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Evaluating the extent of digital transformation in response to the public crisis: Evidence from Small Service Businesses

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Abstract

The COVID-19 pandemic and associated restrictions have significantly altered customer behaviors and business environments, prompting small service businesses (SSBs) to accelerate their digital transformation efforts. This study evaluates the digital maturity of SSBs across seven dimensions of digital transformation as defined by Kane (2017). Employing a mixed-method approach, which integrates quantitative questionnaire analysis with qualitative discourse analysis, the research quantifies the level of digital transformation and identifies key pathways toward digitalization. Findings reveal that only 50% of SSBs reached the intermediate stages of digital maturity, with substantial progress in customer communication and service digitalization. The most commonly adopted digitalization pathways were those with lower capital and technological requirements, such as digital payment mechanisms and social media engagement, rather than high-investment options like digital partnerships or online stores. Furthermore, customer-related digital activities clustered into three categories: transactional, intercommunication, and information sharing, with transactional activities (e.g., online shopping and payments) representing nearly 50% of digital engagement. Sensitivity analysis confirmed the robustness of these findings across business sizes and sectors. These insights contribute to a better understanding of digital transformation dynamics in SSBs during crisis situations and offer practical implications for managers seeking to prioritize digital investments effectively.

***Keywords**: digital transformation, customer relationship, COVID-19 pandemic, small service businesses, digital maturity, sensitivity analysis.*

1. Introduction

The COVID-19 pandemic, along with the resulting restrictions on social interaction, has pushed many businesses to explore alternative modes of operation that minimize physical contact and mobility [1]. For small enterprises in particular, digital transformation (DX) has emerged as a promising pathway to maintain continuity and improve operational efficiency under such unpredictable conditions. In addition to these practical advantages, digitalization also offers environmental benefits, as it enables small and medium-sized enterprises (SMEs) to reduce their

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ecological footprint through more streamlined and less resource-intensive processes [2]. The adoption of advanced technologies—such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain—has played a pivotal role in supporting this transition. These technologies, especially when integrated within robust industrial platforms, serve as key enablers of holistic digital transformation in the SME sector [3]. Yet, despite these opportunities, SMEs often remain disproportionately vulnerable due to infrastructural shortcomings and a range of organizational and financial barriers that complicate the digitalization process [4]. Without adequate support and capacity, such limitations may not only delay but potentially derail digital transformation efforts entirely [5].

Small businesses form the backbone of the global economy, representing nearly 90% of all enterprises, contributing 60 to 70% of total employment, and generating approximately half of the global GDP [6]. Given their central role, the resilience and recovery of the global economy in the aftermath of the COVID-19 crisis hinge significantly on how effectively these businesses adapt to rapidly evolving consumer preferences and market dynamics. In this context, digitalization has emerged as a critical equalizer, helping small enterprises bridge structural gaps and remain competitive in an increasingly digitized marketplace [5]. Recent data from the OECD indicate that the pandemic has acted as a powerful catalyst for digital adoption, with as many as 70% of small businesses reporting an increase in their use of digital technologies during this period [7,8].

Although much of the existing literature has concentrated on the digital transformation of business models and distribution channels [9], comparatively less scholarly attention has been directed toward shifts in customer behavior and the evolving dynamics of customer–business relationships in the digital age [10]. Addressing this gap, the present study adopts a multidimensional perspective on digital maturity (DM), assessing it across key domains such as employee digital competencies, customer engagement mechanisms, organizational structures and workflows, and IT infrastructure readiness. In addition to mapping digital maturity, this research explores the specific digitalization pathways adopted by small businesses, with a focus on their strategic relevance for fostering sustainable digital transformation. Furthermore, the study examines how customer relationships have been reconfigured through digital means in response to pandemic-induced constraints. To guide this inquiry, the study is structured around the following research questions:

1) In which domains have small service businesses (SSBs) undergone digital transformation compared to the pre-pandemic period, and what is the level of digital maturity attained in each domain?
2) What digitalization pathways have SSBs pursued, and how are these strategies prioritized?
3) To what extent have customer relationships with SSBs been digitally transformed?

The structure of this paper is organized as follows. Section 2 provides a review of the theoretical foundations underpinning the study, synthesizing key dimensions of digital transformation as they pertain to SMEs and culminating in the development of a conceptual model for assessing digital maturity and transformation. Section 3 details the mixed-methods research design, which integrates both quantitative and qualitative methodologies to ensure a comprehensive analysis. Section 4 presents the findings derived from statistical and thematic analyses, addressing the central research

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questions outlined earlier. Finally, Section 5 concludes with a discussion of the study's key contributions and practical implications, and suggests directions for future research.

2. Theoretical foundations and literature review

To understand digital transformation (DX) in its full context, it is important to first distinguish it from the closely related concepts of digitization and digitalization. Digitization typically refers to the technical process of converting analog information into digital formats—ranging from creating digital versions of products [11, 12] to incorporating digital tools into product development cycles [13]. In contrast, digitalization goes a step further, referring to the broader organizational use of digital technologies to improve data collection, analysis, and value creation. It plays a pivotal role in fostering innovation and enhancing performance by enabling the development of new digital offerings and embedding digital tools throughout innovation processes [14–17].

