# Digital Transformation: What is new if anything? Emerging patterns and management research

Gianvito Lanzolla, Annika Lorenz, Ella Miron-Spektor, Melissa Schilling, Giulia Solinas, and Christopher L. Tucci

## Introduction

Digitalization and digital transformation have long fascinated scholars, but the recent explosion in the adoption of digital technologies in all types of organizations brought the topic to the forefront of questions about strategy, organizing, and management.

The opportunities associated with digitalization are numerous and manifold. Organizations are using digitalization to reinvent their products, processes, and value chains, and to enter into new markets. It has enabled many companies to work with a wider range of suppliers and offer their products and services to a wider range of customers. In many industries, digitalization has significantly lowered the transaction and coordination costs that shaped the organization structures of the past; the lowering of those costs has unleashed new possibilities for organizational forms, strategies, and management processes. Still, digital transformation also has a dark side. For example, market concentration might increase because of digital incumbents' dominance, with dubious consequences for consumers; algorithms underpinning artificial intelligence may amplify biases in decision-making.

This Special Issue's motivation was studying whether the established assumptions in extant management theories still hold in the light of digital transformation. Embracing the *Academy of Management Discoveries'* spirit, the Special Issue proposed to unpack the issue through its macro, meso, and micro dimensions and a phenomenological lens. More precisely, the call aimed to unfold the relationship of digital transformation with (a) institutions and strategies; (b) business models, organizational design and learning; (c) cognition, creativity, and capabilities.

The Special Issue received 55 submissions in response to the call. After a first revision, the editors invited the authors of 12 papers to participate in a workshop at Cass Business School, City, University of London in December 2019. The workshop enabled all participants to learn about the differing contexts studied, exchange suggestions and constructive feedback, and refine the papers. Seven articles were selected for inclusion in this Special Issue, and they span a wide range of technologies, contexts, and levels of analysis.

In this article, first, we offer an overview of some research areas in management where digital transformation seems to have challenged more severely the legacy assumptions and the suitability of existing management theories. These areas comprise the firm's scope, value creation with demand heterogeneity, business models, organizational design, and organizational learning and creativity. Second, delving into these research streams, we summarize the papers included in the Special Issue which reveals some fresh perspectives on the theoretical and practice implications

of the digital transformation. Finally, we take stock and suggest some areas for further investigation.

## Digital transformation and management theories

Digitalization has resulted in novel organizational phenomena that cut across multiple levels of analysis, including markets, business models and strategies, organization design, cognition, creativity, and capabilities. While some of the newly observed findings fit well with existing organizational theory, others have exposed weaknesses or gaps in existing theories and frameworks. We reflect here on some of the key areas in which digitalization may have a profound effect on management and organization, highlighting areas in which existing theory may or may not suffice.

### Digital transformation and value creation with demand heterogeneity

Digitalization can have a dramatic effect on value creation in markets with demand heterogeneity by (a) expanding the range of goods and services that sellers can offer to buyers; (b) expanding the range of buyers that sellers can reach; (c) decreasing the search costs associated with identifying a match between buyer and seller; and (d) providing data about buyers' unmet preferences that can, in turn, improve product development. This suggests that there may be ample opportunity to develop and/or refine theories about how digitalization influences market scope, value chain reconfiguration, and innovation.

One of the key ways that digitalization has transformed many markets is through providing online search and transaction channels that both increase the range of goods and services that are offered, while simultaneously lowering the search costs for selecting among them. Traditionally, vendors were constrained in their product offering and market reach by the costs of holding inventory and the challenge of providing a physical venue for offering their goods and services. Furthermore, it was typically costly and difficult for customers to sort through a very large and diverse product or service offering to find what they wanted. An online portal, by contrast, has virtually unlimited "shelf space" and unconstrained geographic reach, and by providing rich search tools and review systems, it can guide customers to the products that most closely meet their preferences (Afuah & Tucci, 2001). A wide range of firms such as Netflix, Upwork, DHgate, Alibaba, Amazon, HKTDC, GlobalSpec, TradeKey, and others are now able to connect millions of buyers and suppliers at extremely low search costs. This, in turn, has dramatically increased the ability of buyers and suppliers to find products and services that better match their needs based on the dimensions (e.g., quality, functions, cost, and more) that they care about. These platforms have enabled even unusual customer needs to be fulfilled through equally unusual (and previously hard to find) goods and services—a phenomenon known as "the long tail" (Anderson, 2004; Brynjolfsson, Hu & Smith, 2006). The more heterogeneous these buyer preferences are, the more value that is created by expanding the reachable product range and lowering the search costs (Schilling, 2000).

There are reinforcing effects here as well, as buyers search for ever more precise and sometimes idiosyncratic preferences, they reveal information to suppliers about potential untapped market opportunities. The data generated by search (and reviews) can thus drive product development, leading to even closer matches between the goods suppliers provide and customers seek. In some

cases, digitalization has also facilitated modularization and customization of the products and services themselves (e.g., personalized news feeds instead of newspapers, song playlists replacing albums, mass customization in fashion and other goods) (Aguiar & Waldfolgel, 2018; Schoder, Sick, Putzke & Kaplan, 2009; Steiner & Hergenrother, 2014), which also enables product configurations to be more closely matched to heterogeneous customer preferences.

