Unraveling the Digital Transformation Paths of Industrial Districts: The Role of Relational Learning in the Management of Contrasting Imprints

Unraveling the Digital Transformation Paths of Industrial Districts:
The Role of Relational Learning in the Management of Contrasting Imprints

Abstract

Purpose: *Understa nding digital transformation of SMEs belonging to industrial district is fundamental. Yet, there are disagreeing views regarding how these firms select specific technological trajectories over other available ones. Building on Imprinting Theory, the research explores how Relational Learning is a key capability to balance diverse contrasting imprints affecting digital transformation trajectories.*

Design/Methodology/Approach: *6 purposefully selected case study concerning SMEs operating within the Prato Textile District were considered. Data were collected through 24 interviews with 18 key informants. A Grounded Theory based inductive approach was selected to interpret the encoded data and draw managerial implications.*

Findings*: Relational Learning capability allows SMEs to manage imprints, such as the ones coming from MNEs and the ones from the environment. This organizational capability allows managers to prioritize the right imprint during a susceptibility period. SMEs embedded of Relational Learning are more prone to digitally transform by embracing disruptive innovations and are also more disposed to become imprinters.*

Originality/Value: *Literature about Digital Transformation in Industrial Districts lacks a holistic investigation observing how technologies diffuse in these contexts. Specifically, why a firm selects a specific digital transformation path need to be underpinned.*

Keywords: Digital Transformation; Industrial Districts; SMEs; Imprinting; Relational Learning.

1. Introduction

In response to the challenges posed by globalization and environmental expectations, firms must undergo transformative shifts in their operations and value-generation approaches to pursue competitiveness and meet customer demands (Ponzoa *et al*., 2023). This scenario prompted firms to undertake the digital transformation process, characterized by the disruptive and deliberate integration of digital technologies into their revenue generation activities (Garzoni *et al*., 2020). Digital transformation encompasses the adoption and deployment of cutting-edge digital tools and technologies, including but not limited to artificial intelligence, data analytics, cloud computing, the Internet of Things (IoT), and automation (Marrucci *et al.*, 2023). Whether strategically applied, these radical transformations enable firms to improve their effectiveness, agility, and responsiveness to market dynamics (Feliciano-Cestero *et al.*, 2023). New technological paradigms also facilitate collaboration between businesses and stakeholders, which helps in designing emerging strategies for value creation.

According to several research, large companies have mostly commenced digital transformation processes, SMEs instead often encounter resource constraints, both in terms of financial capital and digital readiness (Rialti *et al.*, 2019; Marrucci *et al.*, 2023). These barriers are more profound in firms that belong to industrial districts (IDs) as the social structure of these agglomeration mainly facilitates incremental technological changes (Hervás-Oliver, 2021). Compared to other businesses, IDs' firms maintain deep-rooted connections to the regions they operate in, and are significantly reliant on the values, traditions, and culture of the area (Pagano *et al*., 2021). Failure to effectively manage this profound attachment can result in greater resistance to change. Therefore, local roots and social ties qualify as potential barriers to the introduction of radical technologies, typically promoting uniformity (Giuliani, 2007). Relevant research also observed how digitization processes are oriented towards the integration of pre-existing knowledge, aiming at the preservation of established network dynamics without causing disruptions in the delicate balance between firms (Hervas-Oliver *et al*., 2018). In spite of these challenges, IDs persist as a vital drivers within regions and serve as a

manifestation of manufacturing excellence. Therefore, it becomes imperative to harmonize cultural traditions with the need for digitalization.

Seminal studies explored the promotion of radical technological paradigms (e.g., Industry 4.0) within industrial settings (Bellandi *et al*., 2019). These studies have shown that the introduction of new businesses is a key factor in breaking the inertia of districts and facilitating substantial transformations (Hervás-Oliver *et al*., 2018). Other contributions have highlighted the significance of collective actions in advancing digital processes (Hervás-Oliver, 2021). When it comes to organizational capabilities, multiple studies elucidated how firms must cultivate absorptive capacity, which involves recognizing and integrating the value of new information to drive radical transformation processes (Giuliani, 2007; Molina Morales *et al*., 2021). While substantial efforts have been directed to the analysis of digital transformation within IDs, existing contributions still provide a partial view of how this process unfolds. Given the importance that IDs hold for the economic and social growth of an area, it is necessary to understand the processes of digital transformation starting from their distinctive characteristics. As IDs are characterized by high levels of collaboration which encompass relationships with multinational customers (MNEs), manufacturing firms, and partner suppliers (Carbonara *et al*., 2002), we decided to delve into the advantages that digital transformation could bring to the relationships of district-based firms (Büyüközkan and Göçer, 2018). Hence it is critical to investigate the influence and power of MNEs in affecting technologies adoption strategies, along with the role played by local traditions and culture (Humphrey and Schmitz, 2002). Using imprinting theory (Simsek *et al*., 2015), we aim to test how MNEs could shape in a multilevel fashion the digital transformation trajectories SMEs from IDs. By delving into multilevel imprinting, we intend to uncover the role of various actors and environment in fostering digital transformation as a collective and social process, rather than an individual endeavor.

In this vein, both social dynamics and internal ones have been explored through the notion of relational learning (Leal-Rodriguez *et al.*, 2014). This construct overcome the traditional individual business perspective of absorptive capacity by postulating that firms' possibility to interpret and integrate external knowledge is achieved thanks to information sharing, joint sense-making and knowledge integration (Albort-Morant *et al*., 2018). While absorptive capacity is critical to driving digital transformation, firms operating in relational contexts as IDs, should cultivate relational learning capability which combines firm's aptitude for integrating and disseminating knowledge with the pursuit of shared growth.

Our hypothesis assumes relational learning serving as a pivot to enable SMEs to select and integrate those imprints from MNEs and the environment capable of producing joint district-wide technological change. Thus, the guiding research question is:

RQ: Is relational learning the key to manage imprints influencing the digital transformation of firms belonging to industrial districts?

To address the proposed research question, the cases of 6 purposefully selected SMEs from Prato Textile District have been analyzed (Eisenhardt and Graebner, 2007). In total, 24 interviews with 18 board members or managers from these businesses have been conducted. The selection of the aforementioned approach allowed to inductively unpack the ways relational learning allows the management of diverse imprints.

The next section will ground imprinting theory within IDs. The third paragraph instead explains the importance of relational learning capabilities in SMEs. The fourth one describes the method and the context of the research. Then, the fifth and the sixth are respectively providing information about the results and implications for theory and practice. The results show that MNEs through their imprints influence the technological transformation processes of district firms.

2. Industrial Districts' SMEs Digital Transformation Amidst Multiple Imprints

2.1. Industrial District and Digital Transformation

IDs are agglomeration of manufacturing firms characterized by specific expertise and robust social networks (Becattini, 1990). Within IDs, individual firms autonomously manage specific stages of production, leading to a geographically diffused division of labor.

IDs have exhibited a propensity for innovation, encouraged by conducive collaborative environments fostering mutual learning and processes improvements. However, contemporary disruptive challenges significantly eroded their ability to generate innovation and value, thus decreasing their competitiveness (Giuliani, 2011; Bellandi *et al*., 2019). For instance, globalization forced district firms to compete and collaborate with suppliers and customers worldwide, leading firms to seek new digital models with which promote these relationships.

Research emphasized how digital transformation is of paramount importance, as new technologies would enable IDs' firms to improve the alignment of activities with market demands while also expanding district boundaries towards digital relational models (Bellandi *et al*., 2019). According to Feliciano-Cestero *et al.* (2023) digital transformation is the key term for expressing the radical organizational changes influenced by emerging technologies. It plays a vital role in empowering ID's firms in the achievement of greater flexibility, efficiency and generate value propositions for innovation ecosystems. Moreover, digital transformation may stimulate innovation to meet market demands promptly and create greater value (IntesaSanPaolo, 2023).

The adoption of traceability systems is leading to reduced transaction costs and increased collaboration (Bellandi *et al*., 2019; Hervas-Oliver, 2021). Similarly, the use of digital technologies has improved network security and facilitate transactions between multiple parties, harmonizing economic activity and developing new models of value creation (Gawer, 2021). Although digital transformation offers numerous benefits across product, process, and network levels, research has paid limited attention to the trajectories pursued by SMEs in IDs when pursuing radical changes (Molina Morales *et al*., 2021). Previous study has mainly emphasized collective learning and proximity within IDs (Giuliani, 2007), arguing that the network structure of districts, characterized by vertically connected and horizontally competing firms, allows firms to learn through user-producer relationships and informal exchange of know-how with competitors. According to Molina Morales (2002) the existence of many firms operating in the same productive activity leads to significant overlap of products and technologies. These existing similarities condition how knowledge is diffused and innovation is adopted, resulting in incremental rather than radical changes. Indeed, firms from IDs often operate in mature industry where technological opportunities are limited as they are tied to the reshuffling of existing knowledge (Gerke and Dalla Pria, 2022; Hervas-Oliver *et al*., 2018).

