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To cite this article: Krisztina Demeter, Dávid Losonci, Andrea Szalavetz & Máté Baksa (2023) Strategic drivers behind the digital transformation of subsidiaries: a longitudinal approach, Post-Communist Economies, 35:7, 744-769, DOI: [10.1080/14631377.2023.2236864](https://doi.org/10.1080/14631377.2023.2236864)

To link to this article: <https://doi.org/10.1080/14631377.2023.2236864>



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Published online: 26 Jul 2023.



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Strategic drivers behind the digital transformation of subsidiaries: a longitudinal approach

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ABSTRACT

This study explores the strategic drivers of digital transformation (DT) at subsidiaries. Our research framework derives strategic drivers from a tripod model that integrates the resource-based, the institution-based, and the industry-based views. We use two longitudinal case studies at global automotive suppliers' Hungarian subsidiaries. We found that each view highlights a different set of strategic drivers. DT in the subsidiaries is boosted by proactive local management and mature process improvement routines (*dynamic capabilities*); parent–pull relation (*internal institutions*) and state support attracting manufacturing FDI (*external institutions*); as well as buyers' increasing expectations and supplier-related factors (*industry-based view*). By combining these views, we claim that drivers related to the external institutional context and the industrial competition are usually filtered by the global management before contributing to resource adjustments at subsidiaries in a coercive top-down manner. Despite this seemingly deterministic DT process, local managements can actively shape DT, even that of the MNE.

ARTICLE HISTORY

Received 19 November 2022
Accepted 11 July 2023

KEYWORDS

strategic drivers; digital transformation; subsidiary; dynamic capabilities; institution-based view; case study

Introduction

Firms' competitive environment is witnessing dramatic changes driven by the emergence and rapid diffusion of digital technologies. While adopting novel technologies, companies go through digital transformation (DT) that requires the reshaping of processes and organisational structure, and ultimately influences all the strategic choices of operations.

There is already a vast body of literature about the challenges, impacts, prerequisites, and consequences of implementing digital or Industry 4.0 (I4.0) technologies in manufacturing firms (e.g. Vial, 2019). Some of these studies are driven by general theoretical concepts, such as dynamic capabilities for DT (Warner & Wäger, 2019), describing ideal paths for change (e.g. Ghobakhloo, 2018) or constructing complex firm-level maturity

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indexes (Schuh et al., 2017). Others are concerned with more ‘practical’, technology-specific issues (Monostori et al., 2016) or investigate how digitalisation impacts performance (Büchi et al., 2020). However, when synthesising the results, we may realise that our knowledge of the strategic drivers that underlie different firms’ DT efforts is fragmented and incomplete.

Furthermore, there is a clear difference between the strategic scope of subsidiaries and headquarters (HQ) (Demeter et al., 2021; Szalavetz, 2019) and the subsidiary perspective does not receive the necessary attention in scientific papers. While there is a rapidly expanding body of literature discussing how subsidiary strategies and value creation within the global company impacts HQ-subsidary relations (e.g. Andrews et al., 2023; Dellestrand et al., 2020; Kostova et al., 2016), in studies discussing DT strategy, the HQ viewpoint is still dominant (Vial, 2019; Volberda et al., 2021 – notable exceptions include Ekman et al., 2020; Szalavetz, 2019).

This is a particularly important gap since DT is one of the most critical developmental challenges that production subsidiaries and countries hosting manufacturing FDI face. Hence, the strategic drivers of DT at production subsidiary level differ from those in the HQ. Strategic drivers are, to some extent, specific to the institutional contexts or in broader terms to the socio-economic arrangements of FDI-hosting economies. Therefore, the dependent market economy (DME) concept (Farkas, 2011; Myant, 2018; Myant & Drahokoupil, 2012; Nölke & Vliegenthart, 2009) is highly relevant for the analysis.

Our paper combines these under-researched aspects. *It aims to identify the strategic drivers of DT in manufacturing subsidiaries operating in DMEs through the combination and integration of several seminal views of strategic management.*

We will show that while these views have previously guided research on strategic drivers separately, i.e. relying on a single strategic management view, their combination provides a more complete picture that is particularly relevant in a DME context.

Papers relying on a single strategic management view would discuss DT by using the industry-based approach (Porter & Heppelmann, 2014), the institutional theory (Hinings et al., 2018), or the resource-based view (RBV) (Yeow et al., 2018). Each of these views can be linked to a set of strategic drivers of DT – also at subsidiaries in DMEs. 1) The *industry-based* approach (Porter, 2008) explores the competitive positioning efforts of subsidiaries. 2) The *institutional theory* approach (DiMaggio & Powell, 1983; Peng, 2009) examines the legitimacy of organisations within the multinational companies (i.e. internal institutions) and in their host countries (i.e. external institutions), specifically looking at how these actors follow rules and norms. Finally, 3) the *RBV* (Wernerfelt, 1984), and especially the *dynamic capability* concept (Eisenhardt & Martin, 2000; Teece et al., 1997) provides insights into why and how companies (at both HQ and subsidiary levels) restructure resources and create new organisational routines during their digital journey.

Based on this background, we collect the influential strategic drivers of DT perceived at the subsidiary level and formulate the first research question, aimed at laying the groundwork for the subsequent investigations, as follows (Figure 1, RQ1):

RQ1: How the three views, one-by-one, drive the digitalisation-related strategic choices of manufacturing subsidiaries?

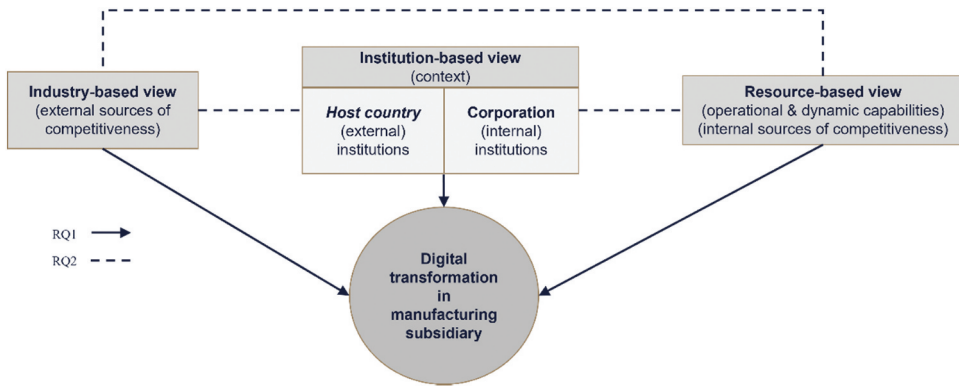


Figure 1. The research framework.

While most papers use and adapt one of these views separately, some studies employ a dual-view or an all-encompassing combination of views. The all-encompassing integration of views is proposed by Peng et al. (2009) in the so-called tripod framework. Although papers combining views to explain DT are scarce (Bag et al., 2021; Dubey et al., 2019; Gupta et al., 2020), they highlight that a combination of views provide a more reliable explanation of DT. In line with the literature, we also argue that these views are closely connected, and they jointly shape the DT-related strategic choices of the subsidiaries. Therefore, we developed a second research question (Figure 1, RQ2):

RQ2: What are the relationships between the three views as they drive subsidiary-level digital transformation?

We examine the DT of two subsidiaries (as longitudinal case studies) along the strategic decisions they made in their operations. Our study identifies the strategic drivers behind their decisions along the three perspectives.