Customers are very likely to have a higher willingness-to-pay for goods that very closely meet their preferences (Schreier, 2006); if these "better matches" can be provided without a commensurate increase in costs, total value creation increases. Notably, these processes also greatly facilitate market segmentation and price discrimination, which we would typically assume increases value capture by the firm. However, digitalization also lowers the search costs for consumers to compare products across firms, exposing firms to more price competition. Thus, while digitization offers clear and large benefits in value creation, that value may often be disproportionately captured by buyers rather than sellers. Many of the mechanisms by which digitalization can increase value creation might be ably explained through application of transaction cost economics and modularity theory. However, these theories will need to be integrated with work on price transparency and price competition to understand how (and by whom) that value is captured. Furthermore, it would be extremely useful to have a richer body of work on when and how buyers infer quality when transacting with geographically distant suppliers.

**Digital transformation and the scope of the firm**

Do digital technologies enact new mechanisms that might affect the scope of the firm? How will firms look in the "Digital Age"? Some researchers have argued that digital technology adoption should enable organizations to become more focused and specialized (e.g., Howells, 2012; Mabey & Zhao, 2017; Newell, Scarbrough & Swan., 2001; Brews & Tucci, 2004). Other researchers have argued that digital technology adoption might broaden the scope of the firm because of the increased potential for coordination and cooperation across multiple "units" (e.g., Friesike, Flath & Wirth, 2019; Kallinikos, Aaltonen, and Marton., 2010; Leonardi & Vaast, 2017; Yoo, Boland & Lyytinen, 2012). This second line of studies has fueled research on platforms (Parker and Van Alstyne, 2014) and organizational boundary reconfiguration. For instance, Barrett, Oborn, Orlikowski, & Yates (2012) show that the introduction of drug-dispensing robots in two UK hospitals reconfigures the boundary relationships among pharmacists, technicians and assistants, and the highly mobile nature of digital materiality allows the two hospitals to share similar tuning processes and outcomes. Finally, other scholars, have linked these mechanisms to increased product scope, whereby firms leverage digital technologies to enter new markets created by technology diffusion, or to enter unrelated markets by re-inventing their legacy value chains (e.g., Lanzolla and Markides, 2020).

Overall, the debate on digital technology and scope of the firm is fueled by the consideration that digital technologies do much more than "informate and automate" (Bailey, Faraj, Hinds, von Krogh, and Leonardi, 2019) since they enable the delivery of brand-new "activities" (Teece, 2010), smart decision making, and pervasive connectivity (Lanzolla, Pesce and Tucci, forthcoming). The traditional arguments that digital technologies might trigger operational and transaction efficiency (Sahaym, Steensma and Schilling 2007; Lanzolla and Frankort, 2016) are complemented by

considerations: (a) on the drivers of control and power in the Digital Age; and (b) the changing nature of knowledge in the digital realm. On the drivers of control and power, normative control and rational control are now complemented by algorithmic control (Kellogg, Valentine and Christin, 2020; Zuboff 1988) which shapes new "contested" terrain for organizational control. The effects of algorithmic control on the dynamics underpinning organizational boundaries is still controversial.

On the changing nature of knowledge, digitalization has been linked to: knowledge modularization by allowing the decomposition / atomization of the elements by which digital artifacts are made, and by re-shuffling these elements to new configurations (Kallinikos et al, 2010); strengthening of *technicalizing* at the expense of *contexualizing* (Jarzabkowski & Kaplan, 2015); and the creation of realities or *logics* across firms (Leonardi & Barley, 2010; Orlikowski & Scott, 2008).

As the above shows, digital technology enacts systematic changes not only in the drivers of operational and transaction efficiency, but also in the modalities through which control is exerted and in the very nature of (inter)organizational knowledge. Research works which investigates the combined action of these forces are likely to reveal more insights on organizational boundaries and the scope of the firm vis-à-vis digital transformation.

**Digital transformation and business models**

Business model research has been another area related to digital transformation where we might wonder whether we need new theories. While there are as many definitions of a business model as there are researchers in business models (maybe more), they usually have elements of the following: "a description of an organization and how that organization functions in achieving its goals (e.g., profitability, growth, social impact,…)" (Massa et al., 2017, p. 73), and "A business model describes the logic of how a business creates and delivers value to users and converts payments received into profits" (Hienerth, Keinz, & Lettl, 2011, p. 346). Business model research has been growing at a rapid clip for many years and shows no signs of abating based on publications and conference presentations; Furthermore, it is a relatively rare topic in that it simultaneously attracts publications from practitioners at an equal or greater rate than academics (Massa et al., 2017).

There are two main ways that digital transformation might influence different organizations' business models. The first is that it may enable business model experimentation in many organizations, including business model design in new organizations and business model reconfiguration in incumbent organizations. In other words, digitalization opens up new opportunities for value creation, value delivery, and value capture, including much-discussed servitization (Visnjic & Van Looy 2013; Visnjic, Wiengarten, & Neely, 2016), platform business (Constantinides, Henfridsson, & Parker, 2018), digitizing the customer experience (Weill and Woerner, 2013), crowdsourcing consumer demand (Afuah and Tucci, 2012), or smart contracts for distributing collecting intellectual property royalties (Dutra et al., 2018).

The second is that digital transformation may help (or hinder) business model reconfiguration processes themselves in established organizations. Digitalization and digital tools might make

search and recombination more expansive, or they might reinforce existing knowledge structures, and adding digital knowledge workers may be useful, or may upset the balance (Lanzolla et al., forthcoming). These tradeoffs apply not only to new products and services, but also have strong implications for new business models, as for example, "smartification" of a current product (selling complements) vs. a digital integration moving to subscription services. In addition, digital technologies can "let 1000 flowers bloom" or become an innovation "surveillance state" in terms of centralization and business model innovation (Tucci, 2019).

