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Transformação Digital em uma Pequena Indústria Calçadista: Uma Leitura à Luz dos Paradigmas Tecnológicos

Digital Transformation in a Small Footwear Company: An Analysis in Light of Technological Paradigms

Transformación Digital en una Pequeña Industria del Calzado: Una Lectura a la Luz de los Paradigmas Tecnológicos

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Resumo: A transformação digital consolidou-se como tema estratégico nas organizações industriais, mas ainda há evidências empíricas limitadas sobre como esse processo ocorre em empresas de pequeno porte e em setores tradicionais. Este estudo analisou o processo de transformação digital em uma pequena indústria calçadista do sul do Brasil, à luz dos paradigmas tecnológicos. Adotou-se uma abordagem qualitativa, com estudo de caso, entrevistas em profundidade, observação sistemática participante, levantamento documental e análise de conteúdo com categorias teóricas a priori. Os achados indicam que a empresa se encontra predominantemente nas fases de digitização e digitalização, com avanços concentrados na área administrativa e baixa integração tecnológica no setor produtivo. Como contribuição analítica, o estudo evidencia que, em pequenas empresas industriais, a transformação digital não decorre necessariamente de uma orientação estratégica autônoma, mas pode assumir caráter incremental, reativo e condicionado às demandas dos clientes, às limitações de qualificação e às restrições estruturais. Sob a ótica dos paradigmas tecnológicos, observou-se uma mudança esporádica, e não contínua, nas trajetórias tecnológicas da empresa.

Palavras-chave: Transformação Digital. Paradigmas Tecnológicos. Indústria Calçadista de Pequeno Porte.

Abstract*: Digital transformation has become a strategic issue for industrial organizations, yet empirical evidence remains limited regarding how this process unfolds in small firms operating in traditional sectors. This study analyzed the digital transformation process at a small footwear company in southern Brazil, in light of technological paradigms. A qualitative case study was conducted using in-depth interviews, systematic participant observation, documentary research, and content analysis based on a priori theoretical categories. The findings show that the company remains mainly in the stages of digitization and digitalization, with advances concentrated in administrative activities and low technological integration in production. As an analytical contribution, the study shows that, in small industrial firms, digital transformation does not necessarily stem from an autonomous strategic orientation; rather, it may be incremental, reactive, and conditioned by client demands, qualification constraints, and structural limitations. From the perspective*

of technological paradigms, the company exhibits sporadic rather than continuous changes in its technological trajectories.

Keywords: *Digital Transformation. Technological Paradigms. Small-Sized Footwear Industry.*

Resumen*: La transformación digital se ha consolidado como un tema estratégico en las organizaciones industriales, pero aún son limitadas las evidencias empíricas sobre cómo se da este proceso en empresas pequeñas y en sectores tradicionales. Este estudio analizó el proceso de transformación digital en una pequeña industria del calzado del sur de Brasil, a la luz de los paradigmas tecnológicos. Se adoptó un enfoque cualitativo mediante el estudio de caso, entrevistas en profundidad, observación sistemática participante, revisión documental y análisis de contenido con categorías teóricas a priori. Los hallazgos indican que la empresa se encuentra principalmente en las fases de digitización y digitalización, con avances concentrados en el área administrativa y una baja integración tecnológica en el sector productivo. Como contribución analítica, el estudio muestra que, en pequeñas empresas industriales, la transformación digital no deriva necesariamente de una orientación estratégica autónoma, sino que puede adoptar un carácter incremental, reactivo y condicionado por las demandas de los clientes, las limitaciones de calificación y las restricciones estructurales. Desde la perspectiva de los paradigmas tecnológicos, se observó un cambio esporádico y no continuo en las trayectorias tecnológicas de la empresa.*

Palabras clave: *Transformación Digital. Paradigmas Tecnológicos. Industria del Calzado de Pequeño Porte.*

Introduction

Technological paradigms describe the main forces that direct technological progress and their interactions, while technological trajectories are the specific paths to solutions developed within these paradigms (Dosi, 1982). Later research has expanded this discussion by emphasizing cultural, political, sectoral, and organizational factors that influence how paradigms emerge, remain stable, and evolve (Russel, 1995; Cimoli & Dosi, 1995; Freire & Baldi, 2014).

Meanwhile, digital transformation is discussed as a phenomenon capable of reshaping processes, structures, and forms of value creation. In some studies, it is linked with new technological, digital, cultural, and organizational paradigms (Castro et al., 2021; Hussain, 2021; Trijueque, 2022; Garcia, 2023). However, the link between these two theoretical ideas is still more often claimed than proven, especially in traditional sectors and small businesses.