Our paper is novel in a) using a complex, theory-driven approach to understand the strategic drivers behind DT; b) having the subsidiary as the unit of analysis and integrating the DME-perspective; c) using a longitudinal approach. With this focus, we need to clarify an important limitation. Our findings are not necessarily valid for all DMEs and all manufacturing industries undergoing DT, since the progress and stages of DT may be different in other contexts. They are, however, generalisable at a conceptual level, regarding the relevance and interactions between the individual streams of the tripod framework.

The article proceeds as follows. After reviewing the relevant literature and introducing the digitalisation-induced changes at the case subsidiaries, the strategic drivers are analysed first along the three views one-by-one, then in combination. Next, the findings are discussed, and propositions are set to guide future research. Finally, conclusions are drawn.

Literature review

There are two unique cornerstones of our research: i) three theoretical perspectives are used to provide powerful explanations for DT; ii) the subjects of our investigations are subsidiaries of MNEs in DMEs. We follow these cornerstones in our literature review.

Explanations of digital transformation from the three theoretical perspectives

In the *institution-based view*, institutions are defined as formal rules (rules of the game, setting the framework for firms' operations) and informal constraints (North, 1990). Following these rules and constraints companies '*are driven by the need for organisational legitimacy*' (Dubey et al., 2019, p. 345). Institutions exert coercive, normative, and mimetic pressures on companies (DiMaggio & Powell, 1983; Dubey et al., 2019). Coercive pressures are in the form of regulatory institutions that companies must follow. Normative pressures are self-imposed norms, values, and guidelines about what constitutes appropriate behaviour to be accepted by other similar professionals/firms. Mimetic pressures are cognitive institutions, stemming from uncertainty and ambiguity, prompting companies to follow what the best ones do (DiMaggio & Powell, 1983).

Among the coercive pressures, laws and governmental regulations towards environmental protection and sustainability are important drivers of digitalisation efforts (Vogelsang et al., 2018) and these efforts are further stimulated by governmental funding of I4.0 initiatives (López-Gómez et al., 2018). Data protection regulations, like GDPR, but also the digital government, setting minimal technological requirements for companies, have an impact on how companies approach digitalisation (Bag et al., 2021). Normative pressures can be detected in the form of supply chain relationships (Bag et al., 2021; Vogelsang et al., 2018), when customers or suppliers require technological compliance from their partner to do business. Successful companies, investing heavily in I4.0 technologies, compel other companies to make efforts towards digitalisation to keep their competitive position on the market (Bag et al., 2021). This mimetic pressure pushes companies with even less strategic thinking into digitalisation by just copying competitors' best practices.

While the institution-based view is about legitimacy and the wider context of companies, the industry-based view is narrowed down to the industry where the company operates and considers the forces that shape its business. The *industry-based view* (Porter, 2008) defines five forces shaping industry structures and firms' profitability. In his more recent work (Porter & Heppelmann, 2014) Porter revisited his five-force model due to the evolving industrial revolution. He claims that the influence of the changes in each of the forces largely depends on the characteristics of the industry. For instance, the bargaining power of buyers may decrease if the company, due to the availability of product usage data, becomes capable of segmenting customers, customising products, setting prices to better capture value, and extending value-added services. On the other hand, the replacement of hardware elements by software or the spread of the product as a service business model may lead to changes in other forces, e.g. increasing threats of new entrants or solutions that substitute legacy products, or higher bargaining power of software suppliers. That is, even if the change seems inevitable, its direction varies.

Overall, the characteristics of the specific industry can highly influence the strategic choices of companies regarding their DT priorities, due to variations of relevant technologies and uncertainties in structures, industrial conditions, and economic returns.

The *resource-based approach* (Wernerfelt, 1984) and the theory of dynamic capabilities (DC), which is based on it (Teece et al., 1997), are the main domains of addressing the relationship between resources and contextual changes. RBV has a static view on resources. DC theory highlights adoption and it claims that resources are about ‘... *the firm’s ability to integrate, build, and reconfigure internal and external competencies to address a rapidly changing environment*’ (Teece et al., 1997, p. 516). Within the RBV, we narrow the focus of our investigations to the DC stream. The seminal work of Teece differentiates sensing, seizing, and transforming or reconfiguring resources (Teece, 2016). An alternative framework (H.-F. Lin et al., 2016) defines four DC components. Besides sensing capability, it includes absorptive capacity (similar to seizing), relational capability, and integrative capability (similar to transformation/reconfiguration).

Studies focusing on DCs revealed their crucial role in DT as firms are undergoing changes in processes, technology, organisation, and business models (Felsberger et al., 2020; T. C. Lin et al., 2020; Soluk & Kammerlander, 2021). DT is a strategic renewal that reshapes microfoundations of DCs by emphasising the role of collaborative approach and renewed culture (Warner & Wäger, 2019). The most influential pillars of DCs during the process of digitalisation are sensing and learning capabilities (Matarazzo et al., 2021). In addition, human factor is a basic requirement: besides the executives and managers (Demeter et al., 2021; Warner & Wäger, 2019) the capabilities of employees are critical as well (Soluk & Kammerlander, 2021).

Despite ‘*calls to integrate insights from institutional theory and resource-based view*’ (Hughes et al., 2017, p. 407), few papers employ a combination of perspectives. Among the few, Zheng et al. (2013), Dubey et al. (2019) and Gupta et al. (2020) claim that, some dimensions of, institutions affect resource configuration. We identified only one paper (Bag et al., 2021) that discusses each of the three legs of the tripod framework, when analysing the impact of institutional pressures on the upgrading of a South African automotive firms’ resources. These authors find that institutional pressures exert a positive impact on firms’ resources (e.g. data connectivity, technology) and capabilities (e.g. the data analytics and soft skills of the workforce). The authors claim that industry dynamism – particularly strong in the automotive industry – further enhances this positive relation. Nevertheless, Bag et al. (2021) do not examine the relationship among the three strategic views.

The three theoretical perspectives at play in subsidiaries’ digital transformation

This section summarises how the above-reviewed theoretical perspectives apply to the subsidiary-level efforts to engage in the DT.

Our point of departure is the institution-based view, specifically that institutions provide the context for companies’ operations (Peng et al., 2009), acting not just as constraints but also as opportunities. The exploitation of these opportunities is contingent on the actors’ (dynamic) capabilities. For example, local industrial and science and technology policies envisaging and supporting the technological upgrading of MNEs’

local subsidiaries can be interpreted as *normative pressures* and opportunities to be harnessed by subsidiaries.

Another important context for subsidiaries digital upgrading is their MNE. Accordingly, subsidiary-level digitalisation trajectories are shaped both by their organisational embeddedness and the national institutional environment of the host countries (Dellestrand & Kappen, 2012; Meyer et al., 2011). The phenomenon whereby a subsidiary is embedded in multiple organisational fields (over and beyond its external context that the host country represents) has been extensively investigated in recent literature (e.g. Decreton et al., 2017; Hughes et al., 2017; Meyer et al., 2011, 2020).

Digitalisation requires the overall reorganisation of firms' operations and management practices and relatedly the accumulation of new skills and capabilities to remain competitive. To respond to these *normative pressures*, MNEs embrace digital technologies and related practices (Gupta et al., 2020), collaborate with a broader range of internal and external actors (Bogers et al., 2019), and devise new arrangements with respect to the internal division of labour. Leveraging the affordances of digital technologies that enable increasingly distributed and decentralised value creation, they delegate additional tasks to subsidiary level (Szalavetz, 2019). This requires investments in the digital upgrading of subsidiaries and the sharing of related knowledge. In turn, subsidiaries respond to the normative pressures manifested in the parent companies' increased requirements in terms of productivity, resource efficiency, and quality, by developing their own digital capabilities.

