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Phygital dynamic capabilities: Microfoundations and their reversed interplay

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ABSTRACT

The convergence of physical and digital worlds—referred to as "phygital"—is reshaping how organizations develop and deploy strategic capabilities. While previous research has mainly focused on customer experience (CX), little is known about the organizational capabilities enabling firms to operate effectively in these phygital ecosystems. Adopting a dynamic capabilities (DCs) perspective, this study examines how firms sense opportunities, seize them, and reconfigure resources within phygital ecosystems. Building on Baskerville et al.'s (2020) notion of "ontological reversal", we position phygital as a distinct form of DC extending beyond CX to impact operational, technological, and structural dimensions. Drawing on an exploratory case study of Webidoo Store, this study investigates how firms develop *phygital dynamic capabilities* (PDCs), the ability to identify opportunities across physical and digital layers, orchestrate hybrid resources, and transform operations by integrating digital intelligence with physical components into a cohesive, data-driven ecosystem. We identify the microfoundations (MFs) of PDCs across individuals, processes, and structure, uncovering mechanisms by which PDCs are created, expressed and transformed. Moving beyond a CX-centric view, this study provides a theoretical foundation for phygital capability development, and managerial insights on how organizations can strategically orchestrate and reconfigure hybrid resources to achieve competitive advantage in an evolving digital-physical landscape.

1. Introduction

Over the past few years, businesses across sectors have been profoundly reshaped by the rise of "phygital". This umbrella term refers to an integrative ecosystem that fuses physical and digital worlds to deliver a unique and interactive customer experience (CX), ensuring a coherent continuum in the creation and delivery of consumer value provided from digital to physical and vice versa (Batat, 2019, 2021, 2024a,b; Belghiti et al., 2017; Pusceddu, 2022; Pusceddu et al., 2023). Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI), and smart interfaces are only some of the technologies that facilitate mixing digital and physical spheres. Global players like Tesco, Zara, H&M, and Amazon are already leveraging these technologies to strengthen customer engagement, accelerate feedback loops, and adapt offerings to evolving consumer preferences.

This evolution calls for re-examining how organizations develop and renew their capabilities to remain competitive in increasingly phygital ecosystems. These ecosystems entail the interplay of human and non-human actors (Mele et al., 2023; Mele and Russo-Spena, 2022), challenging conventional distinctions between human and technological agency. Indeed, scholars highlight their mutual entanglement in co-creating new forms of structure, agency, and value (Mele and Russo-Spena, 2024; Mele et al., 2024). Therefore, as phygital ecosystems become more complex and integrated into firm operations, capturing their full potential requires the development of novel organizational capabilities to sustain competitiveness.

Despite its growing strategic relevance, the concept of phygital remains fragmented and under-theorized. Most studies frame it primarily through the lens of CX, focusing on how phygital ecosystems enable the creation of meaningful consumer connections, emotional engagement, and personalized interactions (Dahish et al., 2025). While these insights have advanced understanding of technology-mediated consumption, they overlook the broader strategic implications of phygital, particularly how firms develop the routines and capabilities required to operate effectively within phygital ecosystems. This lack of attention to the organizational dimension motivates our study.

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Understanding how organizations can strategically navigate the phygital shift is both theoretically and managerially critical. Theoretically, existing frameworks on dynamic capabilities (DCs) have been developed under the assumption that physical and digital domains remain separate, leaving unclear how capabilities evolve when these boundaries collapse. We lack a coherent explanation of how DCs evolve and operate in environments where digital technologies actively shape, extend, and even redefine physical contexts. Managerially, firms increasingly struggle to orchestrate technologies, people, and spaces within phygital ecosystems, where traditional digital transformation strategies are no longer sufficient.

The literature on DCs provides a promising lens for addressing this gap. At its core, this perspective highlights a firm's ability to sense opportunities, seize them, and reconfigure resources as the foundation of sustainable competitive advantage (Teece, 2012). These capabilities are largely considered essential for navigating digital disruption (Karimi and Walter, 2015; Ostadi et al., 2024; Vial, 2021), extending and enhancing firms' ability to compete in rapidly evolving markets (Grego et al., 2025; Matarazzo et al., 2021; Warner and Wäger, 2019). However, insights into the formation and use of DCs in phygital ecosystems are hitherto lacking.

To capture this transformation, we build on the notion of ontological reversal (Baskerville et al., 2020), which challenges the traditional view of the digital as a mere extension of physical reality. Digital artifacts not only mirror but also reshape and constitute physical environments, altering how organizations and individuals interact with the world. In line with this perspective, we argue that phygital is not simply an outcome of digitalization but a new operating logic shaped by both digitalization (physical → digital) and physicalization (digital → physical) (Dahish et al., 2025). This ontological shift demands new types of DCs tailored to environments where physical and digital dimensions continuously co-produce meaning, value, and structure (Gensler and Rangaswamy, 2025).

While prior studies have examined a range of factors as the foundation of digital DCs (e.g., Chirumalla, 2021; Ellström et al., 2021; Sousa-Zomer et al., 2020; Warner and Wäger, 2019), their focus has largely been on how digital technologies can be harnessed and translated into business value (Ceipek et al., 2021; Volberda et al., 2021). However, the specificities of phygital capabilities have not been explored. Important gaps therefore remain, particularly at the *microfoundational level* (Felin et al., 2012), concerning how firms can develop routines that enable organizations to operate effectively within such ecosystem.

Against this background, the aim of this study is to investigate how firms can develop PDCs and what are their microfoundational components. To this end, we conduct an in-depth exploratory case study (Eisenhardt, 1989; Gehman et al., 2018), purposefully selecting the Webidoo Store case, a pioneering phygital retail model that integrates the physical and digital dimensions through the combined use of multiple technologies (e.g., apps, web, social media, mixed reality, VR, and AR) (Bartoli et al., 2023).

With this paper, we contribute to extending prior literature in important ways. First, we extend research on phygital ecosystems (Batat, 2022, 2024a,b; Belghiti et al., 2017; Dahish et al., 2025; Mele et al., 2023) by highlighting their strategic relevance for capability development and competitiveness, moving beyond prior studies centred mainly on customer engagement and experience enhancement. Second, we conceptualize PDCs as a distinct form of DCs (Shen et al., 2021; Warner and Wäger, 2019) that emerge in environments where the digital and physical dimensions are mutually constitutive rather than hierarchically related. This perspective advances the DCs literature by showing that digital and physical realities recursively shape one another through intertwined sensing, seizing, and reconfiguring (Baskerville et al., 2020; Mele and Russo-Spena, 2024). Third, we contribute to the microfoundational perspective of DCs (Felin et al., 2012; Helfat and Peteraf, 2015; Teece, 2007) by identifying the MFs of PDCs that enable firms to synchronize and co-evolve in phygital ecosystems. This perspective advances DCs research by revealing how technological intelligence and human agency jointly constitute the micro-level mechanisms through which firms learn, adapt, and renew their capabilities within interconnected physical–digital environments (Annarelli et al., 2021; Warner and Wäger, 2019).

2. Theoretical background

2.1. Digital dynamic capabilities: enabling firms to sense, seize, and reconfigure in the age of digital transformation

The theory of DCs explains how firms build, integrate, and reconfigure resources and capabilities to thrive and succeed in rapidly changing environments (Helfat and Peteraf, 2015; Schilke et al., 2018; Teece, 2007). DCs consist of three key functions: sensing, which enables firms to detect and respond to opportunities and threats; seizing, which refers to the processes and structures needed to generate value; and reconfiguring, which involves the continuous alignment of tangible and intangible resources with market changes (Teece, 2007).

Recent scholarly contributions have underscored the extent to which the advent of digital technologies has reshaped firms' capacity to adapt and maintain competitiveness within increasingly volatile and rapidly evolving markets (Grego et al., 2025; Karimi and Walter, 2015; Ostadi et al., 2024; Vial, 2021). Within this transformative environment, organizations are progressively leveraging digital DCs as pivotal enablers to adjust their business models, foster agility, and enhance innovation (AlNuaimi et al., 2022; Annarelli et al., 2021; Ellström et al., 2021; Pundziene et al., 2022; Shen et al., 2021; Warner and Wäger, 2019), influencing both employees (Berman, 2012; Dery, 2021; Soule et al., 2016) and customer interactions (Fisk et al., 2023; Saunila et al., 2019). Digital sensing helps firms anticipate technological trends, analyze signals, and build a long-term digital vision (Herold et al., 2023; Jacobi and Brenner, 2018; Warner and Wäger, 2019). Digital seizing involves leveraging resources, applying digital technologies (Annarelli et al., 2021; Warner and Wäger, 2019), and adjusting business models for innovation and scalability (Shen et al., 2021). Digital reconfiguring guides business model transformation, cultural change (Herath and Harrington, 2023), collaboration with external partners, building ecosystems, hiring digital talent, and harnessing internal knowledge (Berbel-Vera et al., 2022; Kroh et al., 2024; Linde et al., 2021).