More recent studies have highlighted the role of leading firms (or gatekeepers) in technological change processes by clarifying how they could direct other firms toward digital transformation and growth opportunities (Giuliani, 2011). Gatekeepers possess an advantage in knowledge acquisition due to their direct relationships with multinationals and also serve as knowledge disseminators within the ID (De Marchi and Grandinetti, 2014). However, while being critical actors, gatekeepers may voluntary choose incremental rather than radical changes to maintain their centrality and power within the network (Hervas-Oliver, 2021). Despite the wide-ranging debate on IDs and digital transformation, the literature still observes some gaps, including the role played by MNEs in promoting radical transformation processes among district firms. In fact, district firms strongly collaborate with multinational customers who participate in the supply chain and could promote the digitization of certain processes. MNEs engaged in collaborations with local firms could bring novel knowledge later assimilated by gatekeepers (Belso-Martìnez *et al*., 2018). Hence, external larger firms may act as imprinters, exerting influence and shaping the attributes to be incorporated and integrated into the district firm, influencing its digital transformation.

2.2. Imprinting Theory

In a seminal attempt to reply why some organizations originating in the same era look similar even after decades, Stinchcombe (1965) conceptualized the notion of "organizational imprinting". Organizational imprinting may be explained as a phenomenon arising in "a brief sensitive period of transition during which the focal entity exhibits high susceptibility", thus coming "to adopt elements of its environment" that persist "despite environmental changes" (Simsek *et al.* 2015, p. 290). Yin *et al.* (2014) coherently postulated that organizational culture and structure are the result of an imprinting process occurring during an *imprintability window*. The persistence of specific imprints in the life of an organization may be interpreted in the wake of Institutional Theory (Di Maggio and Powell, 1983) according to which firms originating in the same moment are frequently facing similar contingencies, such as resource shortage or pressures to conform to the specific industrial contexts (Lyle *et al*., 2022). Moreover, founders born in the same period often shares the same cultural background, thus coming to similar structural solutions and behavioral norms implementation within the organization (Hatch, 1993).

Organizational imprinting is articulated as a three-levels phenomenon (Simsek *et al*., 2015). The first one is represented by the *genesis*. In this phase, an entity -the *imprinter*- provides through knowledge diffusion mechanisms a set of values, norms and practices in the form of *imprints* to a receiving organization -the *imprinted*- (McEvily *et al.*, 2012). Then *metamorphosis* comes. During this step the dynamics underlying the integration of imprinting occurs, as the imprinted starts to institutionalize the practices typical of the imprinter (Marquis, 2003). Finally, in the *manifestation* phase the impact and the effect of the imprinting process arouse and start to generate consequence on the imprinted (Ferriani *et al*., 2020). Imprinting is thus a process happening due to knowledge exchange between the two protagonists. It differs from both *cohort effect* and *path dependency*: the first is the outcome of a same innovative response by similar firms experiencing same technological constrains and identifying a common way out; while the second derives from the sheer amplification of the diffusion of an innovation through positive reinforcing feedback due to emerging accumulating advantage (Marquis and Tilcsik, 2013).

Literature identified several possible imprints' sources (Erdogan *et al*., 2020). Imprinting process may stem from individuals (i.e., the founder), the composition of a team, the environment, or other businesses. Founder's and network imprinting are the two most diffused ones in managerial research. Family business literature has considered founders' imprinting as one of the most relevant factors influencing the core values of the business and its business model's blueprints (Marquis and Tilcsik, 2013). Network imprinting influences the ways relationships are managed, structured, and how they evolve over time. Yet even the other typologies are receiving growing attention by scholars. As an example, it was observed how teams develop a transactive memory rooted on previous functioning mechanisms that persist even after the leaders change (Popli *et al*., 2021). Environmental imprinting studies provides that cultural norms and diffused production methods within a certain context may influence the ways a business will act in the future (Simsek *et al.*, 2015). Finally, organization to organization imprinting has been observed to shape how firms in lower hierarchical positions tend to adopt precepts from their larger counterparts (Liou *et al*., 2021). In particular, imprinting processes have been deemed capable to transmit practices from different contexts to an SME purchased by a MNE (Oertel, 2018). Organization to organization imprinting also influences how new startups gemming from an existing business organize in initial phases (Ferriani *et al.*, 2020).

Imprinting *per se* is neither good nor bad. Conflicting evidence exist about the effects of imprinting on digital transformation and survival of a firms. While it is true that imprints may shape managerial decision-making processes in a negative fashion (i.e., through the diffusion of risk adverse orientation) or the establishment of unconstructive practices (Kidwell *et al*., 2018), it is also true that imprinting from positive example may originate new development trajectories (Popli *et al*., 2021). The socialization process is in fact fundamental also to learn from the best players in the industry, thus stimulating new innovation paths deserving to be considered. This notwithstanding, founding the analysis of the survival of a firm on a single imprint is an oversimplistic view. Some imprints may

become obsolete after some times, and other ones coming from new imprinters may need to be added during the life of a business.

2.2.1. SMEs and the Management of Multiple Imprints

Any business may face multiple moments of high susceptibility in relation to turbulences affecting the market. These disruptive moments are associated with the opening of *imprintability windows*, during which information and knowledge from an imprinter may permeate organizational borders (Simsek *et al*., 2015). This occurrence exposes the business to new and sometimes contrasting-imprints generating a tension between the past of the firm and its future (Maksimov *et al*., 2017), with managers seeking to strike a balance between maintaining traditions and the quest for innovation (Suddaby and Jaskiewicz, 2020).

Building on the imprinting theory perspective, in IDs the tradition can be associated with environmental imprints, while the need to innovate with MNEs' one. Environmental imprinting is in fact the expression of the culture and traditions in which the firm was established. Static environments such as the ones characterizing mature IDs can push SMEs to inertia and unwillingness to innovate due to competitors' low technological level or low competition intensity (Hervás-Oliver, 2021). MNEs are instead an agent of change in IDs. These businesses usually are structured, departmentalized, large in size, and operates in global market. For these reasons, they are receptors and promoters of innovation in their supply chains across boundaries. On the one hand, MNEs perceive market weak signals, regulatory changes, and technological evolution across the world through their R&D departments. On the other one, they make their partners aware of these mutable situations through business transactions capable to support knowledge diffusion (Popli *et al*., 2021). When the innovation promoted by MNEs derives from disruptive changes the imprintability windows opens, and the environmental imprints need to be modified.

According to Wies et al. (2013) imprinted firms' leveraging and bundling capabilities are fundamental to accept a new imprint. Leveraging capabilities are fundamental to integrate existing resources with new ones coming from other businesses. Bundling ones instead allow to combine internal strategies with imprinters' new information (Sirmon *et al*., 2007). The integration of MNEs' imprints into SMEs' value chains occur then through these capabilities, which allow to add new knowledge to existing one. This hypothesis is anyway lacking an interpretation of *how* do imprints join the current existing strategies. According to Sinha *et al.* (2020), emerging imprints engraft into imprinted firms' *strategic guideposts*, which are strategic directions postulated in the early stages, via rearranging and scope modifying processes. In particular, managers could rearrange through rhetoric narratives the original guideposts with new information. Then, thanks to scope modifying process, new complementary corporate objective can be pursued.

The outcome of the imprinting process derives also from the intensity of collaboration between the imprinter and imprinted and internal capabilities of receiving organization (Dobrev and Gotsoupolos, 2010). In fact, just the existence of a collaboration between two firms is not a sufficient condition to make imprinting occur. It need to be strong and persistent enough to have information flowing purposefully between the two actors.

3. Relational Learning and Contrasting Imprints Affecting IDs' SMEs

To comprehend how MNEs imprints affect SMEs' digital transformation in districts, it is necessary to go beyond the traditional path of IDs' technology diffusion associated with collective learning and proximity. Camagni and Capello (2002, p. 16) defined collective learning as a "dynamic and cumulative process of knowledge production, arising from interaction mechanisms typical of an area characterized by a strong sense of belonging and relational synergies". It involves informal social relationships within a limited geographical area that strengthen local innovative capacity through synergistic learning processes. In this perspective, creativity and continuous transformations are considered the result of a collective learning process fueled by social phenomena such as imitation