So, do we require new theories to understand the impact of digital transformation on business models? Massa et al. (2017) and Lanzolla and Markides (2020) propose that at some point, the demand-side view of strategy (Priem, 2007), business ecosystems (Adner and Kapoor, 2010), platforms (Brousseau and Penard, 2006), and complexity theory may complement each other to bear new insights about business model and strategy in the digital age. While each of these subjects are often treated and cited in a distinct fashion, it is plausible that digitalization and digital transformation may be the phenomenon that actually unites them (Teece, 2010). In that sense, while there are existing theories that tackle each of these areas, or that cut across many of them, such as the role of network externalities, the role of digital is so outsized in the business model experimentation process that new theories on the antecedents, consequences, performance implications, and nuances of digitalization on business model innovation may need to be developed further in the coming years.

**Digital transformation and organization design**

Digital transformation influences firms' processes to create output, challenges existing organizational designs and generates new business champions. Intrigued by the thrust and speed of technology adoption, researchers have started speculating on the adapted and new organizational forms. Digital transformation can remodel how organizations map system-wide and agent-based goals and consolidate individual contributions (Kretschmer and Khashabi 2020). This modification causes novelty in task allocation, rewards distribution, information provision, and task division (Puranam, Alexy, and Reitzig 2014). For example, the increasing reliance on big data requires adding analytical capabilities to the existing organization (Galbraith 2014). Organizations may introduce in the organigram the position of Chief Digital Officer, a new function responsible for controlling and linking internal data (Singh, Klarner, and Hess 2019). Such a change increases complexity, it shifts power within the top management team, and creates new tasks and reporting lines. It also enhances prediction capabilities and decision-making by serving as a hub for unstructured and unleveraged (organizational) data. Following the evidence, scholars have started questioning the fit of existing organizational design paradigms as underlying frameworks (Puranam et al. 2014) and proposed developing new theories (Majchrzak, Markus, and Wareham 2016).

Empirical studies have analyzed the relationship between digital transformation and the mechanisms of organizational design – that is, the division of labor through structure and task division and allocation, and the integration of effort (Puranam 2018). Recent research highlights how the role of organizational structure, decision, and control might be inadequate to explain phenomena in which the crowds' role is influential. For example, organizations need to adopt new forms of organizing and become a "catalyst" to embed external knowledge from online

communities into internal innovation processes (Majchrzak et al. 2018). Tasks can also be allocated outside the firm's boundaries because of digital transformation. Forman and McElheran (2019) find that the advent of information technologies in manufacturing production promotes a shift from the vertical integration of the value chain activities to an externally focused design.

A growing literature explores the impact of big data and artificial intelligence in reshaping design mechanisms to integrate agents' effort through individuals' linking and the information flow. Overall, the transformation triggered by digital technologies brings a gradual improvement in forecasting and organizational decision-making (Bajari et al. 2018). Depending on the degree of task routinization and training data, machines even eclipse human decision-makers (Brynjolfsson and Mitchell 2017). Claussen, Peuket, and Sen (2019) show that in the creative industries, on average, algorithms come in first. Yet, this pattern reverses in favor of human decision-makers when the content varies at a fast pace and the task involves interpretation. Furthermore, artificial intelligence systems need a sufficient amount of high-quality data to learn an assignment, to avoid slowing down the process and, crucially, to prevent introducing biases. In the case of personnel selection, when an algorithm is slow in task learning, it could discriminate against minorities (Lambrecht and Tucker 2019, 2020).

A complimentary research stream investigates how robotics' swift adoption has been transforming organizational control and task allocation. Robots increase total employment but displace employees in the production activities (Brynjolfsson and Mitchell 2017). This effect corresponds to changes in organizational design. For a sample of Canadian businesses, Dixon, Hong, and Wu (2019), find that in robotics investments are associated with a decrease in the number of middle managers and a positive shift in the low- and high-skilled labor forces. The authors also discover that, given the middle-managers' cut, the span of control tends to concentrate.

These recent findings feature how digital transformation influences the set of agents that can complete a specific assignment, and the way tasks are divided, grouped, assigned, and executed. There are several pressing avenues for further research. In particular, scholarship has just started mapping the set of tasks where digital technologies replace human actors. Research in organizational design, modularity, and complexity could join forces to understand how this transformation affects efficiency gains, interdependencies, and value-creation processes. Furthermore, configurational theory can provide support in understanding the combinations where the contribution of digital transformation is either complementary or a substitute for the established design mechanisms. Finally, more research is needed to understand whether the existing framework may still explain how the organizational decision-maker solves conflicts caused by algorithmic biases and outsourced tasks.

**Digital transformation, organizational learning and creativity**

As mentioned in the Introduction, the coronavirus 2019 (COVID-19) pandemic has created a wide array of new challenges for organizations and accelerated the adoption of digital technologies (Zhao, Liao & Sun, 2020). Employees and employers had to quickly adjust to virtual communication, universities shifted to online teaching and new technologies were adopted to provide care from afar (Gibson, 2020). Large-scale remote workforces, e-learning, on-demand delivery services, virtual events and online medicine—what seemed impossible until recently has become commonplace (Chesbrough, 2020). These unusual circumstances offer a unique

opportunity to observe the role of digital technology in organizations and examine how it influences their ability to learn and adapt to change.