According to scholars, the effective implementation of digital transformation requires a deeper understanding of capabilities and, particularly, their MFs (Annosi et al., 2023; Iden and Bygstad, 2025). MFs form the core of DCs; they encompass the skills, processes, and structures that enable firms to enact sensing, seizing, and reconfiguring (Abatecola et al., 2020; Teece, 2007). Adopting a microfoundational approach in the study of DCs allows scholars to unpack "the mechanisms by which DCs are created, expressed, and transformed within organizations" (Arndt et al., 2022, p. 424). MFs operate at multiple levels: at the individual level (e.g., cognition, skills, experience) (Barney and Felin, 2013; Felin et al., 2012), at the process level (e.g., collaboration and coordination mechanisms) (Eggers and Kaplan, 2013; Felin et al., 2012; Helfat and Peteraf, 2003); and at the structural level (e.g., organizational designs shaping individual and collective interactions) (Felin et al., 2012).

Prior research has identified a range of elements constituting the MFs of digital DCs, including digital education and training (Chirumalla, 2021; Scuotto et al., 2021), employees' entrepreneurial and risk-taking mindset (Cranney et al., 2025), and collaboration and information exchange both internally and externally (Annosi et al., 2023). Additional MFs concern agile and flexible structures, cross-functional teams, and a mature digital architecture (e.g., Annosi et al., 2023; Chirumalla, 2021; Kroh et al., 2024). Other studies highlight MFs such as digital leadership capabilities (Brunner et al., 2023), human capital and organizational learning (Nguyen et al., 2023), and sociotechnical routines that combine human and technological elements (Iden and Bygstad, 2021).

Recently, Kowalski et al. (2024) have further classified digital sensing MCs as encompassing digital analytical observation and scenario planning (e.g., Chirumalla, 2021; Ellström et al., 2021; Warner and Wäger, 2019), creating a digital mindset (e.g., Warner and Wäger, 2019), and enhancing customer experience through analytics (Kowalski et al., 2024). Sensing MFs also include open innovation, such as exploration of external knowledge and co-creation in digital alliances (Čirjevskis, 2022; Randhawa et al., 2018). Digital seizing MFs involve rapid prototyping capabilities based on agile and lean methods (e.g., Ghouri et al., 2022), strategic agility for resource reallocation (e.g., Chirumalla et al., 2023; Warner and Wäger, 2019), and managing digital portfolios to drive innovation and scale new solutions (e.g., Chirumalla et al., 2023). Finally, digital reconfiguring MFs focus on developing digital maturity via employees' training (e.g., Sousa-Zomer et al., 2020; Warner and Wäger, 2019), orchestrating innovation ecosystems through co-creation with external partners (e.g., Annarelli et al., 2021; Khurana et al., 2022), restructuring internal operations for digital alignment (e.g., Sousa-Zomer et al., 2020; Warner and Wäger, 2019), allocating dedicated human and financial resources for digital transformation (e.g., Sousa-Zomer et al., 2020), fostering a digital entrepreneurial culture based on experimentation and risk-taking (e.g., Sousa-Zomer et al., 2020; Warner and Wäger, 2019), and integrating digital analytics into innovation management (Kowalski et al., 2024). Reconfiguring MFs also involve capabilities that allow organizations to orchestrate partnerships, design and experiment with new services, and scale digital solutions in ways that secure long-term sustainability (Alexandre et al., 2022).

2.2. *Dynamic capabilities in phygital ecosystems: what is next?*

Technological advancements have profoundly transformed how firms and consumers interact. Marketer–consumer relationships have become increasingly immersive through tools such as self-service kiosks, AR applications for in-store visualization, and personalized smartphone promotions, all designed to strengthen consumer relationships (Gamage et al., 2025). This growing integration between the physical and digital worlds has given rise to phygital, which refers to an ecosystem combining physical, human, digital, and media elements (Batat, 2022, 2024a,b) to create seamless experiences in the delivery process of consumer value provided from digital to physical touchpoints and *vice versa*.

Over the past few years, phygital has spanned multiple domains, from tourism—through immersive exhibits, digital heritage, and personalized platforms (Del Vecchio et al., 2023)—to education, where blended physical–digital experiences enhance engagement, accessibility, and adaptability (Chaturvedi et al., 2021). Phygital is also evident in events, where virtual spaces support interactive participation alongside in-person attendance (Mele et al., 2023). In health, digital apps enable anonymous discussions on mental well-being, though they may reduce offline support-seeking (Veer and Dobele, 2024). In urban contexts, phygital blends digital tools with participatory methods, allowing citizens to co-design public spaces via online platforms and real-time data (Bazzanella et al., 2014). Despite the breadth of applications, retail remains the domain most profoundly shaped by phygital, where firms offer "an omnichannel experience combining physical features and digital features in the same point of sale" (Belghiti et al., 2017, p. 65) while creating more engaging and seamless customer journeys (Akmermer, 2022; Alexander and Varley, 2025; Batat, 2024a; Pangarkar et al., 2022). Customers can access product information, compare options, and test scenarios using tools such as interactive kiosks, smart mirrors, and AR displays (Klaus, 2024). Integrating digital and physical worlds consistently helps companies maintain a unified brand image, online and offline (Gamage et al., 2025).

Current research primarily focuses on how phygital enhances CX, emotional engagement, and personalized interactions, ultimately fostering meaningful consumer connections (Dahish et al., 2025). Yet, it ignores the underlying capabilities required for organizations to implement and scale phygital effectively.

We argue that phygital marks a profound transformation: firms must move beyond merely adapting digital tools to physical processes and instead develop and orchestrate resources and capabilities in environments where digital elements actively structure—and are simultaneously reshaped by—physical practices, as the growing entanglement of human and technological interactions reshapes agency, structure, and value creation (Mele et al., 2023, 2025; Mele and Russo-Spena, 2022, 2024). This perspective aligns with the ontological reversal framework (Baskerville et al., 2020), which posits that digital elements are no longer mere enhancements to the physical world but actively reshape and dictate physical realities.

Applying Teece's (2007) DCs framework, we propose that PDCs emerge as a specialized subset of DCs, enabling firms to compete and operate within phygital ecosystems. Prior research has explored digital DCs (Grego et al., 2025; Matarazzo et al., 2021; Warner and Wäger, 2019), including the related sensing, seizing, and reconfiguring MFs (e.g., Chirumalla, 2021; Ellström et al., 2021; Sousa-Zomer et al., 2020; Warner and Wäger, 2019); however, they have mostly emphasized how digital technologies can be leveraged and translated into business value (Ceipek et al., 2021; Volberda et al., 2021). Significant gaps therefore remain, particularly at the microfoundational level (Felin et al., 2012), regarding the mechanisms by which phygital capabilities are created, expressed, and transformed within organizations (Arndt et al., 2022). With this study, we aim to uncover the underlying routines, processes, and structures (Teece, 2007) that underpin what we term phygital dynamic capabilities (PDCs).

3. Methods

3.1. *Research design and case selection*

We adopt a qualitative case study approach (Miles and Huberman, 1984; Yin, 1994) to examine how firms develop PDCs and their microfoundational components, allowing us to capture how digital elements function not merely as tools but as fundamental structuring forces shaping firms' DCs (Oliveira et al., 2024). This methodology is considered suitable to get in-depth empirical insights and build a robust theoretical inference about under-explored phenomena (Dyer Jr and Wilkins, 1991; Eisenhardt, 1989). We focused on a specific case that is critical, extreme, unique, and revelatory (Dubé and Paré, 2003; Silverman, 2013; Stake, 1995; Yin, 1994) to provide a detailed and nuanced exploration of PDCs and identify their underlying MFs within a real-world context.

Our analytical perspective is informed by the notion of ontological reversal (Baskerville et al., 2020), which we use as a theoretical lens to examine how digital elements actively shape - not just support - organizational processes and capability development. This lens allows us to conceptualize phygital not simply as a technological layer but as a transformation in the structure and logic of firm activity.

We purposefully opted for a single case study design by choosing the Webidoo Store. According to Saunders et al. (2015), purposeful sampling is often employed in case study research, typically requiring a small sample, and this form of sampling is suitable for selecting cases that are particularly informative.

3.2. The Webidoo Store

Webidoo Ltd. is a company engaged in Digital Transformation and Digital Marketing. At its core, the company provides integrated solutions to support small and medium-sized enterprises (SMEs) in their digitalization journey[2,3]. The company is structured into different units: Webidoo Digital Services, which provides businesses with technologies, expertise, and strategic thinking to face daily challenges of digitalization; Webidoo Factory, which assists companies with structured marketing needs; Webidoo Chain, which explores emerging technologies to support businesses; Webidoo Coding, which develops technological products and designs tailor-made digital solutions; and Webidoo Store, which applies these approaches to the retail sector.

Webidoo Store (see Fig. 1) is described by the company as a pioneering phygital retail model in Europe[3]. Its philosophy stems from the belief that physical retail is far from obsolete but must evolve. Purchasing a product, therefore, is conceived as an experience grounded in value and trust. The store is organized into seven main areas: electronics, smart mobility, smart home, gaming, sport and fitness, video and audio, and lifestyle and leisure. These areas cover a wide range of products, from smart home devices to equipment for gaming, leisure, and virtual reality. Rather than simply selling technology, the store aims to build a bridge between innovation and everyday life, offering customers tangible encounters with emerging technologies that are not commonly available elsewhere. This orientation reflects a deliberate attempt to make innovation accessible, experiential, and emotionally engaging, transforming the act of purchase into an opportunity for discovery and connection. According to the company, the store aims to transform the traditional retail concept into a technological hub where consumers can interact directly with products and services. The store's uniqueness lies in a continuous global scouting effort: it seeks technologies that are not found elsewhere—often available only online or in foreign markets—and brings them into the store so customers can experience them firsthand before purchasing. The store adopts a Try and Buy model integrating various digital tools, such as interactive displays and QR codes, to create seamless interactions across online and offline channels. In this way, exclusivity becomes immediately accessible. Additionally, it leverages AI, automation, and platform-based processes to enhance CX and continuously adapt the business model.