This perspective is important because digital transformation does not happen uniformly. In smaller-scale settings, limited resources, high customer reliance, and labor-intensive processes can lead to slower, more reactive, and more selective adoption of new technology, challenging the common expectation of steady change often described in the literature.

Furthermore, although previous literature emphasizes the positive effects of digital transformation on performance, innovation, and efficiency (Verhoef et al., 2021; Peng & Tao, 2022; Niu et al., 2023), it remains important to understand how these effects manifest in traditional industrial organizations, where digitization can progress unevenly across administrative and productive areas.

Given this scenario, we aimed to analyze a specific, traditionally economic industrial sector: the footwear industry, posing the following research question: how does the digital transformation process develop in a small footwear business from the perspective of technological paradigms?

The overall objective of this work was to analyze the digital transformation process in a small footwear industry, from the perspective of technological paradigms.

To this end, a qualitative case study was conducted focusing on the diagnosis of the company's

digitization, digitalization, and technological integration practices, as well as the organizational conditions that favor or limit changes in its technological trajectories.

This study highlights that, in small, traditional industrial companies, digital transformation can follow an incremental, externally influenced trajectory. This challenges linear views of digital maturity and broadens understanding of how technological paradigms, organizational reliance, and change capacity are interconnected.

Theoretical Elements of Research

Technological Paradigms

Technological paradigms are concepts that gained prominence in 1982 with the publication by economist Giovanni Dosi: "Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change," which uses elements to explain the main forces driving technological progress and their complex interactions.

According to Dosi (1982), a technological paradigm is a pattern of solutions to specific technological problems, based on principles derived from the natural sciences and material technologies. Therefore, a technological paradigm develops from the need to solve a problem and follows a pattern of solutions. The definition of a technological trajectory is the "normal" activity of solving problems guided by a paradigm, which can be represented by multidimensional "trade-off" movements between the technological variables that the paradigm identifies as relevant; that is, these are the actions taken to address the technological problem (Dosi, 1982).

This led to many studies and debates on technological paradigms and paths. At first, Pavitt (1984) used the idea of technological trajectories to examine sector-specific patterns of innovation and identified four main innovation types, each with a unique technological path: supplier-dominated, scale-intensive, specialized suppliers, and science-based industries.

Russell (1995) contributed to the idea of technological paradigms, noting that the concept itself needs updates to include broader cultural and political factors. He explained that progress along a technological path is indicated by ongoing changes, while breaks are associated with the rise of a new paradigm.

Cimoli and Dosi (1995) discussed paradigms, which entail specific discoveries and visions for "how to do things" and how to improve them. These are often shared by the community of practitioners in each activity and generally define basic models of artifacts and systems that are gradually modified and improved over time.

Sicsú and Rosenthal (2006) describe technological paradigms as focusing on known solutions and on the effort to improve the core knowledge underlying those solutions. Technological trajectories can be understood as the development of various technologies, integrated into products and/or processes, resulting from the effective or potential applications of this paradigm to address problems in the production system.

Similarly, Neto and Shima (2008) argue that technological paradigms have a structure and organization that define the limits of the technological trajectory and the range of possible directions it can take, which are shaped by the nature of the paradigm. Therefore, it is clear that the paradigm is the agent that determines the course of the technological trajectory.

According to Castellacci (2008), technological paradigms refer not only to a series of stagnant techno-economic structural characteristics but also to the system's dynamic behavior, the

investigation of a technology, and the continuity of its economic potential along the directions known as technological trajectories. Several factors influence technological paradigms; these can be either facilitating or restrictive, and may be exogenous (such as government policy) or endogenous (region-specific). Local conditions play a key role in the development of new technological paradigms (Gilbert & Campbell, 2015).

Dosi and Nelson (2016) also state that a paradigm includes a viewpoint, a description of the main problems to be analyzed, and the study patterns to address them, implying consideration of users' potential needs and the characteristics of relevant products or services. Moreover, it incorporates the scientific and technical principles necessary to carry out this work, as well as the specific technologies used. Similarly, the dominant design concept is an important element of paradigmatic knowledge, characterized by the arrangement of particular artifacts or processes that are operational at any given time; that is, at this stage, technological diversity shifts toward standardization.

