

# Organizational Meta Capabilities in the Digital Transformation Era

**Mohammad Rezaur Razzak**

Assistant Professor, m.razzak@squ.edu.om

**Said Al-Riyami**

Assistant Professor and the Head of Department of Management, saidalriyami@squ.edu.om

**Ramo Palalic**

Assistant Professor, r.palalic@squ.edu.om

Sultan Qaboos University in Oman, P.O. Box 50, P.C. 123, Al-khod, Sultanate of Oman

## Abstract

When migrating to Industry 4.0, organizations face the need to adapt to a new context characterized by high levels of uncertainty and complexity. The main driving force in this process are the meta capabilities that ensure high competitiveness and innovativeness. However, their content, classification levels, intersections, and development potential under the influence of digitalization are insufficiently covered by the literature. This article

attempts to fill this gap by analyzing the impact of new technologies on meta capabilities. It presents a conceptual model based on the assumption that the degree of digitalization enhances the effects of the interaction between the top-level meta capabilities - Foresight, strategic flexibility, and ambidextrousness. Additional factors, the inclusion of which in the model will allow for a better study of the nature of the relationship under consideration, are proposed

**Keywords:** Industry 4.0; dynamic capabilities; meta-competences; futures studies; strategies; digital transformation; strategic foresight; strategic agility; organizational ambidexterity

**Citation:** Razzak M.R., Al-Riyami S., Palalic R. (2022) Organizational Meta Capabilities in the Digital Transformation Era. *Foresight and STI Governance*, 16(4), 24–31. DOI: 10.17323/2500-2597.2022.4.24.31



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## Introduction

The fourth industrial age or Industry 4.0 symbolizes the digital transformation driven by intelligent machines that communicate with one another through super-fast bandwidth connectivity. This unique ecosystem driven by advanced technologies can operate complex value chains of organizations (Sima et al., 2020). Whether in manufacturing or the service sector, business organizations around the world are unable to conduct business as usual without considering the implications of being left out of this new digital era. Organizations in many countries have already either partly or fully migrated to this unique ecosystem, while others are contemplating whether to move forward or to wait and see (Martinez-Olvera, Mora-Vargus, 2019). However, in the aftermath the COVID-19 pandemic, the migration of enterprises that were wavering in the past is now accelerating toward digitalization (Kollman et al., 2022). This realization is based on the need to deal with uncertainty by enhancing high-level organizational capabilities through greater strategic foresight, strategic agility, and organizational ambidexterity (Diego, Almodovar, 2022).

The future workplace is no longer going to be the same (Chowdhury et al., 2019), and the technologies that considered the backbone of Industry 4.0 are becoming ubiquitous (Kraus et al., 2019). Despite the buzz created by such advanced technology-driven ecosystems, there is presently an insufficient understanding about whether such a wholesale adoption of digital technologies is going to enable organizations to enhance their capabilities to respond to a dynamic and uncertain business environment (Bal, Erkan, 2019). In the aftermath of the COVID-19 pandemic, organizational focus has been amplified with regard to developing high-level organizational capabilities such as strategic foresight, strategic agility, and organizational ambidexterity (Kumkale, 2022; Pinnsonneal, Choi, 2022). Strategic foresight has been defined as “*the ability to create and maintain a high-quality, coherent and functional forward view and use insights arising in organizationally useful ways*”, and is considered essential in developing second level meta capabilities, i.e. dynamic capabilities. The latter in turn include: seeing the risks and opportunities, seizing opportunities, and organizational transformations (Kumkale, 2022, p. 287; Rohrbeck et al., 2015). While strategic agility is considered an organization’s capacity to undertake strategic long-term commitments and yet remain flexible and nimble. It is the means by which organizations reinvent and transform themselves through adaptability and ensure survival through uncertainty (Doz, 2020). Finally, organizational ambidexterity is a concept that describes two apparently contradictory processes that are undertaken in tandem, exploration and exploitation (Brix, 2020). This means that ambidextrous organizations have the ability to act in a balanced manner simultaneously in two directions: expanding their current business activities through refinement and efficiency and at the same time exploring emerging trends and phenomena as well as future opportunities without losing focus on either goal (Hirst et al., 2018).

