

CONCEPTUALIZING OBSOLESCENCE AND DIGITAL TRANSFORMATION

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ABSTRACT

This study aims to shed light on the notion of technological obsolescence and explore its links with digital transformation to achieve adaptability and resilience. We undertook an interpretive longitudinal study between 2009 and 2020, capturing the digital transformation journey of an award-winning, UK-based high-tech SME that is designing and manufacturing high-end home entertainment systems including digital streaming products, music players, and speakers. As a contribution to literature, we conceptualize and define the link between technological obsolescence and the digital transformation process. We offer a conceptual framework to explain the interplay of the adaptive capabilities through the concepts of empirical sensitivities and habitus in the context of digital transformation in SMEs. We suggest that SME managers should pay attention to developing non-cognitive dynamic capabilities to effectively respond to digitalization trends by orienting their employees toward careful management of technology obsolescence in a manner unique to the firm's history and experiences.

KEYWORDS

Obsolescence, Digital transformation, Small and medium enterprise-SME, Dynamic capabilities

INTRODUCTION

Turbulent environments are characterised by fast changing product lines and increasing and changing competition, as well as rapid and continual technological innovation (Brown and Don, 2006). Therefore, organisations must have the capacity to adapt to changes to gain competitive advantage (Brown and Don, 2006; Junell and Ståhle, 2011; Sparrow and Ringland, 2010). In the wake up of COVID-19 pandemic, managers are faced with ‘forced’ change, accelerated digitalisation and adaptability more intensely than ever before. So, how do adaptive firms respond to rapid technological change to avoid obsolescence? What underpins their adaptive capability? More than ever before, managers are faced with the major challenge of learning how to continuously renew their offerings and processes to keep up with digital transformation trends to prevent obsolescence (Sparrow and Ringland, 2010; Agarwal and Helfat, 2009). As a result, organisations either need to do established things in new ways, stop doing things or do new things (Sparrow and Ringland, 2010).

Obsolescence arises when a new service, product, or technology replaces an older one (Jain, 2016) such as the introduction of digital music downloads, which replaced compact discs (CDs) (Amankwah-Amoah, 2017). Obsolescence hinders a firm’s ability to adapt to the unprecedented changes in the environment, which may lead to deteriorating performance and viability (Le Mens, Hannan and Polos, 2015; Chen and Yu, 2021) and makes firms slowly lose dynamic capabilities due to the obsolescence of technologies and knowledge (Li and Liu, 2014; Chen and Yu, 2021). As such, the capacity to manage technological obsolescence is becoming strategically important for firms to survive and thrive in today’s rapidly changing environment. However, there is a lack of conceptual clarity on the underlying design logic of digitally transformed firms (Ates and Acur, 2022).

We seek to enrich the literature by investigating the digitalization journey of a high-tech, manufacturing small and medium-sized enterprise (SME) to shed light on the topic. Our research question is: *Which adaptive capabilities enable the transition between digital transformation process phases in SMEs?* To address this research question, we aim to develop a framework for managing technological obsolescence in the context of digital transformation.

We proceed by first exploring the relevant literature. We then provide an overview of our case study and qualitative methods before presenting our empirical findings structured as a conceptual model that illustrates the management of obsolescence in SMEs. We then discuss our conceptual model and implications for theory and practice.

LITERATURE REVIEW

Managing Technology Obsolescence

Obsolescence occurs when a component or a system fails to perform required functions or has become useless in some way or another (Adetunji, Bischoff and Willy, 2018). According to Rai and Terpenney (2008), obsolescence is a state in product’s lifecycle which results of the product being no longer ‘wanted’, although it might still be in good working condition and fulfilling its designed purpose. They also point out that product obsolescence usually happens because of technological obsolescence. Obsolescence happens when elements of a system become outdated, which can lead to operational, reliability, logistical and cost implications (Adetunji, Bischoff and Willy, 2018).

