

## Capabilities for digital transformation

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### Supportive capabilities for digital transformation

To thrive in the current competitive era companies need, among other things, (a) to know how to select the technologies that best suit their business models (Warner & Wäger, 2019), (b) to learn how to handle and leverage the available flows of structured and unstructured data (Weichert, 2017; Bharadwaj et al. 2013), (c) to prepare their human resources to operate and make decisions in the digital context (Vial, 2019; Bajer, 2017), (d) to design and implement an organizational structure that enables those people to work digitally (Bennett & Lemoine, 2014; Teece, Peteraf, & Leih, 2016) and (e) to craft a digital culture that makes the changes sustainable in the long term (Schuh et al., 2017; Karimi and Walter, 2015). Each one of those activities requires a specific dynamic capability: Digital technical capability, Data management capability, People management capability, Organizational design capability, and Culture crafting capability.

The five capabilities, described in detail below, represent complementary components; if any of them is missing in a digital transformation journey, the picture is incomplete and the journey may be doomed to fail. For instance, the lack of a data-driven mindset or skilled people, for the selection of inappropriate digital technologies or organizational structures, or for the maintenance of a non-supportive culture. Therefore, we assume that those five capabilities represent components of a complex, first-order dynamic capability that represents their joint effect and can be called Digital Transformation Supportive Capability (DTSC). DTSC can be defined as the capacity of an organization to purposefully create, extend, or modify its resources base to become

data-driven, in the sense of using data as critical evidence to help inform and influence strategy and operations.

*Data management* concerns the company's ability to manage its data sources as well as information and communication technologies. It concerns the activities required to collect, store, filter, organize, analyze, and report data and information that is critical for decision making. Differently from the earlier information technology (IT), nowadays there is increased data availability from a myriad of data sources (Weichert, 2017), which require skills to deal with technologies such as big data analytics, social media, mobile technology, and cloud computing (Bharadwaj et al. 2013). Organizations must be capable to dynamically adapt their infrastructure and competences to collect and use the most updated and accurate data. Additionally, in the digital era the technologies are not restricted to the boundaries of a firm or industry, but involve a broader ecosystem (Hanelt, Bohnsack, Marz, & Antunes Marante, 2020), those technologies are open, flexible, and easy to use by companies and any other person (Tilson et al. 2020). They are different from traditional systems as they are seen as generative, malleable and combinatorial (Kallinikos et al., 2013).

In the beginning, each one of those activities, from collection to reporting, could be, and were done, manually. However, only computers and associated devices are equipped to cope with those activities when the volume of available data becomes overwhelming as it is the current case, where the production of data in binary form is pervasive (Brynjolfsson & McAfee, 2014). That infrastructure encompasses computers, software (both general purpose and for specific applications) and may include non-proprietary technological infrastructure (such as cloud computing). Software development becomes strategic in the sense that it may provide insights for strategic

decision making such as Artificial Intelligence. For that to be viable, the company dataset must be clean, accurate, timely, unbiased, and trustworthy.

In general, data management capability reduces internal and external coordination costs (W. Chen & Kamal, 2016) and improves intra-organizational interactions (Dosi, Gambardella, Grazzi, & Orsenigo, 2008). In the case of multinational enterprises, it enables information-sharing capacity across subsidiaries for internal coordination (W. Chen & Kamal, 2016) allowing them to move from a defensive position, focused on value capture through globally controlled transfer and the exploitation of existing proprietary knowledge to a selective integrated global approach that cedes ownership to foster decentralized value creation (Rangan & Sengul, 2009).

***People management.*** In the digital economy, people management implies in the use of differentiated practices to recruit, develop and motivate highly skilled workers, capable to work collaboratively, tackling complex problems relying on data as much as possible (Vial, 2019). There are shifts in such context to which organization must be ready to adapt, like the increased human-machine interaction and the use of the new technologies to train and hire the most suitable candidate to the job (Bajer, 2017). Digital technologies can help organizations develop new people management capabilities as it enables them to better identify prospective hires, automate process, create learning environment, optimize resources and guarantee broader access to information (Amladi, 2017).