of managerial practices, face-to-face interpersonal contacts, and formal or informal cooperation between proxime companies (Becattini, 1990).
However, the existing studies on this topic have not provided a consistent definition of collective learning, nor have they adequately explored the components that make up this construct. It seems that collective learning is a process resulting from inherent mechanisms, interactions and proximity within districts, without a real structure. Based on these considerations, it may be necessary to reconceptualize learning across IDs as a capability that firms can develop and nurture to achieve radical change (Davenport, 2005).
In this perspective, the role of relational learning in promoting radical processes was emphasized by research (Leal-Rodriguez *et al*., 2014). Håkansson and Snehota (1995) and Selnes and Sallis (2003, p. 81) defined relational learning as an organizational capability where two firms strive to create more value together than they would individually. Other studies have focused on the dynamics of buyer-supplier relationships (Cheung *et al.*, 2011, p. 1062), defining relational learning as "a joint activity in which two firms share information, which is jointly interpreted and integrated into a specific shared memory of the relationship".
Albort-Morant *et al.* (2018) clarified that relational learning is a multidimensional construct modeled by three reflective first-order constructs: (1) information exchange between a company and one or more stakeholders; (2) joint sense-making; and (3) knowledge integration. Organizations' capability to promote and leverage relational learning mechanisms could lead to the creation of collaborative networks among companies and stakeholders, essential for digital transformation processes (Tunisi and Marchiori, 2020). Following the perspective such a perspective, we assume that through active information exchange with both internal and external actors, IDs' firms can develop deeper knowledge bases, overcoming existing technological shortcomings and sharing the risks and costs of research (Leal-Rodriguez *et al.*, 2014). Another pivotal aspect of relational learning is joint sense-making. Joint sense-making is the process through which various external information, insights, and radical ideas merge into something more significant. Finally, knowledge integration allows all the involved district firms to internalize the newly generate knowledge to pursuit digitization objectives (Albort-Morant *et al*., 2018). Unlike collective learning, relational learning is henceforth characterized by a more structured approach, involving both internal and external dynamics (Tunisi and Marchiori, 2020).
This capability may represent an instrument to integrate imprints from MNEs into a firm's strategic guideposts (Wies *et al*., 2013). To innovate while bridging values and cultural heritage from the past with new insights, district firms need to understand and integrate the meaning of a transformation path: knowledge cannot be used effectively without first understanding its profound significance and its possible integration synergies (Sinha *et al*., 2020). According to these viewpoints, among the dimensions that form relational learning, joint sense-making can be consider the elements making various external information, insights, and radical ideas merge into something more significant (Hinings *et al*., 2018). External knowledge may only lead to district firms' digital transformation if they associate a broader meaning with this information, which may then be transferred to firms at a lower hierarchical level.

4. Method

4.1. Context of Research

The setting for our research is the Prato textile ID, which stands as one of Italy's largest IDs as a hub for the production of woolen yarns and fabrics. Its outcomes encompass textiles for the clothing industry, knitwear, and furnishings, reflecting a highly diversified production system characterized by variations in raw materials, manufacturing processes, and end applications (Bellandi and Santini, 2019).
Unlike other highly dynamic industrial agglomerations, the Prato district is distinguished by its maturity and reliance on a localized production framework. The district's growth trajectory has been

underpinned by an ecosystem of SMEs in a state of continual evolution. The transformation from vertically integrated local woolen mills to specialized local manufacturers focusing on specific stages of the production process has been instrumental in driving the district's expansion. This growth has been fueled by strategic product differentiation efforts.
During the early 2000s, heightened competition in yarn and fabric markets emerged, driven by low-cost Asian manufacturers and international value chains. This shift was primarily attributed to reduced trade barriers and technological advancements in transportation and management systems (Becattini *et al.*, 2009).
Nowadays, in response to the challenges posed by emerging technologies and digital paradigms, Prato ID -akin to many mature IDs- has adapted by aligning existing knowledge with the stringent demands of MNEs. However, relying solely on incremental innovations for innovative district development carries inherent risks. Various studies have identified the potential of radical technologies associated with the Industry 4.0 paradigm (I4.0) to facilitate more transparent and efficient collaboration among companies, enhance supply chain traceability, and afford greater production flexibility (Bellandi *et al*., 2019). In this context, research has explored the role of gatekeepers within the Prato textile district in serving as intermediaries and connectors between MNEs and local district firms, thereby fostering current growth. Still, the Prato ID exhibits certain deficiencies and has somewhat lagged in its digitalization efforts. It would be unfair to attribute the entirety of the responsibility for digitalization solely to SMEs. Instead, a central role in promoting digitalization should also be embraced by upstream customers within the supply chain.

4.2. Data Collection

Data were collected through semi-structured interviews with 18 key-informants from the Prato (Italy) ID (Yin, 1994). Semi-structured interviews were identified as a suitable approach to gather information as they allow the interviewees to freely express their opinions while at the same time maintaining the attention fixated on a defined point (Eisenhardt, 1989).
The key-informants has been jointly interviewed by at least two of the authors. The selection of a face-to-face contact made possible to verify the veracity of the assessments through a visive observation of the corresponding phenomenon within the firm. Moreover, according to Bazi *et al.* (2020) in person interactions consent to build interviewees-interviewers' relationships, which in our case fostered the firsts to provide integrative information through different channels even after encounters.
The key-informants belong to 6 businesses positioned in different levels within the supply-chain. 2 businesses are gatekeepers (so directly in touch with MNEs), while 4 businesses are downstream sub-suppliers of the first two firms (see table 1). To explore how imprints from MNEs diffuses through IDs it was deemed necessary to include managers and officers either from SMEs exposed directly to their larger counterparts and sub-suppliers observing the global market through the eyes of gatekeepers (Marrucci *et al*., 2022). It was likewise fundamental to consider a pool of businesses intertwined by standing businesses' collaborations, as only businesses collaborating in some way could be imprinted by others and act as imprinters for lower-level ones (Sinha *et al*., 2020).

Table 1. Selected Businesses and Key Informants

Company	Positioning in the Supply Chain	Headquarter	Core Business	Size (2022)	Rev. Mln (€) (2022)	Business Role of Key Informants	Interview Date (2023)	Duration of the Interview
α (Alpha)	Gatekeeper *(Directly in touch with MNEs)*	Montemurlo (PO)	Yarns Weaving	49	84.7	-CEO -CTO -Purchase Manager	Jan 12th Jan 16th Jun 19th Jan 12th Jan 16th	1h 15 min 1h 2h 30 min 1h 30 min 45 min
β (Beta)	Gatekeeper *(Directly in touch with MNEs)*	Montemurlo (PO)	Yarns Weaving	37	23.4	-CEO	Jan 20th Feb 10th Sep 4th	45 min 1h 45 min 2h 30 min

						-Senior Marketing Manager -Sales Manager -Supply Chain Manager	Mar 7th Jan 20th Mar 7th	1h 15 min 1h 1h 45 min
χ (Chi)	Sub-Supplier *(Principally collaborating with α)*	Montemurlo (PO)	Warping	23	2.9	-CEO -Sales Manager -Production Manager	Feb 13th Mar 6th Mar 6th Feb 13th	2h 15 min 1h 15 min 2h 1h 15 min
δ (Delta)	Sub-Supplier *(Long Standing Collaboration with α, minor collaboration with β)*	Prato (PO)	Dyeing of Fabric	25	4.6	-CEO -Supply Chain Manager	Apr 3rd Apr 3rd	2h 1h 15 min
ε (Epsilon)	Sub-Supplier *(Equal collaboration with both α and β)*	Agliana (PT)	Warping	21	1.5	-CEO -Sales Manager -Supply Chain Manager	Apr 21st Jun 19th May 5th May 5th	2h 1h 30 min 45 min 1h 15 min
γ (Gamma)	Sub-Supplier *(Principally collaborating with β)*	Prato (PO)	Dyeing of Fabric and Warping	35	4.1	-General Manager -Supply Chain Manager -Quality Office	Jul 20th Jul 21st Jul 21st	1h 15 min 1h 30 min 1h 45 min
6 Companies	*2 Gatekeepers* *4 Sub-Suppliers*	*//*	*//*	*//*	*//*	*18 Key Informants*	*24 Interviews*	*36 Hours*

Source: Authors' Elaboration

Some of the key-informants were interviewed more than once, for a grand total of 24 interviews (in Italian). Data collection lasted from January to September 2023. The period of interview is relevant and suitable, as it corresponds to 9 out of the 12 final months in which Italian SMEs can exploit tax breaks for digital transformation provided by Industria 4.0 Law (Marrucci *et al.*, 2023). Data collection was stopped after 9 months as theoretical saturation was achieved, consistently no further themes aroused from the final conversations (Zollo *et al*., 2022). Interviews were recorded, analyzed and then transcribed and translated by all the 4 authors. A final dataset of 85 pages of transcriptions (corresponding to 36 hours of recording) has been obtained.

An interview protocol framed on existing literatures on business-to-business imprinting (Simsek *et al.*, 2015; Sinha *et al*., 2020), IDs' digital transformation (Hérvas-Oliver, 2021) and relational learning capabilities (Albort-Morant *et al.*, 2018) was developed. Moreover, some additional open-ended questions concerning how technological evolution is affecting their businesses were also included to assess how SMEs from Prato ID were reacting to digital revolution. In total, the interview protocol is formed by 16 questions (see table 2). Consistently with Hu *et al.* (2023), interviewees were asked to provide examples of the investigated phenomenon and were left free to suggest any not previously consider topic deemed relevant.