These developments – at both global and subsidiary levels – are guided by *mimetic pressures*. Global companies eagerly study their peers' practices and follow suit through building digital competences and devising digital business models (for example platform/software/data as a service models). At subsidiary level, intra-company, inter-subsidiary competition forces subsidiaries to do their best to absorb the new technologies and integrate the successful practices of partner subsidiaries. Blomkvist et al. (2015) found that foreign units have an increasing importance in technology deployment within MNEs (Blomkvist et al., 2015).

Subsidiaries' efforts may be interpreted in terms of their quest for external (intra-corporate) legitimacy. Since digitalisation also changes firms' informal institutional environment, including organisational culture, values, knowledge acquisition, and sharing practices (Nambisan et al., 2017), these new organisational practices facilitate the development of subsidiaries' digital capabilities.

In the context of these arguments, DT can be interpreted as an emerging tension between the requisite strategy and the resources at hand – resolved by an ongoing adjustment in strategy and resources (Demeter et al., 2021; Yeow et al., 2018). Considered from this perspective, it is easy to recognise that the concepts of DT and DCs are inherently intertwined. Proactive subsidiaries possessing sound local sensing and absorptive capacities can thus achieve an advantageous position when it comes to the reconciliation of DT-related tensions between strategy and resources (Demeter et al., 2021; Riviere et al., 2021). While DT is orchestrated by the HQs, there are various initiatives at all organisational levels, which give rise to mutual learning processes. Accordingly, vertical (HQ to subsidiary and subsidiary to HQ) and horizontal (subsidiary to subsidiary) relations frame DT within MNEs' global organisations (Dellestrand et al., 2020).

This latter idea opens up our analysis to include the DME concept (Farkas, 2011; Myant, 2018; Myant & Drahoukoupil, 2012; Nölke & Vliegenthart, 2009) that is particularly relevant to the subject of this study. As it will be shown in this paper, consistently with prior investigations (e.g. Cséfalvay, 2020; Éltető et al., 2022), the DME variety of capitalism – together with industry-specific factors – can strongly influence the content of MNEs' local digital initiatives. Depending on subsidiaries' dynamic capabilities, the DME context and the related institutional pressures also shape HQ – subsidiary relationships (Kostova et al., 2016).

To summarise, extant literature, investigating the drivers of DT using one or two views of the tripod framework, is limited to establishing the importance of the given theories. Authors argue that institutions, dynamic capabilities, the extent of rivalry and other specifics that influence the evolution of the given industry, the strategic choices of peers, and so forth, exert an impact on firms' adoption of digital technologies. However, over and beyond pointing to a positive causal association, these papers do not reveal the specific mechanisms of this interplay. They do not uncover the ways these causal relations unfold: these mechanisms remain locked in a black box. We argue that using the three views one-by-one (RQ1) and together (RQ2) through context-rich qualitative case studies can open this black box and give a complex insight into the strategic drivers of companies' digital transformation efforts within a specific, DME context.

Research methodology

Considering that our research is exploratory in nature, aiming to disentangle firms' complex motives driving their strategic actions a qualitative approach was chosen, involving multiple case studies (Eisenhardt & Graebner, 2007; Yin, 2014). According to Yin (2014), a case study-based research is an adequate means of investigating context-specific processes and their antecedents as well as identifying the relations among individual drivers. Accordingly, in the context of this paper, we regard the case study approach as a *natural experiment* (Welch et al., 2011) for testing whether certain *existing* theories explain the behaviour of subsidiaries.

Our case companies, wholly owned subsidiaries of MNEs, were selected from the automotive industry. The selection of this sector was motivated by two arguments. 1) The automotive industry is responsible for a relatively large share in the Hungarian value added. 2) The sector is ahead in implementing the newest technologies.

The first empirical step was to select the case subsidiaries. We have followed the principle of purposeful sampling and chose companies that are ahead in the digitalisation journey (Patton, 2002). Accordingly, the case subsidiaries are characterised by relatively high digital maturity (Schuh et al., 2017). They have been selected based on the authors' previous experiences, which makes it possible to follow how actions and strategies unfold over time, providing a longitudinal perspective.

To avoid the single-respondent bias (Eisenhardt & Graebner, 2007) and capture multiple perspectives, we conducted multiple interviews at each site, with relevant managers (e.g. head of process development, head of digitalisation) and experts (e.g. senior lean engineer, IT Business analyst) in varying functions and hierarchy levels. Interviews lasted 30 to 120 minutes and took place in 2018–19, complemented by 2–2 follow-up interviews in 2022. These follow-up interviews were deemed indispensable since the given

Table 1. Case descriptions.

Case subsidiary	No. of employees of the			Interview date	Interviewee position	Other sources of information
	Case subsidiary	MNE	HQ is in			
Auto-A	1,500+	100,000+	Switzerland	July 2018	Head of process development	Student internships and theses, quest lectures, visits, internet and media sources
				July 2018	Senior lean engineer	
				July 2018	IT business analyst & dev	
				April 2022	Digital factory site lead	
				April 2022	I4.0 project manager	
Auto-B	1,800+	200,000+	Germany	March 2018	Head of digitalization	
				April 2018	Lean team lead	
				May 2018	Digitalization expert	
				June 2022	Head of lean and productivity	
				June 2022	Head of digital factory & automation	

companies were characterised by particularly intensive investments in digital technologies. Altogether, we conducted 10 interviews at two sites [Table 1](#). Further information was also used from guest presentations in classes, and from student theses about the selected companies.

We have developed a case study protocol to guide our research and ensure the comparability of the findings. Additional company-specific sources (corporate websites, interviews published in the business press, publicly available balance sheet data and notes to the financial statement) were used not only for the purpose of triangulation but to set the context of the interviews by asking company-specific questions. Based on the interviews, case descriptions were developed to synthesise information. Case descriptions were sent back to companies for verification and approval.

Our data analysis involved a two-stage procedure encompassing a within-case and a cross-case analysis (Miles & Huberman, 1994). In the first stage, the individual cases were analysed by the researchers who conducted the given interview: they interpreted the strategic decisions and the principal developments recounted by the interviewees from the perspective of the individual constituents of the tripod framework.

This exercise required first the operationalisation of how subsidiary's strategic choices in operations were associated with a particular theory or with multiple components of the tripod framework. Our assumption was that although individual strategic choices can be explained using multiple views, a careful consideration of alternative explanations can still distil some 'hierarchy' among them in terms of the strength of a given explanatory factor. Accordingly, we conducted content analysis of the qualitative data obtained from our informants, seeking for their explanations of individual strategic decisions' drivers. Explanations associated with intensifying rivalry, increased customer expectations, and technology-specific commentaries were classified into the category of industry-specific drivers. Explanations associated with parent

Table 2. Keywords illustrating classification decisions.

Explanatory theory	Keywords mentioned during the interviews
institution-based view (external)	support instruments; policy programmes; EHS regulations (e. g. operators must not lift excessively heavy loads)
institution-based view (internal)	“HQ’s expectations in terms of cost cutting and improved operations”; “capacity increase without cost increase”; sharing and adoption of corporate best practice; implementation of the corporate digital strategy; “being the back office of our MNE, we are a primary target of corporate digitalisation efforts”
industry-based view	cost pressures; solution of labour shortages; “keep up with competitors in terms of productivity and resource efficiency”; “implementing MES is the norm in this industry”, more and “more competitors experiment with 3D printing”;
RBV, DC	centre of excellence; self-developed solution; intra-MNC pilot programme; “we devised some digitalisation initiatives”; “we applied for internal funding of the proposed projects”; “the project is part of our continuous development efforts”; “we develop internal competences that enable the absorption of new technologies”;

company initiatives and corporate practices were classified as internal institutional drivers, and strategic actions motivated by the regulatory environment or by national incentives received the label ‘external institutional factor’. If managers underscored that a given project was a bottom-up initiative or recounted the specifics of a collaboration between the subsidiary and a local technology or knowledge provider, the given project was classified as being primarily driven by subsidiary-specific dynamic capabilities. Table 2 provides illustrative examples.