In the digital economy as the decision making routine become more automated, the role of people becomes attached to solving unexpected and unpredicted problems, generally complex problems, using analytic methods. The creation of analytical capabilities at the company level requires new skills and professional profiles such as data analysts and engineers, business analysts, data scientists, and statisticians. At the same

time, Hartley (2017) reminds us that the most important is the system specification and the interpretation of data processing outcomes, which leads him to assert that liberal arts will rule the digital world. Talent management becomes a keyword.

***Digital technical capabilities.*** This new dynamic capability refers specifically to the capacity to understand the potential contribution of the different digital technologies jointly with the data that may feed those data processing systems and build with them a data-driven organization. That concerns capabilities to scout digital technologies, plan digital scenarios, and give the support to create the digital infrastructure, from digital databases to digital mindsets (Warner & Wäger, 2019).

An interesting analogy can be made with the scale Industry 1.0 to 4.0 utilized by the manufacturing industry (Schuh, Anderl, Gausemeier, Hompel, & Wahlster, 2017). It is fair to say, as digital devices became operational around the 1960s only, that digital technical capability was inexistent in stages 1.0 and 2.0 but it emerged as operationally relevant in the 3.0 stage and became strategic in the current 4.0 stage. Data management requires radically new capabilities for the implementation of Big Data reservoirs, guaranteeing their quality and compatibility, governance policies to guide the processing, storage, management, and presentation of data, and protection policies to defend the company from external threats (Schuh et al., 2017).

Since organizations need to combine several other processes, resources, and structures across its business units, this highly complex process (Velu & Stiles, 2013) poses new challenges, one of them being who should be responsible for such a change. Three options are being adopted: the CIO – the Chief Information Officer, the CTO – the Chief Technology Officer, or the CDO – Chief Digital Officer (Govindarajan & Immelt, 2019). Therefore, the digital transformation is imposing structures that is usually quite

complex and still changeable as firms learn about the potential and limitations of digital technologies for their specific purposes.

***Organizational design capability.*** For Galbraith (2000) a company's organization design must be as complex as its business. Every multinational is a blend of production units, country subsidiaries, and business functions and that is being profoundly impacted, in one hand, by the rise of VUCA environments (volatile, uncertain, complex, and ambiguous) and, on the other hand by the new possibilities brought by digital technologies.

The classic, hierarchical, formalized, centralized organizational model was challenged during the 1980s when environmental conditions changed once more, a time of hyper-competitiveness (D'Aveni, 1994) that, to some extent triggered by the emergence of digital technologies that equipped financial globalization in the 1970s, commercial globalization in the 1980s and productive globalization in the 1990s. Reengineering the corporation became imperative and the Japanese companies, especially Toyota, emerged as role models (Womack, Jones, & Roos, 1990). Therefore, organizational design principles shifted to lean thinking and lean organization, employee active participation through group work, decentralization, and the service to clients and markets as the primary criterium for operational decisions.

Disruptive innovation led companies to consider innovation as a prime component of the strategy (Christensen, 1997). However, as that implied long-term investment when companies should also be efficient and profitable in the short-run, there was a call for ambidexterity (Gibson & Birkinshaw, 2004; O'Reilly & Tushman, 2008). At the same time, the iconic born-digital companies, especially Google and Apple, showed organizational features that resembled the organic approach to organizations, identified by Burns and Stalker in 1961 and the more advanced versions of the lean model

emphasized agility to quickly anticipate and respond to operational conditions shifts (Bennett & Lemoine, 2014; Teece, Peteraf, & Leih, 2016).

In short, different prescriptions for the novel demands and pressures, a challenge that is illustrated by Ashkenas (2011) as solving the Rubik's cube of organizational structure. For example, Teece (2007, 2014) argues that in the digital economy context, agility and ambidexterity are jointly orchestrated with organizations' digital resources and competences to create a structure flexible and ready to fast react to a point that enables organizations to identify opportunities (sense), mobilize resources (seize) and continually renew its business (transforming) to respond to environmental change and innovate.

