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Investigating the role of dynamic capabilities and organizational design in improving decision-making processes in data-intensive environments

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Abstract. Business environments are getting increasingly dynamic and data-intensive because of the emerging technologies and advances in data science, and information and communication technologies, which require enterprises to make regular and quick decisions to cope with the changes. This paper explores how big data influences decision-making processes and, consequently, organizational design in turbulent business environments.

This study uses a qualitative approach (multiple case-study) by applying interviews to gain rich and illuminating data from organizations that use large data sets as a source of information based in the UK. In total, 12 participants from 9 organizations were chosen for the interviews who had a deep understanding of organizational and information-processing mechanisms, such as CEOs (chief executive officers), data analysts, data consultants, CIOs (chief information officers) and middle managers.

This study contributes to decision-making theory by providing new insights about dynamic decision making in the context of big data and a better understanding of organizational strategies (either developing new dynamic capabilities or reconfiguring the current ones) for working with and leveraging value from big data. In addition, for the practical aspect, it contributes to guiding decision-makers in evaluating their organizations in terms of required capabilities and processes to become better enabled to reap value from big data.

Keywords: Big Data, Decision making, Dynamic Capabilities, Organizational design

1   Introduction

Business environments are becoming increasingly complex and fast-changing due to various factors, such as Industry 4.0 technologies and advances in data science, and information and communication technologies [1]. "Such advances in digital technologies offer ripe opportunities for firms with superior dynamic capabilities to gain an advantage by deploying them faster and smarter than their rivals" [2:70]. At the same time, they bring about challenges as well. Despite the increasing amount of data collected and stored by companies, many are still looking for ways to improve their competitive advantage [3].

Due to the increasing number of data processing tasks and the complexity of the process, many organizations struggle to make effective decisions. Analyzing increasingly massive data sets is beyond the capacity of traditional databases. This is why they

must adopt agile and flexible methods to process their data. Therefore this study seeks to shed light on some of the changes and capabilities required to take advantage of big data and improve decision-making processes.

2   Literature

Advanced Information technologies have the potential to transform the way organizations operate. Their characteristics, such as providing faster and cheaper communication, greater control over participation, and the ability to store and retrieve vast amounts of data, are expected to significantly impact the structure and design of organizations [4]. One of these phenomena is Big Data (BD), which in simple terms, could be defined as extensive data sets characterized by various features such as volume(exponentially growing), variety(text, image, signal, audio, video etc.) and velocity (timeliness in the acquisition and utilizing) [5]. As it has significant implications for organizations, it is vital to study its impact on organizations.

Investigating the impact of Big Data on organizations requires understanding the interplay between three key elements, including technology (computational power), analysis (identification of patterns in data), and mythology (the cultural aspect of BD referring to believing in the potential of BD in providing insights and intelligence by tapping on advance AI and Machine Learning methods) [6]. For example, the quality of data is only one aspect of the equation when it comes to determining the value of big data. Culture also plays a significant role in determining the success of big data initiatives for policy making [7]. In other words, leveraging business analytics to take advantage of data to make sense of decisions requires great changes. Those changes will not happen without changing the organizational infrastructures such as leadership, planning, culture, and structure. Therefore this study aims to shed light on some of those key aspects required to make the most of big data.

According to the bibliometric literature review conducted by Rialti et al. [8], dynamic capabilities is the primary theoretical approach that scholars have used to investigate the effects of big data on organizations. This is because, in increasingly dynamic environments, only organizations will stay ahead that can sense opportunities, seize them more effectively, and support the organizational transformation by redesigning and external shaping, and dynamic capabilities would enable this [2, 9-11].

In terms of technical aspects, Rialti et al. [8] argue that new data analysis tools based on artificial intelligence are required to handle such massive data sets. Accordingly, "Collaborations, knowledge exchange and big data analytics, which can be facilitated by the effective use of technology, heavily determine big data decision-making capabilities" [12:4]. It seems that relying on legacy systems and IT or investing merely in the big data technologies may not be enough to effectively reap value from big data to improve organizational decision making. In this sense, Mikalef and Krogstie [13] believe the importance of IT governance has been studied broadly. However, there is little effort in researching and establishing big data governance, which is defined as an ability of a firm to organize its resources to maximize the value and insight that could be generated from information [13]. Therefore, it is crucial to investigate the impacts of Big

Data on organizational design such as structure, culture, and IT infrastructures, and the required capabilities in order to reap value from Big Data.