Given these distinctive features, Webidoo Store represents an exemplary case for empirically examining phygital ecosystems through the lens of DCs. The company's structured business model, deeply embedded in driving digital transformation for both enterprises and consumers, makes it an ideal subject for an ontological reversal perspective, where digital elements actively reshape the physical world (Baskerville et al., 2020). This dynamic interplay triggers a profound transformation in how firms develop and deploy capabilities within phygital ecosystems.

3.3. Data collection

To ensure data triangulation (Miles and Huberman, 1984) and enhance robustness (Dubé and Paré, 2003; Eisenhardt, 1989; Yin, 1994), we combined primary and secondary data sources. The dataset includes participant observation, eleven semi-structured interviews with key decision-makers, numerous informal conversations, and systematic content analysis of documents and social media materials. This methodological pluralism allowed us to capture complementary perspectives on how the Webidoo Store navigates and responds to the challenges of a phygital ecosystem.

3.3.1. Participant observation

One of the two first authors spent four consecutive days in December 2021 at the Webidoo Store, invited by the General Manager and one of the three Co-founders. During this period, the author directly experienced the store's phygital ecosystem by engaging in activities such as scanning QR codes, testing products, attending events, and exploring the "Try & Buy" formula. The purpose of this immersion was to live the store experience as a customer while observing how physical and digital elements were orchestrated to support strategic capability development. Field notes were systematically collected, with particular attention to how employees, technologies, and consumers co-constructed value in real time, and how these interactions revealed the firm's ability to sense opportunities, seize them through adaptive service models, and reconfigure offerings. The notes were transcribed and expanded into detailed accounts shortly after the observation period to ensure accuracy.

3.3.2. Interviews

To investigate how to develop PDCs and their microfoundational components, we conducted eleven semi-structured interviews with key informants occupying critical roles, such as Co-founder, Chairman & CEO, Store Manager, and E-commerce Manager (Eisenhardt and Graebner, 2007). Informants were purposefully selected for their strategic involvement in conceiving, implementing, and evolving the Webidoo Store model, and were identified through the collaboration of the General Manager, who facilitated contact with participants.

The interview protocol included ten guiding questions (Strauss and Corbin, 1998) designed to explore how interviewees identify, address, and sustain opportunities in phygital ecosystems. Example questions included: *"What major transformations have characterised your industry in recent years? Which technologies have had the greatest impact?"; "How does your company collect and integrate data from physical and digital channels to understand customer preferences?"; "What kind of customer experience do you offer, and how do you integrate physical and digital touchpoints?"; "How is the adaptation of organizational structures to the phygital ecosystems managed?"*. To ensure clarity and comprehensibility, the protocol was pre-tested with a manager not included in the sample (Yin, 2009), and refined based on feedback (Van Teijlingen et al., 2001).

The interviews were conducted in two phases over a 22-month period: eight interviews in February 2022, three months after the store's opening, and three interviews in November 2023, coinciding with the store's second anniversary, to capture its strategic and operational evolution. Each interview lasted approximately one hour and was conducted online via Google Meet or Microsoft Teams. All interviews were audio-recorded, transcribed, and translated from Italian into English (Bryman and Bell, 2022; Seidman, 2013). When clarification was needed, follow-up questions were sent via email or phone. We ceased data collection upon reaching theoretical saturation (Strauss and Corbin, 1998).

3.3.3. Documents and social media

To complement primary data, we systematically analyzed Webidoo Store's official communications, including press releases, website content, and activity across major social networking platforms (Facebook, Instagram, LinkedIn, TikTok, and YouTube) and online video channels. The analysis covered the period from November 2021 (the store opening) to November 2023. These secondary data provided insight into how Webidoo Store publicly articulated its strategic vision, digital

[2] Webidoo Ltd. grew by 130 % since the beginning of the 2023 with an aggregated result close to 11 million euros in 2022 (showing growth compared to the 9 million euros in 2021) and a positive EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization). After the initial Series A round of 6 million euros in 2021, which saw the entry of the 8a + Fund from Banca Generali and TIM Ventures into the company's shareholding, Webidoo Ltd. has launched a Series B round to support its growth in target markets. Driving development in the first half of the year Webidoo has also launched Jooice, the world's first integrated system for the digitization of SMEs, and Welpy, the Artificial Intelligence at the service of SMEs.

[3] https://webidoostore.com/blogs/notizie/nasce-webidoo-store-il-primo-tech-experience-store-d-europa?srsltid=AfmBOoqazi268alYlPJb3bFyAc7YUAh1vvYtbtC1KYS280vW3e-WVHIz.

Fig. 1. The Webidoo Store.
(Source: Webidoo Stores' web page.)

transformation agenda, and capability development priorities, while also offering triangulation with interview and observational findings (see Table 1).

3.4. Data analysis

NVivo software was used to collect, organize, and analyze the qualitative interview, observational, and archival data. An abductive process guided the study, characterized by an iterative movement between empirical data and theoretical insights (Dubois and Gadde, 2002; Timmermans and Tavory, 2012). Rather than imposing a priori categories, we sought to develop a situated understanding of PDCs as they emerged from the field. Insights from prior literature (e.g., Batat, 2022; Belghiti et al., 2017; Mele et al., 2023) informed the design of the early interviews and offered preliminary sensitizing concepts, while emerging empirical patterns progressively refined our understanding of how PDCs unfold in practice (Denzin and Lincoln, 2011). The data analysis proceeded through three key coding stages, following an ontological reversal perspective (Baskerville et al., 2020) to reflect how digital no longer serves as a tool but actively structures and reshapes the way firms sense, seize, and transform their capabilities in a phygital ecosystem.

To structure the analysis, we followed an iterative, multi-stage process. We first generated first-order codes from the data, then clustered them into MFs as second-order themes, and finally aggregated them into three higher-level dimensions of PDCs (see Fig. 2). The following steps describe this analytical progression in detail.

Table 1
Summary of data sources.

Primary data sources					Secondary data sources
Interview	Participant observation	Role	Gender	Interview time-span	
Interview 1	Participant Observation 1	Retail Manager	M	56′39″	▪ Official website ▪ Facebook (361 posts) ▪ Instagram (164 posts) ▪ LinkedIn (24 posts) ▪ TikTok (62 posts) ▪ YouTube (78 posts) ▪ Archival Data (meeting notes, press releases – articles from the Web)
Interview 2	Participant Observation 2	Co-founder, Chairman & CEO	M	56′16″	
Interview 3	Participant Observation 3	HR Manager	F	35′28″	
Interview 4	Participant Observation 4	Channel Business Manager/Partner Manager	F	58′06″	
Interview 5	Participant Observation 5	Marketing Coordinator	F	75′46″	
Interview 6	Participant Observation 6	Jr. Project Manager	F	58′11″	
Interview 7	Participant Observation 7	General Manager	M	59′03″	
Interview 8	Participant Observation 8	Specialist Recruiting Manager, HR, Brand Ambassador	F	61′37″	
Interview 9		Store Manager & Offline Marketing Manager	M	44′43″	
Interview 10		Co-founder & Head of SMBs Digital Transformation	M	56′38″	
Interview 11		E-commerce Manager	M	57′30″	

Step 1 – First-order coding. Although informed by prior literature, the analysis was not constrained by predefined categories. We began with open coding of the interview transcripts and field notes, employing in-vivo labels to capture participants' own words, meanings, and situated practices as they naturally emerged from the data (Corbin and Strauss, 1990). The data were closely examined to identify initial concepts and recurring patterns, subsequently grouped into more abstract categories (Gioia et al., 2013). This inductive stage allowed us to stay close to the empirical material and to document how phygital was articulated in context. Initial codes were primarily descriptive, capturing empirical manifestations of the phenomenon. Where possible, secondary source material was also used to triangulate our data to increase its reliability. Examples of first-order codes include *direct in-store observation*, *"Try & Buy" formula*, *integrated KPI tracking across offline and online channels*, *product rotation strategy*, and *multisensory exploration*. Collectively, these codes provided a rich repository of empirical manifestations of phygital enactment, reflecting tangible activities as well as more subtle experiential and cognitive processes. At this stage, we deliberately refrained from imposing theoretical interpretation, allowing the data to speak before moving toward higher levels of abstraction.