Research on the influence of digital technology on organizational learning and creativity is still in its infancy (Amabile, 2019; Glikson & Woolley, 2020). Theoretical frameworks of organization learning consider members, tools, and tasks as the primary organizational elements through which knowledge is created, retained, and transferred in the organization (McGrath and Argote 2001). A strong assumption in this conceptualization is that new knowledge develops by organizational members and that organizational knowledge is embedded in its technological tools (Amabile, 2019; Argote & Miron- Spektor, 2011). Tools can enable learning helping to identify new patterns in data and in transferring knowledge from one unit to another (Darr, Argote & Epple, 1995). Similarly, theories of organizational creativity tend to focus on individuals and teams as the main source of creative outputs, with only few studies examining how the characteristics of technology influence organizational members' creativity and learning (e.g., Mannucci, 2017).

With new technological developments, robots and machine learning do more than finding an optimal solution to a defined problem. They can collaborate with humans to stimulate their intelligence, creativity and learning (Alves-Oliveira, et al., 2020). Unlike humans that have limited capacity for processing information, machines can consider countless alternatives and combine numerous elements from loosely connected domains. They are less subject to mental fixedness in the idea generation process (Amabile, 2019; Forbus, et al., 1998), and can easily adjust their decisions based on the data they process (Samuel, 1959). Research suggests that with a proper training that involves a large amount of data, AI can improve the accuracy of decisions (Brynjolfsson & Mitchell, 2017), yet that the training process can also introduce unintended biases that result from the characteristics of the data, the algorithm, and their interaction (Danks & London, 2017). The ability of organizational members to work with AI depends on the extent to which they trust AI agents (for review see Glikson & Woolley, 2020) and distinguish between human and algorithmic work (Jago, 2019).

These recent developments require to revisit our assumptions and invest in inductive and abductive research that will help us discover the role of digital technology in the ability of organizations to create, retain and transfer knowledge. As Teresa Amabile explained, "organizational researchers of creativity and innovation are missing the boat if they don't invest significant energy in studying artificial intelligence and computer-assisted human intelligence, the ways in which they might yield creative breakthroughs, and how those innovations might impact—and be impacted by—workers, consumers, organizations, and society" (2019, p.5).

**The Articles in the Special Issue**

Drawing from highly varied settings and phenomena, the special issue's papers reveals further insights on the circumstances under which digital transformation imposes either a significant, minor, or no revision of the extant assumptions.

Three papers focused heavily on how digitalization changes an organization's activities, investments, and sources of advantage. First, Kronblad's (2020) "**How digitalization changes our understanding of professional service firms**" details how digitalization has fundamentally transformed how work is done in professional service firms, and has challenged everything that

used to make them special. Professional service firms have found that they can no longer rely solely on human capital for value creation, but instead must invest in digital technology that alters their business model and sources of advantage. It has also forced them to consider new models to price their service, while leaving the highly profitable hourly billing (and the partnership model) behind. Kronblad argues that the changes to professional service firms are so extensive that we will need to challenge what we have previously thought to be true about these firms and the individuals that populate, manage, and own them.

Second, and somewhat contrastingly, Selander and Jarvenpaa's (2020) "**Xenografting organizational logics in political activism: The decoder project at Amnesty International**" highlights a situation in which digitalization did not reduce the cost or difficulty of coordination as much as might have been expected. They explore how Amnesty International utilized digital technologies to engage in crowdsourcing political activism, and the changes this induced in their resource requirements and costs. Somewhat surprisingly, they find that digitalization did not render crowd-based political work as easy or costless as had been anticipated. Furthermore, rather than inducing transformative change, the deployment of digital technologies led to logics co-existence and developmental change. Selander and Jarvenpaa's study suggests that one should not necessarily assume or expect transformative change with digital technologies. Moreover, transformative changes are not needed for digital technologies to provide value. They highlight that we need more longitudinal studies to understand how existing theories must be adjusted or rethought in the digital age.

Third, Hartmann and Henkel's (2020) "**The Rise of Corporate Science in AI: Data as a Strategic Resource**" looks at how the importance of artificial intelligence in digital technologies led to a shift in where basic research -- and the basis of competitive advantage in such technologies -- is located. In particular, they show that basic research in artificial intelligence is increasingly conducted by large corporations rather than academic institutions. Companies such as Google, Facebook, and Alibaba hire leading researchers and increasingly publish high-quality basic AI research in journals. Conventional explanations fail to fully explain why corporations would undertake and disseminate this research. They argue that owning strategic data resources makes firms "lead users" of AI tools, gives them a novel comparative advantage over universities in doing research in AI, and constitutes a specialized complementary asset that facilitates value appropriation. Thus, data is not just another resource; rather, it is a resource whose strategic value unfolds in new ways, requiring new theorizing.

Three papers explore how digitalization changes the sources of power and control in the firm, and the strategies this power and control enables. First, Ebert et al.'s (2020) "**No stone left unturned? Towards a framework on the impact of datafication technologies on organizational control"** develops a framework to understand how datafication technology enables a transformation of organizational control systems. They develop 36 "datafication control elements" that allow researchers and practitioners to identify ways in which traditional organizational control may change and expand. Previously informal controls could be codified through data and may create a near perfect "panopticon," in which every individual's every action can be observed. The authors claim that technologies with sophisticated analytical capabilities will not only enable goal alignment (as in traditional control systems) but will also create new goals based on their learning features. Thus, it could be argued that these new technologies not only automate some aspects of

control but also bear the potential to automate leadership itself. As a closing point, the research advises (re-)considering the scope of organizational control theory in light of digitalization.