The decision-making process is referred to as a mental process that involves coming up with a solution that is ideal for a given problem. This is a central component of a company's management structure [14]. Data-driven decisions have gained significant attention due to the values they can provide throughout the businesses and in all tiers of organizations. For example, data-driven mindsets can hugely benefit marketing strategies [15]. In this sense, organizations need to create their big data analytics [16] to provide their decision making processes with valuable information. In doing so, the integration between various elements of organizations is imperative. For example, organizations can improve their operations and develop new knowledge through the ability to integrate the various digital and human components [17]. In this regard, it is imperative to study how decision processes are influenced by big data, and which are components are required to enhance those dynamic decision-making processes.

3   Methodology

This study aims to investigate how Big Data influences decision-making processes and, consequently, organizational design. In other words, how organizations make sense of big data by changing their decision-making processes and developing new capabilities. Investigating the influence of such data sets on organizations calls for focusing on a few specific areas such as knowledge management, capabilities necessary to deal with big data, organizational routines and processes, and data itself as a source [8]. For this study, a mono qualitative method has been chosen based on the interpretivism philosophical stance and the research question's essence. This study seeks to study the decision-making processes (as a particular management activity), and how managers design their organizations by developing dynamic capabilities to keep pace with fast-changing and data-intensive environments.

A multiple case study approach has been chosen for this research to gain an in-depth understanding of the topic concerned. The cases of this study include organizations that are using big data as a primary source of information for decision-making based in the UK. Qualitative data was collected through semi-structured interviews for this study. In total, 12 participants from 9 organizations were chosen for the interviews who had a deep understanding of organizational and information-processing mechanisms, such as CEOs, data analysts, data consultants, CIOs, and middle managers.

The grounded theory method was used to analyze the qualitative data and interpret the participants' perspectives. The grounded theory method is believed to be very effective in context-based and process-oriented studies [18]. The grounded theory method was conceptualized in social sciences as a way of generating theories that are based on empirical data. It aims to explore the current state of knowledge instead of prescribing solutions. This method helps researchers analyze the data until they reach theoretical

saturation [19]. The coding approach is employed to analyze the data by means of attaching conceptual labels to the data. Emerged open codes developed into subcategories and those subcategories eventually shaped the main themes of the study. Then the relationship between the constructs was analyzed by the researchers to build theories. It is important to note that the constant comparison between data and literature has been made to help the researchers to better conceptualize the theories. The dynamic capabilities approach was used as a lens during the data analysis to guide the coding stage. For example, concepts concerning informal Dialogue (meso-level) were labelled and coded as interpersonal communication. Therefore, the constant shift between literature and data has helped the researchers to remain focused on the subject being investigated.

4 Results

The three main research themes that emerged from the data analysis process were decision making, dynamic capabilities, and organizational design.

4.1 Decision making

Several subcategories associated with decision-making, including normative decision-making, intuitive decision-making, and team-processes, were identified by the participants. The findings show that data analysis plays a vital role in supporting decisions in terms of providing managers with real-time insights. This is relevant in all tiers of decision making, including operational, tactical, and strategic decision making. However, participants believed that it is not always easy to analyze and evaluate the available information as businesses are facing a huge amount of unstructured data.

The results show that decision-makers might resort to their intuition based on either their cognitive style or lack of understanding the data. Participants have identified other reasons as well such as the abundance of data, time pressure and lack of trusting insights that emerged from data.

Participants also highlighted the importance of team processes as decisions made in teams tend to be faster, benefitting from various expertise and skills of others. However, the responsibility for the decisions is usually attributed to the person in charge of the decision unit. Participants have repeatedly emphasized the importance of information flow in decision making as one of the key factors that are usually more effective within team decision units.

4.2 Dynamic capabilities

Several subcategories associated with dynamic capabilities were identified, including managerial capabilities, knowledge management, and learning.

Participants highlighted the role of management in improving the attitude of their employees toward data-driven decisions as not everyone necessarily trusts data and the

insights that are emerged from it. Another critical factor that was repeatedly mentioned by the participants was the awareness of and understanding of both the business and the data. Cognition was also identified as one of the dimensions of managerial capabilities that varies from person to person based on their perceptions, skills, thought processes, experiences and knowledge acquisition techniques. Social capital is also another vital dimension of managerial capabilities identified as it is concerned with social relations, interactions and networking within a team that facilitates the flow of information and influences the decision-making process

The concepts of Knowledge Articulation and constructive collaboration have been identified as two of the most important dimensions of knowledge management by which collective knowledge can be made available within the organization. Participants believe that by using collaboration, not only can they share the extant knowledge but also learn from others and update the existing knowledge. Those concepts refer to the articulation of the knowledge which is supposed to be coming from a source. In this sense, knowledge exploration is also mentioned referring to actively seeking new knowledge. Once the knowledge is available and articulated, it might be codified or remain as tacit knowledge in the minds of organizational members.