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Many authors have come up with different methods and tools to manage or mitigate obsolescence. Hurst (1995) explains that during the renewal cycle, managers can not directly manage change. They can only manage the organisation's ability to change, that is to prevent obsolescence. He gives an example of a gardener who is growing plants. The gardener cannot make the plants grow, only create the optimum conditions for the plants and allow them to grow by themselves (Hurst, 1995). Rojo, Roy, Shehab and Wardle (2009) point out that planning and managing the organisations response are the only ways to mitigate the risk and minimise the impact of obsolescence.

Obsolescence management has proactive and reactive elements. Ideally, obsolescence management would be proactive in the way that every circumstance would be pre-planned and addressed before becoming a critical issue (Pugh, 2015). This is usually not the reality, but obsolescence is often an afterthought or an aftereffect, which leads to the fact that obsolescence solution is often a reactive approach to resolve occurred issues (Adetunji, Bischoff and Willy, 2018). The reason is that it can often be hard to anticipate the change that is going to happen in the environment, and enough time to plan for obsolescence is usually not given during the design process (Adetunji, Bischoff and Willy, 2018). However, organisations in a technology driven environment need to address the issues of obsolescence proactively if they want to compete and thrive in the global economy because reacting to an obsolescence after it has already happened requires more cost and risk. Therefore, is it necessary for organisations to have processes for digital transformation to manage obsolescence proactively (Pobiak, Mazzuchi and Sarkani, 2014).

Many authors have come up with different methods and tools to manage obsolescence that unfolds over time. For example, Hurst (1995) explains that during the renewal cycle, managers can not directly manage change. They can only manage the organization's ability to change that is to prevent obsolescence. Besides, Rojo et al. (2009) points out that planning and managing the firm responses are the only ways to mitigate the risk and minimize the impact of obsolescence. So, it is necessary for organizations to have processes and capabilities to manage obsolescence proactively (Pobiak, Mazzuchi and Sarkani, S., 2014). As Adetunji et al. (2018) pointed out obsolescence is here to stay as digitalization and technological turbulence continue to rise. Therefore, it is important to develop necessary adaptive capabilities to counter obsolescence (Vial, 2019; Warner and Wäger, 2019).

Dynamic Capabilities Lens

The digital transformation process comprises three phases: 1) digitization, 2) digitalization, and 3) digital transformation (Verhoef et al., 2021). To explain the adaptive capabilities required to execute ongoing digital transformation to avoid obsolescence, we focus on Dynamic Capabilities (DCs) theory (Teece et al., 1997), one of the most prominent theoretical developments in addressing the ongoing firm adaptations to survive and thrive is the concept of DCs. We aim to contribute to the DCs literature and provide empirical insights into what types of noncognitive capabilities might be required for digital transformation phases.

According to the DCs theory, 'dynamic' indicates that competencies must undergo strategic renewal along with changes in the environment. The second term 'capabilities' refers to the role of strategic management to adapt, integrate, and reconfigure skills, resources and competences with the outcome being the fulfilment of the requirements of the business environment. Teece and his colleagues define DCs as 'the firm's ability to integrate, build and reconfigure internal and external competencies to

address rapidly changing environments' (Teece et al., 1997: 516). According to Teece et al. (1997: 509), DCs are particularly applicable to very dynamic and competitive environments, characterized by competition based on innovation and price as well as by "creative destruction" against established capabilities. In fact, they are said to allow better decision-making in an environment that is unpredictable, but attractive.

Another defining characteristic of Teece's approach is that DCs must be built rather than bought because "dynamic capabilities are about doing the right things" (Teece & Leih, 2016: 7). Building "sensing, seizing and transforming" capabilities thus allow a firm to craft strategy for ongoing adaptations to environmental affordances (Teece, 2012: 1396; 2018). Sensing (and shaping) is about horizon scanning and should take place across the firm (Teece & Linden, 2017). Seizing is another key capability that is experiential, path dependent and its execution is more complex and non-transferable (Day & Schoemaker, 2016). Transforming is the capability that enables execution of strategy and ensures ongoing adaptations in a rapidly changing environment (Teece et al., 1997). Despite these internally consistent explanations, what underpins the construction of sensing, seizing, and transforming capabilities remains undertheorized (Nayak et al., 2020).