In this regard, the digitalization of firms in Industry 4.0 is likely to be factor in driving such high-level organizational

capabilities (Elgazzar et al., 2022). For instance, they have enabled seamless supply chain management through use of real-time demand data to eliminate pressure on an organization’s need to build-up large quantities of inventory. Instead, the nimbleness offered by the new ecosystem enables organizations to work with smaller inventory levels by ordering more frequently based on demand. Such orders are being filled by using advanced technologies that are the backbone of the Industry 4.0 environment, such as Artificial Intelligence, Virtual Reality, Augmented Reality, Internet of Things, Cloud Computing, Big Data Analytics, 3-D Printing, Additive Manufacturing, and so on. Thus, customer orders are channeled in real-time through hyper-connected networks that distribute orders to manufacturers located worldwide. Once the product is ready, the shipment and delivery system also follow a digital stream of instructions until it reaches the customer.<sup>1</sup> Additional benefits relate to shorter time-to-market and order fulfillment, faster delivery, and lower transportation costs (Moeuf et al., 2018). Organizations, such as the e-commerce giant Amazon, are taking advantage of such technologies and are proactively positioning their meta capabilities that have taken productivity and efficiency to unprecedented levels (Jimenez-Zarco et al., 2019). The complex combination of new technologies within the described ecosystem provides a solid foundation for reinforcing dynamic capabilities. Organizations using machine analysis tools can process large amounts of data in real time (collected from sensors and automated devices connected to computing systems), and on that basis reconfigure production to adapt to any changes (Rosa et al., 2019; Reischauer, 2018).

As suggested earlier, digitalization is not confined to manufacturing, but in fact service organizations are rapidly considering migrating to the new ecosystem (Schmidt, Scaringella, 2020). However, new risks and challenges also form an integral part of Industry 4.0. In such a “hyper-connected” environment, new challenges arise, particularly in the area of cybersecurity. Thus, the question that remains is that whether such a migration to a more intelligent environment, where machines communicate with other devices, is enhancing organizational abilities to respond to external opportunities and threats through increased levels of strategic foresight, strategic agility, and organizational ambidexterity (Jermittiparsert et al., 2020). Therefore, it is deemed necessary to attempt to propose a conceptual framework to better understand the links between these dimensions. In light of the preceding discourse, this study proposes a conceptual framework that suggests that digitalization moderates the relationships between strategic foresight and both strategic agility and organizational ambidexterity.

## Meta Capabilities and their Classification

One of the basic concepts in strategic management, the resource-based view (RBV), stipulates that competitive advantage is achieved when a firm acquires resources that are valuable, rare, and inimitable by its competition, while the organization is able to exploit these qualities (Newbert, 2008). However, the limitations of the resource-based view (RBV)

<sup>1</sup> <https://www.forbes.com/sites/gregpetro/2020/02/17/walmart-challenges-amazon-on-sustainability/#2fdccf65bb8a>, accessed 28.03.2022.

lie in interpreting the development and re-development of resources and capabilities to address rapidly changing business environments (Bala et al., 2019). The theory of organizational capabilities serves as both an extension to and an attempt to overcome the limited notion offered by RBV (Collis, 1994; Winter, 2003; Zahra et al., 2006; Ambrosini et al., 2009). It emphasizes building internal organizational capabilities (both management and technological) to respond to short-term changes rather than changing the external forces when migrating to the Industry 4.0 ecosystem (Fainshmidt et al., 2019). Collis (1994) proposed four categories of organizational capabilities. The first “are those that reflect an ability to perform the basic functional activities of the firm.” The second category concerns dynamic improvements to the activities of the firm such as continuous improvement activities. The third category is “to recognize the intrinsic value of other resources or to develop novel strategies before competitors.” The fourth category is labeled “higher order” or “meta capabilities”, with the help of which organizations can change their other capabilities (Gurkan Inan, Bititci, 2015).

Organizational meta-capabilities have their own hierarchy. High-level capabilities include: 1) strategic foresight, 2) strategic agility, and 3) organizational ambidexterity (Diego, Almodovar, 2022; Kumkale, 2022; Pinnsonault, Choi, 2022; Clauss et al., 2021).

The second level of capabilities is dynamic capabilities (Teece, 1997; Teece et al., 2018; Zahra et al., 2006). This classification includes: the ability to identify changes and trends, opportunities and threats (sensing), respond to them through action (seizing), and to change organizational culture, business models, etc. (transforming) (see Figure 1).

Following the provided hierarchy, our conceptual model is built on high-level meta capabilities, i.e., strategic foresight, strategic agility, and organizational ambidexterity.