4.3   Organizational design

In terms of organizational design, human resource management, organizational structure, and organizational culture were among the important dimensions of the organizational design identified by the participants.

Regular collection of a massive amount of structured and unstructured data has influenced organizational structure in terms of IT infrastructures, collecting, storing, cleansing, analyzing and disseminating data. For example, some participants argued that it is not always possible to collect the data automatically by leveraging AI, so they might need a team of experts to do this, meaning creating new roles and tasks. Similarly, the participants have mentioned the important role of HR in recruiting skilled data analysts and scientists as well. However, as there is a shortage of those skilled experts, therefore this comes with a high price which would influence the resource allocation as well. In this sense, some of the businesses rely heavily on one person's skills in terms of analyzing and getting insight from data.

In terms of organizational structure, the participants have repeatedly mentioned and highlighted formal and informal communication channels. The participants have argued that informal communication channels such as Dialogue could be equally effective as formal communication channels such as formal meetings.

According to the findings, many of the participants identified the importance of culture as one of the key factors that can influence an organization's success in implementing and managing big data analytics. This concept was also mentioned by them several times in their discussions about the subject. For example, some people rely heavily on insights emerging from data in their decisions, although others, regardless of access to the data, are unwilling to change their decision-making styles. This concept has been identified as openness to change.

In the previous sections, the key role of data analysts and scientists was highlighted. Power dynamics is another concept that emerged from data. This concept refers to the impact of big data on organizational power dynamics as data analysts and scientists are gaining more power as the role of data in running businesses is increasing. In other words, those key individuals analyze and get insights from data and provide the necessary support for decision-makers.

5   Discussion and conclusion

Decision-makers rely on various decision-making styles, such as normative and intuitive styles. The abundance of new data, lack of sufficient data, time pressure and lack of trusting insights emerged from data are among the reasons that cause decision-makers to resort to their instincts in decisions. The results indicate that data-driven decisions are more effective in data-intensive environments. The findings show that wherever directors deal with familiar markets and data, processing the data will be much easier. However, facing the deluge of new data coming from brand new markets, data processing individually might be challenging. So, this would call for collaboration and team processes. Diversity of thoughts, ideas, expertise, and personalities could contribute to better decisions by challenging various ideas and bringing a wider variety of thoughts to the table. Awareness and understanding of the data could also enhance communication, perception, and interpretation of data across the organization.

At the meso level, the findings show that Dialogue has a key role in not only sharing knowledge but also helping individuals with generating new ideas and reflecting on them. A constructive dialogue can be critical in developing new ideas, sharing thoughts, and learning from other members of the organization in a short period of time in comparison with other learning methods. This would contribute to more dynamic decisions and more effective organizational learning.

At a macro level, resource orchestration is also influenced by introducing big data analytics. In other words, organizations should be designed to facilitate the flow of information coming from Big Data. Accordingly, one influential factor in facing new data and information to make decisions is organizational culture (as one of the crucial drivers of evidence-based decision making) because changing decision-making culture and design could influence the power structure, people's roles, and the ways by which people in organizations communicate and share knowledge and information.

The study findings indicate that deriving value from big data is not just a technical issue. It's also a social issue that requires organizations to develop their managerial capabilities and monitor environmental dynamics constantly. The results indicate that managerial capabilities, knowledge management capabilities, and learning abilities, are among the most critical dynamic capabilities. In terms of organizational design, Human resource management (awareness of the needs and talent management), organizational culture (openness to change and analytical culture), and organizational infrastructure are also imperative in improving decision making in data-intensive environments. In a nutshell, this study highlights the importance of all three levels of dynamism in organizations, from the Micro-level (habits and cognitive styles of decision-makers), and the

Meso level (referring to interpersonal relations) to the Macro level (concerning resource orchestration) [20]. All of the mentioned levels are interconnected and could contribute to enhancing the information processing and communication within the organization, by tapping the power of big data tools and technologies coupled with natural language processing [21-23] and advance deep learning methods [24-26], resulting in better, faster, and more informed decisions in data-intensive and dynamic environments.

Developing the necessary systems and capabilities to handle big data can help organizations transform their operations and become more agile. This could allow them to respond more effectively to the changes brought about by the new technologies [8]. This has important implications for practitioners as to what factors are key in reaping value from big data. As it is indicated in the results, practitioners can facilitate this process by increasing awareness about the data and its value, enhancing the data-driven culture (mindset), and facilitating formal and informal communication channels. By taking a holistic approach and integrating all the necessary capabilities discussed, organizations can be more resilient in turbulent climates.

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