These results were then discussed involving the other members of the research team. One of the principal objectives of the research team’s regular meetings was theory triangulation: a process that involves the clarification of how the idiosyncratic developments can be interpreted from the perspective of other views of the tripod framework. An important pattern that has crystallised from these analyses is that even though alternative explanations – e.g. the other two views of the tripod – cannot be ruled out in most cases, the key explanatory factor can still be identified.

In addition, this theory triangulation exercise allowed for an initial identification of the inherent linkages among the individual theoretical perspectives that form the tripod framework. These interim results laid the groundwork for the cross-case analysis, when the case-specific theoretical claims were compared to refine, modify, or confirm the emergent patterns.

Case descriptions: general characteristics and digital transformation

Hereby the case subsidiaries and their digital transformation are described shortly.

Auto-A

The subsidiary, established in 1992, is part of an MNE with several divisions and locations. It produces electronic components, mainly connectors and cables for automotive companies. In the last decade, it has gone through a massive DT.

The machines deployed are equipped with sensors and are interconnected. Many lean tools are digitised. Real-time data are available on the shopfloor. Lately, mobile robots are introduced for internal logistics, which also requires layout changes. Quality is enhanced by digitalised tools (e. g. e-Andon, e-QCPC = quality control process chart, real-time

quality data). There are experiments for predictive maintenance, sensors and cameras are used for inspection.

Locally, digital improvements were initiated and managed by the operational excellence (lean) group, more specifically by its head. Later the subsidiary became a pilot factory in the region, and the lean group refocused its efforts on digitalisation. A web-based platform exists for sharing successful demonstrated practices among factories. After implementing pilot projects at various subsidiaries, the MNE developed a region-based digital organisational hierarchy in parallel with a top-down digital strategy. There are centres of excellences (CoEs) at various subsidiaries, as well as at this one. The MNE supports the subsidiary heavily. Both a team for local digitalisation projects and a new, digitally equipped plant is financed by the parent company.

Regarding intangible investments (in human capital), a brand-new training centre was established, and the workforce is continuously trained. There is a digital operator learning management system developed at the subsidiary. Skills are developed for digital projects (engineering, IT, project management, data science). Although both the subsidiary and the corporate levels resort to technology providers, they strive to develop digital capabilities internally.

Auto-B

Auto-B supplies electronic components to several divisions within its MNE. Having won many new projects, including building new facilities, the subsidiary aims to double its productivity and use digitalisation to support this aim. The MNE launched its top-down digital manufacturing strategy a few years ago. It integrates I4.0 and lean concepts at shop floor level and embeds them into a learning culture. In 2018, the subsidiary already had an advanced Manufacturing Execution System (MES), and the CoE for MES was also located at the subsidiary. Digital strategy of the MNE categorises I4.0 solutions. Sensors and business intelligence (BI) reporting (CoE for BI is also located at the subsidiary), advanced robotics and 3D printing are in the forefront. Artificial intelligence (AI), mobile devices and big data are defined as pilot applications. Digitalisation is predominantly financed by the MNE. By 2018, the factory had two dozen collaborative robots, and by 2021, it had more than 120. Automated new lines were designed to use robots instead of humans. It has been important to minimise the number of new entrants due to rising labour cost. Several RPA (Robotic Process Automation) solutions were introduced in the support functions after 2019. The layout of the older buildings (and the warehouse) constrains the use of automated-guided vehicles. 3D printing to produce non-production materials is widely used. Savings (e.g. in FTEs), avoided costs (e.g. purchasing) and returns are calculated for digital projects. Organisation has also been adjusted. Execution is the responsibility of the local I4.0 department that includes the lean team. It is a deliberate decision that the MNE buys hardware (e.g. robot arms) and develops its own software knowledge at the CoE and local levels (e.g. installation of robots). Thus, programming has become an important engineering competence. Knowledge sharing in the network is vital. The factory tries to expand its own financial resources for digitalisation. For instance, as an I4.0 sample factory, an initiative to help the dissemination of state-of-the-art operational practices, it has received financial support from the Hungarian government. The megatrend of electric cars has already shaped the structure of the

corporation. The manufacturing footprint is planned to be reorganised. In the new concept, subsidiaries will serve only one division with a refined product mix. The case subsidiary is likely to supply a product mix that is not compatible with current lines using advanced robotics.

Subsidiaries' general and DT-specific features are collected in Table 3. We can find many similarities across the case subsidiaries: 1) there has been an increase in capacities involving new facilities in both cases, which can be the result of the case subsidiaries' good performance not only in general but also in relation to digital developments. 2) The culture of continuous learning is common, which provides a good basis for keeping pace with (digital) changes in the environment. 3) Good performance is supported by the fact that both subsidiaries have CoEs. It means that they have more expertise in a specific digital tool than other subsidiaries within their MNE. It may also indicate parent companies' commitment to distribute some of the digitalisation-related R&D tasks and organise a systematic sharing of knowledge.

There are differences, as well. 1) the digital directions are slightly different: Auto-A inclined more towards manufacturing efficiency (connecting machines, mobile logistics robots, quality, and maintenance), while Auto-B puts more emphasis on information-related digitalisation (like BI, big data, digital decision support). 2) Auto A seems to have a pioneer role in DT within the regional MNE. We could not identify such a role for Auto-B, even if they are also active and successful in DT. 3) Auto-B searches for financial opportunities at national level, we did not detect such intention for Auto-A.

Next, we investigate the drivers behind these developments using the three views.

The influence of each view of the tripod model – a one-by-one analysis

In this section, we elaborate each view's strategic drivers influencing DT. As an illustration, we prepared a detailed analysis along some crucial aspects for the three views. Table 4 summarises the main findings.

The institutional view

Many drivers can be linked to *external institutions* that are peculiarities of the DMEs where subsidiaries operate. The supply of low cost, skilled, and flexible workforce has been a core element in the 'value proposition' of the DME countries in the last decades. Governments have developed financial incentives to attract foreign direct investments. In this 'lock-in' status as governments want to sustain economic performance, they must also sustain the allocation of huge financial transfers (usually based on the so-called discretionary governmental decision, tax refunds or cash transfer). Before 2019, when firms applied for financial subsidies, they had to promise new workplaces. From 2019, mainly due to labour shortages and stagnant productivity, applicants are not tied to hiring additional employees. Further reputational initiatives were also developed for example, the government has signed strategic alliance contracts with many large multinational companies (including one of our cases).

There is a remarkable coercive incentive in this investment context dominated by government decisions. Since the governmental bodies push digitalisation through various national strategies and support instruments (such as the sample factory project in

Table 3. The case companies.