Whereas Ebert and colleagues examine how data expands the potential for managerial control over employees within the firm, Rietveld, Ploog and Nieborg's (2020) "**The coevolution of platform dominance and governance strategies: Effects on complementor performance outcomes**" examines how a firm's power and control over an ecosystem influence its strategic choices. Specifically, they study how digital platforms' governance strategies evolve as a platform cements its position of dominance in the market. In the early stages, the platform focuses on increasing the options for value creation and capture for complementors ("structural governance changes") to extend both the depth and breadth of the complement pool ("boundary-spanning governance changes"). As a platform becomes more influential, it shifts its strategic governance into redirecting users in their choice of complements ("redistributive governance changes"). The authors find that during this evolution, average demand for complementary goods (e.g., games, apps, micro-loans, creative projects) declines, demand becomes more concentrated, and it becomes harder for complementors to capture value.

Rietveld and colleagues argue that that their work implies a need for a fresh perspective on technological dominance in the context of digital transformation. Digitalization enables firms to constantly change their products, allowing them to both improve their products' technological architecture and tweak the rules for the products' users (e.g., complementors, end-users) over time. This creates strong lock-in mechanisms for users, making it even harder for entrants to displace a dominant technology. In the era of digital transformation, we should thus expect to see firms enjoy stronger positions of technological dominance with increased leverage over their users.

Third, Cennamo, Marchesi and Meyer's (2020) "**Two sides of the same coin? Decentralized versus proprietary blockchains and the performance of digital currencies**," shows that firms can shape how much power and control they have over their ecosystems through their choices about how specialized and integrated (i.e., non-modular) their products are. They study the context of blockchain, and start by asking the question, "When a new digital currency is created, what drives its ultimate success?" They find that though digital currencies are often hailed as decentralized financial tools, they seem to thrive best when firms centralize parts of them in order to retain control over key strategic dimensions, including the data flow on the blockchain. By studying a dataset of 345 digital currencies, the authors find that when a firm creates its own blockchain platform network for its own digital currency, the more valuable products or services that are available on the platform, the less likely users are to exchange the digital currency for another.

Their results both confirm some insights from the literature on technological modularity and challenge existing thinking. For instance, the idea that modular general-purpose technologies, such as blockchains, can be leveraged "plug and play" to extract value might need to be revisited. Firms might need to gain greater "architectural control" over the technology itself to steer the direction toward the intended goals. Connecting to modular infrastructures might not reduce the risks of interconnection per se. In fact, they show that volatility of those currencies could increase, and be linked to the underlying greater volatility of the blockchain they are connected.

Last but not least, one paper, Schneider and Sting's (2020) "**Employee perspectives on digitalization-induced change: Exploring frames of industry 4.0**" attempts to understand the employee perspective on digitalization, asking, "How do workers perceive strategic digitalization initiatives?" In this paper, the authors studied worker perceptions of the ongoing digital transformation in manufacturing, also referred to as Industry 4.0. Adapting an image-based technique from market research to the manufacturing shop floor, they found mixed perceptions and resonances of Industry 4.0 That is, workers had multiple coexisting frames for understanding digitalization, creating interesting challenges for managerial communication and change management. They conclude that there is considerable work to be done in understanding and shaping the employee interpretation and response to digitalization.

## Taking stock and some points for research agenda

Digital transformation: Is there anything new that should be factored in management research and management practices? The papers published in this Special Issue and the considerations brought forward by the editors in this article allow us to delineate some emerging patterns and some implications stemming from these patterns.

First, digital technologies trigger new born-digital phenomena such as digital currencies, new work practices, new business models, new search behaviors. The papers published in this Special Issue are focused on these new phenomena. Yet, the list of born-digital new phenomena is definitely not exhaustive, and it is constantly being enriched with new additions, e.g., autonomous vehicles. Digital transformation promises to provide researchers with new intriguing phenomena—and empirical contexts—for many years to come.

Second, these new phenomena are unleashed by the idiosyncratic "affordances" brought forward by digital technologies. We still do not have a comprehensive conceptual definition of digital technology's affordances and digital technology does not seem to fall into any of the existing categories—e.g., general-purpose technology, modular technology, architectural—perhaps because it contains elements of all of them. Yet, it is clear that the affordances enacted by digital technology—including "smart" automated decision making, pervasive connectivity and exponential computing power—interact with people, organizations, societies, and institutions to create new possibilities for organizations that go well beyond the ones created by preceding waves of information technology diffusion. Overall, firms are, and will be, operating within new growth, sustainability, regulatory, organizational, and managerial paradigms enabled by digital technology. As such, firms will have to grapple with digital technologies as a strategic capability, regardless of the market needs they fulfill and irrespective of whether they develop digital technology, adopt digital technology, and/or partner to acquire such digital capabilities.

Third, when we turn our attention from the phenomenological level to the underlying economic, psychological, and social forces driving these new paradigms, it is not yet fully clear whether digital technology shifts the baseline in existing management tradeoffs or whether it creates brand new mechanisms and tradeoffs. For instance, the papers published in this Special Issue range from concluding that in the Digital Age, legacy logics will co-exist with new logics (Selander and Jarvenpaa, 2020) to suggesting the need for more radical adaptation (Kronblad, 2020; Hartmann

and Henkel, 2020). Overall, the debate is far from settled. Yet, the analysis of the literature shows that some of the areas of management research are approaching an inflection point in the debate. Here we mention some of these research areas: search and buying behaviors in digital environments; scope of the firm; employee frames and emotions; algorithmic intra/inter organizational control and coordination; human-digital interaction for creativity and learning; and competition vis-a-vis platform businesses.

To conclude, the reflections and the articles published in this special issue suggest that to develop more definitive conclusions on the broader implications of the digital transformation, researchers should: integrate different theoretical perspectives; innovate their methods. On the latter point, we suggest that they should triangulate evidence and perspectives and intertwine complementary methodologies to disentangle the nature of digital transformation more accurately. Overall, we believe that interdisciplinary teams are more likely to contribute and establish successful research programs. The management of expectations on how the research process will unfold is complex. Yet, new insights are much needed to provide managers and policymakers with more reliable compasses to navigate the Digital Age.