Recent research by Nayak et al. (2020, p.284) suggests that it is important to go beyond the concepts of analytical best practices and routines (Eisenhardt and Martin, 2000) and focus on 'a firm's collectively shared, historically shaped practices and predispositions' to understand tacit, *noncognitive* aspects of dynamic capabilities that explains ongoing adaptation. Hence, they suggest that 'empirical sensitivity' and 'habitus' are the two key concepts to study the underpinnings of tacit dynamic capabilities (Nayak et al., 2020, p. 288]. Nayak et al. (2020, p. 282) argue that 'a finely honed sensitivity to changing environmental conditions and the corresponding development of a set of generic coping skills are what underpins dynamic capabilities.' They suggest that we need to investigate firms' empirical sensitivities that reflect its distinctive collective history and experiences to explain noncognitive aspects of dynamic capabilities.

Consequently, what underpins the adaptive capability in SME context is yet to be fully understood, providing the research focus for the remainder of this study. Therefore, we address the call for further research into micro foundations of adaptive capabilities in various contexts by Peteraf et al. (2013) and Nayak et al. (2020). Consequently, our theoretical approach goes beyond best practices and reflects how adaptive capabilities needed to manage the digital transformation to avoid obsolescence originate from the accumulation of everyday actions in high-tech SME context (Chia and Holt, 2006; Ates and Acur, 2022).

METHODOLOGY

The longitudinal and interpretive approach that was applied attempts to make sense of SME managers' lived experiences and reflections, in their broader and often unique historical context (Chia & MacKay, 2007; Nayak et al., 2020). This calls for a study, which enables concentration on a single case over a period, necessary for an in-depth, intensive description, analysis, and interpretation of data.

Case Selection and Context

We followed a similar approach suggested by Pettigrew (1990) and selected our single case by applying three criteria: first, the research problem set the requirement to gain access to mature SMEs in which ongoing renewal evolved during a long period of time. The case study firm's history is characterized by multiple efforts at major strategic transformations. Conducting rigorous longitudinal case studies can be very resource intensive and demands a considerable time and effort to collect and interpret data over a long period time. Therefore, access and having long-term relationships with the case firm was an important asset. Second, we focused on the technology intensive manufacturing SMEs as the rate of change is high in the context of Industry 4.0. This requirement is obvious because of a longer history of technological change within high-tech manufacturing industries. Third, since the purpose of this study is to investigate an ambiguous phenomenon in practice, the selection of this case study with a unique history (Nayak et al., 2020) and recognized awards for strategic renewal would be a fertile foundation for the analyses. Linn has won several innovation awards including the Queen's award for innovation (Northrop, 2012). Its longest selling product was awarded in 2016 by the What Hi-Fi as one of the most important products of the last 40 years (Drucker, 2000). Also, Stereophile calls the product "a classic, a revolutionary, an iconoclast, a survivor" (Linn Products, 2018). These external recognition and prestigious awards make this case more visible with high experience levels of the phenomenon under study as suggested by Pettigrew (1990).