	Auto-A	Auto-B
Global company	present in 140 countries turnover ₂₀₂₂ : \$16.3b employees: 85k+ global engineering centres: 100+ automotive connectors, connector housings, electronic components €220.5m (a) 99+ 1307 116.5 (a) digitalisation of lean tools; machine connectivity; robotisation (logistics); digital connection of operations, control, and management; digital platform for operator learning; small-scale pilot use cases Basis: learning-based lean culture	present in 57 countries turnover ₂₀₂₂ : €39.4b employees: 200k+ R&D expenses: 7.3% of sales case plant: automotive electronic components and microelectronic circuit modules (the MNE owner has 12 facilities in Hungary) €968m (b) 84 (b) 3049 (in case plant), 5565 (in HU) 124.3 (b) robotic process automation of various blue-collar (production and logistics) and white-collar activities; 3D printing; manufacturing execution system (MES); shift to data-driven decision-making; dozens of new small-scale DT projects
Products manufactured by case subsidiary		
HU: Turnover ₂₀₂₁ *		
Share of exports %		
Employment ₂₀₂₁ *		
ΔLP 2021/2016		
Content of DT projects		
MNE and local organizational characteristics of DT	DT timeline: first, experimental projects lead by the local lean group; second, the subsidiary becomes a pilot factory within the region; third, region-based top-down digital organisational hierarchy and digital strategy at subsidiary: CoEs, new digital factory financed by the MNE connected factory: Realtime production data; mobile robots for in-plant logistics; digital quality control tools introduced; digital preventive maintenance (being developed); data-driven decision-making	Basis: learning-based lean culture DT top-down digital strategy; local and divisional digital experts and managers; CoE at case site location for robots and BI; I4.0 sample factory project (financed by the HU government); MNE financial resources are available for a new digital facility and digital tools (if part of the strategy) connected factory, data capture and analytics technologies for business intelligence; advanced automation and robotisation of production and support activities; data-driven decision-making
Digital maturity in 2022		

* = Business year 2021: from October 2021 to September 2022.

(a) using an exchange rate of 1 EUR = 360 HUF for 2021/2022 and 1 EUR = 315 HUF for 2016.

(b) consolidated financial statement data: they refer to the performance of Auto-B's all Hungarian facilities and not only to the case plant where the interviews were conducted.
LP = labour productivity; ΔLP = Sales/employees 2021/2016%.

Table 4. Summarized findings about digitalisation by views (RQ1).

View	Strategic drivers	Consequences for subsidiaries
<i>Institution-based view – Host country legitimization (DME)</i>	<i>Normative pressure:</i> a) government financial support to foster technology is no longer connected to the creation of new workplaces; b) national Digital Strategy, policy incentives	a) They do not have to keep (or hire new) employees, they can focus on what is the best for them economically b) Investments in DT are expected to grant legitimacy (e.g. pilot factory showcase program)
	<i>Mimetic pressure:</i> Professional associations (new and old) address digitalisation issues through events	Learn best practices from local companies
<i>Institution-based view – Internal legitimization</i>	<i>Coercive pressure:</i> parent-pull digitalisation	Prescribed projects
	<i>Mimetic and normative pressure:</i> CoE (knowledge hub) of a technology is created at a subsidiary with best-in-class knowledge	Develop and share best practice, horizontal and reverse knowledge flows become common
	<i>Normative pressure:</i> lean organisational culture	Lean facilitates (technology) changes
	<i>Coercive pressure:</i> strict financial control	Subsidiaries should invest in DT without additional financial support from HQs
<i>Industry-based view</i>	<i>Location:</i> low-cost labour country, but decreasing comparative advantage	Digital solutions are needed to increase resource efficiency and counterbalance the decreasing advantage
	<i>Buyers</i> are the main drivers of digitalisation	Buyers expect increased efficiency, flexibility, and transparency
	<i>Rivalry in the network:</i> fierce competition within MNEs	Subsidiaries must keep up with their peers in implementing digital technologies
	<i>Suppliers:</i> a) labour shortage; b) fast increasing knowledge at technology providers	a) Implement replacing technologies; b) Decreasing prices, internalised knowledge
	<i>Substitute products and new entrants</i>	Restructured subsidiary product portfolio (Auto-B)
<i>Resource-based view</i>	<i>Sensing:</i> ambitious and susceptible managers due to technology intensive context	Proactive experiments with various technologies and with digitalisation in general:
	<i>Absorptive capacity:</i> focus on process excellence, mature lean culture	Lean groups' leading role; CoE formal and informal knowledge sharing, quick learning
	<i>Integrative capabilities:</i> adjust local and global strategy and governance structure	Develop local digitalisation-related organisational routines, skill development of individuals becoming a CoEs within the MNE
	<i>Relational capabilities:</i> active relations with HQs, CoEs and internal network members; technology providers, universities, research institutes	Get access to up-to-date information, knowledge and inventions; learn from external sources

case of Auto-B) (Marciniak et al., 2021), subsidiary managers are motivated to move into this direction.

Regarding the *internal institutions*, that is the MNE behind the subsidiaries, we state that each subsidiary is under *strict control*. Several MNE level organisational routines shape DT and local subsidiaries have limited room for self-determination.

Process improvement, especially lean management, has become a core process in manufacturing MNEs (Netland, 2013). Lean organisational culture as an internal institution has emerged as a very crucial common booster of digitalisation. Lean organisational culture at both companies supports continuous innovation and improvement.

Both MNEs established dedicated organisational units responsible for digitalisation. These units prepare the digital strategy and decide on the expected/proposed digitalisation projects that the subsidiaries must follow. We refer to this phenomenon as a parent-pull model of subsidiary digitalisation. Nevertheless, there are some

opportunities at the subsidiaries if they are eager to act proactively. They have their own budgets to experiment with novel solutions, and in some approved cases they can get further financial resources to launch a larger project (e.g. automated factory logistics at Auto-A).

It is a general best practice at both MNEs that they establish CoEs for new technologies. These centres then become knowledge hubs that contact and control suppliers, experiment with novelties, share knowledge with other subunits, and facilitate knowledge sharing in the internal network. These hubs are usually separated in legal terms from the subsidiary, even if they, or their members are located there. However, the co-location leads to a fertile relationship with the subsidiary, not least because even the location decision of the CoE has been influenced by excellent local performance/knowledge.

The above-mentioned initiatives describe the evolvement of a new digital governance structure. Although, the related new internal institutions determine the context for our case subsidiaries, our results underline that subsidiaries could actively influence DT. A key feature is that the vertical and hierarchical knowledge flows are supported with hybrid forms (i.e. horizontal and reverse knowledge flows). Experimentation and knowledge hub status increase subsidiaries' digital assets and digital competences which contribute to subsidiaries' upgrading both in process and functions. In the DME context, the financial risks of investments could also be shared to some extent with the local government.

The industry-based view

As for the industry-based view (Porter, 2008), our results confirm that it is a vital approach to identify strategic drivers of DT at subsidiaries.

DT helps to survive in the – perceived – *fierce competition*. The main potential achievements are higher efficiency, increased flexibility, and transparency – all requested by the *buyers*. This driver might stem from the key feature of DME's factory economy status: local actors are specialised in production and other assembly-type business processes. Consequently, digital solutions were applied to improve the resource efficiency of these, relatively, low value adding activities.

On the *supplier* side, workforce and technology providers should be highlighted. There is a(n economy wide) lack of qualified workforce, who can support digital efforts. Regarding blue-collar workers, two issues arose: the lack of workforce with adequate skills (even to be trained to work in unskilled jobs (!)) and the rapidly increasing labour costs. So, companies strive to substitute robot technologies for labour and enhance the management of the production process with real-time performance management. As the price of automation technologies has decreased considerably in recent years, the affordable technologies have boosted experimentation. However, the power of suppliers is aimed to be reduced by companies as they develop the MNE/local knowledge hubs in the internal network.