Digital transformation, as distinct from the above, is a comprehensive and strategic process through which organizations leverage digital capabilities to fundamentally reshape their operations, customer value propositions, and relationships with stakeholders [18]. Unlike digitization or digitalization, which may target specific functions, digital transformation affects the organization holistically—altering business models, customer experiences, internal processes, organizational culture, and network dynamics [19, 20].

The global business landscape underwent a dramatic shift in the wake of the COVID-19 pandemic, with Small and Medium Enterprises (SMEs) experiencing some of the most severe operational disruptions [21]. These firms, often operating with constrained financial resources, underdeveloped technological infrastructures, and workforce skill deficiencies, have encountered significant barriers in their pursuit of digital transformation [22, 23]. Vogelsang et al. [24] and Matt et al. [25] categorize these obstacles into three principal domains: human, technological, and financial. In response, many SMEs have increasingly turned to digital technologies as essential tools for enhancing resilience and ensuring business continuity amid uncertainty [26, 27].

Recent scholarship has explored both the progress and challenges associated with digital transformation in SMEs, revealing considerable variation across organizational functions [28–32]. To measure the depth of digital transformation, researchers have developed several maturity frameworks, typically emphasizing domains such as business model innovation, organizational structures, employee skillsets, process optimization, IT infrastructure, product and service offerings, and customer engagement [33–36]. Among the most influential contributions is the seven-dimensional model introduced by Wade [37] and Kane et al. [38], which captures the breadth of transformation across these critical domains. Complementary to this, Westerman and Bonnet [39] proposed a nine-block framework organized under three strategic pillars—customer experience, operational processes, and business models—which aligns closely with Kane's typology and has further enriched the analytical landscape for studying digital transformation.

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Table 1 **:**Digital transformation maturity framework for SSBs evaluation

DX Dimension	Criteria/indicators	Maturity level				
		1	2	3	4	5
Business Model	• DX strategic vision • Channels of distribution • Revenue stream and profitability • Communicate channels with partners • Digitalization level of key activities	Prematurity level	Early digitalization level	Developing level	Digital establishment level	Maturity level
Organization Structure	• Decentralization level • Vertical and horizontal integrate • Management control system • Cross-functional cooperation					
Employees' skills, abilities & culture	• Distant working index • Digital savvy of employees • New abilities of employees (ML, AI, …) • Knowledge sharing culture • Virtual interpersonal communicate					
Processes	• Level of automation across organizational processes • Level of business processes adaptability to change • Level of consistency of processes across the organization • BPR and enterprise resources planning	Starting block / Prematurity level	Beginning of DX / Early digitalization level	DX diffusion level / Developing level	Digital establishment level	Maturity level
IT capabilities	• Existence of IT infrastructures (data-bases, DSS, expert System, networks , IOT integration) • Effectiveness of websites, mobile-sites, social media, etc. • Linkage of IT strategy to corporate strategy • Driving value from generated data					
Offering (products & services)	• Level of products and services digitally-enabled • Percentage of smart products and service among all • IOT integration in the products and services	Starting block / Prematurity level	Beginning of DX / Early digitalization level	DX diffusion level / Developing level	Digital establishment level	Maturity level
Engagement model with customers & suppliers	• Customer relationship (how many touch-points: mail, mobile, weblogs, portal, LAN, customer club…) • Channels of communication • Virtual idea sharing with partners • Level of co-creativity with suppliers and customers					

The concept of digital maturity (DM) has gained prominence as a crucial complement to the broader discourse on digital transformation, offering a lens through which an organization's preparedness and capacity for structured digital evolution can be evaluated [40–42]. Unlike mere technological adoption, DM encapsulates a wider spectrum of organizational attributes—including cultural orientation and managerial capabilities—that enable employees to effectively engage with and leverage digital tools [43–45]. Several scholars, including Haryanti et al. [46], have synthesized a range of digital maturity models, categorizing key dimensions such as organizational structure, strategic orientation, business processes, corporate culture, technological infrastructure, customer

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engagement, and employee competencies. In the practical realm, frameworks like the TM Forum's maturity model evaluate these elements across business domains such as customer experience, strategic focus, technological readiness, operational effectiveness, organizational culture, and data utilization.

Building upon these existing frameworks, the present study introduces a digital transformation maturity model specifically designed for Small Service Businesses (SSBs). This model comprises seven core dimensions, each assessed across five levels of maturity, to capture the nuanced stages of digital development (see Table 1). Given the fast-paced evolution of digital environments, maintaining a competitive edge requires organizations to conduct ongoing evaluations of their digital maturity and to adapt proactively [47, 48]. The proposed model not only offers a structured diagnostic tool for assessing current transformation efforts but also equips managers with strategic guidance to identify gaps, allocate resources effectively, and prioritize initiatives for continuous improvement.

3. Research Gap

Although scholarly interest in digital transformation (DX) and digital maturity (DM) has grown substantially in recent years, notable gaps persist—particularly in relation to Small Service Businesses (SSBs). While a variety of frameworks have been developed to assess digital transformation maturity [33–39], these models often emphasize large corporations or specific industrial sectors. As a result, they frequently overlook the distinct characteristics and constraints of SSBs, including limited financial capital, underdeveloped technological infrastructure, and a shortage of specialized human resources [22–27]. Furthermore, much of the existing research prioritizes the technological dimensions of digital transformation, paying insufficient attention to the organizational, cultural, and human factors that are especially critical in the context of small firms [24, 25, 40]. This has led to a fragmented understanding of how SSBs can cultivate digital maturity across multiple dimensions in a cohesive and integrated manner. The literature also reveals a lack of holistic, context-specific maturity models that adequately reflect the managerial realities and sectoral challenges faced by SSBs [46, 47].