Step 2 – From codes to MFs (second-order themes). We subsequently compared and refined the initial codes to identify broader patterns of action and meaning, which we conceptualized as MFs. This step involved clustering related activities, routines, and mechanisms that operated at individual, process, and structural levels (Barney and Felin, 2013; Felin et al., 2012). For instance, *collection of digital analytics* and *direct in-store observation* converged into the individual-level MF *AI-driven insight gathering* (Felin and Hesterly, 2007; Spanos and Prastacos, 2004) as they capture a dual detection mechanism where digital inputs augment human perception through real-time data on customers' characteristics, first impressions, and product interactions, while individuals' observational skills refine, personalize and enrich digital analytics with qualitative insights regarding customer behaviors in the physical context. Moreover, codes such as *analyze digital-offline analytics* and *creating tailored customer journeys* were grouped under the process-level MF *Customer intelligence mastery* (Eggers and Kaplan, 2013; Felin et al., 2012; Helfat and Peteraf, 2003), as they highlight the dynamic process through which firms synthesize structured data from both digital and physical sources to inform strategic choices and operational execution. Similarly, *facilitate innovation access* and *create a coherent business model* informed by the structural-level MF *Phygital sensemaking* (Eggers and Kaplan, 2013; Felin et al., 2012; Helfat and Peteraf, 2003), reflecting the organizational framework that ensures that digital and physical insights are transformed into shared knowledge, guidelines, and operational practices. Following the same logic, additional second-order themes were derived, including *Customer-centric phygital catalyst*, *Blended response system*, *Convergent strategic agility*, *Improve phygital maturity*, *Recalibrate offline–online resources*, and *Phygital entrepreneurial culture*. These MFs collectively captured the mechanisms through which phygital capabilities are enacted at varying levels.

Two researchers worked independently to generate and refine the coding structure, iteratively comparing interpretations and resolving discrepancies through discussion. Throughout this process, concepts were revised, merged, or discarded as patterns became clearer and more theoretically meaningful. This collaborative and reflexive approach strengthened the internal validity of our analysis by ensuring that emerging categories were both empirically grounded and conceptually distinct.

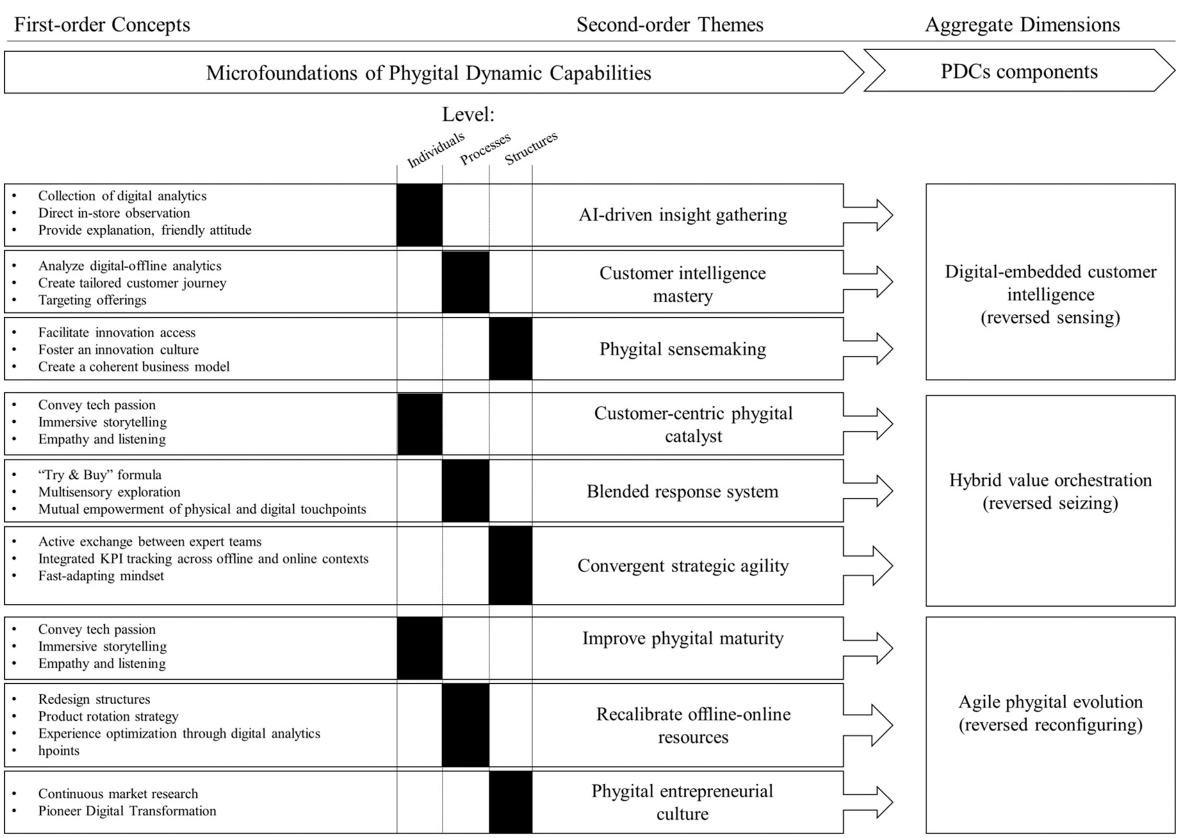

Fig. 2. Data coding process.[a]

[a]The table distinguishes (i) first-order codes, representing empirical manifestations of phygital enactment (e.g., tangible activities, experiential patterns, and cognitive processes), (ii) second-order themes, capturing clustered skills, routines, and organizational arrangements across individuals, process, and structural levels (i.e., microfoundations) (Barney and Felin, 2013; Felin and Foss, 2005), and (iii) aggregate dimensions, corresponding to the reversed sensing, seizing, and reconfiguring components of PDCs (Teece, 2007).

To enhance theoretical robustness, we continuously compared the emerging MFs with prior literature. Whenever established constructs provided a more accurate representation of our observed phenomena, we integrated them into the analysis. This step reduced redundancy, sharpened conceptual boundaries, and facilitated a tighter integration between our empirical insights and prior theory, a key feature of abductive theorizing.

Step 3 – From MFs to aggregate dimensions. The third analysis stage involved the generation of aggregate dimensions that represented a higher level of abstraction in the coding. In this step, we drew on Teece's (2007) framework of DCs to classify the emergent themes. Specifically, we sought to determine whether the identified MFs could be interpreted as expressions of sensing, seizing, or reconfiguring capabilities. Here, we used insights from the literature to form theoretically sound dimensions of PDCs relating to sensing, seizing, and reconfiguring (Teece, 2007). Thus, the aggregate dimensions are built on the first-order categories and second-order themes to present a theoretically and practically grounded categorization of how PDCs are enacted across individual, process, and structural levels. For instance, the aggregate dimension *Digital-embedded customer intelligence (reversed sensing)* comprises the MFs *AI-driven insight gathering* (individual), *Customer intelligence mastery* (processes), and *Phygital Sensemaking* (structure). This dimension encompasses the firm's ability to continuously capture and analyze customer insights (such as actions, reactions, and preferences) across both physical and digital layers, to identify emerging opportunities and latent threats with greater timeliness, thereby supporting more informed and adaptive decision-making processes. The aggregate dimension *Hybrid value orchestration (reversed seizing)* includes the MFs *Customer-centric phygital catalyst* (individual), *Blended response system* (processes), and *Convergent strategic agility* (structure). This dimension reflects the firm's ability to seize phygital opportunities by proactively leveraging insights from both physical and digital domains to deliver personalized, emotionally engaging, and actionable experiences, where digital interactions are continuously enriched through human engagement in the physical context. Finally, the aggregate dimension *Agile phygital evolution (reversed reconfiguring)* encompasses the MFs *Improve phygital maturity* (individual), *Recalibrate offline-online resources* (processes), and *Phygital entrepreneurial culture* (structure). This dimension points to the firm's ability to continuously realign and evolve its physical and digital components' arrangement, behavior, or characteristics through recursive learning, synchronized processes, and an entrepreneurial culture of experimentation.

All authors conducted the coding independently and in parallel. After each stage, we ran a Coding Comparison Query and discussed discrepancies until achieving a Kappa coefficient > 0.75 (Bazeley and Jackson, 2013). We adhered to established qualitative research standards to ensure trustworthiness (Lincoln and Guba, 2013; Shah and Corley, 2006): credibility (transparent aims; dialogic validation of interpretations with key informants), transferability (thick contextualization and multiple roles within the Webidoo Store), dependability (triangulation across interviews, observations, and secondary materials), and confirmability (audit trail, verbatim quotations, and evidence-linked inferences).

4. Findings

In this study, we set out to investigate how PDCs develop by examining their underlying MFs at the level of individuals, processes, and structure (Barney and Felin, 2013; Felin et al., 2012). By examining an exemplary case - the Webidoo Store - our findings reveal that, in a phygital ecosystem, the traditional capabilities of sensing, seizing, and reconfiguring operate in a reversed way. Unlike conventional models where firms first sense physical signals and translate them into digital strategies, our framework highlights a digital-to-physical ontological reversal: digital reality actively shapes physical reality, influencing firms' strategic and operational decisions; physical reality, in turn, feeds back into digital reality, refining and enhancing digital intelligence through real-world interactions. This recursive interplay is visually represented in Fig. 3, where opposing arrows illustrate the cyclical relationship between the digital and the physical.