Additionally, Rogers (1983) ties the diffusion of innovation to a model that describes how an innovation is communicated through specific channels over time among members of a social system. This development process of an innovation includes all decisions, activities, and their effects that occur from recognizing a need or problem through research, development, and commercialization, and afterward through diffusion and adoption by users, leading to its consequences. These six phases do not necessarily follow a strict order; that is, the sequence may vary, or some steps might not occur at all. Furthermore, the innovation process in organizations can be divided into initiation, which involves gathering information, concepts, and plans to implement an innovation, and implementation, which encompasses all events, actions, and decisions involved in using the innovation.

Since paradigms and technological trajectories are recognized as important frameworks for understanding evolutionary processes, a paradigm shift is observed occurring in this process. This shift occurs when a new technological paradigm emerges that outperforms the previous one, transforming the entire structure and organization of the technological domain and creating a new knowledge framework for solving problems within technological trajectories (Suenaga, 2019; Mun et al., 2019). Therefore, it is evident that the emergence of a new paradigm is linked to the innovation process. Digital transformation is one of these processes and its paradigm, and its impact has been observed in innovation processes (Hussain, 2021).

The rise of digital paradigms and the spread of computing have marked a new era of information exchange across economies and societies. Massive amounts of data, processed by intelligent algorithms that offer extensive connectivity and computing power, combined with traditional methods and contextual details, can provide unprecedented opportunities to discover, understand, predict, optimize, and innovate in areas that were previously difficult to access (Castro et al., 2021).

Digital transformation should not be seen merely as a process of implementing technology, but as a new cultural and social paradigm that strategically influences organizations, both at the organizational level and in how they operate and manage (behaviors, routines, and customs), as well as on a personal level (Trijueque, 2022). New paradigms driven by technological innovation are fueling digital transformation in organizations (Garcia, 2023), emphasizing the strong link between technological paradigms and digital transformation.

Digital Transformation

Digital transformation is the process by which companies adapt to environmental changes and utilize digital technologies to create value. Therefore, it is clear that digital technologies are essential to the transformation process that companies undergo to generate value (Vial, 2019).

In addition to digital technologies, two other factors have propelled digital transformation: the rise of the World Wide Web and its global adoption, along with shifts in consumer behavior driven by the digital revolution. However, digital technologies are undoubtedly the most prominent factor in this process (Verhoef et al., 2021). The development of digital technologies requires making digital transformation a strategic priority, helping companies stay competitive during tough times and encouraging managers to accelerate it for long-term growth (Niu et al., 2023).

In this way, digital transformation can greatly enhance companies' performance, encourage business innovation, lower costs, boost revenues, and improve efficiency. These are the primary ways digital transformation supports business growth, with business innovation having the most significant influence (Peng & Tao, 2022). In fact, it is clear that digital transformation positively affects corporate innovation, potentially helping to ease companies' financial limitations and strengthen corporate governance. This effect removes barriers to business innovation and is especially strong in high-tech and highly competitive industries (Niu et al., 2023).

However, business innovation often incurs high costs, and to reduce these costs for companies, digital transformation utilizes digital technologies to enhance the allocation of business and idle factors, improve companies' ability to analyze user needs in real time, and boost their capacity to collect and organize information, thereby increasing response speed (Peng & Tao, 2022).

The challenges of adapting to a digital world impact countries, cities, industries, companies, and people, sparking academic interest in recent years in research on digital transformation, whose main goal is to address challenges related to efficiency and effectiveness (Kraus et al., 2021).

Furthermore, digital transformation has become a necessary response to meet the demands and expectations of the growing global population and is no longer just a technological opportunity. This shift from the physical world to a digital world has prompted organizations to implement meaningful changes, such as introducing new processes and mechanisms within key business structures, along with developing and executing digital transformation strategies, as companies struggle to operate and compete effectively in the new digital environment (Kraus et al., 2021).

According to Verhoef et al. (2021), the digital transformation process happens in three distinct stages: digitization, digitalization, and digital transformation. While the first two stages are seen as incremental and essential for progressing to the next, the third stage achieves a higher level of maturity and knowledge dissemination.

Digitization, the first phase, is the process of converting analog information into digital data and is closely related to the digitization of internal and external documentation. However, it does not alter value-creation activities, such as the use of digital forms and surveys (Verhoef et al., 2021). It can also be viewed as the automation of processes through information technologies (Kraus et al., 2021).

Digitalization, the second phase, involves improving processes to enhance customer experiences. Companies apply digital technologies and improve business processes to facilitate coordination of activities and create additional value for customers by developing user experiences (Pagani & Pardo, 2017). This includes creating online or mobile communication channels that allow customers to connect with companies, thereby changing traditional interactions between businesses and customers (Verhoef et al., 2021). In this context, digitalization requires new forms of communication and collaboration in the workplace and can be understood as the use of digital

technologies and data to generate results, improve operations, and replace or modify business processes (Kraus et al., 2021).