Built-in rigidities within management often limit the development of meta capabilities that subsequently impact a firm’s ability to generate excellent performance and sustain competitive advantages (Jimenez-Zarco et al., 2019). Hence managers are the pillars behind building and embedding them into the organizational culture. They need the ability to sense and seize the opportunity (or threat), orchestrate resources, and adapt the organization and its business model. The visionary role requires propagating the organization’s vision and values,

aligning people with strategy, and motivating them (Teece, 2018; Chowdhury et al., 2019).

## Dynamic Capabilities

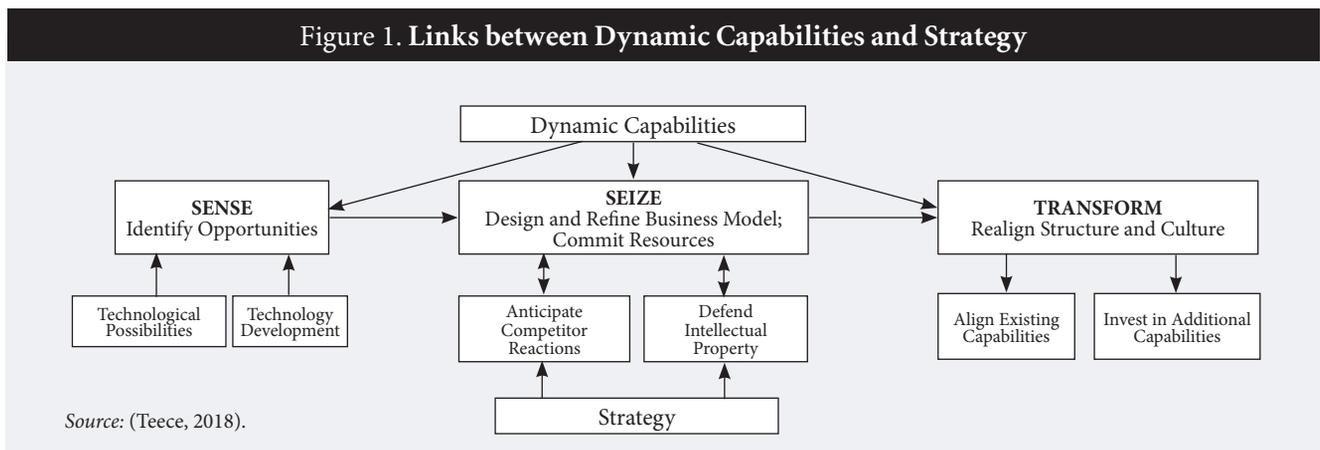
### Ability to Sense Opportunities and Threats

In a rapidly changing globally competitive business environment, consumer behavior, emerging technologies, and competitors’ activities are in a constant state of flux. Opportunities emerge for both incumbents and newcomers (Teece, 2018). Specific emerging trends on the market are pretty obvious, while others are not so apparent. For instance, in the retail sector, consumers’ shifting preference to online purchasing was quite evident. The existential need to adopt Industry 4.0 technology to respond to consumer requirements was not apparent to everyone (Wijewardhana et al., 2020). The reality is that most emerging opportunities and threats are not easy to discern unless an organization orients its capabilities in the correct manner. Therefore, sensing new opportunities or threats is scanning the horizon for emergent phenomena, learning rapidly about them, and interpreting the consequences of such changes (Teece, 2018).

The ability of organizations to sense opportunities and threats goes beyond investments in knowledge assets. It is more about having a mechanism by design that constantly assesses how new phenomena are likely to give a quantum boost or pose existential threats to the organization (Randhawa et al., 2020). In specific industries, the sensing capability is noticeably well developed for various reasons that may not be organic. For instance, in the banking industry, periodic stress tests mandated by the BASEL-III accord along with changes in IFRS (International Financial Reporting Standard) compliance regulations force banks with global operations to frequently assess the value of their assets in light of emerging risks by simulating different extreme scenarios (Feldberg, Metrick, 2019).

To sense opportunities (or threats), a firm needs to search for and explore markets and technologies constantly, whether said markets be local or far away (Teece, 2018). This requires investment in research activities aimed at probing customer needs and expectations and how new technologies would enable one to address such needs. When the first glimpse of new opportunities or threats appears, businesses with the ability to sense opportunities can interpret such information in terms of “market segments to target” and “technologies to deploy”

Figure 1. Links between Dynamic Capabilities and Strategy



(Zhang et al., 2020). This sensing ability is also likely to include collaboration with key customers and suppliers to assess the nature and potential of these opportunities and threats.