An additional shortcoming lies in the predominantly cross-sectional nature of prior studies. Given the accelerating pace of digital innovation, organizations must continually reassess and adapt their digital capabilities. Yet, longitudinal research tracking the evolution of digital maturity within SSBs over time remains scarce. Addressing these research gaps is crucial for developing practical and adaptable strategies that support sustainable digital transformation in small service-oriented enterprises.

Despite the COVID-19 pandemic acting as a catalyst for digital transformation across industries worldwide, there remains a surprising scarcity of empirical research focused on how Small Service Businesses (SSBs) specifically adapt and evolve their digital maturity in response to such unprecedented disruptions [21, 26]. This gap highlights the need for a more nuanced understanding of the unique challenges and opportunities faced by SSBs in times of crisis. Addressing this, the present study proposes a comprehensive digital transformation maturity framework tailored to the realities of SSBs. The framework encompasses seven critical dimensions, each defined by five levels of maturity, offering a structured approach for managers to assess their digital capabilities. By doing

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so, it aims to serve as a practical guide for identifying priority areas for development and fostering sustainable competitive advantage within the fast-changing digital landscape.

4. Research methodology

This study employs a mixed-methods approach, integrating a 5-point Likert scale questionnaire with in-depth semi-structured interviews. This multimethod design was chosen to leverage the statistical rigor and generalizability offered by quantitative analysis, alongside the contextual richness and nuanced understanding provided by qualitative inquiry. The research unfolded through four key stages:

(1) An An extensive review of the literature on digital transformation was undertaken to identify a model that best fits the specific context of Small Service Businesses (SSBs). Following thorough evaluation, a conceptual framework grounded in seven dimensions, adapted from Kane et al.'s widely recognized model published in the MIT Sloan Management Review [41], was selected as the basis. Relevant attributes and indicators were then systematically extracted from the literature and aligned with these dimensions to accurately capture their essential features (see Table 1).

(2) A digital transformation maturity framework was developed, consisting of five distinct maturity levels. Specific practices and attributes were systematically assigned to each level within every dimension of digital transformation. This framework provided respondents with a clear guideline for completing the questionnaire. To ensure its robustness, the framework's reliability and validity were evaluated by a focus group of three experts drawn from both academia and industry. These experts assessed the framework against three criteria adapted from ISO standards [2]:

   a. Sustainability: The framework's appropriateness for assessing digital transformation maturity (DXM) within Small Service Businesses (SSBs).
   b. Completeness: Its capacity to comprehensively evaluate the full DXM process, from inception to completion.
   c. Objectivity: The clarity and precision of maturity level descriptions to guarantee fair and unbiased assessments.

(3) The questionnaire was distributed among 100 SSBs across three economic sectors: restaurant, retail, and building maintenance. CEOs of these companies responded to items measuring their firms' digital transformation status across the seven dimensions, both before and after the onset of the COVID-19 pandemic, using a 5-point Likert scale. This design enabled a comparative analysis of digital maturity levels pre- and post-pandemic. Factor analysis validated the model, with all seven dimensional indicators exhibiting t-values above the significance threshold of 1.96 and covariation coefficients exceeding +0.5. Additionally, a supplementary questionnaire adapted from Priyono's study [49] was utilized to identify six key digitalization pathways pertinent to the sample.

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(4) To capture the customer perspective, semi-structured interviews were conducted with 70 customers of the sampled SSBs, focusing on how their interactions with suppliers evolved during the COVID-19 pandemic. Central questions included: “What types of digital interactions did you have with your supplier companies during the COVID-19 pandemic?” and “What transformations have occurred in your interactions with supplier companies as a result of the pandemic?” The interview responses were analyzed using MAXQDA software to systematically quantify the frequency and nature of digital engagement reported by participants.

The following section details the results of the quantitative and qualitative analyses alongside the key research findings.

5. Finding

The empirical analysis of 100 Small Service Businesses (SSBs) across three key sectors—building maintenance, restaurants, and retail—provides valuable insights into the status and evolution of digital transformation (DX) maturity before and during the COVID-19 pandemic.

5.1. Sample Characteristics

The study sample consists of 30 firms in building maintenance, 34 in the restaurant sector, and 36 in retail. Regarding organizational size, approximately one-third (33%) of these firms are classified as very small, employing fewer than 10 individuals; 65% fall within the small business category, employing between 10 and 50 staff; and the remaining 2% are medium-sized, with over 50 employees. These distributions realistically reflect the predominance of micro and small service businesses in developing economies, where micro-enterprises are particularly prevalent.

5.2. Pre-Pandemic Digital Maturity

Prior to the COVID-19 outbreak, the majority of SSBs exhibited minimal advancement in their digital transformation efforts. Across all seven dimensions of DX—namely business model, organizational structure, employee digital skills and culture, business processes, IT capabilities, offerings, and engagement models—more than 60% of firms remained within the "prematurity" or "early digitalization" stages. Importantly, none of the dimensions achieved an average maturity level corresponding to the "development" stage. The process dimension recorded the highest mean score ($M = 2.31$, $SD = 1.04$), while employee digital skills and culture scored the lowest ($M = 1.78$, $SD = 0.94$), underscoring the limited digital competencies and organizational culture necessary to support transformation. Collectively, these results indicate that prior to the pandemic, SSBs were generally underprepared for digital transition.