Finally, the third phase, called digital transformation, represents a complete change within the company and shifts toward new business models that can generate and capture value through a new approach (Verhoef et al., 2021). During this phase, digital technology is fully integrated into the organization, leading to infrastructural changes in how the company is managed and how value is delivered to customers. New business models may also emerge (Kraus et al., 2021). As a result, companies need to be ready for changes or even the replacement of their current processes with new ones, which are often challenging and happen very quickly (Horvath & Szabo, 2019).

Furthermore, the different phases of digital transformation involve important strategic imperatives, which include digital resources, organizational structure, digital growth strategies, and metrics. Digital resources, the first strategic imperative, emphasize that the most essential elements for digital change are digital assets, digital agility, digital network capacity, and big data analytics capabilities. The organizational structure, the second strategic imperative, considers digital change flexibility as fundamental to organizational transformation, alongside agile organizations and digital functional areas. On the other hand, the digital growth strategy, the third strategic imperative, identifies the use of digital platforms as the primary growth approach, since they offer high scalability and reinforce network effects. Finally, the fourth and last strategic imperative involves metrics and goals necessary for companies to measure performance improvements in key indicators, facilitate learning, and adjust their business models, thereby enabling the full potential of digital transformation (Verhoef et al., 2021).

Methodological Elements of the Research

To analyze the digital transformation process in the footwear industry from a technological-paradigm perspective, a case study was conducted (Eisenhardt, 1989). A case study is understood as a "contemporary phenomenon in its real-life context, especially when the boundaries between the phenomenon and the context are unclear, and the researcher has little control over both" (Yin, 2002).

The case was chosen by the researchers based on accessibility and convenience criteria, selecting a small footwear industry located in the Vale do Rio dos Sinos region, in the state of Rio Grande do Sul, Brazil, that has been operating in the footwear manufacturing market for over 25 years.

Data collection involved in-depth interviews, systematic participant observation, and document review, following the data triangulation method proposed by Yin (2002). The interview tool was created based on analytical categories derived from the theoretical review of technological paradigms and digital transformation, summarized in Table 1. This structure guided both the collection and interpretation of results, promoting a stronger connection between the theoretical framework and the empirical analysis.

Four interviews were conducted with two company managers and two production supervisors, all of whom have over twenty years of experience in footwear manufacturing and have worked at the current company for at least five years. The interviews took place in November and December 2023, in person, at designated meeting rooms provided by the company. They were audio-recorded, totaling 4 hours, and transcribed within 1 day of each interview (Table 2).

Along with the interviews, systematic participant observation and document review were conducted, supported by a checklist based on the analysis categories. This approach enabled a

comparison of the interviewees' responses with observed practices and organizational records, thereby enhancing the interpretive consistency of the study.

Table 1 – Categories of analysis

Categories of analysis – Digital Transformation	**Authors (year)**
Digital technologies	Vial (2019); Verhoef et al. (2021) Niu et al. (2023); Peng e Tao (2022); Nadkarni e Prügl (2021); Kraus et al. (2022); Horvath e Szabo (2019); Hess et al., (2016)
Strategic priorities	
Capacity to improve business performance	
Capacity to stimulate business innovation	
Challenges to digital adaptation	
New processes and mechanisms	
Digitization Phase	
Digitalization Phase	
Digital Transformation Phase	
Strategic Imperatives (necessary digital resources, organizational structure, digital growth strategies, and metrics)	
Categories of analysis - Technological Paradigms	**Authors (year)**
Pattern for solving a technological problem/Technological trajectories	Dosi (1982); Russel (1995); Cimoli e Dosi (1995); Sicsú e Rosenthal (2006); Rogers (1983); Neto e Shima (2008); Castellacci (2008); Gilbert e Campbell (2015); Dosi e Nelson (2016); Hussain (2021)
Cultural and political dimensions/Continuous change	
Sharing discoveries and insights/Improving existing solutions/Disseminating innovation/Structure and organization	
Dynamic behavior of the system	
Facilitating and restrictive factors/exogenous or endogenous/Local conditions	
User needs/Features of relevant products/services/Dominant design	
Innovation development process	

Source: Developed by the authors

All collected empirical data, including interview transcripts, field diary entries, and organizational documents, were analyzed using content analysis based on Bardin (2011). The process occurred in three stages. In the pre-analysis, an initial reading of the material and the dataset's organization was conducted. During the exploration stage, thematic coding was used, with predefined categories derived from a theoretical framework, such as digital technologies, strategic priority, phases of digital transformation, technological trajectories, and facilitating or restricting factors, while still allowing for the identification of new and recurring elements in the data. Finally, the coded content was grouped based on similarities and differences across interviews, observations, and documents. This grouping enabled the interpretation not only of the presence of digital practices but also of their tensions, limitations, and asymmetries across different areas of the company.