As a result, this study is based on deep collaboration with a UK-based family business that is a high-tech SME that manufactures high-end home entertainment and music systems. Linn Products Ltd is a medium-sized, mature Scottish SME that employs 175 people. The firm is a major exporter to Europe, Japan and the US (Masterson, 2017). Since there is generally little published information about SMEs, Linn is an exception and receives significant media attention in its sector. It is the recipient of several innovation awards, e.g., the UK Design Council's Millennium Product award (Buxton, 1998), the prestigious Royal Warrant status as official supplier of entertainment systems to the British royal family (The Engineer, 2003), Gramophone Record Label of the Year award (Bolger, 2010; The Times, 2010), and the Queen's Award for Innovation (FT.com, 2012). Also, Linn is an interesting case to research because the firm has managed to survive major shifts in a highly dynamic market since the firm was established in 1973. Firstly, there was a major shift from mechanical to electronics engineering capability, then from Turntables to Compact Disc (CD) technology, then CD to Digital Streaming (DS), and more recently to integrated open platforms and space optimization technology enabled by the Industry 4.0 movement (e.g. IoT, Cloud), to name a few of the most prominent adaptations.

Data Collection and Analysis

Qualitative data were obtained through studies of internal and public documents, a total of 22 semi-structured face-to-face interviews, discussions, and observations (Table 1). As the last step of data collection, secondary sources such as the company website (i.e., our story section), archival information, and publicly available written documents from media (e.g., magazine and newspaper articles), as well as recent podcasts about the firm, were collected. All primary and secondary data were uploaded to a database using NVivo 11 Pro software for coding purposes. Data analysis occurred by way of an open coding process using thematic analysis. The thematic analysis offers effective

identification of patterns in a large and complex dataset, as well as links within analytical themes (Braun and Clarke, 2006).

Table 1. Data sources

<i>Data sources</i>	<i>Type of data</i>
Semi-structured Interviews	22 face-to-face, semi-structured interviews with the management team
Direct participant observations	Total of 10 days of participant observation of workshops
Project meetings with senior management team	9 face-to-face meetings (a total of 23 days) held bi-annually. Each meeting lasted 2-3 days and observations and discussions were recorded in progress reports and meeting minutes.
Internal documents	24 Online meetings. Average meeting duration: 1 hour. Internal presentations, key performance indicator (KPI) reports, other strategy documents, research reports
Public documents	Public presentations, practitioner magazines, newspaper articles, web pages, secondary research reports. Total of 86 documents analysed and the most relevant 45 documents uploaded to NVivo database for coding, e.g., Financial Times, Business Wire, Scottish Business Insider, BBC, The Herald.
Totals/ summary	22 in-depth interviews/ 336 pages of transcripts 10 days of participant observation 9 strategy workshops/ 270 pages of summary reports 23 days of project meetings (52 pages reports/ 5.65GB electronic folder size) 24 online meetings/ 72 pages of meeting minutes 86 published reports/ 617 pages secondary data

FINDINGS

Although Linn is known for their iconic turntables, they are pioneering digital audio streaming technology in their sector (May, 2021). We observed that Linn actors developed an empirical sensitivity to evolving environmental affordances and capitalised on them at the right time through ongoing adaptations. Major adaptations proffered by environmental affordances were a shift from (i) mechanical to electronics engineering capability, (ii) Turntables to Compact Disc (CD) technology, (iii) CD to Digital Streaming (DS) products, and (iv) more recently, a shift towards integrated open and modular platforms and space optimisation technology enabled by the Internet-of-Things (IoT) and Cloud. Over time, refreshment of turntables via modularity and upgradability helped Linn avoid an obsolescence trap. Moreover, replacement of CD players was a successful and proactive renewal to avoid a competency trap. On the other hand, Linn went into a period of growing rapidly and becoming overly diversified (e.g., failed businesses with Aston Martin and a large German TV manufacturer) due to moving away from their core purposes of quality and longevity. This failure trap was overcome quickly by an intended shift to digitalisation. Besides, adaptation of Digital Streaming, IoT and Cloud technologies prevented Linn being trapped into obsolescence.

In doing so, we found that Linn Products went through three phases of digital transformation (See Figure 1): phase 1 in converting analog to digital technology in order to tighten IT alignment with obsolescence, phase 2 in building the foundation for both obtaining non-cognitive capabilities and continuing alignment to avoid technological obsolescence, and phase 3 infusing business and technology to avoid obsolescence by company-wide change, implementing and constantly revising non-cognitive dynamic capabilities (Nayak et al., 2020; Verhoef et al., 2021).