5.3. Pandemic-Period Digital Maturity

The COVID-19 pandemic acted as a catalyst for accelerated digital transformation, with significant advancements observed across all seven DX dimensions. Notably, five dimensions exceeded the "development" maturity threshold, highlighting a rapid digital adaptation to crisis-induced challenges. The most pronounced improvements were evident in business processes ($M = 3.66$), IT capabilities ($M = 3.46$), and product/service offerings ($M = 3.44$). These findings suggest that SSBs

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prioritized technological enhancements and operational agility to maintain business continuity. However, the dimension of employee digital skills and organizational culture (M = 2.27) remained below the development level, indicating that internal cultural and human capital adaptations lagged behind technological progress. This disparity underscores the ongoing challenge of aligning workforce competencies and organizational culture with evolving digital infrastructures.

Table 2a **:**Frequency distribution and descriptive statistics SSBs' CEOs' comments on the maturity levels of DX dimensions before the COVID19 pandemic.

DX Dimension	Frequency distribution					Total sample size	$\bar{X}$	SD	CV
	Level 1	Level 2	Level 3	Level 4	Level 5				
	Prematurity	Early digitalized	development	Digital establishment	Maturity				
Business Model	28	32	26	11	3	100	2.29	1.10	0.48
Structure	47	20	18	13	2	100	2.03	1.20	0.50
Employee's skills & culture	54	23	16	5	2	100	1.78	0.94	0.53
Processes	26	33	27	12	2	100	2.31	1.04	0.45
IT Capability	33	28	22	14	3	100	2.26	1.10	0.48
Offerings	33	26	30	9	2	100	2.21	1.07	0.48
Engagement model	39	26	23	10	2	100	2.10	1.08	0.51

Table 2b :Frequency distribution and descriptive statistics of $SSB_S CEO_S$ comments on the maturity levels of DX dimensions during the COVID19 pandemic.

DX Dimension	Frequency distribution					Total sample size	$\bar{X}$	SD	CV
	Level 1	Level 2	Level 3	Level 4	Level 5				
	Prematurity	Early digitalization	development	Digital establishment	Maturity				
Business Model	11	16	19	27	27	100	3.43	1.32	0.38
Structure	25	15	20	20	20	100	2.95	1.46	0.49
Employees' skills & culture	40	19	22	12	7	100	2.27	1.23	0.54
Processes	9	12	19	24	36	100	3.66	1.29	0.35
IT Capability	14	15	13	27	31	100	3.46	1.34	0.39
Offerings	11	13	24	25	27	100	3.44	1.28	0.37
Engagement model	12	16	22	20	30	100	3.40	1.33	0.39

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Furthermore, the standard deviations for all dimensions increased during the pandemic, indicating a widening gap in digital maturity levels among the sampled firms. This growing disparity likely reflects differences in organizational size, as larger businesses tended to exhibit more advanced digital capabilities—a relationship corroborated by the data presented in Table 4. Despite this variability, the coefficient of variation (CV) remained moderate across most dimensions, implying a generally consistent adoption of digital transformation practices among the firms. The notable exception was the dimension related to employees' digital competencies, which displayed the highest degree of dispersion (CV = 0.54), highlighting uneven progress in workforce digital skills across the sample.

5.4. Prioritization of DX Dimensions

The results of Friedman's test indicate that among the seven dimensions, business processes ranked highest in digital maturity (mean rank = 5.20), followed by IT capabilities (4.57) and business model innovation (4.43). In contrast, employee skills and culture (2.04) and organizational structure (3.25) received the lowest rankings. These findings highlight a tendency to prioritize technological and process-oriented elements of digital transformation while underemphasizing the critical human and organizational components that underpin sustainable change. The observed imbalance between digital enablers, such as IT infrastructure, and investments in human capital development raises concerns about the long-term viability of digital transformation efforts in Small Service Businesses.

Table 3 :Prioritization of DX maturity dimensions over the COVID-19 pandemic.

DX dimensions	Mean rank (Friedman's test)	Priority
Business model	4.43	3
Organization structures	3.25	6
Employees' digital skills and culture	2.04	7
Processes	5.20	1
IT capabilities	4.57	2
Offerings (products and services)	4.33	4
Engagement model (with suppliers and customers)	4.20	5

5.5. Differences by Firm Size and Activity

The Kruskal-Wallis test identified statistically significant differences in digital transformation maturity across business sizes within three dimensions: processes, IT capabilities, and offerings ($p < 0.05$). Larger firms consistently demonstrated higher maturity levels in these areas, which aligns with expectations given their comparatively greater access to financial resources, technological infrastructure, and organizational flexibility. These advantages facilitate more effective adoption and integration of digital solutions. No significant differences were found across firm sizes in the remaining dimensions, suggesting that certain aspects of digital transformation may be less dependent on company scale.

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Table 4 :DX maturity in seven dimensions in terms of SSBs size and field of activity.