Table 2 - Profile of respondents

Respondet	**Sex/ Age**	**Years of professional experience**	**Years working at the company**	**Interview duration**
E1	Man/ 52 years old	30 years	26 years	1 hour and 20 minutes

E2	Woman/ 39 years old	18 years	15 years	1 hour and 15 minutes
E3	Man/ 50 years old	29 years	10 years	45 minutes
E4	Man/ 35 years old	19 years	5 years	40 minutes

Source: Developed by the authors

Results and Discussion

The footwear industry involved in the research, based in the Vale do Rio dos Sinos region in Rio Grande do Sul, Brazil, participates in footwear manufacturing and has been operating in the market for over 25 years.

It is a footwear manufacturing service provider with contracts with three major footwear companies, its main clients, producing an average of 1 million pairs annually and generating an average annual revenue of 3 million reais. Currently, it employs 60 people and works with 20 suppliers of inputs and materials used in production. The company is located in a footwear hub, a strategic location for attracting new clients.

Background of Digital Transformation

This section presents the results in line with the categories in Table 1, aiming to go beyond mere confirmation of the existing literature. It focuses on how digital transformation exhibits specific features in a small, traditional industrial firm characterized by low strategic autonomy, heavy reliance on contracting clients, and differences between the administrative and production sectors.

According to all interviewees, technology is important to the company. They stated that the technologies used include computers, online software, email, messaging apps (such as WhatsApp), barcode readers, and cloud data storage. These were introduced over the years based on the company's evolving needs. Observations showed that these technologies are mainly concentrated in the administrative sector. In contrast, the production sector still relies heavily on analog processes, with minimal use of digital technologies.

Therefore, it is clear that the company is responding to environmental changes and adopting digital technologies, which are the main factors in the digital transformation process (Vial, 2019; Verhoef et al., 2021). In this sense, digital transformation is

an essential strategy for driving organizational change. It is worth noting that this transformation is not limited to technological changes but also involves cultural and strategic aspects (Mahraz et al., 2019).

According to interviewees E1 and E2, there is no strategic priority regarding the use of digital technologies because the company heavily depends on what its clients request for services. As a result, its strategic focus is shaped by these client demands. However, since the company recognizes that some technologies can improve processes, it seeks ways to implement them.

Given this, the observation showed that the contracting companies control the contracted company through daily supervisors who check processes and product quality. Additionally, the

reports from these supervisors are verified, and the requested requirements relate to the quality of the products produced.

Therefore, the company's strategic focus is not on advancing digital technologies but on meeting the operational and production demands set by the contractors. This suggests that, in this type of small company, digital transformation tends to be more reactionary than intentionally strategic, which challenges the idea, present in the literature, that digitization always originates from an internal organizational renewal agenda (Niu et al., 2023).

Regarding how digital technologies can contribute to business improvement and performance, interviewees E1 and E2 believe the company can become more agile in its processes. Conversely, E3 and E4 do not understand how technology can enhance business performance in production processes. Thus, it appears that managers see improvements in business performance because they are closer to the administrative sector, which adopts more technologies, while supervisors do not perceive these improvements because they are closer to the production sector, which uses fewer technologies.

Based on the company's financial statements for the last two years, the financial performance was satisfactory. According to interviewee E1, this was due to managers regularly monitoring reports stored in the cloud, which allows for monitoring at any time and ongoing control. Therefore, it can be understood that, even with limited use of digital technologies in some specific sectors, the company has already demonstrated better business performance and efficiency in its results and processes. As Peng and Tao (2022) acknowledge, this is a consequence of digital transformation in organizations.

It follows, therefore, that adopting digital technologies does not automatically lead to a broader transformation. In the case studied, the perceived benefits are mainly in control, agility, and administrative monitoring, with little effect on the core of production. There is, therefore, a significant internal imbalance: digitalization enhances coordination routines but has not yet substantially altered the logic of production.

Although respondents generally recognize that digital technologies can promote business innovation, the case shows that this potential remains limited when the production base is mainly manual and technological integration happens only intermittently. This contrasts with broader approaches in the literature and indicates that, in traditional sectors, the link between digital transformation and innovation depends on the nature of the production process and the extent of technology integration.