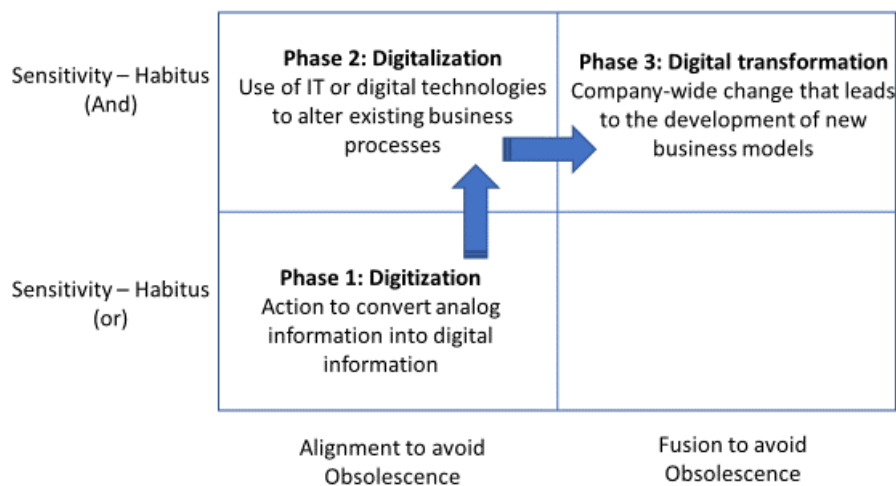


Figure 1. The three phases of digital transformation at Linn

This high-tech SME's digital transformation journey is continuing today but tracking it through the different phases of transformation shows us an insight into how non-cognitive capabilities development help to counter obsolescence. Two key non-cognitive capabilities motives stand out. First, enterprise-wide, empirical sensitivities and habitus of the firm have created the foundation for an enterprise to move through different phases of digital transformation.

In terms of digital technology, this is manifested in a technology development exploration and exploitation activity. This comprises the operational pillar where exploration and exploitation of digital streaming technology and the use of Industry 4.0 technologies are developed and deployed at the ecosystem level. In terms of business, non-cognitive capabilities are manifested in the concurrent but mutually reinforcing efforts within each digital transformation phase to drive the exploitation of existing business via repositioning and exploration of new growth opportunities.

Noncognitive DCs Underpinning Adaptive Capability

Using a rich case story, we illustrate the noncognitive DCs underpinning Linn's adaptive capability. It is evident that (i) selectivity of what you do and don't do, (ii) strategic focus on core competencies to avoid strategic drift, and (iii) affinity with network innovation are central sensitivities, which enable the development of adaptive capability over time. These empirical sensitivities coevolve over multiple practices through the firm, cumulatively shaping the firm's habitus while enabling Linn and its managers to ultimately achieve continuous digital transformations to avoid obsolescence in the

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context of high technological turbulence. One senior manager highlighted the importance of adaptive capability:

There's a timeline of year by year we've added more and more amazing stuff that people just can't believe that when they bought this product in 2007, in 2016 they are now able to enter in through our configuration application a physical geometric model of their listening room and we'll do the physics to calculate and optimise the sound in their room. So, if you'd said, 10 years ago, "you're going to have a hi-fi system where software is going to make it sound better many years after you've bought it", you'd have said "no, you're crazy, it's never going to happen". Well, it's here [...] The key thing is to recognise that the world is going to change and to build that adaptability into the core of your product design in the first place. So, to recognise that there's a limit to what you know today and then just have the best ability to adapt and change built into the product. (2016)