DX dimensions	Size (number of employees)			field of activity		
	Statistic value	Sig. level	Mean ranks	Statistic value	Sig. Level	Mean ranks
Business model	3.538	0.060	Under 10 employees: 46.52 Over 10 employees: 57.89	25.032	0.000	Building: 29.32 Restaurant: 54.65 Retail: 64.24
Organization structures	3.572	0.059	Under 10 employees: 46.49 Over 10 employees: 57.94	17.331	0.000	Building: 35.50 Restaurant: 48.38 Retail: 65.00
Employees' digital skills and culture	0.862	0.353	Under 10 employees: 48.54 Over 10 employees: 54.14	1.210	0.546	Building: 54.38 Restaurant: 46.51 Retail: 51.03
Processes	7.241	0.007	Under 10 employees: 44.81 Over 10 employees: 61.07	18.058	0.000	Building: 32.07 Restaurant: 55.81 Retail: 60.85
IT capabilities	4.288	0.038	Under 10 employees: 46.12 over 10 employees: 58.64	19.161	0.000	Building: 31.42 Restaurant: 60.97 Retail: 56.51
Offerings	6.266	0.012	Under 10 employees: 45.20 Over 10 employees: 60.34	1.334	0.513	Building: 46.17 Restaurant: 50.21 Retail: 54.39
Engagement model	1.190	0.167	Under 10 employees: 47.58 Over 10 employees: 55.93	1.065	0.587	Building: 48.82 Restaurant: 47.82 Retail: 54.43

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When segmented by field of activity, retail businesses consistently outperformed those in the restaurant and building maintenance sectors across four dimensions: business model innovation, organizational structure, processes, and IT capabilities. Notably, restaurants exhibited relatively strong performance in IT capabilities compared to other sectors. These inter-industry differences likely reflect variations in customer interaction models and operational complexities. Retail and restaurant businesses, being more directly affected by lockdown measures and reliant on customer-facing digital touchpoints, appear to have accelerated their digital adoption more rapidly than building maintenance firms.

5.6. Pathways to Digitalization

Table 5 Table 5 presents the utilization of six digitalization pathways among SSBs during the pandemic. Payment mechanisms, such as digital payment links via platforms like Zarinpal, emerged as the most widely adopted strategy (mean rank = 4.02), followed closely by social media engagement (3.96) and the outsourcing of digital tasks (3.87). In contrast, Internet forums, online store creation, and digital partnerships were less frequently employed. These results suggest that SSBs predominantly favored low-barrier, easily implementable digital solutions. The prominence of payment integration and social media channels highlights a practical focus on enhancing customer engagement and expanding revenue streams with minimal infrastructural demands. Meanwhile, the relative underuse of digital partnerships and e-commerce storefront development may reflect constraints related to resources or limited strategic planning among these businesses.

Table 5 :The usage frequency of each digital pathway toward DX maturity by the SSBs.

Digital pathways	Never	A few times	Sometimes	Usually	Always	Total	Mean rank/Friedman test	Priority
Digital partners (e.g., Snapp Food and Snapp Market)	29	11	9	17	34	100	3.25	4
Creating an online store	27	12	19	20	22	100	3.01	5
Social media	4	17	15	24	40	100	3.96	2
Internet forums	21	17	24	14	24	100	2.90	6
Outsourcing digital activities	9	15	17	22	37	100	3.87	3
Payment mechanisms (e.g., the link to the Zarinpal sales app)	2	13	15	34	36	100	4.02	1

5.7. Pathways by Size and Sector

The Kruskal-Wallis test results presented in Table 6 reveal significant differences in digital pathway adoption across both industry sectors and revenue sizes. Specifically, digital partnerships

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and online store creation were significantly more prevalent among retail and restaurant businesses compared to building maintenance firms ($p < 0.005$). Additionally, adoption rates of these digital tools increased with higher annual revenues; businesses generating over $300,000 annually demonstrated greater use of such pathways than their lower-revenue counterparts. These findings corroborate earlier results suggesting that digitally mature firms tend to embrace more comprehensive digital strategies, including partnerships and e-commerce platforms. Furthermore, the observed sector-specific patterns reflect the inherent suitability of customer-facing digital channels for retail and food service industries relative to the more operationally focused maintenance sector.

Table 6:Kruskal-Wallis test results concerning the usage frequency of six pathways based on SSB_S size and field of activity.

DX Dimension	Field of activity				Size (annual turnover)			
	Stat. value	Sig. level	Mean ranks		Stat. value	Sig. level	Mean ranks	
Digital partnership	29.07	0.000	Building	27.33	15.601	0.001	< 50,000 $	30.82
			Restaurant	60.22			50,000-150,000$	44.68
			Retailing	60.63			150,000-300,000$	64.98
							> 300,000$	49.74
Creation of an online store	10.51	0.005	Building	38.13	8.782	0.032	< 50,000 $	31.36
			Restaurant	50.47			50,000-150,000$	47.28
			Retailing	60.83			150,000-300,000$	56.33
							> 300,000$	54.92
Social Media	3.359	0.186	Building	44.33	15.907	0.001	< 50,000 $	40.14
			Restaurant	56.94			50,000-150,000$	32.20
			Retailing	49.56			150,000-300,000$	59.48
							> 300,000$	57.27
Internet Forums	2.379	0.304	Building	51.07	4.168	0.244	< 50,000 $	47.14
			Restaurant	44.90			50,000-150,000$	41.13
			Retailing	55.32			150,000-300,000$	50.64
							> 300,000$	56.73
Outsourcing of digital activities	26.994	0.000	Building	88.33	9.148	0.027	< 50,000 $	35.07
			Restaurant	61.00			50,000-150,000$	47.18
			Retailing	59.06			150,000-300,000$	61.59
							> 300,000$	49.45

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Payment mechanisms	3.094	0.213	Building	45.87	5.185	0.159	< 50,000 $	40.75
			Restaurant	57.16			50,000-150,000$	43.95
			Retailing	48.07			150,000-300,000$	57.52
							> 300,000$	52.59

5.8. Transformation of Digital Customer Relationships

Table 7 presents the results of a discourse analysis based on 135 citations of digital activities reported by customers of 70 small service businesses (SSBs), categorized into three primary groups: information-gathering, transactional, and communication activities. This categorization facilitates a detailed understanding of how customer-SSB digital interactions evolved throughout the COVID-19 pandemic.