### ***Ability to Seize Opportunities and Evade Threats***

When a firm has identified an opportunity (or threat), it has to address it through strategic moves that reconfigure its products, services, processes, or even business models (Zhang et al., 2020). Typically, in the early stages, organizations have to choose between multiple strategies that may be at odds with each other. If the previously physical location of the organization was a vital resource (for example, in the world of retailing), then in the Industry 4.0 context, other capabilities have become more crucial such as agility in deploying technologies such as virtual and augmented reality, 3-D printing, and data analytics (Wagner et al., 2020; Ashdown, 2020; Olaf, Hanser, 2018). Seizing upon novel opportunities involves maintaining and continuously improving assets and competencies (Chowdhury et al., 2019). Firms can move on and invest substantially in the research and development of relevant technologies and designs. A crucial factor is to get the timing right to start transformations (Wagner et al., 2020). Many organizations sense opportunities and threats and yet decide to remain unfettered on their existing strategies and business models due to organizational inertia (Wagner et al., 2020). For example, retailers such as J.C. Penney have been in business well over 100 years and decided to stay the course and keep large physical stores that were hemorrhaging cash from the company even though consumer behavior was shifting toward online retail.<sup>2</sup> It is obvious that J.C. Penney's management was aware of the changes in the consumer behavior, however strategic rigidity prevents it from breaking out of path dependence. Such rigidity has led such companies to near bankruptcy, which has further been accelerated by the COVID-19 pandemic. Therefore, organizations must be geared up to quick decision-making to seize upon opportunities and threats they have sensed, which must be embedded into their organizational decision-making processes. High tech companies such as Apple, Netflix, Google, and others, in contrast with traditional ones, have succeeded in finding novel business models in a timely manner, and thus have become a part of the emerging innovation "mainstream". As a result, just over the last two decades they have achieved a market value that is greater than some of the largest traditional companies such as Exxon, Gazprom, GE, and Citigroup (Verhoef et al., 2021).

### ***Ability to Transform: Reconfigure Organizational Capabilities***

Maintaining evolutionary fitness depends upon an organization's ability to recombine, reconfigure, and transform organizational structures and assets together with changes in the markets and technologies (Yu et al., 2018). As more and more assets come under the control of organizations, they need to protect the firm from mismanagement and misconduct by preventing free-riding and manipulating information by dishonest employees. Organizations face such dilemmas as the number of people in their organization becomes more

significant with time, and their operations spread out over wider geographical zones (Zacca, Dayan, 2018). Such companies develop rules and hierarchies that eventually begin to constrain their ability to rapidly react to new knowledge and information (Zhang et al., 2020). Changing established routines is costly and causes anxiety within the organization unless the firm's culture is designed to accept high levels of internal changes (Teece, 2018).

Reconfiguration and transformation may involve a re-design of the business model, a re-alignment of assets, and revamping of routines. Such re-deployment may be through sharing capabilities between the supply chain partners or the geographical transfer of abilities from one market to another. Both are possible but not accessible unless the organization is designed to transform in response to the environment. To sustain such dynamic capabilities, top management needs a multi-level holistic perception of the wider environment. Strategic decision-making should be aligned within multiple levels of organizational hierarchy and must be focused on market realities (Teece, 2018).

## **High-Level Organizational Capabilities**

### ***Strategic Foresight***

Strategic foresight as a tool for deciphering emerging trends, opportunities, risks, and causalities allows the organization to make more informed decisions about matters that will impact their strategic decisions and long-term goals. Strategic foresight suggests that organizations recognize that multiple futures are possible. The extant literature also indicates that strategic foresight is comprehended in two different ways. A cluster of researchers view it as a process for re-designing strategies, while others perceive the concept as a basis for strengthening dynamic capabilities (Rohrbeck, Kum, 2018). In the seminal study by Rohrbeck et al. (2015), the authors assert that research on dynamic capabilities should be integrated with strategic foresight, because the concept of organizational foresight and the ability to sense in DCV are conceptually similar.