In agreement, respondents E1 and E2 stated that there were difficulties in implementing digital technologies. In the administrative area, these difficulties were less severe, as most people already had basic knowledge of the main technologies. However, E3 and E4 argue that the challenges are greater in the manufacturing process because the level of knowledge is lower. Therefore, the digital adaptation process in the production sector is slower, while it is quicker in the administrative sector. The employee registration forms support this difference: all members of the administrative area have completed high school, whereas in the production sector 75% have not. More than just an operational hurdle, this data indicates that workforce qualification is a tangible factor in the company's digital progress.

Accordingly, respondents E1 and E2 stated that new processes and mechanisms were adopted using digital technologies. For instance, many administrative tasks started to be handled online, which eventually facilitated a shift to remote work. Additionally, many decisions and meetings are now made online via video calls, and communication with suppliers and clients has shifted to messaging apps, resulting in faster resolution of specific problems.

From this perspective, it was observed that managers frequently communicate with suppliers and customers online, and many specific questions and problems are resolved instantly. Similarly, documents and reports are often sent via messaging applications, which, according to interviewee E4, makes processes less bureaucratic. Therefore, the introduction of new processes and mechanisms within the company's main structures capable of developing digital transformation strategies is understandable, according to Kraus et al. (2021).

Stages and Consequences of Digital Transformation

According to interviewees E1 and E2, much of the company's administrative and financial information that was previously stored only in physical form is now stored digitally. Similarly, reports that were once prepared manually are now generated and analyzed digitally. Additionally, through document review, it was found that many documents no longer exist in physical form and that access to them requires a request to the administrative department for digital retrieval.

In agreement, interviewees E3 and E4 highlight the use of software that enabled online product control, replacing the previously used manual method. Therefore, through observation, it can be seen that this software marks a significant change in product control, as product readings are now performed directly in the production sector via barcodes, allowing everyone, including the contracting company, to access online product control. Consequently, we found that the company has already started the digital transformation process, currently in the digitization phase of its operations, converting analog information to digital and digitizing internal and external documentation (Verhoef et al., 2021).

As observed in the interviews, all respondents believe that because the footwear manufacturing process is mostly manual, digital technologies are rarely used in production but are more common in administrative areas, leading to improvements there. Participant observation also showed that the administrative sector uses technology the most and enhances its processes, while the production sector is just beginning to adopt some technologies, with observable improvements already happening. Documentary research uncovered reports generated by product control software that assist managers and supervisors in analyzing which products have been delivered and which are delayed and require attention. Therefore, it appears that the company is in the second phase of digital transformation, the digitalization phase (Verhoef et al., 2021), which involves improvements to business processes (Pagani & Pardo, 2017). This phase requires new communication and collaboration methods at work and involves using digital technologies and data to achieve results, improve the business, and replace or modify business processes (Kraus et al., 2021).

All interviewees perceive that there is currently no integration of digital technologies; rather, only some are used individually. In this sense, interviewee E1 states that the company needs to evolve significantly in relation to digital technologies, both in implementation and, subsequently, in integration. Interviewee E2 believes that the company is not creating value in an innovative way and that the delivery of value in this sector has not shown great evolution. Furthermore, interviewees E3 and E4 add that, for the integration of technologies, qualified professionals and internal training will be necessary.

Thus, participant observation also showed that the company still needs to develop in how it implements and integrates digital technologies, as their use remains limited and scattered. Therefore, it is clear that the company has not yet reached the full stage of digital transformation, as there has been no comprehensive organizational change or reconfiguration of the value-creation and capture

model (Verhoef et al., 2021). Analytically, this indicates that shifting from digitalization to digital transformation depends not only on adopting tools but also on strategic alignment and integration into core operations. This aligns with Vial (2019), who states that digital transformation requires combined changes in resources, structures, routines, and value logic, and agrees with Warner and Wäger (2019), who argue that digital renewal in traditional industries relies on building dynamic capabilities rather than simply adopting technologies. In the case studied, adoption remains localized and functional, with no evidence of broader strategic reconfiguration, which contrasts this finding with more straightforward views of digitalization as a naturally evolutionary process.

When considering the strategic imperatives that influence the outcomes of digital transformation, according to interviewees E3 and E4, the company has historically been seen as relatively inflexible in responding to digital changes, with no significant modifications over time. Additionally, interviewees E1 and E2 note that this is due to the lack of major changes in the footwear manufacturing process, which has remained consistent over the years.