The The analysis reveals that transactional activities dominate digital interactions, accounting for 54.81% (74 out of 135) of all citations. The most frequently mentioned transactional activities include digital payment systems (33.8%), online shopping (32.5%), and order registration (20.2%). Collectively, these three account for over 86% of all transactional references, underscoring a significant behavioral shift towards direct digital engagement for economic exchanges. This trend is likely driven by the necessity to maintain business continuity amidst social distancing and lockdown restrictions, positioning digital tools as essential enablers of core commercial functions.

Information-gathering activities represent 24.44% of total citations (33 out of 135), indicating a secondary yet substantial role in shaping customers' digital behaviors. Within this category, advertising (21.2%), search channels (18.2%), price comparison (18.2%), and product information retrieval (15.2%) are the most cited activities, together comprising roughly 85% of information-related interactions. This pattern suggests increased customer reliance on digital platforms not only for transactions but also for evaluating and comparing products and services prior to purchase decisions, reflecting an enhancement in digital literacy and informed consumer behavior.

Communication-based digital interactions, though comprising a smaller share of citations (20.74%), represent an important dimension of digital relationship management. Leading activities in this domain include idea sharing (32%), communication with service providers (25%), and participation in customer clubs (18%). While less frequent than transactional interactions, these communication activities play a crucial role in sustaining customer relationships, fostering loyalty, and encouraging community engagement. Additionally, less frequent activities such as participation in virtual events and peer recommendations indicate the emergence of digital social capital within the service ecosystem.

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Table 7:The frequency of the digital activities cited by the interviewees.

Information gathering activities (24.44% of total citations)			Transactional activities (54.81% of total citations)			Communication activities (20.74% of total citations)		
Digital activates	Frequency	Frequency percentage	Digital activities	Frequency	Frequency percentage	Digital activities	Frequency	Frequency percentage
Advertisement	7	21.2%	Payment	25	33.8%	Ideas sharing	9	32%
Price comparing	6	18.2%	Shopping	24	32.5%	Communication with service providers	7	25%
Search channels	6	18.2%	Order registration	15	20.2%	Membership in the customer club	5	18%
Product information	5	15.2%	Service scheduling	7	9.5%	Participating in a virtual event	3	11%
Price information	4	12.2%	Service promotion coupons	3	4%	introducing to the friends' community	2	7%
Orders tracking	2	6%	Total frequency	74	100%	Public event	1	3.5%
Inventory information	1	3%				Service evaluation and scoring	1	3.5%
Special offers	1	3%				Total frequency	28	100%
activity domains	1	3%						
Total frequency	33	100%						

The distribution of citations clearly indicates that the fundamental transformation in supplier–customer relationships during the COVID-19 pandemic was driven predominantly by transactional digitalization. While 74 citations were concentrated within only five transactional activities, a total of 61 citations were spread across 16 different activities in the information-gathering and communication categories. This marked asymmetry highlights a pragmatic and utilitarian approach to digital adoption among customers, who prioritized convenience, access, and the continuity of service delivery over more exploratory or engagement-focused digital behaviors.

In summary, the discourse analysis corroborates the broader empirical findings of this study by demonstrating the largely functional nature of digital engagement during the pandemic. The crisis accelerated customer acceptance and utilization of digital tools primarily for essential transactional purposes such as payments and order processing. Concurrently, the observed increase in information-seeking and the emergence of communication-oriented digital interactions, though more limited, suggest the early stages of a transition toward more sophisticated and relational digital customer relationships. This nascent evolution has the potential to deepen post-pandemic, contingent on strategic investment and active support by service providers.

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6. Result and Discussion

The central finding of this study highlights the catalytic effect of the COVID-19 pandemic in accelerating the digital transformation maturity of small service businesses (SSBs). Confronted with an unprecedented and sustained crisis, many SSBs were compelled to rapidly adopt digital technologies. This external shock functioned as a forcing mechanism, driving businesses—often out of immediate necessity rather than long-term strategic planning—to advance along the digital maturity continuum. Nevertheless, this progression was far from homogeneous. The data reveal considerable heterogeneity in both the degree and nature of digital transformation, varying significantly across sectors and firm sizes. Larger SSBs, typically equipped with greater financial, technological, and managerial resources, demonstrated more substantial progress toward digital maturity compared to smaller firms.

Sectoral disparities further accentuated this uneven development. For example, businesses in retail and other consumer-facing services were better positioned to maintain or even enhance their digital engagement, owing partly to their prior exposure to online tools such as e-commerce platforms and digital marketing strategies. These sectors also encountered fewer operational disruptions during lockdowns. Conversely, SSBs in high-contact or predominantly offline service domains experienced near-complete operational halts, resulting in minimal or no advancement in their digital transformation efforts. As illustrated in Table 2b, nearly 50% of the sampled SSBs remained below the “digital establishment” or “digital maturity” thresholds, underscoring the fragmented and uneven trajectory of digital progress under crisis conditions.