### ***Strategic Agility***

Strategic agility is considered an organization's capacity to undertake strategic long-term commitments and yet remain flexible and nimble, and is the means by which organizations reinvent and transform themselves through adaptability and ensure their survival through uncertainty (Doz, 2020). Strategic agility comprises of three dimensions: strategic sensitivity, leadership unity, and resource fluidity (Doz, Kosonen, 2010). Strategic sensitivity is the sharpness of perception and the intensity of awareness and attention to strategic developments. Resource fluidity is the internal capability to reconfigure capabilities and redeploy resources rapidly. Leadership unity is the ability of the top team to make bold, fast decisions. The concept of strategic agility at business organizations can be traced back to the discussions on what types of national strategies were needed to attain leadership in an unpredictable, rapidly changing world (Abshire, 1996). Then this approach migrated to the business environment, where the terms "ag-

<sup>1</sup> <https://www.forbes.com/sites/gregpetro/2020/02/17/walmart-challenges-amazon-on-sustainability/#2fdccf65bb8a>, accessed 28.03.2022.

ile manufacturing” was introduced to describe the focus on a tailored response to customer needs, arguing that the need for agility ought to take precedence over mass production as the future of 21st century manufacturing (Diego, Almodovar, 2022). Over time the research on organizational agility spread to other areas such as supply chain management, services, and organizational capabilities (Haarhaus, Liening, 2020).

### Organizational Ambidexterity

Organizational ambidexterity is defined as an organization’s ability to explore and exploit at the same time. Exploit means focusing on current operational activities while explore means focusing on strategic development. (Duncan, 1976; March, 1991) referred to it as an organization’s ability to pursue two apparently contradictory goals that are exploration and exploitation. Exploration refers to risk taking, searching for new frontiers, and innovation, while, exploitation focuses on refinement, focus on efficiency, and the execution of current strategies (Brix, 2020). More recent studies have refined the concept further by defining organizational ambidexterity as the ability of an organization to simultaneously pursue incremental and radical innovations, where incremental innovations meet existing customer needs, while radical innovations meet emerging customer needs (Brix, 2020). Hence, ambidextrous organizations are able to expand current activities and simultaneously explore future emerging horizons (Venugopal et al., 2020).

### Conceptual Framework and Propositions

It is challenging to maintain sustainable organizational performance in a dynamic environment. Therefore, firms must constantly reconfigure and re-deploy their resources to match rapidly changing circumstances (Teece, 2018). Business organizations require meta capabilities that enable them to create, maintain, and modify strategies and business models to sustain their relevance on the market (Vanpoucke et al., 2014). The digital transformation of organizations in the Industry 4.0 environment would therefore be a rational move if migration to such an ecosystem strengthens their strategic agility and organizational ambidexterity through the enhancement of a firm’s ability to sense, seize, and transform their business models as reflected through the manifestation of greater levels of strategic foresight. The logic behind such an assertion may

be deduced from observing the strategies implemented by some of the modern-day corporate behemoths such as Amazon, Apple, Google, Tesla, and Alibaba, which have demonstrated high levels of strategic foresight.<sup>3</sup> Their strategic moves are indicative of their strategic agility and organizational ambidexterity. It is obvious that some of these companies realize that future reliance upon targeted social media advertisements on their platforms as their primary source of revenue is unlikely to be sustainable for a long period. Therefore, the organizations not only continue to harvest profits from the ongoing business of targeted advertisements through AI-based algorithms but has also launched itself toward a new futuristic business horizon. The ability of these organizations to sense and seize opportunities and deal with threats through unprecedented levels of strategic foresight has translated into high levels of strategic agility in terms of response to the market, while these companies continue to focus on their existing businesses as well as their development of future opportunities, which is indicative of their organizational ambidexterity.

The extant literature on organizational capabilities research indicates that researchers have shown extensive interest in understanding the connection between capabilities and firm-level outcomes such as business performance, productivity, internationalization, R&D, and innovation (Khan et al., 2019). However, most of these studies have focused on a particular aspect of capabilities, such as marketing capabilities as part of a wider management capability or IT capability as part of technological capability (Kurtmollaiev, 2020). Furthermore, relatively few studies have examined the combined impact of both management and technical capabilities on CA (Fainshmidt et al., 2019; Kaur, Mehta, 2017). Kurtmollaiev (2020) and Diego and Almodovar (2022) have stressed the need to undertake further research on how the DC of organizations influences high-level capabilities such as strategic agility and organizational ambidexterity. At the same time, other studies suggest that such organizational capabilities are significantly influenced by strategic foresight (Haarhaus, Liening, 2020). However, there appears to be a dearth of sufficient understanding on how the digital transformation of organizations in the Industry 4.0 ecosystem is likely to interact with strategic foresight to drive organizational goals such as agility and ambidexterity.