Building on these insights, we propose a multi-layered framework for developing PDCs, which intertwines individual, processes, and structure MFs. MFs serve as the basic building blocks. From these MFs, firms develop core reversed sensing, seizing and reconfiguring capabilities, which integrate a bundle of different kinds of resources and capabilities to pursue a strategic direction. These include: digital-embedded customer intelligence, hybrid value orchestration, and agile phygital evolution. The interplay of these core capabilities gives rise to PDCs, which emerge as higher-order mechanisms that enable continuous renewal within phygital ecosystems where the physical and the digital are deeply intertwined. PDCs can be conceptualized as *the organizational ability to identify opportunities across both physical and digital layers, orchestrate hybrid resources, and dynamically transform operations by integrating digital intelligence with physical components into a cohesive, data-driven ecosystem.*

In the following section, we delve into the details of the analysis of the case study. This section is split into the three core reversed sensing, seizing and reconfiguring capabilities and their MFs (individuals, processes, structure, and their interaction), highlighting their distinctive features and roles.

4.1. Digital embedded customer intelligence (reversed sensing)

Our findings show that, in the Webidoo store, information generated by technological tools guides in-store practices (digital → physical), shaping how employees interact with customers and enhancing the organization's ability to detect shifting needs. At the same time, insights derived from the physical context, collected through direct observations and qualitative feedback, are systematically reintegrated into digital systems (physical → digital), thereby fuelling a process of continuous learning. This bidirectional interplay shows the dual nature of phygital sensing, where digital mechanisms shape physical behaviors, which subsequently feed back into the updating of digital processes through the experiences and interactions that occur within the physical context. Through this continuous exchange, organizations develop a more accurate and immediately actionable understanding of customers. We define this reversed sensing capability as *digital embedded customer intelligence*, namely the continuous capture and analysis of customer insights (such as actions, reactions, and preferences) across both physical and digital environments. This capability allows individuals and organizations to identify emerging opportunities and latent threats with greater timeliness, thereby supporting more informed and adaptive decision-making processes.

4.1.1. Individual-level MF: AI-driven insight gathering

We observed that, in the Webidoo Store, digital systems first capture customer insights (mapping behaviors, emotional responses, and interest levels) before human intervention. For instance, high-resolution depth cameras and heat-mapping tools identify which products attract the most attention and how long customers interact with them, as the Co-founder, Chairman & CEO explained: "*It's all mapped out […] we also have marketing cameras inside the Store where we see how many times people stop in front of a product, so we understand which products create the most interest*". Similarly, emotion-recognition technologies enrich profiles with affective cues and demographic markers: *"[…] We then introduced, in the beta testing phase, a small camera that profiles all customers based on their emotions, determining whether they are happy, neutral, sad, or angry, as well as identifying their gender, presence of facial hair, wearing glasses, having children, or not having children"* (Store Manager & Offline Marketing Manager).

Employees then adjust their own behaviors (choosing when to approach, when to step back, and how to personalize communication)

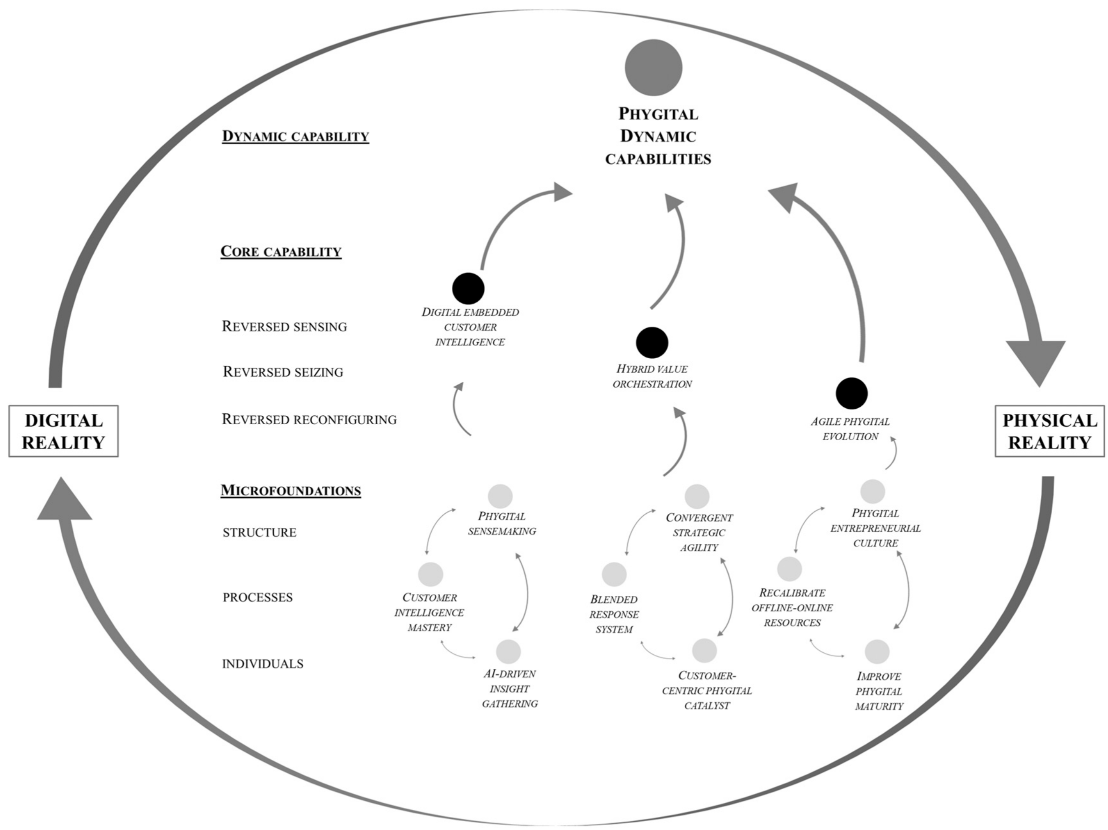

Fig. 3. Theoretical framework for Phygital Dynamic Capabilities' development.

based on this intelligence (Participant observation, Retail Manager). As the Jr. Project Manager emphasized, it is crucial to complement digital signals with observational skills and human sensitivity: *"[…] understand when the person wants to be left alone, wants to be able to walk around […] I tell you where you are, I tell you what you can find, you can find the information through the QR code, if you need any information, I'll walk around you, so I'm at your disposal, but obviously you recognize it the moment you approach the person"*. Participant observation confirmed that employees frequently paused before initiating contact, waiting for subtle signals from customers (Field observation, General Manager).

Taken together, these findings highlight the limits of digital tracking alone. While technologies provide real-time, structured data on customer characteristics and product interactions, human observation enriches this data with contextual and qualitative nuance. Indeed, customer understanding requires employees to actively observe behaviors in the physical environment, where first interactions with products occur. Valuable insights thus emerge from the interplay between digital tools and human interpretation. This interplay was clearly visible in the store's layout and interaction patterns (Participant observation, Channel Business Manager/Partner Manager).

We define this MF as AI-driven insight gathering, a dual detection mechanism that forms the bedrock upon which digital embedded customer intelligence is built at the individual level. Digital inputs augment human perception by providing real-time data on customers' characteristics, first impressions, and product interactions, while employees' observational skills refine, personalize, and enrich digital analytics with qualitative insights regarding customer behaviors. This continuous exchange enables firms to capture market insights more effectively, meeting evolving customer expectations with customized service.

4.1.2. Process-level MF: customer intelligence mastery

In the Webidoo Store, digital and physical data streams are integrated to anticipate customer needs and personalize engagement. Bluetooth tracking and cross-channel purchase histories, for instance, allow the Store to recognize returning customers and immediately connect them to prior transactions. As the General Manager explained, *"[…] we are working to understand the identity of individuals […] who have made both online and offline purchases. We aim to trace the customer's journey […] We are implementing Bluetooth tracking to monitor when people enter the Store,"* linking them to past purchases and alerting sales staff when a familiar customer walks in. These systems equip employees to tailor experiences to distinct customer profiles, such as business buyers (e.g., gym managers looking for specialized equipment), early-adopter tech enthusiasts, or brands seeking to showcase their latest innovations. The Retail Manager emphasized that this integration enables *"proposing something that is naturally strongly targeted and that the user, in that logical path, can recognize as one of their needs."* In practice, data synthesized from digital tracking and physical observations allows the Store to orchestrate "targeted pathways" in real time, aligning marketing campaigns and service delivery to evolving customer profiles (Participant observation, General Manager). The anticipatory nature of this approach means that insights do not merely react to customer actions but proactively shape them. As the Store Manager & Offline Marketing Manager noted, *"we have comprehensive information about everyone who enters, enabling us to discern potential new marketing campaigns or local marketing strategies."*

Our findings show how the process level comes into play to ensure that individual-level capabilities are executed and optimized, translating digital and physical insights into actionable strategies. Hence, customer intelligence mastery emerges as a key process-level MF of digital embedded customer intelligence. It is defined as the ability to synthesize structured data from both digital and physical sources to inform strategic choices and operational execution. This synthesis enables more effective orchestration of operations, more accurate decision-making, and an improved phygital experience across online and offline contexts.

4.1.3. Structural-level MF: phygital sensemaking

The Webidoo Store operates in a market that spans both B2B and B2C customers, engaging them online and offline: *"[…] Webidoo Store is a space where customers can get hands-on with the latest Hi-Tech innovations. Companies and professionals can discover the potential of advanced web platforms, e-commerce, and digital advertising. Technology brands will have access to a unique marketplace to showcase and promote their products, all with the support of digital specialists from Webidoo […]"* (Press release). This duality makes close cooperation among organizational members, technologies, and digital analytics essential as the market segment evolves continuously and customers' expectations and preferences significantly change.