Table 2. Interview Protocol

Level of Analysis	***Topic*** (Sources)	***Question***	***Targeted Business*** G= Gatekeepers S= Sub-Suppliers
a) Macro Level *(Environmental Macro-Factors Affecting the ID)*	*Competitive Positioning* (Giuliani, 2011; Bellandi and Santini, 2019)	Which position does your business hold within the supply-chains existing in Prato ID?	G, S
	New Technologies Emerging in the Industry and within ID (Hervás-Oliver, 2021)	Since the emergence of the I4.0 paradigm (2011), what level of digital maturity has your business achieved?	G, S
		Could you please describe the principal motivations underlying the pursuit of digital transformation through I4.0 technologies?	G, S
b) Meso Level *(Relationships between MNEs and businesses from the ID)*	*Most Relevant Stakeholders* (Giuliani, 2011)	Can you kindly identify the most relevant partner, amongst all the possible stakeholders, for your business?	G, S
	Top-Down Influence in Strategic Management Decisions (Simsek *et al.*, 2015)	Do technological change and requests of your customers influence your business digital transformation strategies? If so, please provide some examples.	G, S
		Is your customers' satisfaction more important than deliberated strategies amidst environmental turbulences (i.e., digital transformation)?	G, S

	Perceived Top-Down Support Between Supply-Chain Members (Simsek *et al.*, 2015)		Are customers supporting your business in transformation processes?	G, S
	Bottom-Up Influence in Strategic Management Decisions (Simsek *et al.*, 2015)		Is your business weighting the opinion of your suppliers before embracing transformation processes? Otherwise, is your business attempting to influence their transformation paths?	G
	Perceive Bottom-Up Support Between Supply-Chain Members (Simsek *et al.*, 2015)		Are suppliers more supportive or skeptical about the transformation processes started by your business?	G
c) Micro Level *(Processes Occurring Within the Business, Supporting Capabilities, and Strategic Decisions)*	*Relational Learning Capabilities* (Albort-Morant *et al*., 2018)	*Information Sharing*	Do you think that businesses in your supply chain or in the ID formally or informally exchange and combine information?	G, S
			Does your business possess the capacity to share information top-down or bottom up?	G, S
		Knowledge Integration	Is your business, or any other business within your supply chain or the ID, capable to integrate external knowledge? If so, how do this process occur?	G, S
		Joint-Sense Making	Are joint teams present in your business? If so, are these teams capable to solve emerging problems related to supply processes?	G, S
	Digital Technologies Integration (Molina-Morales, 2021; Marrucci *et al.*, 2022)		How were digital technologies integrated in your business processes, with a specific attention at the ones concerning supply chain? How were internal resistances overcome?	G, S
	Digital Strategies Decision Processes (Sinha *et al.*, 2020)		How were digital technologies engrafted in your existing strategies? Were new ad hoc strategies developed or old ones modifies?	G, S,
	Outcomes (Rialti *et al.*, 2019)		Could you describe the outcomes of technology integration within your businesses, with specific attention at supply chain changes?	G, S

Source: Authors' elaboration

4.3. Triangulation and Data Coding and Analysis

The transcript of the interviews represents the starting point of the analysis. Additional information has been obtained, and existing one refined, through the triangulation approach postulated by Yin (2014).

In our case, further information sources were represented by corporate websites, social media pages, accounting documents, local newspapers, chambers of commerce's reports, existing research on the companies, and informal insights gathered from MNEs representatives while on their visits in the 2 gatekeepers' plants. Triangulation has been pivotal to evaluate which data were to be maintained in the successive phases of research and which ones had to be weighted or excluded. In doing so, the final dataset was extended to 89 pages. Blurred information pieces, not verifiable or replicable ones, and not completely accurate parts have consistently been excluded, while some new insights were added from additional sources (Zollo *et al.*, 2022)

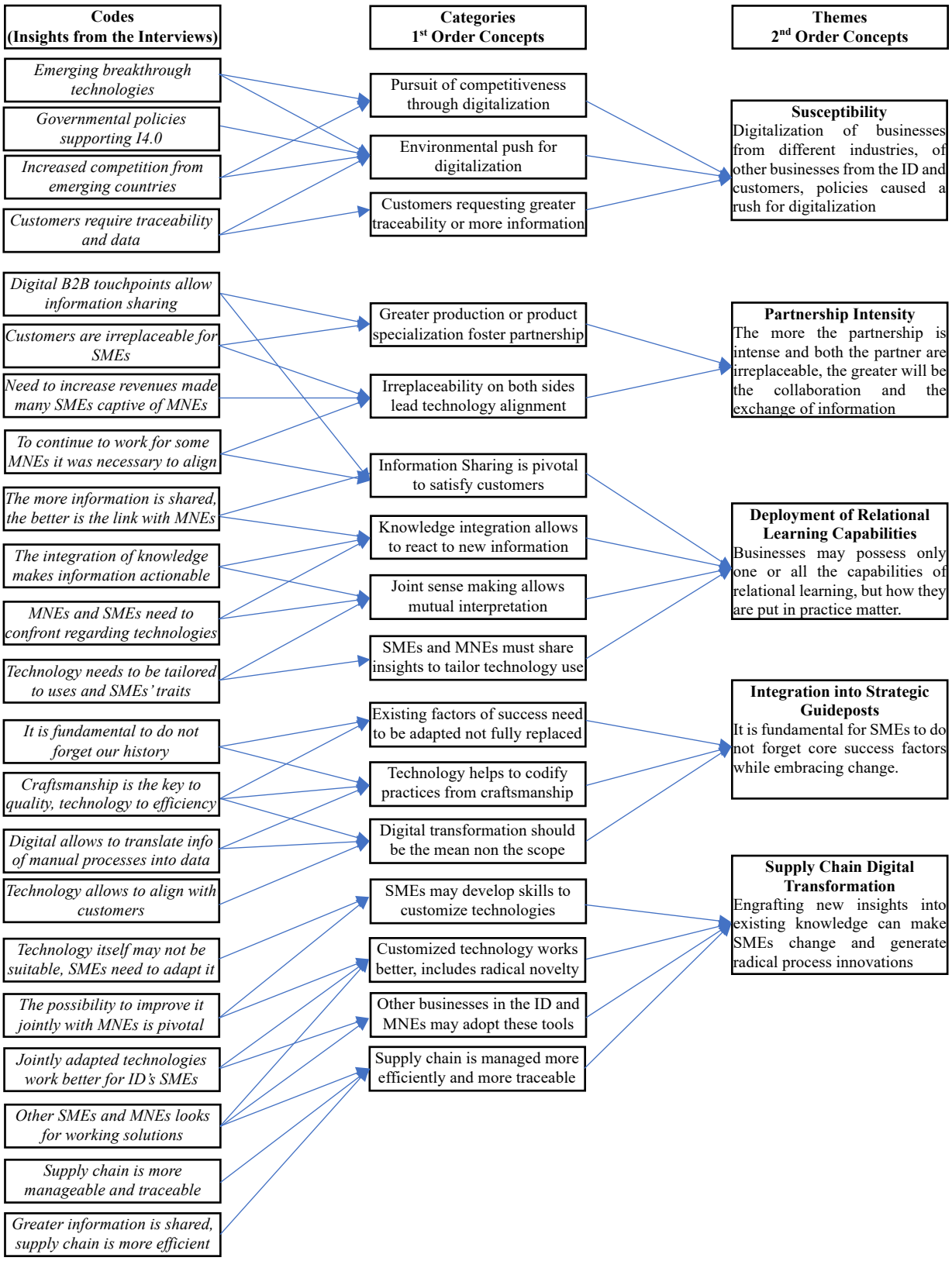
The authors adopted a grounded theory-based approach relying on a constant comparison between the dataset and theory. Initially, the research rationale was identified through the exploration of what has already been investigated on IDs' digital transformation while adopting the imprinting theory as a theoretical lens (Erdogan *et al.*, 2020; Hervás-Oliver, 2021). In this way, the logic for the investigation was jointly defined by the authors and matched with existing literature (Glaser and Strauss, 1967). Then, a rigorous qualitative analysis was performed, and insights for theoretical extension were developed (Hu *et al.*, 2023).

An open and axial manual coding strategy was selected. This tactic allowed the authors to progressively interpret data and compare them with other potentially emerging insights and idea. Accordingly, the following steps were performed to analyze the interviews:

1) Identified key points were labeled as codes;
2) Codes characterized by thematic similarity were put together to form 1st order concepts labelled as categories;
3) Categories were related each-other to form 2nd order concepts (a.k.a., themes).

In total, 22 key insights, 16 themes and 5 categories were identified. Figure 1 summarizes the adopted process.

Figure 1. Result of the Coding: Insights from Interviews, themes, and Macro-Categories



Source: Authors' Elaboration

5. Results

5.1. Results of the Qualitative Analysis

Five principal themes emerged from the analysis of the semi-structured interviews:

1) Factors triggering the emergence of a moment of susceptibility;
2) Intensity of partnerships with MNEs and within the ID;
3) Development and deployment of Relational learning capability;
4) The role of Relational learning in the integration of emerging imprints into existing strategic guideposts;
5) The process of supply chain digital transformation and its effects.