## References


Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal, 31*(3*)*, 306-333.

Afuah, A. and Tucci, C.L., 2001. *Internet Business Models and Strategies: Text and Cases*. New York: McGraw-Hill.

Afuah, A. and Tucci, C.L., 2012. Crowdsourcing as a solution to distant search. *Academy of Management Review*, *37*(3), pp.355-375.

Aguiar, L & Waldfolgel, J. 2018. Platforms, promotion and product discovery: Evidence from Spotify playlists. NBER Working paper, 24713.

Alves-Oliveira, P., Gomes, S., Chandak, A., Arriage, P., Hoffman, G., & Paiva, A. (2020). Software architecture for YOLO, a creativity-stimulating robot. SoftwareX, 11.

Amabile, T.M. (2019). Creativity, Artificial Intelligence, and a World of Surprises Guidepost Letter for Academy of Management Discoveries. Academy of Management Discoveries, https://doi.org/10.5465/amd.2019.0075

Anderson, C. (2004). The long tail. Wired, 12 (10). October.

Argote L, Miron-Spektor E (2011) Organizational learning: From experience to knowledge. Organ. Sci. 22: 1123-1137.

Ashworth M, Mukhopadhyay T, Argote L (2004) Information technology and organizational learning: An empirical analysis. Proc. 25th Annual Internat. Conf. Inform Systems (ICIS), 11-21.

Bailey, D., Faraj, S., Hinds, P., von Krogh, G. & Leonardi, P., 2019. Special Issue of Organization Science: Emerging Technologies and Organizing. *Organization Science*, *30*(3), pp.642-646.

Bain, P., & Taylor, P. 2000. Entrapped by the 'electronic panopticon'? Worker resistance in the call centre. New Technology, Work and Employment, 15(1): 2-18.

Bajari, Patrick, Victor Chernozhukov, Ali Hortaçsu, and Junichi Suzuki. 2018. "The Impact of Big Data on Firm Performance: An Empirical Investigation." National Bureau of Economic Research (NBER WP no. 24334):1–72.

Barrett, M., Oborn, E., Orlikowski, W.J. & Yates, J., 2012. Reconfiguring boundary relations: Robotic innovations in pharmacy work. *Organization Science*, *23*(5), pp.1448-1466.

Bernstein, E. S. 2017. Making transparency transparent: The evolution of observation in management theory. Academy of Management Annals, 11(1): 217-266.

Bhave, D. P. 2014. The invisible eye? Electronic performance monitoring and employee job performance. Personnel Psychology, 67(3): 605-635.

Blackburn, S., LaBerge, L., O'Toole, C., & Schneider, J. 2020. Digital strategy in a time of crisis. McKinsey Insights.

Brews, P.J. & Tucci, C.L., 2004. Exploring the structural effects of internetworking. *Strategic Management Journal*, *25*(5), pp.429-451.

Brousseau, E., & Penard, T. 2006. The economics of digital business models: A framework for analyzing the economics of platforms. Review of Network Economics, 6(2): 81-110.

Brynjolfsson, E., Hu, Y.J., & Smith, M.D. 2006. From niches to riches: Anatomy of the long tail. *Sloan Management Review*, 47(4), 67-71.

Brynjolfsson, E. & Mitchell, T. 2017. "What Can Machine Learning Do? Workforce Implications." Science 358(6370):1530–34.

Cardinal, L. B., Kreutzer, M., & Miller, C. 2017. An aspirational view of organizational control research: Re-invigorating empirical work to better meet the challenges of 21st century organizations. Academy of Management Annals, 11(2): 559-592.

Cardinal, L. B., Sitkin, S. B., & Long, C. P. 2010. A configurational theory of control. In S. B. Sitkin, L. B. Cardinal, & K. Bijlsma-Frankema (Eds.), Organizational Control: 51-79. Cambridge, UK: Cambridge University Press.

Cascio, W. F., & Montealegre, R. 2016. How technology is changing work and organizations. Annual Review of Organizational Psychology and Organizational Behavior, 3: 349-375.

Cennamo, C., Marchesi, C., & Meyer, T. 2020. Two sides of the same coin? Decentralized versus proprietary blockchains and the performance of digital currencies. *Academy of Management Discoveries*.

Chesbrough, H. W. 2003. Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business School Press: Boston, MA.

Chesbrough, H. W. 2020. Finding Our Next Normal In The Covid-19 Recovery, Forbes Magazine.

Claussen, Jörg, Christian Peukert, and Ananya Sen. 2019. "The Editor vs. the Algorithm: Targeting, Data and Externalities in Online News." SSRN Electronic Journal: 1–17.

Constantinides, P., Henfridsson, O. and Parker, G.G., 2018. Introduction-Platforms and Infrastructures in the Digital Age. *Information Systems Research*, *29*(2), pp.381-400.

Dahlander, L. & Wallin, M. 2020. Why Now Is the Time for "Open Innovation", Harvard Business Review.

Danks, D., & London, A. J. (2017). Algorithmic bias in autonomous systems. International Joint Conference on Artificial Intelligence, (January), 4691–4697. https://doi.org/10.1111/j.13652796.2007.01905.x

Darr, E. D., L. Argote, D. Epple. 1995. The acquisition, transfer and depreciation of knowledge in service organizations: Productivity in franchises. Management Sci. 41(11) 1750–1762.