The Store's phygital model was designed to address a structural gap between brands and consumers. Rather than replicating traditional retail, it combines product interaction with data-driven intelligence in a hybrid environment. The General Manager explained that the concept arose from recognizing *"a gap between the brand and the end customer that had to be filled precisely with the experience, between the products and the end user […] when there was the possibility of putting technological products and renting them and testing them, the light bulb went on and we said this is exactly what we want, innovation."*

This approach makes technology tangible and accessible. Customers can explore unconventional products in design, lifestyle, hi-tech, and gaming, items otherwise absent from the Italian market. The physical space is deliberately "contaminated" with digital intelligence: every interaction produces insights, and those insights reshape displays and customer experiences. As the CEO explained, visitors are invited to *"touch it with their hands […] come in to have an experience, to take a path, to see, feel innovation, and every month you find something new."* Similarly, the Store Manager stressed the value of showcasing technologies that customers *"do not have the opportunity to try anywhere."*

The mission extends beyond selling products; it is about cultivating a culture of innovation by making digital transformation tangible. As the Marketing Coordinator put it, *"our mission must be to encourage people to really understand what technology is through our products […] we try to explain how important digital is."*

Individual capabilities and processes are effectively amplified when aligned with the structural level of the organization, which provides the necessary framework to make sure that an innovation culture is embedded into the firm's business model. We define this MF as phygital sensemaking, which anchors digital embedded customer intelligence at the structure-level. Unlike the individual level, where AI-driven data enhances personal observation, or processes, where customer intelligence refines real-time engagement strategies, the structure establishes phygital sensing as a core strategic function across the firm. This structural integration means that phygital sensing mechanisms are not isolated to specific processes or teams, but rather institutionalized across the organization. Phygital sensemaking represents a structural capability that ensures that digital and physical insights are integrated into the organizational framework and transformed into shared knowledge, guidelines, and operational practices aimed at democratizing access to innovation as a collective, organization-wide function.

4.1.4. Interaction between individuals, processes, and structure

Taken together, these findings reveal how reversed sensing, namely, digital embedded customer intelligence, is not a sum of isolated practices but a cumulative system where individuals, processes. and structure levels do not operate in isolation, but are interconnected and reinforce each other. At the individual level, digital cues refine human observation, while human insights enrich digital data. Notably, AI-driven insight gathering generates raw data and contextual interpretations, which in turn feed into process-level customer intelligence mastery, enabling the orchestration of anticipatory engagement. In our case study, the synergy between digital tracking and physical observation produced a richer and more comprehensive understanding of customers: their characteristics, preferences, and ways of approaching products and services. Digital and physical data streams are interpreted and structured to inform both strategic choices and operational execution. In particular, data-driven insights helped map tailored customer journey paths for heterogeneous needs. These processes then scale into a structural-level phygital sensemaking, which guides the design of the retail environment and the broader organizational phygital strategy. It translates the bidirectional flow of signals (digital → physical, physical → digital) into shared trajectories of action, guiding strategic priorities and resource allocation.

4.2. Hybrid value orchestration (reversed seizing)

Unlike sensing, which emphasizes the capture and interpretation of signals, seizing is centered on acting upon opportunities to stimulate customer engagement, foster loyalty, and accelerate conversion. Our findings reveal that, in the Webidoo Store, digital seizing mechanisms (such as QR codes, platforms, and interactive touchpoints) create a frictionless entry point for engagement, but their effectiveness materializes only when re-embedded into physical interaction (digital → physical), where employees adapt narratives, tone, and communication strategies in real time. At the same time, experiential inputs from the physical context, such as customers' emotional responses, body language, or expressed needs, are systematically reintegrated into digital processes and tools (physical → digital), refining ongoing campaigns, KPIs, and strategic initiatives. Reversed seizing thus exhibits a hybrid and adaptive nature: the digital dimension not only provides customers with immediate access to information and transactional opportunities but is continuously reinterpreted and activated through human engagement in the physical context. This dual activation enables employees and organizations to personalize value creation across convergent phygital touchpoints. We define this reversed seizing capability as *hybrid value orchestration*, namely the proactive use of insights across physical and digital domains to deliver tailored, emotionally engaging, and immediately actionable experiences.

4.2.1. Individual-level MF: customer-centric phygital catalyst

Technologies such as QR codes provide frictionless access to product information, but the true capability lies in how employees use this data to personalize engagement in real time (Participant observation, General Manager). Shop assistants interpret cues, adapt their messaging, and dynamically tailor the communication of product value and innovation to the specific customer in front of them. As the Retail Manager put it, success requires *"you need to look and listen actively […] knowing how to fragment communication based on the type of user you have in front of you."* This personalized engagement turns potential interest into real-time satisfaction and loyalty.

Employees are expected to embody passion, empathy, and innovation, acting as ambassadors of the brand (Participant observation, HR manager). The key difference lies in the employees themselves: customers do not interact with cashiers but with consultants—true experts who use the store as a laboratory. The Co-founder, Chairman & CEO explained: shop assistants must be *"technology enthusiasts who transfer this passion to the customer […] They don't have to sell; they must help the customer have the best experience […] Above all, they must have empathy and connection with customers, targeting them and identifying their needs through open questions."* Listening is the company's main priority: trust is used to build genuine and lasting relationships with customers.

Our findings also highlight the crucial role of immersive storytelling. Digital tools such as QR codes are not used merely to list specifications but to enrich the interaction with narrative elements. As the Store Manager emphasized, *"the real game-changer lies in the storytelling aspect of our products […] focusing solely on technical features categorizes you as a Shop Assistant. A Customer Experience Specialist is an inquisitive individual with an entrepreneurial mindset, capable of navigating sales dynamics."* By combining passion, knowledge-sharing, and emotional connection, employees create authentic experiences that elevate customer expectations. As the Co-founder & Head of SMBs Digital Transformation observed, this authenticity naturally turns customers into advocates who share positive stories with friends, family, and colleagues, amplifying loyalty and business success.

These findings show that hybrid value orchestration rests on the individual-level MF of a customer-centric phygital catalyst, where people and technology act in synergy to transform insights into immediate value creation. Digital tools provide the infrastructure, but employees activate them through empathy, storytelling, and adaptive communication. This human–digital synergy transforms insights into real-time engagement, enhancing satisfaction, loyalty, and word-of-mouth advocacy.

4.2.2. Process-level MF: blended response system

As the Channel Business Manager/Partner Manager observed, the Store offers customers the possibility of *"continuing with the online procedure but being able to touch the product with [their] own hands [...] renting some products for short periods [...] the physical and the online work hand in hand, strengthening each other and not contrasting each other."* This system relies on the real-time integration of technologies such as QR codes, touch screens, and the *Try & Buy* model, creating a dynamic and interactive customer experience. As the Jr. Project Manager explained, it combines *"the real experience, lived in any store, with the digital experience [...] trying the product directly in store, trying it at home, but then combining the digital, so if you want to buy it or rent it you go through the platform anyway."* The process is deliberately non-linear, but designed to enable multiple engagement and conversion pathways: *"The formula is therefore straightforward: all the products on display have a QR CODE which, when scanned via your mobile phone, allows you to discover all the features and prices. Moving, therefore, from the physical store to the virtual one, it is possible to decide to rent the product to try it for a few days, paying a daily fee, and then at a later time purchase it (recovering the money spent on the trial) or return it"* (Press release).

This phygital "liminal" space creates an immersive, multisensory experience where customers are not passive observers but active participants. They explore drones, smart home devices, electric vehicles, and fitness technologies in an environment designed as a "playground" for innovation, where they feel "surrounded by a digital transformation" (Channel Business Manager). As the Co-founder & Head of SMBs Digital Transformation emphasized, the Store offers *"a kinesthetic experience [...] to make them touch and experiment with the object. This is typical of the human being. We have various senses [...] phygital allows you to break down distances, to establish a connection."*

Based on our findings, hybrid value orchestration is anchored in the process-level MF of a blended response system. We define it as an adaptive framework that integrates physical and digital dimensions to deliver value across diverse customer segments. By merging physical interaction with digital platforms, the system creates flexible, multisensory pathways that adapt to customer needs in real time. This integration ensures that digital and physical players reinforce each other, transforming innovation into accessible, engaging, and actionable customer journeys.