Beyond these descriptive patterns, the study uncovers three deeper, structural insights into the nature of digital transformation during the pandemic. First, the prioritization of investments—as detailed in Table 3—reveals a marked emphasis on technological infrastructure and process digitalization, with comparatively limited attention to human-centric dimensions such as organizational culture, workforce digital skills, and structural readiness. This technology-centric focus echoes longstanding critiques within the digital transformation literature, which caution against equating transformation solely with technology adoption. Scholars emphasize that sustainable digital transformation requires the integration of technological advancements with strategic organizational change and the development of human capital [50, 51]. In line with this, established methodologies such as Business Process Re-engineering (BPR) often fail when implemented without parallel structural adaptation [52, 53]. The empirical data in this study corroborate these concerns: only 5 out of 100 SSBs achieved the highest level of maturity across all seven digital transformation dimensions, indicating that isolated technological upgrades lacking organizational alignment produce limited and fragmented outcomes.

Second, Second, the findings reveal a pronounced stratification of digital transformation strategies according to firm size and resource availability (see Table 6). More capital-intensive pathways—including the development of proprietary digital platforms, outsourcing to specialized firms, and forming technology-based partnerships—were predominantly adopted by higher-revenue SSBs. These approaches require not only significant financial investment but also advanced managerial capabilities and strategic foresight. In contrast, smaller and less-resourced firms tended to rely on more accessible digital solutions such as mobile payment systems and participation in Internet-based

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marketplaces. This bifurcation underscores that digital inequality is not simply a matter of digital literacy or awareness, but is deeply rooted in structural disparities related to financial and managerial capacity. These observations align with recent research advocating for context-sensitive prioritization frameworks tailored to SMEs and cooperatives with limited financial resources, emphasizing the necessity of staged and strategic investment sequencing to foster inclusive digital advancement [54].

Third, the dimension of customer and supplier relationships—as detailed in Table 7—adds further nuance to the digital transformation narrative. Among the 21 digitally mediated activities identified, three transactional functions—online shopping, digital payments, and digital order registration—accounted for nearly half of all citations. This disproportionate emphasis on transactional efficiency underscores that the most immediate and tangible benefits of digitalization during the pandemic were realized in areas directly linked to operational continuity and revenue generation. Notably, these transactional activities often leveraged existing digital infrastructures, facilitating rapid deployment under crisis conditions. Conversely, more engagement-oriented functions—such as interactive marketing, customer feedback platforms, and community-building mechanisms—remained largely marginal. This pattern suggests that many small service businesses (SSBs) approached digital transformation primarily as a short-term, survival-driven imperative, prioritizing utilitarian outcomes over deeper relational engagement.

Such a narrow, transactional focus represents a missed strategic opportunity. Contemporary digital transformation is increasingly characterized not only by operational digitization but also by the depth and quality of stakeholder engagement and integration within broader digital ecosystems. Neglecting these softer dimensions risks undermining long-term customer loyalty and organizational resilience. Recent studies emphasize the importance of understanding the structure and trajectory of digital transformation through bibliometric and integrative approaches to inform comprehensive and future-ready strategies [55]. Furthermore, hybrid methodological frameworks that combine qualitative insights, data analytics, and contextual sensitivity offer a robust pathway to address complex challenges posed by digital disruption, energy crises, and public health emergencies [56].

Taken together, the findings of this study portray digital transformation among SSBs during the COVID-19 pandemic as largely opportunistic rather than strategic, and fragmented rather than holistic. While the crisis acted as a catalyst for accelerated digital adoption, these changes were often reactive and unevenly distributed. Firms lacking sufficient resources defaulted to minimal compliance with prevailing digital trends, whereas more resource-endowed businesses pursued more substantive innovations. Crucially, the sustainability of these transformations remains uncertain. Without coherent strategies that effectively balance technological implementation with human capital development and organizational alignment, many SSBs risk stagnating at intermediate levels of digital maturity—levels insufficient to secure competitive advantage in a post-pandemic service economy that is increasingly shaped by complex, digitally enabled ecosystems.

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7. Conclusion

Small Service Businesses (SSBs), despite their substantial role in economic development—particularly in fostering employment, diversifying the Gross National Product (GNP) structure, and contributing to trade balance—were disproportionately impacted by the COVID-19 pandemic relative to larger enterprises. Amidst this unprecedented disruption, digital transformation emerged not only as a reactive mechanism but also as a strategic imperative to sustain business continuity and enhance organizational resilience. This study aimed to comprehensively assess the scope and depth of digital transformation among SSBs by measuring maturity across seven fundamental dimensions, identifying predominant digitalization pathways, and analyzing the evolution of customer-supplier digital interactions throughout the pandemic period.

The The empirical evidence indicates that, while numerous SSBs achieved notable advancements in select facets of digital maturity—particularly process digitalization, enhancements in product and service offerings, customer and supplier engagement frameworks, and elements related to business model digitalization and IT infrastructure—critical areas such as employee digital competencies, organizational culture, and structural readiness lagged behind. This shortfall was especially evident among micro-enterprises with fewer than ten employees, underscoring the pressing need for customized support mechanisms to address the unique challenges faced by the smallest firms.