Dixon, Jay, Bryan Hong, and Lynn Wu. 2019. "The Employment Consequences of Robots: Firm-Level Evidence." SSRN Electronic Journal: 1–70.

Dutra, A., Tumasjan, A., & Welpe, I. M. (2018). Blockchain is changing how media and entertainment companies compete. MIT Sloan Management Review, 60(1), 39-45.

Ebert, I., Schafheitle, S. Weibel, A. Kasper, G. Schank, C., & Leicht-Deobald, U. 2020. No stone left unturned? Towards a framework for the impact of datafication technologies on organizational control. *Academy of Management Discoveries*.

Forbus, K. D., Gentner, D., Markman, A. B., & Ferguson, R. W. (1998). Analogy just looks like high level perception: Why a domain-general approach to analogical mapping is right. Journal of Experimental & Theoretical Artificial Intelligence, 10, 231-257.

Forman, Chris and Kristina Steffenson McElheran. 2019. "Firm Organization in the Digital Age: IT Use and Vertical Transactions in U.S. Manufacturing." SSRN Electronic Journal: 1–49.

Fuchs, C., Sting, F. J., Schlickel, M., & Alexy, O. (2019). The ideator's bias: How identityinduced self-efficacy drives overestimation in employee-driven process innovation. Academy of Management.

Friesike, S., Flath, C.M., Wirth, M. & Thiesse, F., 2019. Creativity and productivity in product design for additive manufacturing: Mechanisms and platform outcomes of remixing. *Journal of Operations Management*, *65*(8), pp.735-752.

Galbraith, Jay R. 2014. "Organizational Design Challenges Resulting From Big Data." *Journal of Organization Design* 3(1):2.

Gibson, C. 2020. From 'Social Distancing' to 'Care in Connecting': An Emerging Organizational Research Agenda for Turbulent Times. *Academy of Management Discoveries*, https://doi.org/10.5465/amd.2020.0062

Glikson, E., & Wooley, A.W., 2020. Human Trust in Artificial Intelligence: Review of Empirical Research. *Academy of Management Annals*. https://doi.org/10.5465/annals.2018.0057

Hienerth, C., Keinz, P., & Lettl, C. 2011. Exploring the nature and implementation process of user-centric business models. *Long Range Planning*, *44*(5), 344-374.

Howells, J., 2012. The geography of knowledge: never so close but never so far apart. *Journal of Economic Geography*, *12*(5), pp.1003-1020.

Jago, A. S. 2019. Algorithms and authenticity. *Academy of Management Discoveries*, 5(1), 38–56. https://doi.org/10.5465/amd.2017.0002

Jarzabkowski, P. & Kaplan, S., 2015. Strategy tools-in-use: A framework for understanding "technologies of rationality" in practice. *Strategic Management Journal*, 36(4), pp.537-558.

Kallinikos, J., Aaltonen, A. & Marton, A., 2010. A theory of digital objects. *First Monday*.

Kronblad, C. 2020. How Digitalization Changes our Understanding of Professional Service Firms. *Academy of Management Discoveries*.

Hartmann, P. & Henkel, J. 2020. The Rise of Corporate Science in AI. *Academy of Management Discoveries*.

Howells, J., 2012. The geography of knowledge: never so close but never so far apart. *Journal of Economic Geography*, 12(5), pp.1003-1020.

Kellogg, K.C., Valentine, M.A. & Christin, A., 2020. Algorithms at work: The new contested terrain of control. *Academy of Management Annals*, 14(1), pp.366-410.

Kretschmer, T. and Khashabi, P., 2020. Digital transformation and organization design: An integrated approach. *California Management Review*. https://doi.org/10.1177/0008125620940296

Lanzolla, G. & Frankort, H.T., 2016. The online shadow of offline signals: Which sellers get contacted in online B2B marketplaces? *Academy of Management Journal*, 59(1), pp.207-231.

Lanzolla, G. & Markides, C., 2020. A business model view of strategy. *Journal of Management Studies*.

Lanzolla, G., Pesce, D. & Tucci, C. The digital transformation of search and recombination in the innovation function: Tensions and an integrative framework. *Journal of Product Innovation Management*, forthcoming.

Lambrecht, A. and Catherine E. Tucker. 2020. Apparent Algorithmic Bias and Algorithmic Learning. *SSRN Electronic Journal*: 1–25.

Lambrecht, Anja and Catherine Tucker. 2019. Algorithmic Bias? An Empirical Study of Apparent Gender-Based Discrimination in the Display of Stem Career Ads. *Management Science* 65(7):2966–81.

Lazar, M. Miron-Spektor, Mueller, J. (2020). Love at First Sight: An Attachment Perspective on Early-Phase Idea Evaluation.

Leonardi, P.M. and Barley, S.R., 2010. What's under construction here? Social action, materiality, and power in constructivist studies of technology and organizing. *Academy of Management Annals*, *4*(1), pp.1-51.

Leonardi, P.M. and Vaast, E., 2017. Social media and their affordances for organizing: A review and agenda for research. *Academy of Management Annals*, *11*(1), pp.150-188.

Majchrzak, Ann, M. Lynne Markus, and Jonathan Wareham. 2016. "Designing for Digital Transformation: Lessons for Information Systems Research from the Study of ICT and Societal Challenges." MIS Quarterly 40(2):267–77.

Majchrzak, Ann, Terri L. Griffith, David K. Reetz, and Oliver Alexy. 2018. "Catalyst Organizations as a New Organization Design for Innovation: The Case of Hyperloop Transportation Technologies." Academy of Management Discoveries 4(4):472–96.