4.2.3. Structural-level MF: convergent strategic agility

According to our findings, in the Webidoo store, all departments and individuals with specialized expertise are interconnected, fostering a holistic approach to customer engagement that grounds digital transformation within the physical context. As the Retail Manager explained, this depends on *"strong interaction and cross-functional collaboration to understand where improvements can be made with a joint exchange of information [...] analysis, benchmarking, internal meetings, brainstorming."* This agile orchestration is also evident in the coordination between marketing and store teams (Participant observation, Channel Business Manager/Partner Manager). The HR Manager described how the "SPA" marketing team collaborates directly with the store: *"Every two or three weeks, the video maker, the copywriter, and the art director go to the store, make videos, and create content for social networks that are then conveyed and shared over time."*

Such collaboration creates organizational flexibility, enabling continuous updates and knowledge sharing across online and offline functions. Central to this synergy is the integration of KPIs, which leverage digital analytics and in-store tracking to monitor and optimize the customer experience, thereby aligning different functions toward new, shared goals. As the *E*-commerce Manager noted, *"the e-manager keeps track of everything that happens on the e-commerce side, but of course, offline and online [...] are very connected, so we are in close contact every day, both with the physical store and logistics. We work in close contact, so basically, we feel as if we have a 24-hour connection with the Milan store."*

These findings show that hybrid value orchestration at the structural level rests on the MF of convergent strategic agility, the ability to rapidly adapt physical and digital elements in a unified strategy by connecting teams with cross-functional skills. By embedding collaboration, shared metrics, and knowledge exchange across functions, the organization ensures that physical and digital initiatives evolve in tandem. This structural capability allows the firm to continuously adapt, orchestrating unified customer experiences that align strategic vision with operational execution.

4.2.4. Interaction between individuals, processes, and structure

Our analysis shows how reversed seizing, conceptualized as hybrid value orchestration, is enabled by three interdependent MFs. At the individual level, employees' adaptive storytelling and empathetic engagement transform digital touchpoints, such as QR codes, into meaningful experiential inputs. These micro-level actions flow into organizational processes, shaping the way blended response systems flexibly synchronize physical and digital dimensions, whether through Try & Buy initiatives or QR-driven storytelling. This ongoing alignment demands cross-functional collaboration, shared KPIs, and integrated analytics, allowing process mechanisms to scale upward and crystallize into structural-level convergent strategic agility. Convergent strategic agility, in turn, reinforces physical and digital catalysts by providing updated tools and feedback loops, ensuring that they are aligned with the firm's strategic goals.

4.3. Agile phygital evolution (reversed reconfiguring)

From the data, it emerges that, in the Webidoo Store, digital technologies (e.g., platforms, analytics) provide new directions for adaptation, which are then embodied and tested through physical practices such as reskilling, store redesign, and product experimentation (digital → physical). Conversely, lessons emerging from the physical context, whether through employees' upskilling needs, customer interactions, or entrepreneurial initiatives, feed back into digital infrastructures and strategic roadmaps (physical → digital), strengthening the firm's capacity for renewal. In this way, reversed reconfiguring unfolds as a recursive, non-linear process of organizational transformation: the digital dimension not only accelerates the reorganization of physical processes but is itself continuously reshaped through embodied practices, cultural transformation, and organizational experimentation in the physical context. We define this reversed reconfiguring as agile phygital evolution: the firm's ability to continuously realign and evolve its physical and digital components' arrangement, behavior, or characteristics through recursive learning, synchronized processes, and an entrepreneurial culture of experimentation.

4.3.1. Individual-level MF: improve phygital maturity

As the General Manager explained, *"by improving ourselves, we have found the most suitable individuals for these roles. We must be able to change and adapt quickly, capturing external data, and this is precisely the strategic approach within a startup, especially an innovative one."* The Store fosters a culture of ongoing learning to ensure high-quality service, especially in sectors where technologies evolve quickly and require constant updating. Updated technical skills of employees empower the firm to address customer queries, provide personalized recommendations, handle concerns, and deliver top-notch assistance. The Co-founder & Head of SMBs Digital Transformation described how training is demand-driven: *"questions were asked about possible topics, and it emerged that people expressed an interest in gaining a better understanding of ChatGPT […] we devised a training program based on these requests, including weekly sessions with different classes. For instance, if someone is interested in ChatGPT, the trainer might be a well-known YouTuber with expertise in that platform."*

At the individual level, agile phygital evolution rests on the MF of improved phygital maturity, characterized by continuous reskilling and upskilling through training, empowerment, and skill development. Continuous reskilling and upskilling equip employees to adapt quickly, integrate digital expertise into physical interactions, and maintain high standards of service. This ongoing investment in learning not only enhances individual performance but also strengthens the organization's overall ability to thrive in a rapidly evolving environment.

4.3.2. Process-level MF: recalibrate offline-online resources

A feedback loop based on digital analytics and in-person interactions drives continuous adjustments to both product offerings and store layouts. As the Co-founder & Head of SMBs Digital Transformation explained, *"the magic ingredient to consistently search for products, cultivate passion, rotate the inventory effectively, and extensively study data involves understanding the Store model […] it's crucial to question why certain items attract more attention and utilize all this information. This represents a new model in the retail industry."* Offline improvements focus on stock management, product placement, and frequent product rotation to align with changing customer interests (Participant observation, General Manager). Brands are displayed for three to six months, ensuring a recognizable yet constantly renewed customer journey to sustain customer excitement and increase customers' opportunity to discover items matching their preferences. Parallel refinements occur online through updates to webpages, social media content (e.g., Facebook, Instagram, LinkedIn, TikTok, YouTube), and navigation design, ensuring coherence with market demand. Crucially, these adjustments are synchronized across physical and digital channels. The *E*-commerce Manager highlighted the importance of this integration: *"offline and online, in our case, are closely connected, so we are in close contact every day, both with the physical store and logistics […] items must have the same quantity in-store and online, prices must be updated on both platforms […] and communication channels are completely identical."*

Our findings show that, at the process level, phygital reconfiguring is anchored in recalibrating offline–online resources, the dynamic alignment of in-store and digital operations to optimize efficiency and customer engagement. Through tightly coupled adjustments across digital and physical realities, firms ensure consistency, responsiveness, and efficiency. This alignment not only streamlines operations but also enhances the customer journey by offering coherent, up-to-date, and engaging experiences across touchpoints.

4.3.3. Structural-level MF: phygital entrepreneurial culture

As the General Manager explained: *"There are products that are a certainty because they are already somewhat known, while others are more like bets. Sometimes you invest in something that doesn't work, but other times something surprises you, and you say, 'Wow, this works!'"* Rather than resisting change, the organization structurally aligns its digital and physical infrastructures, decision-making processes, and team configurations to support both exploration and exploitation. This forward-looking orientation is reflected in how Webidoo frames its mission: *"We are a group with many souls, all sharing the same propensity for the future […] We do this intending to put new technologies at the service of the growth of businesses of all types and sizes, in Italy and abroad"* (Web page).

Innovation is constant, and the company actively embraces it by experimenting with new strategic directions—ranging from Virtual and Augmented Reality for 3D store exploration, to WhatsApp shopping, metaverse events, NFT integrations, and personalized AI-driven shopping assistants. Such initiatives position the Store at the forefront of retail transformation, offering customers a dynamic, forward-looking experience while reinforcing competitive advantage through exclusive and differentiated offerings: *"Pursuing evolution also means taking multiple paths simultaneously, developing ideas and experiences in different fields. For us, this means working in different company divisions to discover new approaches and develop new technologies to bring to the market to promote positive transformations"* (Web page).

This entrepreneurial mindset is sustained by cross-functional, innovation-oriented teams tasked with exploring emerging digital–physical frontiers. The Co-founder, Chairman & CEO emphasized this experimental spirit: *"Here, we like to explore what could happen. So exploring the blockchain, metaverse, and NFTs […] we have developed a multidisciplinary team of computer engineers, researchers, designers, and materials experts to explore this whole world, even creating objects coded by Webidoo from both a digital and physical perspective."*

The structural-level MF of reversed reconfiguring is embodied in the phygital entrepreneurial culture, a mindset oriented toward anticipating market needs, setting ambitious goals, and taking risks to achieve them. This culture combines transversal competencies and a proactive, out-of-the-box attitude in the pursuit of excellence.

4.3.4. Interaction between individuals, processes, and structure

Agile phygital evolution emerges from the dynamic interaction of three interdependent MFs. At the individual level, employees' phygital maturity, nurtured through continuous learning and upskilling, equips them with the digital competencies required to integrate innovations into physical customer interactions. Individuals' readiness fuels offline–online process recalibration, where synchronized feedback loops from digital analytics and in-person interactions align physical and digital operations to enhance efficiency and coherence. At the structural level, a phygital entrepreneurial culture institutionalizes experimentation and risk-taking, and aligns innovation efforts with strategic objectives by providing an enabling environment for continuous renewal.

5. Discussion

In this paper, we build upon existing literature on phygital ecosystems (e.g., Batat, 2022, 2024a,b; Mele et al., 2023; Mele and Russo-Spena, 2022, 2024) and DCs (Helfat and Peteraf, 2015; Schilke et al., 2018; Teece, 2007) to advance an integrative framework for PDCs development and to provide a microfoundational view on their formation. As illustrated in our framework (see Fig. 3), our findings show that, to effectively operate and thrive in phygital ecosystems, firms need to enact specific capabilities grounded in microfoundational elements (individuals' skills, processes, and organizational structures) which integrate physical and digital worlds as a continuum. Our findings provide several contributions to theory and management practice.