Regarding Regarding digitalization pathways, the study revealed a clear preference for cost-effective and easily deployable solutions, including digital payment systems, social media integration, and outsourcing of digital functions. In contrast, more resource-intensive and technologically demanding strategies—such as proprietary online store development, digital partnerships, and participation in Internet forums—were markedly less adopted, likely reflecting the financial and technical limitations prevalent among smaller businesses. This adoption pattern aligns with broader observations that smaller firms tend to prioritize digital initiatives yielding rapid returns and low upfront investment, even if such choices do not culminate in comprehensive digital maturity.

The analysis of digitally transformed supplier-customer relationship activities further highlights a concentrated shift toward transactional functions. Core activities, including digital payments, online shopping, and order registration, constituted the majority of digital engagement, supplemented to a lesser extent by communicative actions such as idea sharing, customer-provider interaction, and service scheduling. These findings suggest that the pandemic accelerated digitalization primarily in essential operational domains critical for commercial exchange and immediate client engagement, while deeper relational or experiential aspects of digital customer interaction remained underdeveloped.

In view of these findings, it is recommended that future research and practical interventions focus on re-engineering core business processes where digital deficiencies persist. Techniques such as process mining and Business Process Re-engineering (BPR) offer promising avenues for identifying and rectifying structural inefficiencies, particularly in areas including employee empowerment, business model innovation, customer communication channels, and IT infrastructure enhancement. Developing a balanced and sustainable digital transformation strategy that integrates technological adoption with organizational readiness and cultural alignment is essential. Ultimately, although the

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COVID-19 pandemic acted as a powerful catalyst for digital adoption, the long-term success of digital transformation within SSBs will depend on their ability to embrace a holistic approach—one that harmonizes technological investment with human capital development and organizational change. Only through such an integrated pathway can small service businesses fully leverage the competitive advantages afforded by digitalization in a post-pandemic economic landscape.

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Appendix

Digital transformation maturity (DXM) levels attributs and practices

DX areas	criteria/measures	DXM levels attributs and practices				
		Level 1	Level 2	Level 3	Level 4	Level 5
		prematurity	Early digitalization	developing	establishment	maturity
Business Model	-Logic of business and its key components configuration	-No strategic vision of DX deployment -No Roadmap -No portfolio of DX projects	-starting of DX vision -Lack of explicite strategic orientation -Existance of Roadmap	-existance of strategic vision of DX in the BM -Building of implicie portfolio of DX projects	-BM transformation towards digital and data-driven BM -Exitance of explicite portfolio of DX projects with prioritization	-Data-driven BM -Clear and coherent digital strategy
Organization structure	-Level of hierarchical and divisions integration -Level of centralization -Level of authority delegation -Distribution of responsibilities	-Nobody responsible for managing DX -Lack of any division leading DX across the organization -classical centralized and pyramidal structure	-Assignement of an expert or an organizational division for managing Dx in the organization structure	-Identification of requirements for enterprise architecture -digitalization is managed more or less across the organization structure	-Vertical integration across organization structure -Organizational change management	-Horizontal integration -Integration of network at the business level -Enterprise architecture maintenance and assessment -Decentralized innovative structure
Processes	-Level of automation and digitalization -Level of standardization -BPR implementation	-Minimum level of automation -Minimum consistency across the processes -Minimum level of adaptability to change	-Starting the process of digitalization across the processes	-Business processes become digitalized through technology -Substitution of physical item by virtual world across the processes	-Key processes are well designed and implemented consistently -Standardization of digital processes -BPR deployment	-Extended operational visibility -Vertical Business integration -High BPM maturity level
Engagement model with customers & suppliers	-CRM -Touch points (mail, mobile no, portal , weblog , …) -Channels of communication -Virtual idea sharing plat -Co-creativity with suppliers and customers -Supplied relation	-Classical channels & physical channels (mailing and tell , …) -No idea sharing -Direct touch point	-Starting the virtual communication with suppliers and customers	-Customer data governance -LAN -Creation of customer club	-digital CRM and SCM	-customer life cycle mgt
Employees skills abilities and culture	-Distant working index -Level of knowledge sharing cultured -Level of HR digital skills -Level of HR empowerment	-Minimum digital skills -No digital abilities -No horizontal communicates and only vertical and hierarchical	-Training program implicitely existe in order to change the attitude of employees vs digitalizate	-well defined training and recruitment program deploy -employees risk taking with management support increases	-Sustainable learning management -High distant working index -IT culture establish -Knowledge sharing culture is promoted	-Trusted knowledge sharing culture -Employees empower -HR capabilities manage

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IT capability and infrastructure	-Existance of IT infrastructure (data-bases, DSS, expert systems network mgt, …) -Effectiveness of website, social media, mobile application	-non existance of related technology	-Existance of simple devices and preliminary know-how	-Software development -MIS secured -IT strategy definition -investment on IT	-Integration of IOT devices up to ERP	-Seamless information exchange between the networks
Offerings (Products & services)	-Linckage of IT strategy to business strategy -Smart products and services -Level of products digitally enabled -Level of services digitally enabled -Idea sharing across NPD -Co-creativity	-physical & behavioral relationship with customers and suppliers	-Efforts to apply virtual relationship with cust. & supp. to offer services	-Standardization of products and services for digital world	-Digital offering	-Use of data analytic tools to improve product and service quality

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