5.1.1. Factors triggering the emergence of a susceptibility moment

The emergence of a susceptibility moment is fundamental to open the *imprintability window* of a firm (Simsek *et al*., 2015). The objective of the research regards the identification of the mechanisms that SMEs put in action whether exposed to new imprints, it was then deemed necessary to understand the characteristics of the genesis stage of these imprints (Suddaby and Jaskiewicz, 2020). A particular attention thus has been paid to the moment in which the observed SMEs started to spot changes in environmental dynamics and in the ways MNEs were operating. It is in fact in this moment that usually a business questions its traditional procedures and technology strategies (Erdogan *et al.*, 2020).

The interviewed managers consistently stressed how they started to weight new strategic approaches in the wake of increased availability and scalability of new digital technologies (Rialti *et al.*, 2019). The diffusion of the I4.0 paradigm, indeed, made several new technologies such as sensors, IoT kits, RFID and big data analytics cheaper than ever, thus affordable. The emergence of more user-friendly human-computer interfaces also influenced managerial evaluations, as they felt more confident about employees' capacity to use advanced technologies (Marrucci *et al.*, 2022). Then, massive incentives from Government pushed the purchase of new technologies as SMEs could get a tax break corresponding to the 50% of the total value of new tools (Marrucci *et al.*, 2023). In this vein, the CTO of α highlighted how these three factors triggered business' attention toward digital transformation:

> "*Out of the blue, it was 2014 or 2015, we started to hear the expressions digital transformation and Industry 4.0 from all our technology providers. Everyone was selling new software and hardware to start to trace our productions phases and to collect data from machines. Economic newspapers were publishing insights about the power of data and how it was possible to get new technologies and get a tax break. It was also possible to observe 4.0 technologies applications in other traditional businesses outside Prato. In that moment, we decided it was time to start to rethink our technological strategies and evaluate if we could benefit too from these innovations*"
> (α, CTO, January 12th 2023)

The diffusion of new technologies was anyway not sufficient in the stimulation of a sense of urgency in all the businesses. Another pivotal factors the pursuit of new technologies was represented by the growing awareness that competitors from emerging countries had already started to reap the benefits of digital technologies to trace not-conform products and reduce costs. Moreover, MNEs -which were collaborating with suppliers from all over the world- started to ask for additional information about production batches and product traceability (Wies *et al*., 2013). Accordingly, the CEO of β states:

> "*Our costumers highlighted how their Chinese suppliers -working for the outlet lines- were starting to adopt new yarns' traceability technologies, such as more advanced and resistant RFID capable to withhold the whole production processes. Consistently, the quality from*

emerging countries also started to increase. Our customers also stressed how it was easier for them to collect data thanks to these technologies"
(β, CEO, February 10th 2023)

Accordingly, the following proposition can be drawn:

P1: *The emergence of I4.0 paradigm is causing a susceptibility moment capable to open the imprintability window of Prato ID SMEs. In such a moment, insights from MNEs observing global markets were extremely valuable.*

5.1.2. Intensity of partnerships with MNEs and within the ID

Any business faces multiple imprints in its life. Only few of these ones anyway persist over time and are in the end considered in business strategy. It is possible to hypothesize that the likelihood for an imprint to be included in the future plans of a company depends also from its source (Liou *et al*., 2021). During a phase of susceptibility, reputable sources -such as the largest customers- may tend to be perceived as more considerable; the future success of the business is necessarily related to their willingness to nurture the partnership. Moreover, interactions between a business and its customers, due to their commercial nature, are extremely frequent and prolongated (Marquis and Tilcsik, 2013). For this reason, more information come from these partners than from any other one. A great number of managers and employees are similarly in touch with these stakeholders, elevating MNEs to a fundamental source of imprints. How inputs from MNEs may influence the technological choice according to partnership intensity has been stressed by the CEO of α. In particular, it was observed how some imprints are valued more than others also in respect of the kind of action required to make the partnership continue (i.e., future products desired by the customers).

"One of the purchase managers from our main customer assessed that new digital traceability tools were deemed necessary to ensure the quality and the sustainability of our products. We are not dependent from our customers, but their opinion matters a lot for us. They look after suppliers capable to manage all their supply chains digitally, as these ones are deemed capable to transmit them more data to plan the production. Then, to be capable to improve our service level, we started to evaluate new technologies. Their support and expertise in the identification of the most suitable tools for us were also constant and valuable"
(α, CEO, January 16th 2023)

The same also happens between the gatekeep and its sub-suppliers, as stressed by the production manager of χ:

"α has continually stressed the trust they have in our company and their willingness to maintain the collaboration in place. The companies have been long-standing partners for decades. In the moment they asked us to collaborate to satisfy their principal customers, we dedicated a team to the project. In the end we adopted the same technological tools, but obviously customized to our needs"
(χ, Production Manager, February 13th 2023)

By the way, in the case the collaboration is more recent, and the relationship is not based on trust but price-convenience, the reverse may also occur, as indicated by γ General Manager:

"We got aware of α new technologies through word-of-mouth within the ID. We were a bit disappointed, but our collaboration was mostly based on our temporary cost-advantage and maybe it means that we won't be considered for future projects"
(ε, Supply Chain Manager, May 5th 2023)

Building on these acumens, the following proposition can be drawn:

> P2: *Partnership intensity, deriving from willingness of both MNEs or Gatekeepers to collaborate with their respectively subordinate firms, is related to imprinting persistence and influence.*

5.1.3. Nurturing relational learning capability and the integration of emerging imprints into existing strategic guideposts

The capacity of an imprint to influence the future trajectories of a business depends on how it is integrated into existing strategies. Sirmon *et al*. (2007) consistently postulated that imprinting *per se* does not necessarily have positive effects, what makes a difference is how it got adapted during the metamorphosis stage (Kidwell *et al.*, 2018). In the case of the ones from MNEs, anyway, these imprints derive from the business they originated from. As an example, an imprint regarding a technological solution working appropriately in a MNE may not be immediately suitable in a SME (Rialti *et al.*, 2019). SMEs need to revise the imprints they receive and make them appropriate according to specific functional and strategic needs. Rhetorical narratives from managers proved to be fundamental in changing the minds of employees to the point new imprints could be progressively integrated into strategies and prioritized (Sinha *et al.*, 2020). Still, this approach comes short in the explication of the process regarding SMEs appropriation of an imprint and its tailoring to specific purposes and processes.

Building on research about the importance of capabilities in imprints rearrangement (Sirmon *et al.*, 2007), it was assumed that the constructs belonging to relational learning capability may explicate this process. In particular, information sharing is fundamental in the development of the mutual trust required to share news and innovations between the imprinter and imprinted (Leal-Rodríguez *et al.*, 2014). Joint sense making is the key to customize the imprint while attaining to indications from customers. This construct provides that an innovation may generate mutual benefits only when it starts to be adapted to supply chain partners' request not disrupting existing mechanisms (Leal-Millán *et al.*, 2016). The enactment of joint sense making allows an in depth understanding of the inner meaning of the innovation, and to put it in practice in relation to the right requirement. Knowledge integration then matters for the inclusion of new knowledge into existing strategy. Thanks to knowledge integration capability SMEs managers may identify the strategic guidepost on which the imprint needs to be engrafted (Albort-Morant *et al.*, 2018). Knowledge integration provides the passage from tacit information knowledge to explicit and defined one. First, SMEs managers may accordingly develop new strategy without neglecting existing ones. Second, they can communicate the strategic change to employees in a formal way and through the explication of the new technology potential (Sinha *et al.*, 2015).

The basic constructs forming relational learning capability are easily deployable capabilities of the most of firms. Anyway, building on dynamic capabilities co-specialization literature (Teece, 2007) it is possible to consider that all of the three may unleash their potential only whether deployed together. Only in this way the relational learning capability may allow managers to generate radical changes which could be beneficial for the whole ID. Indeed, through the nurturing of all the three composing capabilities it is possible to develop digital transformation paths with the main partners, while having which of them customize it according to the specific needs.

The following interviews from α, δ, and γ corroborates these hypotheses.