The rivalry among existing competitors and the bargaining power of buyers put an ever-growing pressure on companies to cut costs and increase output. The way towards I4.0 is enabled by the decreasing cost of technologies, and by the must to resolve labour shortage.

The resource-based view

Dynamic capabilities at subsidiaries are about adjusting the resource configurations in a changing environment. Acknowledging the multi-level routine sets in MNEs, we focus on the subsidiary level. To review the patterns, we apply H.-F. Lin et al. (2016) process-type DC approach.

Sensing capability is associated with the company's subjective perception of environmental change and its ability to identify opportunities. Technology intensity and commitment towards (lean) process improvement made subsidiaries, and local managers, susceptible to digitalisation as it promised further significant performance improvements. The case subsidiaries proactively experimented with novel digital solutions. Auto-A took a leading role in the internal network, and organised local digital knowledge brokers of the region, even before any top-down decision had been made. However, proactive the case companies have been, subsidiary-level DT has been boosted mainly by formalised, top-down initiatives, as HQ-level routines evolved.

Absorptive capacity refers to a set of abilities to integrate external knowledge. This capacity was strengthened through parallel organisational changes, implemented at both subsidiary and corporate levels. At subsidiary level, where maturity in lean culture is vital to engage with DT and the focus of digitalisation efforts is on process excellence, the lean team took a leading role in managing digitalisation projects (Auto-A), or in the case of Auto-B, it complemented the skill set of the I4.0 department. The absorption of digital technologies and the implementation of the related changes in processes and workflows thus relied on the local, well-established lean culture, complemented with an extensive training of both frontline workers and managers. Meanwhile, central (knowledge broker) initiatives fostered MNE-level absorption. CoEs became responsible for the roll-out of novel technological solutions, and local and central teams were assigned responsibility for specific DT projects. Formal and informal knowledge sharing was encouraged and exploited to enhance absorptive capacity at all levels.

Integrative capabilities are paramount for the integration and productive use of new resources. Self-evidently, integration builds on companies' existing resources and capabilities but these need to be recombined and organisational practices and routines rebuilt during the integration process. In the case companies, both the HQs and the subsidiaries have adjusted their 'modus operandi'. It was a significant, albeit not a revolutionary adjustment. HQs initiated top-down digital strategies with correspondingly adjusted governance structures. Subsidiaries combined their existing lean resources with the newly integrated digital ones, and as an outcome, they developed new (redesigned) routines. A salient example is the way quality problems were addressed. The efficiency of collecting data about previous days' quality problems, analysing them, and searching for root causes has been tremendously increased through the automation of data collection and analytics. In this way, the quality control team (Auto-B) could immediately start addressing the problems and feeding the lessons back into the lean processes (recombination).

Finally, *relational capabilities* are about building and maintaining close relationships in the network. Subsidiaries are mainly oriented by the central bodies (HQs, CoEs) and usually have closer relations with some peer plants in the internal network. Many external links are also managed by the responsible employees as defined in the digital organisational governance structure. The examined subsidiaries continuously monitor emerging

technological solutions and collaborate with (local) technology providers, universities, and research institutes. They make joint experiments and projects and meanwhile strive to develop their own skills (IT, project, data science, AI).

There is a shared belief at the case subsidiaries: digitalisation is the only viable option to improve processes and handle cost pressure, so adjusting resources is inevitable. Sensing capabilities and absorptive capacity are crucial to engage with DT. In addition, our cases also underline that an ambitious local management can influence relational and integrative capabilities of the MNE.

The three individual views – concluding notes

Each view of the tripod framework provides a valid narrative about subsidiaries' DT. Furthermore, each view is associated with a specific set of strategic drivers that facilitate subsidiaries' DT. The revealed strategic drivers and their consequences are listed in Table 4.

The industry-based view depicts remarkable changes in the markets. It concludes that increasing customer expectations can only be met with technology deployment that at the same time resolves labour shortages.

The institutional view delineates internal and external institutions, and it also explains their interrelatedness in DME context. Although external institutions (e.g. low labour cost, favourable taxation, direct financial support) influence MNE' decisions such as location decisions, the ongoing DT is mainly driven by internal institutions.

Finally, DCs provide a high-resolution description of DT actions. Proactive local management with proper sensing capabilities redirects process improvements from lean towards digital. As the new organisational context is orchestrated, case subsidiaries try to formalise their pioneer attitude in integrative and relational capabilities as well.

It is evident that some firm practices (or consequences) can be related to more than one view, and hence to different set of drivers. For example, CoE has an important role in the institutional and DCs views as well. Altogether, as the next section presents it, our results underline the complementary nature of the individual views of the tripod framework.

Digital transformation approach by the tripod – relationships of the three views

This section investigates the interactions between the individual constituents of the tripod framework.

One of the reasons that Auto-A's HQ decided to build a new facility at the subsidiary is the good cost position of the subsidiary. Although the focus on cost is necessary given the fierce industrial competition (industry-view), the low-cost labour factor, a further attractive features of DMEs (e.g. taxation, direct support) (external institution), would not have been enough to win this new capacity. The lean manager had recognised that with the classical lean tools only minor further improvements are possible, while he was expected to increase efficiency considerably (internal institutions, normative pressure). Therefore, he started to make small-scale experiments with digital tools with the support of various partners (DCs, sensing and absorptive capabilities). Due to his efforts and demonstrated

capabilities, the subsidiary became a pilot factory for digitalisation within the internal network (internal institutions; DCs, relational and integrative capabilities) and had launched many successful projects. Besides the Hungarian plant, a German plant was considered as a pilot factory in DT. Due to these projects in parallel with continuous efforts towards lean, they remained ahead in efficiency and capacity utilisation within their internal network. That fact ensured the HQ to get the highest possible return if they locate the new factory there. Meanwhile, DT-related group-wide reorganisation efforts aiming to enhance knowledge flows and sharing led to further initiatives at the subsidiary, e.g. CoE (internal institutions; DCs, relational and integrative capabilities).

Auto-B's large-scale adoption of collaborative robots to boost productivity (industry-based view) is consistent with the top-down expectations of the HQ that proposed robotisation as one of the main areas of Auto-B's DT (internal institutions). However, this path was also forced by the changing DME context (external institution): increasing labour costs and the lack of available workforce are nowadays' challenges for firms in the country. As the deployment and dissemination of technology is the new priority of the DME hosting, the case subsidiaries (external institution), Auto-B's subsidiary applied for such a financial support scheme. A local team with relevant technological and process knowledge (absorptive capacity) started robotisation in manufacturing as a flagship hub at MNE level. At the same time, the subsidiary has started to transform its advanced process control knowledge backed by MES into business intelligence (DCs, sensing and absorptive capacity), and attracted a CoE (internal institution, DCs relational and integrative capabilities). Later, robotisation has been extended to supporting activities (DCs, sensing capabilities and absorptive capacity).

