani et al. (2022)	Technological	Strategic and Planning	Human Resource and Skills	Organizational	Policy and Support			

Iliescu (2020)	Financial	Knowledge and Awareness	Organizational	Strategic and Market-Driven				
Yıkılmaz and Kör (2023)	Leadership and Strategic	Human Resource and Skills	Financial	Organizational	External Support (policy..)			
Brink and Packmohr (2022)	Individual	Organizational	Technical	External	Missing skills			
Johannesson et al. (2022)	Technological	Human Resource and Skills	Organizational	Security and Compliance	Strategic			
Brink and Packmohr (2023)	Organizational	Technical	Human Resource and Skills	Standards and Regulatory				
Judijanto et al. (2024)	Financial	Organizational	Technological					
Zhang et al. (2022)	Technological	Organizational	Human Resource and Skills	External Support	Resource Management	Strategic		
Borana et al. (2024)	Financial	Technological	Operational and Process	Human Resource and Skills	Organizational			
Gupta and Jagtap (2024)	Technical	Organizational	Skilled labor	Dynamic information	Finances			
Ifeoluwa et al. (2022)	Strategic	Human	Technological Infrastructures	Organizational	Leadership	Security	Budget	Government
Aygün and Sati (2022)	Financial	Organizational	Human Resource and Skills	Technological	Regulatory and Standards	Strategic		