Mannucci, P.V. (2017). Drawing Snow White and animating Buzz Lightyear: Technological toolkits characteristics and creativity in cross-disciplinary teams. Organization Science, 28(4), 711-728.

Massa, L., Tucci, C.L. and Afuah, A., 2017. A critical assessment of business model research. *Academy of Management Annals*, *11*(1), pp.73-104.

Mathieu, J. E. 2016. The problem with [in] management theory. Journal of Organizational Behavior, 37(8): 1132-1141.

Mabey, C. & Zhao, S., 2017. Managing five paradoxes of knowledge exchange in networked organizations: new priorities for HRM? *Human Resource Management Journal*, *27*(1), pp.39-57.

McGrath, J. E., L. Argote. 2001. Group processes in organizational contexts. M. A. Hogg, R. Scott Tindale, eds. Blackwell Handbook of Social Psychology: Group Processes. Blackwell, Malden, MA, 603–627.

Mueller, J. S., Melwani, S., & Goncalo, J. A. (2012). The bias against creativity: Why people desire but reject creative ideas. Psychological Science, 23(1), 13–17.

Newell, S., Scarbrough, H. and Swan, J., 2001. From global knowledge management to internal electronic fences: Contradictory outcomes of intranet development. *British journal of Management*, *12*(2), pp.97-111.

Orlikowski, W.J. and Scott, S.V., 2008. 10 sociomateriality: challenging the separation of technology, work and organization. *Academy of Management annals*, *2*(1), pp.433-474.

Parker, G. and Van Alstyne, M. W., 2014. Platform Strategy. *The Palgrave Encyclopedia of Strategic Management*. http://dx.doi.org/10.2139/ssrn.2439323

Priem, R. L. 2007. A consumer perspective on value creation. *Academy of Management Review*, 32: 219–235.

Puranam, Phanish, Oliver Alexy, and Markus Reitzig. 2014. "What's 'New' about New Forms of Organizing?" *Academy of Management Review* 39(2):162–80.

Puranam, Phanish. 2018. *The Microstructure of Organizations*. Oxford: Oxford University Press.

Rietveld, J., Ploog, J., & Nieborg, D. 2020. The coevolution of platform dominance and governance strategies: Effects on complementor performance outcomes. *Academy of Management Discoveries*.

Ritchey, T. 2012. Outline for a morphology of modeling methods: Contribution to a General Theory of Modelling. *Acta Morphologica Generalis*, 1(1): 1-20.

Sahaym, A., Steensma, H.K. and Schilling, M.A., 2007. The influence of information technology on the use of loosely coupled organizational forms: An industry-level analysis. *Organization Science*, *18*(5), pp.865-880.

Samuel, A. L. 1959. Some Studies in Machine Learning Using the Game of Checkers. *IBM Journal of Research and Development*, 3(3), 210–229. https://doi.org/10.1147/rd.33.0210.

Schilling, M.A. 2000. Towards a general modular systems theory and its application to inter-firm product modularity. *Academy of Management Review*, Vol 25:312-334.

Schneider, P. & Sting, F. 2020. Employees' Perspectives on Digitalization-Induced Change: Exploring Frames of Industry 4.0. *Academy of Management Discoveries*.

Schoder, D, Sick, S, Putzke, J & Kaplan, AM. 2006. Mass customization in the newspaper industry: Consumers' attitudes toward individualized media innovations. *International Journal on Media Management*, 8:9-18.

Schreier, M. 2006. The value increment of mass-customized products: An empirical assessment. *Journal of Consumer Behavior*, 5(4):317-327.

Selander, L. & Jarvenpaa, S. 2020. Xenografting in Political Activism: Co-Existing Logics Powered by Resource Injections. *Academy of Management Discoveries*.

Singh, Anna, Patricia Klarner, and Thomas Hess. 2019. "How Do Chief Digital Officers Pursue Digital Transformation Activities? The Role of Organization Design Parameters." *Long Range Planning* 53(3):1–14.

Steiner, F & Hergenrother, I. 2014. Modular product architectures as an enabler of the simultaneous application of a mass customization strategy and efficient ramp up management. *International Journal of Product Development*, 18(4):231-253.

Teece, D.J., 2010. Business models, business strategy and innovation. *Long range planning*, *43*(2-3), pp.172-194.

Tucci, C. L. 2019. The digital transformation of innovation: Implications for business model innovation. Presentation, Academy of Management Annual Meeting, Boston, MA, August 13. https://doi.org/10.5465/AMBPP.2019.14623symposium

Visnjic Kastalli, I. and Van Looy, B. 2013. Servitization: Disentangling the Impact of Service Business Model Innovation on Manufacturing Firm Performance. *Journal of Operations Management* 31(4): 169-180.

Visnjic, I., Wiengarten, F. and Neely, A., 2016. Only the brave: Product innovation, service business model innovation, and their impact on performance. *Journal of Product Innovation Management*, *33*(1), pp.36-52.

Yoo, Y., Boland Jr, R.J., Lyytinen, K. and Majchrzak, A., 2012. Organizing for innovation in the digitized world. *Organization Science*, *23*(5), pp.1398-1408.

Weill, P., & Woerner, S. L. (2013). Optimizing your digital business model. MIT Sloan Management Review, 54(3), 71.

Zhao, M., Liao, H.T. and Sun, S.P., 2020, May. An Education Literature Review on Digitization, Digitalization, Datafication, and Digital Transformation. In *6th International Conference on Humanities and Social Science Research (ICHSSR 2020)* (pp. 302-306). Atlantis Press.

Zuboff, S., 1988. *In the age of the smart machine*. Basic books.