> "*The difference between our digital transformation process and the one from some of our competitors stands in the fact that our leading customer did not only provide hints to us about the best technologies. They listened to our request, and also sent to our company some people from the IT department which helped in the tailoring of the instruments to our size and*

expertise. Through confrontation with our IT and employees, everyone grasped the importance of innovation, but our uniqueness was respected"
(α, CTO, January 12th 2023)

"*Sharing information, and having the availability and support from people from α allowed to start our transformation from a good example. They were already aware of our problems, and we solved team working together. Sharing information is useful, but what matters is how to use innovations according to our traits. Many production phases are still manual and these elements cannot be changed; in such a regard, we anyway digitalized the most of them as we implemented friendly interfaces capable to improve traceability for us, them and their customers*"
(δ, Supply Chain Manager, April 14th 2024)

"*While we get some information from α, our main customer is β. β only provided us information about how to implement new tools and which are the expected use. Yet, they did not insist or provided us any help. We purchased the tools, we will put them in practice sooner or later, but in my opinion, it will end like the ERP they suggested us to purchase to increase data exchange, which is used at no more that the 50% of its potential*"
(γ, General Manager, July 20th 2023)

The following propositions have consistently been drawn:

P3: *Relational learning exists when it three composing capabilities are jointly deployed. In this case, it is possible for SMEs to actively get the sense of a digital transformation path*.
P4: *In the case the imprint is fully understood in the SME, it can be adapted to their specific need. Then, a new strategy can be developed integrating radial changes into traditional way of running business.*

5.1.4. The process of supply chain digital transformation and its effects
Within IDs, gatekeepers can understand the significance of the digital transformation process if they perceive the change through relational learning and partnership with MNEs. In such a case, gatekeepers may appropriate of the digital transformation path and be eager to diffuse it also at lower hierarchical levels to sub-suppliers. The sharing of a new imprint from gatekeepers to sub-suppliers requires anyway that both these partners possess complete relational learning (Sinha *et al.*, 2020).
Thanks to this mechanism it was possible to observe the adoption of I4.0 tools such as IoT, RFID, Cloud Computing, BDA, AI, and Digital Platforms by Prato SMEs. The digital transformation process started with the adoption of technologies for data collection from machines and the embracing of RFID for products' traceability (Bellandi *et al.*, 2019). One of the main requests of MNEs was in fact to have the possibility to monitor the dispersed production stages while having the information embedded directly on products. Successive stages involved the adoption of Cloud Computing (empowered by BDA and AI) to share data in a single online database accessible by all the partners (Bellandi and Santini, 2019). These tools enacted the possibility to mutually develop shared sourcing strategies between all the players. The current evolution concerns the development of a digital platform where it is possible for any SMEs to propose new products or available production capacity to its partners. Radicality of innovation is shown in the way SMEs were capable to interpret and customized the tools. In fact, as in the case of RFID, without a joint application from both SMEs and MNEs it would have not been possible to develop new RFID capable to withstand all the production phases. Likewise, the existing weaving machines were not capable to produce data, it was a commune initiative that allowed SMEs to monitor the production through computers (Hervás-Oliver *et al.*, 2018). Finally, it was an MNE which promoted the use of a cloud-based platform to share data, but it

was a collaborative process brining the use of such a kind of tool at any level within SMEs. This occurrence is explained by the purchase manager of α

> *"In the initial stage of transformation, we had no idea about the best tool for us. Through confrontation with MNEs managers we got aware first of RFIDs, yet it required joint efforts to develop a kind of RIFD capable to resist during dyeing. Moreover, they facilitated the development of cloud-computing information sharing. Nowadays, differently from some years ago, we are managing all our purchase processes digitally. Their help was fundamental, we then also instilled some of the procedures in two suppliers: χ and δ"*
> (α, Purchase Manager, January 16th 2023)

A different path may anyway be taken by SMEs. This path may either lead to technological isomorphism or absence of digital transformation. Technological isomorphism means that the firm has adopted digital technologies analogous to its competitors, but the effects of adoption are still not evident as the tools are not fully used. Existing process are thus still in place with limited digital technology reliance (Di Maggio and Powell, 1983). In this case, the SME was not capable to appropriate of the knowledge to use the digital technologies. Such an occurrence derives from the fact that upstream firms (either MNEs or Gatekeepers) share information but are not engaged in joint-sense making activities (Albort-Morant *et al.*, 2018). The second case, absence of digital transformation, regards companies refusing to evaluate the adoption of new technologies. In this case information is shared, but the receiving firm lack the capability to jointly collaborate or to integrate knowledge. The next extract from ε Supply Chain Manager is explicative:

> "*We observed what was happening in other business from Prato. We asked the same technological providers to implement the same solutions. What is missing to succeed in our case is support from our main customer. None from them seems interested in our new technologies. We also lack the skills to fully exploit these technologies, and we have no idea were to get these ones. These problems hampered the application of these tools, we spent a lot of money in digitalization but we are not seeing any benefit*"
> (ε, Supply Chain Manager, May 5th 2023)

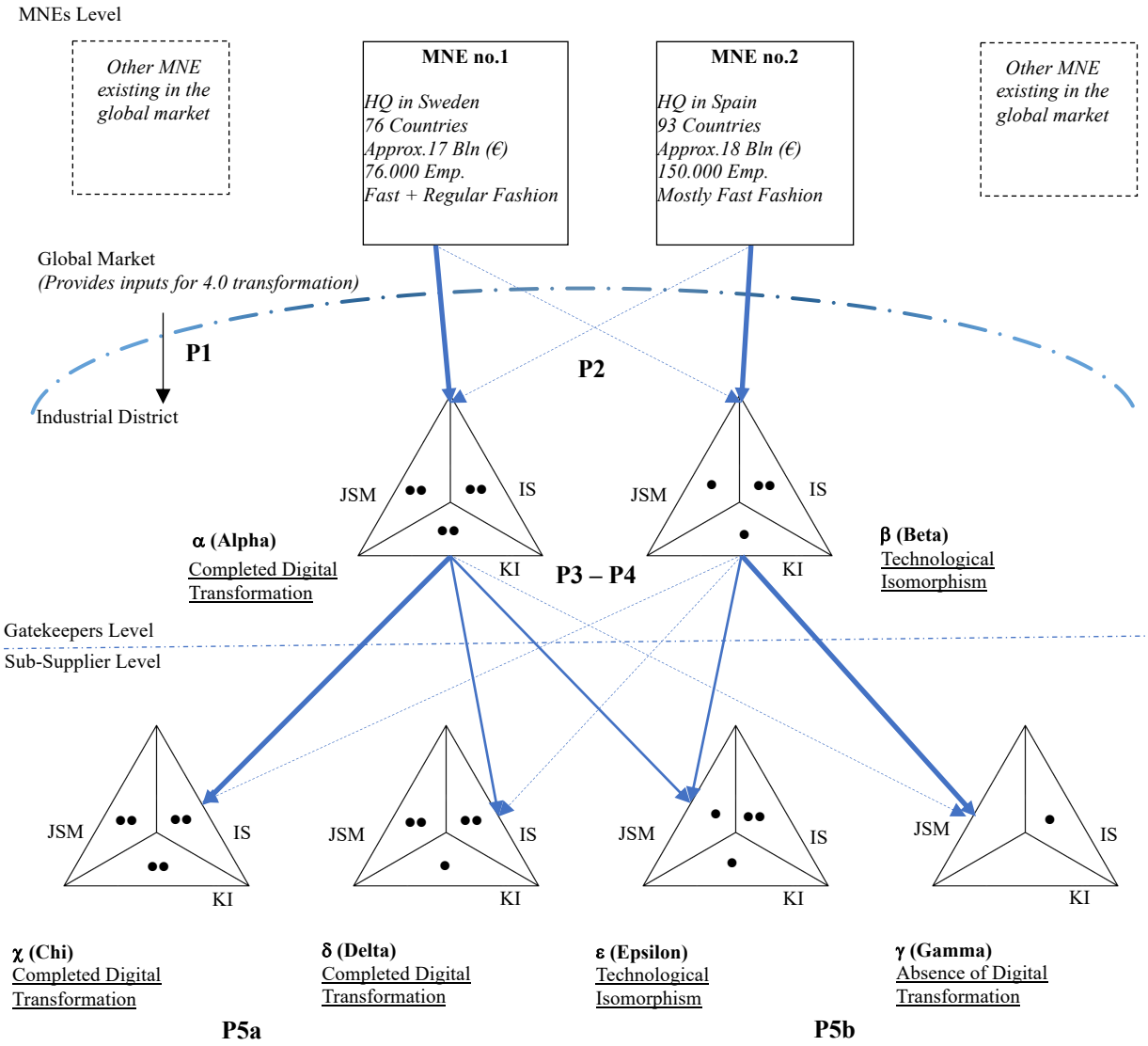
The following propositions have consistently been drawn:

> P5a: *Engrafting imprints through relational learning allows also to extend its novelty to different areas to create radical supply chain innovations, which can then spread through the ID.*
> P5b: *Conversely, a passive approach by an upstream business may lead to unresponsive adoption/technological isomorphism or absence of digital transformation.*

5.2. Unpacking Digital Transformation Trajectories Within Prato ID

The analysis of the interviews provided the opportunity to develop a conceptual model explaining how the imprints regarding digital transformation diffuse in an ID. Starting from MNEs level (the global market) it was possible to recognize how imprints diffuse through intense partnerships. Then, what happens within the single business was represented by the consideration of how the three constructs forming relational learning capabilities are deployed either exclusively internally or reciprocated by the upstream business generating the imprinting.
This process, accordingly, may generate diverse trajectories of digital transformation (See Figure 2).