Based on this, participatory data collection showed that the company lacks an organizational structure that promotes the use of digital technologies and establishes strategies and metrics for digital growth. Additionally, the financial reports, through documentary research, confirm this: only financial performance metrics were verified, with none related to the company's digital growth.

Therefore, it is clear that the company is focused solely on its digital transformation strategy. Beyond the simple absence of metrics or formal structure, the case highlights a gap in digital governance: there is use of technologies, but no clear guidance to align resources, skills, indicators, and priorities for digital growth. In small industrial companies, this gap helps explain why localized technological improvements often do not lead to a broader organizational transformation.

Technological Paradigms and their Impact on Digital Transformation

Regarding the standard for solving a technological problem, for interviewee E1, the company does not appear technological, as it is an industry that still relies on manual labor in its manufacturing, and the machines used have remained the same for many years, without evolution. In other words, these are traditional industries with limitations in technological progress. Technological progress is the advancement of a given product or service, and at each stage, it is influenced by economic viability and constrained by the technological paradigm, the frontier of current knowledge. Progress along a technological course is associated with desirable technical and economic improvements in a product, equipment, or tool (Freire & Baldi, 2014). In this sense, contrary to Freire and Baldi (2014), it is understood that market forces influence the conditions for technological adoption.

Thus, interviewees E2, E3, and E4 state that technological problems do not happen often because technology use is still very limited. Likewise, participant observation also confirmed the low use of technology in the manufacturing process and the high reliance on machinery and manual labor. Accordingly, it was verified through machine and equipment reports and documentary research that the company has acquired many machines since its founding and that there is no frequent replacement of machinery and equipment.

It is understood that the company rarely encounters paradigm shifts. The emergence of new technological paradigms happens sporadically, usually when the market or external forces call for a specific use of technology. This supports the idea that, in the studied context, technological paths are less driven by independent technological exploration and more influenced by relational and economic pressures from the immediate business network. Therefore, there is significant tension between the

idea of a paradigm as an internal driver of solutions and the external dependence that characterizes the small company analyzed.

Regarding the cultural and political dimensions, which reflect ongoing change, interviewee E1 states that the company has experienced technological advancements over time in the administrative area. Interviewee E2 emphasizes that the most significant change was computer equipment, including upgrades to computers and printers, and the installation of software.

Interviewee E3 states that the culture of change is not very significant, but when something arises that could benefit the company, the technology is analyzed for implementation. Finally, interviewee E4 highlights that there are no internal policies related to the change process, but that, in general, changes that need to be made are evaluated infrequently according to the company's needs. Therefore, from the combination of documentary elements and participant observation, it is clear that continuous change is not a factor in the organization, as its focus is on the continuity of business operations rather than the discontinuities associated with the emergence of new paradigms (Russell, 1995).

In sharing discoveries and improvements in solutions, as stated by E1, guidance on how to perform or enhance activities occurs between employees and supervisors, usually at the production site, through informal conversations and meetings. Interviewee E3 confirms that this is indeed how information is shared and adds that everyone can easily understand it. Interviewees E2 and E4, on the other hand, emphasize that there is no formal model or structure for information sharing, but they always strive to quickly pass along innovations that can improve a company's processes.

In light of this, it was observed through participant observation that managers and supervisors share information with other employees at the production site, as well as engage in informal conversations about the production environment. This indicates that sharing does occur, but mainly in a tacit, unstructured manner. This trait is ambivalent: on one hand, it promotes agility; on the other hand, it hampers the development of more systematic routines for organizational learning and the spread of technological changes.

Additionally, in the context of digital transformation, it becomes clear that digital technologies rely on skilled employees and leaders to realize their full potential; that is, digital transformation requires both technology and people to come together (Nadkarni & Prügl, 2021). Leaders who guide digital transformation in organizations select the right technologies at the appropriate times, build competent teams, and enjoy the benefits of digitization, such as automated processes, lower costs, a better understanding of customer behavior, and consequently, an easier delivery of an improved experience, leading to increased sales and profits (Harvard Business Review Analytic Services, 2017).

Regarding the behavioral dynamics of innovation, it was observed in interviews with interviewees E1 and E2 that when some type of innovation needs to be implemented in the company, everyone tries to adapt as quickly as possible. However, interviewees E3 and E4 emphasize that innovations are not related to the implementation of technology, but to how something is done in the manufacturing process — in other words, the pursuit of expertise in the processes.