Although the two constructs *strategic agility* and *organizational ambidexterity* appear to be conceptually overlapping, they are quite distinct, and both represent two different aspects of high-level organizational capabilities (Clauss et al., 2021). Regarding strategic foresight as a potential driver of both the above capabilities, Clauss et al. (2021) conducted a study on 150 German mid-sized businesses in the engineering industry and found that both organizational ambidexterity in conjunction with strategic agility mediated the relationship between strategic foresight and competitive advantage. This finding suggests that strategic foresight has a positive association with both the constructs: strategic agility and organizational ambidexterity.

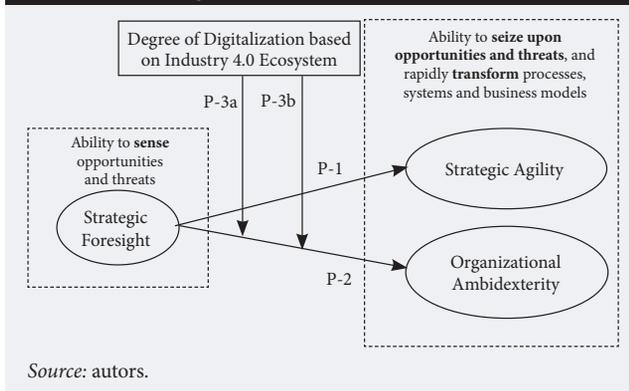
**Table 1. Priorities for Exploration and Exploitation within Organizational Ambidexterity**

Exploitation focus	Exploratory focus
<ul style="list-style-type: none"> <li>• Competing on mature markets</li> <li>• Reliance upon mature technologies</li> <li>• Control</li> <li>• Efficiency</li> <li>• Incremental improvement</li> </ul>	<ul style="list-style-type: none"> <li>• Competing for emerging markets</li> <li>• Introduction of new technologies</li> <li>• Experimentation</li> <li>• Autonomy</li> <li>• Risk taking</li> <li>• Innovation</li> </ul>
<p>Source: authors, based on (O’Reilly, Tushman, 2004; Brix, 2020).</p>	

<sup>2</sup> <https://www.forbes.com/sites/michaellisicky/2020/05/17/from-its-beginnings-to-bankruptcy--a-company-timeline-of--jcpenny/?sh=7a3d146d31de>, accessed 28.03.2022.

<sup>3</sup> <https://www.forbes.com/sites/warrenshoulberg/2020/06/15/its-alibaba-not-walmart-that-amazon-should-be-really-worried-about/#71e2cb627ddc>, accessed 28.03.2022.

**Figure 2. Conceptual Framework of Links between Degree of Digitalization and High-Level Meta Capabilities»**



Furthermore, the literature indicates that the digitalization of organizations positively influences organizational agility (Hadjielias et al., 2022). Meanwhile, Miceli et al. (2021) show that digitalization impacts sustainability, strategic agility, and organizational resilience. Similarly, Park et al. (2020) found that degree of digitalization has a positive association with organizational ambidexterity. In another study by Belhadi et al. (2021), organizational ambidexterity has been found to mediate the relationship between the digital business transformation and Industry 4.0 capabilities and sustainable supply chain performance.

Based on the preceding discourse, it is posited that strategic foresight positively influences both strategic agility and organizational ambidexterity. Furthermore, when such organizations migrate to the Industry 4.0 ecosystem, the degree of digitalization will moderate the relationships between strategic foresight and both strategic agility and organizational dexterity. Therefore, the following propositions are made as depicted in the conceptual framework in Figure 2.

**P-1:** Strategic foresight has a positive association with strategic agility

**P-2:** Strategic foresight has a positive association with organizational ambidexterity

**P-3a:** The degree of digitalization will moderate the relationship between strategic foresight and strategic agility.

**P-3b:** The degree of digitalization will moderate the relationship between strategic foresight and organizational ambidexterity.