Figure 2. Graphical Representation of Multilevel Imprinting Process within IDs



Legenda:

1) *Triangles represent SMEs (both gatekeepers and sub-suppliers)*
2) *Squares represents MNEs*
3) *JSM = Joint Sense Making; KI = Knowledge Integration; IS = Information Sharing*
4) ➔ *Correspond to the existence of an intense and long-standing partnership*
5) ⟶ *Correspond to the existence of a long-standing partnership of regular intensity (the sub supplier is not over-reliant on the gatekeeper)*
6) ⇢ *Correspond to a weak partnership*
7) • *Represent the existence of the capability in the SMEs, but not the reciprocation from the upstream business*
8) •• *Represent the existence of the capability in the SMEs and the fact that it is reciprocated from the upstream business*

Source: Authors' Elaboration

6. Discussion and Managerial Implication

Through an exploratory analysis, the research sheds light on the dynamics regarding digital transformation trajectories within IDs. Building on imprinting theory (Simsek *et al*., 2015), it was underscored that digital transformation in IDs is a relational process influenced by specific internal and external dynamics. MNEs, with their power and global reach, can in fact sway the decisions of

district firms regarding the adoption of new technologies at supply chain level. However, the interviews revealed that SMEs' technology appropriation occurs only whether customers actively participate in the relationship through a bidirectional formative collaboration (Sinha *et al.*, 2020). This two-way relationship is expressed across three dimensions of relational learning (Leal-Rodriguez *et al.*, 2014). Through the active exchange of information, the effective integration of new ideas, and the pursuit of a common purpose that transcends individual objectives, it is possible to establish collaborations between MNEs and district firms resulting in radical change (Tunisi and Marchiori, 2020). Moreover, relational learning yields an additional outcome known as multilevel imprinting. Technological appropriation indeed enables manufacturing firms to harness radical change and diffuse it among their suppliers, thus promoting positive district-wide change (Marrucci *et al.*, 2022).

Yet, the findings clarify that relational learning is a necessary but not sufficient condition for fostering digital transformation process. According to our results, IDs' firms should have a high partnership intensity with MNEs to facilitate bidirectionality and integrate imprints from these players in environmental one that might hamper digital transformation (Oertel, 2018). For instance, traditions, and culture, along with the stable network connecting district firms, could qualify as barriers in technological transformation processes. By establishing trust-based partnerships with MNEs, IDs' SME could moderate these environmental levers and direct them toward digital transformation (Liou *et al.*, 2021). The combination of relational learning and partnership trust could accordingly promote a balance between tradition and radical digitization.

Despite these insights, it was also demonstrated that the absence of relational learning and partnership intensity does not preclude the possibility of some form of digitalization. The lack of bidirectional collaboration between MNEs and SMEs limits the technological appropriation among the latter. This outcome suggests that district firms can readapt their procedures based on the demands of their customers, while failing to grasp the needs of technological change and lacking a joint development process. These elements lead to technological isomorphism, as district firms perform pure execution procedures that conform to other district firms (Di Maggio and Powell, 1983). Moreover, such a kind of enforced digitization also prevents the development of multilevel imprinting and, consequently, the technological growth of the entire district. In such a case, gatekeepers are consistently not capable to imprint sub-suppliers.

Overall, the research offers important contributions to the advancement of imprinting theory and to the literature on digital transformation in IDs. First, research has shown that along with the imprints of founders and the environment, the MNEs imprinting can condition a SMEs' digital transformation trajectories (Erdogan *et al*., 2020). The results also allow to overcome the view of imprints absorption based on the rhetoric narrative, according to which managers have the duty of convincing internal and external stakeholders of the readaptation of original guideposts through new information so as to motivate technological change (Sinha *et al.*, 2020). We have shown that in mature industrial settings MNEs customers have a decisive impact in facilitating radical technological change especially at supply chain level. However, for this change to become lasting and profound, firms must appropriate of these technologies. These processes can only unfold in the presence of a mutual willingness to drive change. The findings also allow to broaden the discussion on relational learning, which should be considered as a capability underlying the development of firms and manufacturing areas (Albort-Morant *et al*., 2018). We have demonstrated that relational learning is thus capable of directing imprints toward long-term sustainable changes.

Finally, the results highlight that the promotion of digital transformation in IDs, can occurs if there are joint efforts between customers and firms.

These considerations could also offer relevant managerial implications. District firms should seek to develop relationships with their customers based on mutual trust. Through intensive partnerships it will be possible to foster lasting collaborations capable of promoting radical changes. In addition, managers should make efforts in selecting their customers by favoring those that combine productive flexibility with a willingness to jointly collaborate and grow. As radical digital changes empower

firms to handle market perturbations and demands, it is necessary to select those players with whom joint development can be promoted.

7. Conclusions and Limitations

The research contributes to the growing literature of digital transformation in IDs' firms. In particular, through MNEs imprints and relational learning the research sought to identify various alternative pathways influencing processes of radical technological transformation. This perspective represents a novelty in the literature, as little attention has previously been paid to the role played by MNEs and the environmental context in transformation processes, as well as the internal capabilities that IDs' firms should develop.

The analysis shows that in traditional IDs it is possible to promote a digital transformation process whther there is a bidirectional, trust-based collaboration with MNEs, based on joint development and sense-making. This avoids the establishment of technological isomorphism among firms in the district.

Despite these significant contributions, the research has some limitations. The first concerns the research context: although the Prato textile district is highly relevant, the analysis in other IDs could have yielded different results. Then, the qualitative methodology could be corroborated by a quantitative one. Future research could verify the results with different methodologies.

References

Albort-Morant, G., Leal-Rodríguez, A.L., and De Marchi, V. (2018). Absorptive capacity and relationship learning mechanisms as complementary drivers of green innovation performance. *Journal of Knowledge Management*, Vol.22, No.2, pp.432-452.

Bazi, S., Filieri, R. and Gorton, M. (2020). Customers' motivation to engage with luxury brands on social media. *Journal of Business Research*, Vol.112, pp.223-244.

Becattini, G. (1990). „The Marshallian Industrial Districts as Socio-Economic Notion"(w:) F. Pyke, G. Becattini, W. Sengerberger (red.). Industrial Districts and Inter-Firm Cooperation in Italy.

Becattini, G., Bellandi, M., and De Propris, L. (eds.) (2009): *The Handbook of Industrial Districts*. Edward Elgar Publishing, Cheltenham.

Bellandi, M., and Santini, E. (2019). Territorial servitization and new local productive configurations: The case of the textile industrial district of Prato. *Regional Studies*, Vol.53, No.3, pp.356-365.

Bellandi, M., De Propris, L., and Santini, E. (2019). *Industry 4.0 + challenges to local productive systems and place-based integrated industrial policies*. In P. Bianchi, C.R. Durán, and S. Labory (Eds.), Transforming industrial policy for the digital age: Production, territories and structural change (pp. 201–218). Edward Elgar Publishing, Cheltenham.

Belso-Martínez, J.A., López-Sánchez, M.J., and Mateu-García, R. (2018). New MNE subsidiaries in old clusters: when, why, and how. *Review of Managerial Science*, Vol.12, pp.441-467.

Büyüközkan, G., and Göçer, F. (2018). Digital Supply Chain: Literature review and a proposed framework for future research. *Computers in Industry*, Vol.97, pp.157-177.

Camagni, R.P., and Capello, R. (2002). *Milieux Innovateurs and Collective Learning: From Concepts to Measuremen*t. In: Acs, Z.J., de Groot, H.L.F., Nijkamp, P. (eds) The Emergence of the Knowledge Economy. Advances in Spatial Science (14-45). Springer, Berlin – Heidelberg

Carbonara, N., Giannoccaro, I., & Pontrandolfo, P. (2002). Supply chains within industrial districts: A theoretical framework. *International journal of production economics*, Vol. 76, No.2, pp.159-176.

Cheung, M.S., Myers, M.B., and Mentzer, J.T. (2011). The value of relational learning in global buyer-supplier exchanges: a dyadic perspective and test of the pie-sharing premise. *Strategic Management Journal*, Vol.32, No.10, pp.1061-1082.