***Culture crafting capability.*** According to Schein (1985), organizational culture” is a pattern of basic assumptions that a group has invented , discovered, or developed in learning to cope with its problems of external adaptation or internal integration and that have worked well enough to be considered valid and be taught to new members as the correct way to perceive, think and feel in relation to these problems” (Shein, 1985 p.9). Barney ,1991 considers that organizational culture can be a source of competitive advantage. There is consensus among practitioners, backed by academics, that the first step toward digital transformation is the creation of digital culture, to yield the capability of digital transformation (Karimi & Walter, 2015; Vial, 2019). People must believe that, when the factors influencing a decision are diverse, the best decisions rely on sound data and an informed interpretation, which must take into account the positioning of the company in a rather turbulent environment.

The digital economy requires a culture open to changes, to test new technologies and new processes. Culture also influences organizational responses to technological change inherent to digital transformation (Leonard-Barton, 1992; Tripsas & Gavetti, 2000) and leads to dynamic capabilities regarding product innovation (Slater, Mohr, &

Sengupta, 2014). Therefore, organizational culture must promote fast and constant learning and autonomy which can subsidize agile decision making. Leadership is key to support organizations' values based on flexibility, trust, and collaboration within the organization and across its partners and ecosystems (Schuh et al., 2017). Karimi and Walter (2015) identified three dimensions of a digital culture capability: innovation; a common language, and multimedia mindset. The digital culture needs to encourage the development of collaborative work environments, creativity and innovation, challenges and initiatives and permanent improvements through a shared digital strategy (Kane et al. 2015).

Therefore part of the uniqueness of organizations' digital capability resides in its culture because it provides a past-dependent aspect to the firm's signature processes and signature business model which is difficult to replicate (Gratton & Ghoshal, 2005). In fact, it is possible to relate them to the activities of sensing, seizing, and transforming by looking at how Warner and Wäger (2019) detailed these dimensions for the digitalization journey.

See Table 4 below.

Table 4 – Connection between the components of DTSC and dynamic capability processes

	<b>Sensing</b>	<b>Seizing</b>	<b>Reconfiguring</b>
<b>Data management capability</b>	Data is considered as the new combustible. Data management enables companies to identify and shape opportunities from both structured and unstructured data.	As modern products and services are increasingly more data-intensive, the data management capability enables the company to filter and absorb the most relevant data	Data management capability generates data that subsidizes the reconfiguration process as well as its subsequent assessment leading to an eventual rereconfiguration
<b>People management capability</b>	People management must prepare and equip employees to generate insights and identify opportunities based on both structured and non-structured data.	People management empowers employees to conduct and perform what is required for the execution of absorptive capability tasks at firm level.	The more digitally-savvy the employees are, the bigger their contribution for the reconfiguration process.
<b>Digital technical capability</b>	Understanding the potential contribution of available digital technologies is paramount to see (create) opportunities in (with) them.	There is a tremendous challenge in the assembling and continuously upgrading an efficient hardware/software system to cope with the data processing requirements	Technical choices must be coherent with organizational design criteria to reinforce in the short and long run.
<b>Organizational design capability</b>	The organizational design should create an internal environment for employees to be more sensitive to data that is valuable for the company.	The organizational design ought to stimulate, capture, select, implement and reward opportunities emerging out of employees' ideas and suggestions.	Organizational design must evolve continuously in response and as a trigger of the socio-technical evolution aiming at digital transformation.
<b>Culture crafting capability</b>	The organizational culture must stimulate and reinforce the individual and group work that is needed for digital transformation	Use of analytics and correct interpretation to capture shifts (internal and external) that require revision in values, practices and leadership styles	Changes in values, attitudes and behaviors timely incorporated in to practices and leadership style that build the organizational culture.