Firstly, selectivity in what they do and don't do influence the building of adaptive capabilities. Linn has been at crossroads to make tough decisions to leverage their continuous innovations multiple times, e.g. whether to kill their successful CD business or not. Linn decided to stop manufacturing CD players although it represented a quarter of their turnover in 2009. Surprisingly, this exit decision was not a consequence of the declining industry or product lifecycles. In fact, they shocked the industry by exiting their award-winning CD business. In the end, this risky decision payed off and Linn managed to avoid a competency trap. As the MD put it repeatedly:

This is a critical point, if you want to innovate you have to be ruthless, you have to cut the past, and move forward. And so, when we cut CD players in 2009 it was 25% of our revenue but we cut it. People said 'oh you're crazy to cut all that revenue', but in a few years the digital streamers were more than the CD players, but they wouldn't have been if we'd kept selling CD players because we'd been sending a confused message to the customers, what's best, play CD or streaming. Well we know it's streaming so you have to be clear, innovate, push forward, and sell people the right product. (2013)

Secondly, following a conscious decision to replace the CD business, the firm had a focused strategy and accelerated its innovations in the digital domain by adaptation of DS products. Their exploration started two years before their competitors via a large public-private R&D investment. In 2007, they launched their first DS player. By creating platforms of technology, the firm was able to build core technology that can be continuously improved over time towards the objective of better sound. Driven by the deep understanding of the uneven pace of technology evolutions, Linn's ethos was future proofing and continuously refreshing their DS products via focusing on modularity and upgradability to avoid obsolescence. One manager explained that:

So conceptually, at the beginning in our architecture, we split the player, server and controller and that, then, was a really crucial decision that would allow progress to occur on any one of those things independently. And so it's an architecture where you can have N number of players, N number of servers, N number of controllers. And, over the past years each of these things has progressed in completely independent ways. Servers get better. They get better at a different rate of change than a player. And controllers have got better and they get better at a different rate of change to players and servers. [...] Then, because it connected to the internet, when we launched, of course there was no such thing as an iPhone but because when you use open standards it leaves open all the possibilities for the future like the arrival of an

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iPhone or an iPad, even better. So, our products launched – our first intelligent connected players – in 2007. But the iPad came along in 2010. Six months later it was the Number One choice for our customer to control their systems with. If we made it a proprietary system then we would not have been able to ride that wave of the iPad. (2018)

Thirdly, Linn's core values have been built on an ethos of longevity and high quality. In several times during the interviews, Linn actors stressed the importance of opening and paying attention to community, platform, and modularity for futureproofing products. When they navigate innovation ecosystems to find suitable partners, they seek to have similar ethos, values, and purposes now. By functioning as an open ecosystem, Linn carefully chooses its partners from retail networks, suppliers, banks, and distributors. This companywide approach to network innovation has been an essential sensitivity, supporting Linn's digital transformation over the years. In doing so, Linn demonstrates embeddedness in an ecosystem and aims to marry competencies through effective partnerships. Thus, the creation of affinity with network innovation is an empirical sensitivity that ensures the ongoing refreshment and adaptation of new products. Unsurprisingly, due to the ecosystem embeddedness, Linn is constantly affected by developments in the ecosystem which creates dependencies and limitations. One manager explained the importance of networked innovation in a more open world that:

Google's ethos has gradually changed to become fairly indistinguishable from Apple to the point now where you'd probably say the most open of these big companies is actually Amazon, who has got this ethos of... 'Get everybody using the back end of Amazon,' because they can see if they can get the mindshare, people bought into using their services, then they're going to build this and are building this mega global community around not just the shop but all of the infrastructure they've developed behind it... I'm not saying give away the IP, by the way, of course not. There's a difference between enabling a community and protecting your IP... I don't think Amazon's risking any of its web services IP by getting all these technology startups to use it and everybody... they go round evangelising it, trying to get everybody onto their platform. (2015)

Lastly, we found that empirical sensitivities often emerge and materialise into adaptive actions through predispositions, tendencies representing the habitus (Nayak et al., 2020) of the firm. Most importantly ethos is shaping the firm's unique habitus. As repeated several times in the interviews, Linn's ethos is product longevity through modularity and upgradability, strategic alignment with organisational purpose, relentless pursuit of innovation to avoid obsolescence, and grass roots involvement in innovation. This ethos underpins their empirical sensitivities to shifting environmental circumstances and the corresponding development of a set of adaptive actions.