Davenport, S. (2005). Exploring the role of proximity in SME knowledge-acquisition. *Research Policy*, Vol.34, No.5, pp.683-701.
De Marchi, V., and Grandinetti, R. (2014). Industrial districts and the collapse of the Marshallian model: looking at the Italian experience. *Competition & Change*, Vol.18, No.1, pp.70-87.
Di Maggio, P.J., and Powell, W.W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, No.10, pp.147-160.
Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review*, Vol.14, No.4, pp.532-550.
Eisenhardt, K.M., and Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, Vol.50, No.1, pp.25-32.
Erdogan, I., Rondi, E., and De Massis, A. (2020). Managing the tradition and innovation paradox in family firms: A family imprinting perspective. *Entrepreneurship Theory and Practice*, Vol.44, No.1, pp.20-54.
Feliciano-Cestero, M.M., Ameen, N., Kotabe, M., Paul, J., and Signoret, M. (2023). Is digital transformation threatened? A systematic literature review of the factors influencing firms' digital transformation and internationalization. *Journal of Business Research*, Vol.157, 113546.
Ferriani, S., Lazerson, M.H., and Lorenzoni, G. (2020). Anchor entrepreneurship and industry catalysis: The rise of the Italian Biomedical Valley. *Research Policy*, Vol.49, No.8, 104045.
Garzoni, A., De Turi, I., Secundo, G., and Del Vecchio, P. (2020). Fostering digital transformation of SMEs: a four levels approach. *Management Decision*, Vol.58, No.8, pp.1543-1562.
Gawer, A. (2021). Digital platforms' boundaries: The interplay of firm scope, platform sides, and digital interfaces. *Long Range Planning*, Vol.54, No.5, 102045
Gerke, A., and Dalla Pria, Y. (2022). The role of social capital in territorial development: the case of a French post-industrial region. *Regional Studies*, pp.1-14.
Giuliani, E. (2007). The selective nature of knowledge networks in clusters: evidence from the wine industry. *Journal of Economic Geography*, Vol.7, No.2, pp.139-168.
Giuliani, E. (2011). Role of technological gatekeepers in the growth of industrial clusters: Evidence from Chile. *Regional Studies*, Vol.45, No.10, pp.1329-1348.
Giuliani, E., Balland, P.A., and Matta, A. (2019). Straining but not thriving: Understanding network dynamics in underperforming industrial clusters. *Journal of Economic Geography*, Vol.19, No.1, pp. 147-172.
Glaser, B. and Strauss, A. (1967). Grounded theory: the discovery of grounded theory. *Sociology, the Journal of the British Sociological Association*, Vol.12, No.1, pp.27-49.
Dobrev, S.D., and Gotsopoulos, A. (2010). Legitimacy vacuum, structural imprinting, and the first mover disadvantage. *Academy of Management Journal*, Vol.53, No.5, pp.1153-1174.
Håkansson, H., and Snehota, I. (1995). *The burden of relationships or who's next*. In IMP Conference (11th) (Vol. 11). IMP.
Hatch, M.J. (1993). The dynamics of organizational culture. *Academy of Management Review*, Vol.18, No.4, pp.657-693.
Hervás-Oliver, J.L. (2021). Industry 4.0 in industrial districts: Regional innovation policy for the Toy Valley district in Spain. *Regional Studies*, Vol.55, No.10-11, pp.1775-1786.
Hervás-Oliver, J.L., Albors-Garrigos, J., Estelles-Miguel, S., and Boronat-Moll, C. (2018). Radical innovation in Marshallian industrial districts. *Regional Studies*, Vol.52, No.10, pp.1388-1397.
Hinings, B., Gegenhuber, T., and Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization*, Vol.28, No.1, pp.52-61.
Hu, L., Olivieri, M., and Rialti, R. (2023). Dynamically adapting to the new normal: unpacking SMEs' adoption of social media during COVID-19 outbreaks. *Journal of Business & Industrial Marketing*. DOI: https://doi.org/10.1108/JBIM-01-2022-0052

Humphrey, J., & Schmitz, H. (2002). How does insertion in global value chains affect upgrading in industrial clusters?. *Regional studies*, Vol.36, No.9, pp. 1017-1027.

IntesaSanPaolo (2023). 15° Rapporto Economia e finanza dei distretti industriali. Link: https://group.intesasanpaolo.com/it/research/research-in-primo-piano/distretti-e-territorio/2023/rapporto-annuale-economia-e-finanza-dei-distretti-industriali-2023 Retrieved 31/07/2023

Kidwell, R.E., Eddleston, K.A., and Kellermanns, F.W. (2018). Learning bad habits across generations: How negative imprints affect human resource management in the family firm. *Human Resource Management Review*, Vol.28, No.1, pp.5-17.

Leal-Rodríguez, A.L., Roldán, J.L., Ariza-Montes, J.A., and Leal-Millán, A. (2014). From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context. *International Journal of Project Management*, Vol.32, No.6, pp.894-907.

Leal-Millán, A., Roldán, J.L., Leal-Rodríguez, A.L., and Ortega-Gutiérrez, J. (2016). IT and relationship learning in networks as drivers of green innovation and customer capital: Evidence from the automobile sector. *Journal of Knowledge Management*, Vol.20, No.3, pp.444-464.

Liou, R.S., Lamb, N.H., and Lee, K. (2021). Cultural imprints: Emerging market multinationals' post-acquisition corporate social performance. *Journal of Business Research*, Vol.126, pp.187-196.

Lyle, M.C., Walsh, I.J., and Prokopovych, B. (2022). Engaging with the past: Discerning meaning in organizational imprints. *Strategic Organization*, Vol.21, No.3, pp.596–620.

Maksimov, V., Wang, S. L., and Luo, Y. (2017). Institutional imprinting, entrepreneurial agency, and private firm innovation in transition economies. *Journal of World Business*, Vol.52, No.6, pp.854-865.

Marquis, C. (2003). The pressure of the past: Network imprinting in intercorporate communities. *Administrative Science Quarterly*, Vol.48, No.4, pp.655-689.

Marquis, C., and Tilcsik, A. (2013). Imprinting: Toward a multilevel theory. *The Academy of Management Annals*, Vol.7, No.1, pp.195-245.

Marrucci, A., Rialti, R., Donvito, R., & Syed, F.U. (2022). "Connected we stand, disconnected we fall". Analyzing the importance of digital platforms in transnational supply chain management. *International Journal of Emerging Markets*. Forthcoming.

Marrucci, A., Rialti, R., and Balzano, M. (2023). Exploring paths underlying Industry 4.0 implementation in manufacturing SMEs: a fuzzy-set qualitative comparative analysis. *Management Decision*. DOI: https://doi.org/10.1108/MD-05-2022-0644

McEvily, B., Jaffee, J., and Tortoriello, M. (2012). Not all bridging ties are equal: Network imprinting and firm growth in the Nashville legal industry, 1933–1978. *Organization Science*, Vol.23, No.2, pp.547-563.

Molina-Morales, F.X. (2002). Industrial districts and innovation: the case of the Spanish ceramic tiles industry. *Entrepreneurship & Regional Development*, Vol.14, No.4, pp.317-335.

Molina Morales, F.X., De Marchi, V., and Martínez-Cháfer, L. (2021). Absorptive capacity and radical innovation in industrial districts. *Technology Analysis & Strategic Management*, Vol.33, No.9, pp.1088-1100.

Oertel, S. (2018). The role of imprinting on the adoption of diversity management in German universities. *Public Administration*, Vol.96, No.1, pp.104-118.

Pagano, A., Carloni, E., Galvani, S., & Bocconcelli, R. (2021). The dissemination mechanisms of Industry 4.0 knowledge in traditional industrial districts: evidence from Italy. *Competitiveness Review: An International Business Journal*, Vol.31, No. 1, pp. 27-53.

Ponzoa, J.M., Gómez, A., and Mas, J.M. (2023). EU27 and USA institutions in the digital ecosystem: Proposal for a digital presence measurement index. *Journal of Business Research*, Vol.154, 113354

Popli, M., Raithatha, M., and Fuad, M. (2021). Impact of institutional imprinting on the persistence of superior profits: A study of regulatory punctuation in India. *Journal of Business Research*, Vol.124, pp.223-235.

Rialti, R., Zollo, L., Ferraris, A., and Alon, I. (2019). Big data analytics capabilities and performance: Evidence from a moderated multi-mediation model. *Technological Forecasting and Social Change*, Vol.149, 119781.

Selnes, F., and Sallis, J. (2003). Promoting relationship learning. *Journal of Marketing*, Vol.67, No.3, pp.80-95.

Simsek, Z., Fox, B.C., and Heavey, C. (2015). "What's past is prologue" A framework, review, and future directions for organizational research on imprinting. *Journal of Management*, Vol.41, No.1, pp.288-317.

Sinha, P. N., Jaskiewicz, P., Gibb, J., and Combs, J. G. (2020). Managing history: How New Zealand's Gallagher Group used rhetorical narratives to reprioritize and modify imprinted strategic guideposts. *Strategic Management Journal*, Vol.41, No.3, pp.557-589.

Sirmon, D.G., Hitt, M.A., and Ireland, R.D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review*, Vol.32, No.1, pp.273-292.

Stinchcombe, A.L. (1965). "*Social Structure and Organizations*". In March, J. G. (ed.). Handbook of Organizations (142-193). Vol. 7.: Rand McNally & Co, Chicago.

Suddaby, R., and Jaskiewicz, P. (2020). Managing traditions: A critical capability for family business success. *Family Business Review*, Vol.33, No.3, pp.234-243.

Teece, D.J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, Vol.28, No.13, pp. 1319-1350.

Tunisini, A., and Marchiori, M. (2020). Why do network organizations fail?. *Journal of Business & Industrial Marketing*, Vol.35, No.6, pp.1011-1021.

Wies, S., Moorman, C., and Chandy, R.K. (2023). Innovation imprinting: why some firms beat the post-ipo innovation slump. *Journal of Marketing*, Vol.87, No.2, pp.232-252.

Yin, R.K. (1994). Discovering the future of the case study. *Method in Evaluation Research, Evaluation Practice*, Vol.15, No.3, pp.283-290.

Yin, S., Lu, F., Yang, Y., and Jing, R. (2014). Organizational culture evolution: An imprinting perspective. *Journal of Organizational Change Management*, Vol.27, No.6, pp.973-994.

Zollo, L., Pellegrini, M.M., Faldetta, G., and Rialti, R. (2022). How to combine multiple identities and gaining stakeholders legitimacy in hybrid organizations? An organizational design response. *Journal of Management and Governance*, pp.1-34.