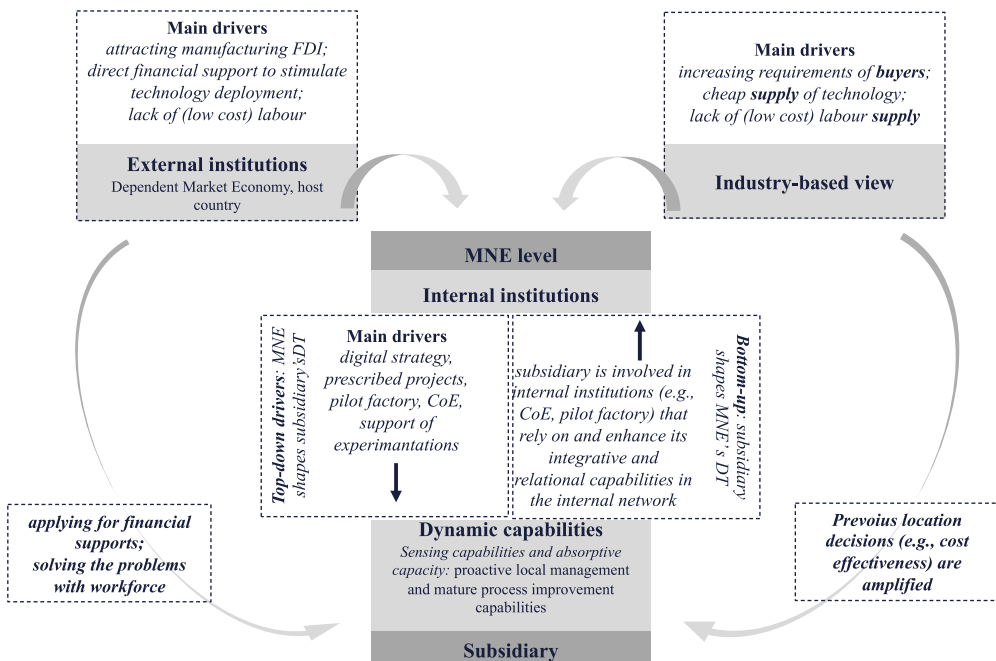


Figure 2. Relationship among tripod's views in the evolving DT – industry, institutions, and dynamic capabilities.

Both case subsidiaries' DT illustrate the interrelation of the three views. As depicted by [Figure 2.](#), our results indicate that within a complex web of interconnections among the views, parent companies, that is, internal institutional factors are the key drivers of DT at subsidiary (coercive pressure). The internal institutions represented by HQs' decisions are highly influenced both by the external institutional context (host-country-level, DME) and the industry-specific factors, such as cost pressure and efficiency-seeing. In other words, external institutions such as changing financial support schemes and key industry factors such as improved technology and labour shortage shape internal institutions of MNEs. Considering the embeddedness of the subsidiaries in their MNE, HQs has a strong top-down influence to set direction of DT and define the role of subsidiaries in that. (Besides parent–subsidiary relationships, top-down pressures might be identified at different levels, e.g. between policy makers/regulators and corporate management as well as management and employees.)

These strategic drivers filtered by internal institutions require changes in resources, routines, and capabilities at subsidiaries. Subsidiaries' efficiency at which they sense and seize digital solutions could meet or even exceed parent companies' expectations. In these efforts, they are usually capitalising on existing resources such as process management, technological expertise, or people's skill. As they exceed requirements, they enhance their importance in bottom-up experimentations (i.e. pilot factory, lead factory) and MNE level knowledge flows (i.e. CoE). Successful local experimentation and CoE role reflect mutual interdependences as they shape internal institutions in a bottom-up manner.

External institutions (e.g. government subsidies) and industry-specific factors (labour shortage) also have some direct effects on subsidiaries' DT. However, at the subsidiary level internal institutions are more crucial in boosting DT than external institutions.

Discussion and propositions

In this section, beyond comparing our results to the literature, propositions are formulated to articulate our findings better and to stimulate further research. Overall, it is visible that the technology-induced digitalisation seeps into each view, which requires adaptation and alignment at every level (subsidiary, industry, MNE, country).

As for the institution-based view, investigating subsidiaries of MNEs, our study highlighted two influential stakeholders, seldom considered together (Dubey et al., 2019). Host country policymakers and MNE HQs represent different arms of the institutional duality (Meyer et al., 2020). And according to our findings, the latter (seeking for internal legitimacy) has far larger impact on how digitalisation rolls out at subsidiaries. The coercive pressures (projects prescribed in strategy, financial constraints) dominate among the influencing factors. We also found evidence for the other factors mentioned in the literature (Bogers et al., 2019; Gupta et al., 2020), such as the normative pressures in the form of governmental, and competitive influences or the mimetic pressures to learn best practices (Nambisan et al., 2017) within the MNE (CoEs) and from local economic actors (through knowledge sharing events). Therefore, for the institution-based view, we formulate the following proposition.

P1: Subsidiaries' quest for internal legitimacy exerts stronger influence on their digitalisation efforts than their aspirations for external legitimacy.

Regarding the *industry-based view*, in accordance with global (Björkdahl, 2020) and local (Horváth & Szabó, 2019) experience, our cases also indicate that the subsidiaries started to implement advanced technologies to increase their efficiency and lower their operational costs partly to satisfy their powerful buyers and to stand fierce competition. Digitalisation did not change the competitive position or the industrial structure of the subsidiaries considerably, rather it amplified previous DME-context related forces. The most significant change can be seen due to industry-specific disruptive effects (e.g. electrification, autonomous driving). They compel automotive MNEs to rethink their product portfolios and business models. But these changes are not yet reached the subsidiary level, where lower-level optimisation in the form of process efficiency is in the focus.

P2: *Industry-based aspects stem from a global viewpoint and are determined mainly by the DME-context of subsidiaries.*

The development of new routines and resources supporting digital organisational change brings the *resource-based view* into the forefront. In accordance with previous works (Demeter et al., 2021; Yeow et al., 2018), our findings also underline that DCs help to mitigate the tension between resources and digital strategy as DT evolves.

Path dependency, a key concept of DCs, offers explanation for why DT starts. Seminal concepts of process improvement, like lean or quality management, have played significant role in the 'birth' of DC theory (Pisano, 2017; Teece et al., 1997) and have become one fits all best practices (Netland, 2013). These concepts are about maintaining the 'doing things right' approach. As the S-curve about the performance impact of management innovation predicts, firms exploiting lean in their operations to a great extent are reaching a performance frontier with it (Netland & Ferdows, 2016). On this path, exploiting sensing capabilities and absorptive capacity, our case subsidiaries have explored digitalisation to upgrade (and to further exploit) their current 'doing things right' lean practice.

P3: Advanced lean process improvement knowledge at the subsidiary facilitates digitalisation efforts.

P4: High level of sensing capabilities and absorptive capacity related to process management at subsidiary facilitates its digitalisation efforts.

The interplay of views leads to further propositions. The changing nature of DME (increasing cost of labour and labour shortage), the (perceived) fierce competition in the industry and the sensing capabilities at the subsidiaries contributed to experimentations with digital solutions. Although, Dubey et al. (2019) claim that institutional factors directly influence resources (as big data is applied), we proved it worth considering the duality of institutions at subsidiary level. At subsidiary level, the largest direct influencing power arrives in form of top-down expectations (i.e. from HQ to the

subsidiary). However, idiosyncratic subsidiary initiatives can be facilitated from the external institutions in the form of direct financial support for technology deployment, which can help the subsidiary to upgrade within the MNE, while it also supports DME aspirations.

P5: Subsidiary digitalisation and upgrading efforts can support DME digitalisation aspirations.

The upgrading of the subsidiaries in the sample into a (divisional) CoE also exemplifies the interconnection between the *three views and the two level of operations (subsidiary and MNE)*. As outlined in the literature review, digital technologies enable the delegation of additional tasks to subsidiary level. The automotive industry faces the disruptive and complementary effects of an array of new technologies affecting industry-specific competitive strategy and practices (Porter & Heppelmann, 2014). The multi-technology features of competition prompt MNEs to redistribute components of corporate value creation and arrange for new knowledge-sharing practices (i.e. modify the informal institutional context (Nambisan, 2017)). Subsidiaries possessing strong DCs and adopting proactive, entrepreneurial behaviour can leverage these digitalisation-induced opportunities and upgrade, for example into a CoE (Teece, 2016) that has a central position in knowledge generation and sharing. At the same time, through the lenses of another view, these subsidiaries' efforts shape the relational and integrative capabilities of the MNE.