In this study, we examined empirical sensitivities underpinning adaptive capabilities for digital transformation and avoiding obsolescence, and our findings have important contributions to literature and practice that we will discuss next.

DISCUSSIONS

In this study, we examined empirical sensitivities underpinning adaptive capabilities for digital transformation and avoiding an obsolescence trap. Our findings have important contributions

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to literature and practice. During our longitudinal research, we aimed to make sense of how firm sensitivities to evolving environmental affordances emerge and materialise into ongoing adaptations by drawing on managers' lived experiences over the years. Throughout our fieldwork, we found that explaining non-cognitive dynamic capabilities through replicable best practices, or analytical stepwise processes was not possible (Teece, 2007). Instead, we found that habitus – a firm's complex history of accumulated practices influence how firm sensitivities emerge and materialise into ongoing adaptations. Indeed, adaptive capabilities are shared through the firm's sensitivities reflecting its unique collective history (Nayak et al., 2020), and experiences.

We realize a conscious shift toward the exploitation of technological and environmental certainties to counter the competence or failure trap and the exploration of new possibilities to counter the obsolescence trap. These include the development of new non-cognitive capabilities for “search, refinement, selection, re-focus, network connectivity,” on the one hand, and “variation, modularity, strategic alignment, grassroots involvement in innovation, flexibility, upgradability” on the other hand. As such, there is a mutual influence between empirical sensitivity and the habitus of the firm (i.e., empirical sensitivity generates habitus, and habitus constrains empirical sensitivity). The observation is consistent with current literature that highlights reciprocal interactions between empirical sensitivities and habitus that have been conceptually discussed before [e.g., Bruineberg and Rietveld, 2014; Nayak et al., 2020]. These qualities, which often complement one another, are fundamental indicators of the challenging demands for SMEs.

The second motive of a digitally transformed SME to avoid the obsolescence trap is to bridge the hidden split between the social side of business and technology. This statement is, again, in line with current practitioner literature that searches to evaluate the digital transformation corresponding to tightening IT alignment with business or reorganization around business capabilities (i.e., sensing, seizing, and transforming) (Teece et al., 1997; Warner and Wäger, 2019). The treatment is often a development to a higher level of digital superiority (e.g., from an IT alignment to becoming a digital leader) via the development of dynamic capabilities. But what is stimulating with the case of our high-tech SME is the extent of penetration required in business-digital technology integration at the ecosystem level.

Hence, the insights derived from the transformation journey of our high-tech SME company support the conceptual framework in Figure 2 in unpacking the non-cognitive dynamic capabilities development logic of a digitally transformed SME. The greater the extent of non-cognitive capabilities namely environmental sensitivity and habitus that an SME can develop in moving digital transformation phases, the more alert it will be in adapting to counter obsolescence trap. The more continuous the business-digital technology fusion SME can achieve, the more it is able to adjust digital ubiquitously to counter obsolescence in all aspects of its business.