## Discussions and Future Research Directions

The discourse presented in the preceding sections leads to the proposition of a conceptual framework that asserts that different aspects of meta capabilities of organizations interact with one another to enhance an organization's ability to deal with uncertainties in the business environment. Leveraging the three micro-foundations of the theory of dynamic capabilities (i.e., to sense, seize, and transform), strategic foresight is a reflection of an organization's ability to sense opportunities and challenges emerging on the horizon. Furthermore, both strategic agility and organizational ambidexterity are high-level

capabilities that reflect an organization's ability to seize upon these opportunities and evade threats as well as rapidly transform their processes, systems, and business models when required. The primary contribution of this study is to argue that the degree to which such organizations adopt digitalization in their processes and systems based on the Industry 4.0 ecosystem will moderate (in this case strengthen) the relationships between strategic foresight and strategic agility as well as the relationship between strategic foresight and organizational ambidexterity.

The propositions presented in the current study require empirical investigation. A rigorous data-driven examination of the model would likely provide evidence on whether migration to Industry 4.0 technologies drives significant increases in the levels of abilities to sense changes in the competitive environment and then have the rapid decision-making capacity to seize upon emerging opportunities on the business horizon. Subsequently, such decisions have to be backed by the organization's built-in capabilities to reconfigure systems, routines, and possibly business models to bring about the transformation. In addition to testing the framework empirically, future researchers may consider that other variables not considered in this study may influence the relationships. For example, since this study looks at capabilities that enable organizations to cope with uncertainties, other pertinent variables that may play a significant role in the relationships are environmental uncertainty, flexibility, and decision rationality. Furthermore, other strategic goals such organizational resilience, productivity, and competitive advantages may also be considered outcome variables that provide deeper insights into how digitalization effects capabilities and organizational performance.

Another important construct that may be of significant importance is the potential relationships between the adoption of Industry 4.0 technologies and the abilities to sense, seize, and transform may also be contingent upon whether knowledge management within the organization is optimized. Based on prior empirical literature, it appears that knowledge management comprises of four dimensions: the acquisition, conversion, application, and protection of knowledge. Each of these knowledge management components is likely to influence the strength of the relationships between strategic foresight, strategic agility, and organizational ambidexterity. Hence, the framework may be expanded further to consider the role of knowledge management. Another important variable that may also be taken into consideration by future researchers is ensuring system security needed for data protection in the hyper-connected Industry 4.0 environment.

## Conclusion

The framework presented in this study is by no means the end of the road. It is a proposition for future researchers to move the initiative forward toward a conceptual model that may be tested and validated through empirical studies. The idea being presented in the current study is to start a conversation that would draw researchers' interest and push them to find a robust model to determine how the capabilities of organizations are impacted when they migrate to an environment driven by the cutting-edge technologies that drive Industry

4.0. The potential impact of the adoption of Industry 4.0 on business organizations' long-term goals is still not clear, and more frameworks need to be developed that enable the measurement of organizational performance when they migrate to such advanced technological ecosystems. In addition to the basic framework outlined in this study, further development toward a sound conceptual model may require the consideration of other exogenous and endogenous constructs not covered here.

The idea behind developing a robust model for measuring organizational benefits resulting from migration to an Industry 4.0 environment remains a challenge. Part of the challenge emanates from the fact that articulating a proper definition of Industry 4.0 has not been easy. People tend to grasp the systems and technologies that drive the fourth industrial age, but defining this era clearly and concisely remains a challenge. Despite the popularity of the term Industry 4.0 in academic and management circles, there are more than 100 definitions of this term in engineering and management literature (Culot et al., 2020). According to the consulting firm McKinsey Group, Industry 4.0 is a combination of many managerial and technological concepts and is more or less a confluence of

trends and proposals for how products and services should be made and delivered, merging advanced technologies into the production and delivery environments.

Empirical studies related to the impact of the digital transformation upon organizations seems to be mostly limited to parts of the world where research and development related to advanced industrial and manufacturing technologies are more pervasive. While it appears that many emerging economies are also prioritizing the adoption of digitalization, most are lagging behind due to a lack of sufficiently trained personnel.

A contribution of this study may be considered the step it made toward theory development in terms of relating digitalization to organizational capabilities in an uncertain and rapidly changing world. With advanced technologies becoming ubiquitous in human society, both academia and industry need to obtain a firm grasp on the benefits and potential challenges that organizations will encounter as the digital transformation becomes more pervasive. Future empirical studies based on such models will enable policymakers to have a better understanding of how to regulate and promote migration to Industry 4.0.

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