P6: Subsidiary with high level of sensing capabilities and absorptive capacity are expected to strive for a central position in internal institutions (e.g. CoE, lead factory) in the internal network to meet the increasing requirements.

P7: Subsidiary with high level of sensing capabilities and absorptive capacity are expected to strive for shaping MNE level relational and integrative capabilities to meet the increasing requirements.

A further dynamic interplay between the subsidiary and MNE levels has been also revealed that can be best explained by combining the *institutional view and DCs*. Our case-subsidaries continuously strive for upgrading themselves using their DCs. However, due to the intense knowledge exchange within the MNEs, novel solutions are quickly institutionalised. That is, bottom-up initiatives become top-down expectations and directives (coercive pressures) in the internal network. In that sense, the globally distributed manufacturing units would sooner or later adopt similar digital technology-enabled practices, as suggested by DiMaggio and Powell (1983). This helps the MNE to position itself upwards and compels subsidiaries to initiate further new digitalisation projects to meet internal institutional pressures (Gupta et al., 2020).

We can explain the same changes drawing on Riviere et al. (2021). They say that MNEs are multi-level systems and DCs can appear at subsidiary and at MNE level, as well. We argue that the quick institutionalisation, which transforms bottom-up initiatives into top-down expectations is a dynamic capability of the HQ and the relationship between the

subsidiary and HQ's DC is established by the legitimacy-seeking behaviour of the subsidiaries.

P8: Novel digital solutions of subsidiaries are quickly institutionalised in a coercive manner within the internal network in case of high subsidiary and MNE level DCs.

Managerial implications

Although, our findings stem from the experience of subsidiaries facing fierce global competition, we believe that their current practice could offer valuable insights for managers in other settings as well. Hereby, we highlight the desirable managerial roles.

Regarding subsidiary level, firms should find committed *managers who do play a crucial role in sensing the changes*. Managers have a great responsibility in building and maintaining the necessary individual and organisational capabilities and culture – both in the period of local and in the period of central initiatives. Our cases illustrated that digitalisation goes well beyond technological issues and that successful DT depends on *adjusted routines related to strategy, governance, and project management*. Firms can become a pilot factory or host a CoE if *managers possess strong relational capabilities*. Finally, as digitalisation requires capital investment, *the ability to raise funds*, either at local bodies (e.g. local top management, state support) or at HQ, to experiment with pilot DT projects can form the basis for deeper and wider DT.

Regarding MNE-level implications, HQ executives need to be aware of the fact that the evolutionary subsidiary-level (bottom up) path reaches its limits quickly without top-down initiatives aimed at exploiting the real potential of digitalisation. In the DT process, pilot factories and CoEs help to rationalise the investments at MNE level. Therefore, internal institutions have a crucial role in how the digitalisation process takes place.

Implications for public policy

The evidence presented in this study holds important implications for public policy. Over and beyond the common argument that well-conceived public policy is needed to incentivise and steer DMEs' DT-driven high-road development, the confirmed relevance of the tripod framework suggests the following takeaways.

The industry-based perspective reinforces that digital maturity increasingly determines value creation capability. It means that a dedicated policy instrument is a must as digitalisation seems to be inevitable. We propose schemes that direct firms towards DT projects that engender subsidiary-level knowledge accumulation, e.g. through the digitalisation of additional production support functions and/or establishment of centres of excellence specialised in selected dimension of DT. However, as the competitive landscape can change rapidly and considerably, one should account for the adjustments in industrial structure as well.

Relatedly, the confirmed relevance of the DCs suggests that the main area in which public policy could stimulate the progress of DT at global companies' manufacturing

subsidiaries is through fostering human resources development in general and the accumulation of digital capabilities in particular. In addition, policies should also consider that subsidiaries are different. Based on our findings, we advise that a proper policy reconciles subsidiary's digital readiness and its process improvement capabilities.

Regarding the institution-based view, our findings highlight that public policy in DMEs needs to take into account the dependent (parent-pull) character of DT. If foreign subsidiaries possess the critical capabilities to deploy and use digital resources effectively, facilitating the spillover of good practices to local stakeholders – as it happened in the case of the government-financed pilot factory programme – may offer a good return on public investments.

The evergreen question whether public policy support fostering the DT of manufacturing subsidiaries can stimulate additional investment by the parent companies is closely related to the interplay between the individual constituents of the tripod framework. Since investment in new resources and capabilities usually begets complementary investments (and particularly so in the complex automotive industry), the normative pressures that public support programmes represent will interact with the coercive pressures from the internal institutional environment in a synergistic manner, which bears the promise of a relatively high additionality.

Conclusions and limitations

Our empirical work underlined that the tripod framework is a powerful tool to capture the main strategic drivers of DT at subsidiaries. In addition, our study brought some novel insights into how subsidiaries and MNE shape DT.

First, we proved that each view of the framework has a distinct explanatory power on how digitalisation rolls out in the automotive sector. The industrial view encompasses the direct competitive pressures, the strong bargaining power of customers and intense competition (also filtered through the MNE HQ), which force subsidiaries to find new ways for obtaining an advantage in the market. Recently, supplier side has also changed: labour shortage could be offset by rapid decrease in the price of novel technologies. A duality in the institutional view serves as a contextual filter. The external institution is the DME context that amplifies the increasing customer requirements and directs subsidiaries' focus on process efficiency. Internal institutions of the MNE describe the governance mechanism and define the boundaries of subsidiaries' control over the DT. DCs highlights the importance of the lean organisational culture and local management that together reflect high sensing capability and absorptive capacity. In addition, these might promise the potential upgrading of subsidiary in the internal network.

Second, relying on the tripod, we propose a complex narrative of DT combining macro and micro perspectives. The dominant industrial logic determines the FDI (technology transfers, factory extensions and establishments) and outsourcing decisions of MNEs in the region. These decisions continuously shape the internal (within MNE) and external (host country, DME) institutions of subsidiaries and cause changes in their resource stocks through developments. The subsidiary adaptation influences the institutions and realise the targeted competitive industrial (cost) position. Therefore, the three views are dynamically interrelated.

Third, by focusing on subsidiaries in a DME, we provided a unique approach of DT. According to Meyer et al. (2020, p. 539), *'few studies focus on the foreign subsidiary as the*

unit of analysis. Most studies view subsidiaries from the perspective of HQ rather than from the perspective of the subsidiary itself.' We concluded that although MNE determines DT in subsidiaries to a great extent, this digital journey is not deterministic. Subsidiaries exploiting sensing capabilities and absorptive capacity could remarkably shape digital journey of the MNE.

As for limitations, subsidiaries in the automotive industry are in fierce global competition, which compels them to continuously develop their capabilities to remain competitive. That is the reason why at both MNE and subsidiary level, DC are developed. In less competitive environments, the impetus for digitalisation might be weaker. Therefore, investigating sectors with different competitive situation and different levels of DCs can bring new insights into the complex relationship of various drivers.

Our results are valid for DME countries and wholly owned subsidiaries. These subsidiaries are usually under high parent control, and therefore, the ratio of top-down decision is higher. Still, in MNEs, even lead factories should execute many top-down decisions. Nevertheless, it would be worth investigating subsidiaries in more developed countries and comparing subsidiary experiences with the parent's viewpoint.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Hungarian National Scientific Research Fund (K138846 and K135604)

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