5.1. Theoretical contributions

Firstly, this study extend research on phygital ecosystems (Batat, 2022, 2024a,b; Belghiti et al., 2017; Dahish et al., 2025; Mele et al., 2023) by highlighting their strategic relevance for capability development and competitiveness, moving beyond prior studies centred mainly on customer engagement and experience enhancement. Previous research has shown how the combination of physical and digital elements strengthens customer interactions, enhances engagement, and creates immersive and consistent brand experiences (Batat, 2022, 2024a,b; Belghiti et al., 2017; Dahish et al., 2025; Gamage et al., 2025; Mele et al., 2023). Our research extends prior literature by developing organizational capabilities specifically designed to compete in such ecosystems. Therefore, we introduce a strategic perspective, explaining how firms can leverage phygital ecosystems to develop novel competitive capabilities rather than merely experiential touchpoints that foster meaningful consumer connections, emotional engagement, and personalized interactions.

The second contribution concerns the literature on DCs, particularly studies that have examined how digital technologies have reshaped firms' ability to adapt and maintain competitiveness within increasingly volatile and rapidly evolving markets (e.g., Annarelli et al., 2021; Grego et al., 2025; Shen et al., 2021; Warner and Wäger, 2019). Drawing on Baskerville et al.'s (2020) concept of ontological reversal, we argue that phygital represents a fundamental shift in organizational transformation. Within phygital ecosystems, the digital does not simply extend the physical; rather, the two dimensions are interdependent and co-constitutive, generating recursive feedback loops that redefine agency, structure, and value creation (Mele and Russo-Spena, 2024).

To capture this fundamental ontological shift, we introduce the concept of PDCs, which we define as the organizational ability to identify opportunities across both physical and digital layers, orchestrate hybrid resources, and dynamically transform operations by integrating digital intelligence with physical components into a cohesive, data-driven ecosystem. This definition goes beyond digital DCs where the physical realm passively follows digital innovations, as it emphasizes a recursive and co-constructive model in which digital and physical elements are interdependent, not sequentially linked, and continuously shape one another. The ontological reversal (Baskerville et al., 2020) provides a novel foundation for understanding PDCs: unlike conventional digital DCs—where digital layers merely supplement or enhance physical operations—PDCs emphasize the ontological shift in which digital elements actively reshape the physical world. In this reversed interaction, strategic and operational decisions are shaped by digital technologies, while continuous feedback from the physical environment refines and enhances the digital layer. This bidirectional interplay fosters innovative sensing, seizing, and reconfiguring of opportunities, driven by mechanisms such as digitally embedded customer intelligence, hybrid value orchestration, and agile phygital evolution (Fig. 3).

In particular, unlike digital sensing, which focuses on forecasting technological trends and building digital visions (Herold et al., 2023; Jacobi and Brenner, 2018; Warner and Wäger, 2019), reversed sensing, or digital-embedded customer intelligence, entails a bidirectional learning process between digital systems and physical practices. Firms continuously collect and analyze feedback from both contexts to develop a more accurate and immediately actionable understanding of customers. Moreover, unlike digital seizing, which focuses on the systematic use of digital technologies to innovate and scale business models (Annarelli et al., 2021; Shen et al., 2021; Warner and Wäger, 2019), reversed seizing relies on hybrid value orchestration, the strategic intertwining of opportunities emerging from the digital–physical integration. While the digital dimension enables instant access to data and transactions, its full value materializes only through human interaction in the physical context, allowing for the personalized creation of value across convergent phygital touchpoints. Finally, unlike conventional digital reconfiguration, in which firms primarily focus on adapting digital infrastructures, reallocating resources, and redesigning processes in response to technological change (Berbel-Vera et al., 2022; Kroh et al., 2024; Linde et al., 2021), reversed reconfiguring, or agile phygital evolution, reveals a recursive and co-constructive dynamic between physical and digital components. This dynamic is fundamentally distinct from linear models of digital transformation, in which the digital dimension triggers the reorganization of physical processes, as it is itself continuously reshaped through embodied practices, cultural transformation, and organizational experimentation within the physical context.

Finally, this study advances the microfoundational perspective on DCs. Prior research on the MFs of digital DCs has predominantly focused on mechanisms rooted in analytical competences and digital alignment, aimed at innovating and scaling digital solutions (Chirumalla et al., 2023; Ellström et al., 2021; Warner and Wäger, 2019). Our findings conceptualize the distinctive MFs that underpin the development of PDCs, offering a comprehensive, multi-level understanding of how skills, processes, and structures are configured to enact reversed sensing, seizing, and reconfiguring within phygital ecosystems. These capabilities operate across specific MFs, ensuring that digital technologies do not passively support physical realities but actively structure and redefine business processes, decision-making, and competitive dynamics. The identified MFs reveal how technological intelligence and human agency jointly constitute the micro-level mechanisms through which firms learn, adapt, and renew their capabilities within interconnected physical–digital environments. At individual level, MFs across reversed sensing, seizing, and reconfiguring, show how human intuition integrates with machine intelligence, enabling the co-constitution of knowledge and decision-making. Advanced technological tools do not merely enhance human cognitive abilities, skills, or decision-making; they reshape how individuals perceive, interact with, and respond to their environment. At the process level, physical and digital elements are intertwined within integrated value-creation systems, where data, knowledge, and interactions circulate and reinforce one another across both layers. Technology not only facilitates but redefines coordination and collaboration processes. These processes integrate digital and physical elements into a unified system for value creation. Finally, at the structural level, MFs institutionalize a phygital logic within governance, culture, and decision-making, thereby enabling the systemic co-evolution of physical and digital components throughout the ecosystem.

5.2. *Managerial implications*

This study offers several implications for managers and practitioners navigating the new frontier of phygital ecosystems. As digital transformation accelerates, managers must move beyond the linear adoption of technology and instead cultivate PDCs that strategically integrate digital intelligence, human interpretation, and embodied action. The proposed framework provides guidance for orchestrating this integration across organizational levels. Managers should design cross-functional processes that connect algorithmic insights with physical execution, ensuring that digital analytics, human experience, and material infrastructures evolve as an interconnected system.

Yet embracing phygital transformation requires more than operational alignment—it demands an ontological reversal. Managers must recognize that digital technologies no longer merely *represent* or *support* organizational reality; they *constitute* it. Each algorithmic process, sensor, or interface participates in shaping how work is perceived, coordinated, and valued. In this ontological reversal, the physical and digital continuously co-create one another, transforming data into material experience and experience into data. Understanding this dynamic enables leaders to move from managing tools to orchestrating realities, where human intention, machine intelligence, and material environments recursively define the organization's capacity to learn and adapt.

Resource allocation should be viewed as mutually reinforcing across technological, human, and spatial dimensions, rather than as separate investment domains. Developing PDCs also requires reshaping organizational learning. Training initiatives should go beyond digital upskilling to foster phygital expertise—where employees learn to collaborate with intelligent systems, interpret AI-generated insights critically, and translate them into meaningful phygital experiences. The challenge for managers is to orchestrate evolving forms of human–AI collaboration, where analytical precision and experiential understanding converge to drive adaptive strategy and innovation. Ultimately, competitive advantage in phygital ecosystems will derive not from technology itself, but from the organization's ability to continuously orchestrate sensing, seizing, and reconfiguring across digital and physical realities—transforming adaptation into a dynamic, collective capability.

5.3. Limitations and future research

This study has certain limitations that also pave the way for meaningful avenues of future inquiry. The single-case design employed inevitably constrains the transferability of findings across settings. Future research could build on this foundation through comparative, multi-case, or longitudinal designs to explore how PDCs evolve across industries, organizational forms, and temporal horizons. As technological frontiers expand rapidly, new lines of inquiry should address how robotic systems, generative AI, autonomous agents, and embodied machines redefine the MFs of phygital sensing, seizing, and reconfiguring. Understanding how humans and intelligent artifacts co-learn, co-decide, and co-create value will be critical to advancing phygital capability theory. Future research might interrogate how algorithmic systems and robotic agents become co-active participants in organizational sensing, decision-making, and reconfiguration—blurring the boundary between “tool” and “actor.” Beyond methodological extensions, future research should investigate the broader organizational, ethical, and epistemic consequences of such transformations. As firms increasingly operate through hybrid constellations of humans, algorithms, and machines, the study of PDCs may illuminate the next stage of organizational evolution, where adaptability, intelligence, and creativity emerge from the collective dynamics of interconnected human–robot systems.

6. Conclusion

This study advances research on DCs and phygital ecosystems by conceptualizing PDCs as a distinct and co-constitutive form of capability, in which digital and physical dimensions evolve recursively rather than hierarchically. Building on the notion of ontological reversal (Baskerville et al., 2020), we frame phygital as a fundamental shift in which digital elements no longer merely support or extend the physical world, but actively reshape and are reshaped by it through continuous feedback loops. Our framework elucidates how firms enact three interdependent capability dimensions: digital-embedded customer intelligence (*reversed sensing*), hybrid value orchestration (*reversed seizing*), and agile phygital evolution (*reversed reconfiguring*). Each dimension is sustained by specific MFs at individuals, processes, and structure levels, integrating human intuition with machine intelligence, and embedding phygital logic into organizational routines, structures, and cultures. Collectively, these insights move beyond existing notions of digital transformation, offering a recursive and integrative view of how organizations learn, adapt, and renew within phygital ecosystems where technology and embodied practice continuously shape one another.

CRediT authorship contribution statement

Ludovica Moi: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gianluca Pusceddu:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Francesca Cabiddu:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used Grammarly and ChatGPT in order to improve English language quality. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Data availability

The data that has been used is confidential.

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