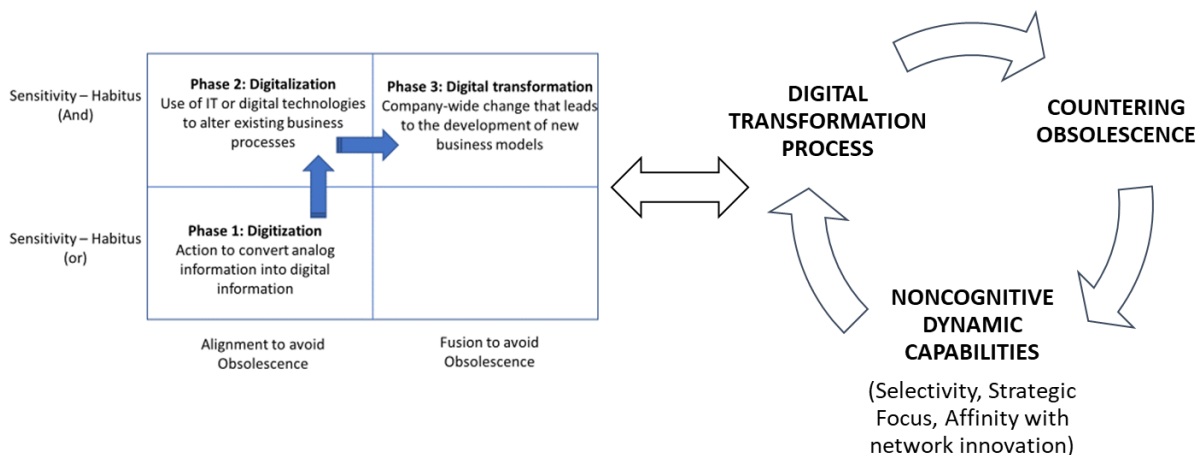


Figure 2. The conceptual framework

The ideal level of non-cognitive capabilities and business-digital technology fusion may differ in different digital transformation phases. For example, in a less complex environment, or in an industry that has less competition less IT alignment or business-digital technology fusion may suffice to avert technological obsolescence. Most digital transformations are likely to be at the first phase of the digital transformation process, largely taking efforts focusing on environmental sensitivity to reposition existing businesses or habitus to seek new growth opportunities, with strong support from digital technology. The second and third phase of digital transformation tends to be more pervasive in driving both environmental sensitivity (e.g., select, refocus processing-acquired intelligence - a finely honed empirical sensitivity to environmental solicitations and the discernment of obsolescence) and habitus (e.g., internal responsiveness nurtured through the collective complex history of an SME—its tacitly acquired/transmitted outlooks, social predispositions, and internalized practices). An additional level of complexity in digital transformation comes from the fusion between business and digital technology—that is, such sensitivity and habitus efforts are motivated by Industry 4.0 technologies where business and technologies are effortlessly integrated. The fusion provides a greater skill to counter the technology obsolescence trap. Mere digital technology alignment is insufficient to avert obsolescence demanded in the digital future.

CONCLUSIONS

Adaptive capability underpins business resilience and viability in changing environments as opposed to optimising stable systems. Accordingly, we conceptualised non-cognitive dynamic capabilities for ongoing adaptations on empirical sensitivities and habitus (Nayak et al., 2020) that are typically enacted and shared through social practices and the firm’s unique history including ethos, past experiences, and organisational breakdowns. In doing so, we also contribute to theorising offered by Nayak et al. (2020) by bringing empirical sensitivities to life in an SME context. Based on the findings from the review of relevant literature and empirical research, we presented the relationships between the key theoretical constructs emerging from our study in a model for digital transformation to avoid obsolescence in an SME context in Figure 2. As with all research, the current study is not without its limitations. First, the conceptual clarity of obsolescence, non-cognitive capabilities, and digital transformation link consequently help to bridge the gap between academic

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research and what SMEs are practising. The framework (as shown in Figure 2) provides a way to outline conceptually the level of complexity for different digital transformation phases' efforts to counter obsolescence.

In conclusion, making obsolescence obsolete has become increasingly a key organizational capability for SMEs in a technology-driven environment to stay viable. We offer a novel conceptual framework to explain the interplay of these empirical sensitivities and habitus, that collectively shape the noncognitive dynamic capabilities, in the context of digital transformation in SMEs. Finally, continued study of making obsolescence obsolete capability in firms operating in technology-driven environments will serve to improve our understanding of firm survival and viability in a world with rapid and unprecedented change.

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