In this sense, it was also observed that these innovative behaviors are mostly driven by contracting companies' demands, such as using a different chemical product or changing how a specific material is attached. Therefore, the company demonstrates adaptive skill in its manual processes but not necessarily a proactive approach to technological change. This finding is important because it demonstrates that operational adaptation and digital transformation are distinct.

The technological paradigm influences a series of technical and economic decisions made by organizations, which vary across sectors and adopted strategies (Dosi & Nelson, 2016). These decisions, seen as the direction of technological development, are known as technological trajectories (Dosi, 1982). A technological trajectory is the path taken, represented by technological changes that can be incremental or radical. Technological change involves integrating new technologies into an organization's production capacity.

In this context, the factors that enable or hinder technological change are significant. Similarly, all interviewees agree that they do not receive any assistance from government policies that influence the company in resolving technological issues. Instead, they typically address internal problems with the support of partners, customers, and suppliers— their closest network of contacts.

Thus, it can be observed that the company is open to receiving support from its network of contacts, which has a positive influence by facilitating adjustments and solutions. However, the dominance of this relational dependence also indicates a low level of internal institutionalization of its own technological prospecting mechanisms. In other words, external facilitators assist in solving immediate problems but do not replace a more structured strategic approach for paradigmatic change. This is important because studies in process industries show that technological adoption tends to have more consistent effects when combined with innovation in products and services and internal mechanisms for exploring and leveraging knowledge (Blichfeldt & Faullant, 2021), something still in the early stages in the case analyzed.

Regarding user needs, for E1 and E2, the criteria for adopting technological solutions focus on the investment value and expected return. E3 and E4, in turn, state that the criteria are unclear, although they appear to address the most immediate urgencies. Observations showed that the needs of contracting clients are the most evident criterion. Therefore, the company's technological approach seems less driven by its own future vision and more by the need to respond quickly to the demands of the service it provides.

Finally, highlighting the perspective of the innovation process in the small-scale industrial environment, as observed by all interviewees and identified through participant observation, the company does not have any mapping of the innovation development process. Therefore, it is understood that this is a gap that can be explored by the company through the implementation of the phases of the innovation development process, starting with the recognition of a need or problem, then moving through the research, development, and commercialization of an innovation, and afterward, the diffusion and adoption of the innovation by users until its consequences (Rogers, 1983).

According to interviewee E1, the steps that precede implementing a technological innovation in the company include analyzing the resources and labor required. For interviewee E2, how the innovation will be implemented is one of the most critical actions. Meanwhile, interviewees E3 and E4 highlight that, generally, any innovation and implementation process is carried out by a specialist in the area who is present and directs the entire process.

However, at the time of observation, the company was not engaged in any innovation process to determine what actions it was taking. Therefore, it is understood that the company is going through the innovation process, which, according to Rogers (1983), is divided into initiation, consisting of gathering all the information, concepts, and plans to implement an innovation, and implementation, which includes all the events, actions, and decisions related to the use of the innovation.

Thus, it is clear that, in the studied case, digital transformation cannot be defined simply by the adoption of tools. It involves changes in culture, processes, skills, and organizational coordination; however, these changes still happen gradually and unevenly. Instead of a total, paradigm-shifting

break, what is seen is an incremental, selective process shaped by structural constraints and external demands.

Final considerations

Digital transformation is considered a strategic focus for industrial organizations. However, there is still limited empirical research on how this process unfolds in small businesses within traditional sectors. Therefore, this study examined the digital transformation process in a small footwear company from the perspective of technological paradigms.

Through a qualitative case study, it was concluded that the company has already begun its digital transformation but remains mostly in the digitization and digitalization stages, with limited technological integration in manufacturing. From a technological paradigms perspective, it was found that change occurs sporadically rather than continuously, as the organization still prioritizes analog routines and largely responds to external demands rather than its own technological renewal strategy.

From a theoretical perspective, the study shows that the relationship between digital transformation and technological paradigms in small industrial firms is characterized by internal asymmetries, customer dependence, and limitations in training and governance. This indicates that digitalization can progress without necessarily leading to a major paradigm shift or significant innovation in the core production process.

In practical terms, the results highlight the need to better prioritize digital technologies, build internal skills, establish digital growth metrics, and create more structured learning and innovation systems. These elements can help close the gap between isolated technology adoptions and a more consistent organizational transformation.

A limitation of the study is that it focuses on a single case. Therefore, future research could expand the comparison to include other footwear industries and companies of different sectors and sizes, using comparative designs and quantitative methods, to verify whether the incremental and reactive dynamics observed in this study are present in other contexts.

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