Developing an Artificial Intelligence Capability: A Theoretical Framework for Business Value

Patrick Mikalef[1,2], Siw Olsen Fjørtoft[1], and Hans Yngvar Torvatn[1]

[1] SINTEF Digital, S.P. Andersens veg 5, 7031, Trondheim, Norway
[2] Norwegian University of Science and Technology (NTNU), Sem Sælands vei 7-9, 7034, Trondheim, Norway

Abstract. Despite the claim that Artificial Intelligence (AI) can revolutionize the way private and public organizations do business, to date organizations still face a number of obstacles in leveraging such technologies and realizing performance gains. Past studies in other novel information technologies argue that organizations must develop a capability of effectively orchestrating and deploying necessary complementary resources. We contend that if organizations aim to realize any substantial performance gains from their AI investments, they must develop and promote an AI Capability. This paper theoretically develops the concept of an AI capability and presents the main dimensions that comprise it. To do so, we ground this concept in the resource-based view of the firm and by surveying the latest literature on AI, we identify the constituent components that jointly comprise it.

Keywords: Artificial Intelligence, Organizational Capability, Resource-Based View, Theoretical Framework

1   Introduction

Artificial Intelligence (AI) can be defined as a set of technologies that simulate human cognitive processes, including reasoning, learning, and self-correction. Following the rapid growth of data and processing power, AI has re-emerged on the stage as a key technology that will likely play a central role in realizing performance and competitive value for firms [1]. The main value proposition of AI is that it can perform a large number of manual tasks with greater speed, accuracy, and detail compared to humans, therefore enabling the human work force to engage in activities that require competences that are distinctively human [2]. While a large proportion of the discussion has centered around the role of AI in replacing certain human tasks, there is also a growing debate regarding the potential symbiosis between humans and machine, enabling in such a way the core strengths of each in a complimentary manner [3]. Nevertheless, while traditionally AI has been talked about in technical terms, the renewed interest in the tools and techniques that underpin AI have given rise to a new type of focus, i.e.

how AI can be leveraged in business and how organizations should prepare for harnessing its potential.

This shift in the focus regarding AI use in the organizational setting has raised concerns about the areas where organizations should focus their efforts. As with other emerging technologies and information systems, it is widely acknowledged that adopting and leveraging such technological innovations is a firm-wide effort and requires significant attention in several key areas [4]. Building on this perspective of leveraging emerging technologies as a key organizational capability, Bharadwaj [5] argued that firms need to develop an Information Technology (IT) capability in order to be able to effectively utilize new and emerging technologies. The concept has been adapted in recent years and been narrowed down to specific technologies [6, 7]. Most notably, there has been a stream of research examining the ability of firms to utilize their big data investments, giving rise to the notion of a big data analytics capability [8, 9]. Similar to big data analytics, AI requires that organizations develop a plan that enables them to leverage the full potential of such technologies. Nevertheless, to date there is still no theoretical framework to define the important dimensions and aspects that are critical to realize business value.

The purpose of this study is to take a theoretically grounded approach in developing an Artificial Intelligence Capability and its main dimensions. We define an AI capability as *the ability of a firm to orchestrate organizational resources and apply computer systems able to engage in human-like throughout processes such as learning, reasoning, and self-correction towards business tasks*. This definition adopts a broader perspective on AI taking into account the fact that in order to be able to deploy such technological innovations and for them to be applied to business tasks a firm-wide effort is required. We adopt the theoretical underpinnings of the Resource-Based View (RBV) and through a review of existing literature review the core dimensions that are relevant in the context of AI [10, 11]. The purpose of this study is to develop a theoretical framework through which the maturity of organizations AI capability can be assessed and benchmarked. From a practical perspective this instrument can be used to identify areas that have been neglected and to formulate roadmap in order to streamline deployments and increase business value.

The rest of the paper is structured as follows. I the next section we introduce the RBV and overview the existing studies on AI and business value. Next, in Section 3 we define the dimensions of an AI capability and briefly discuss what each encompasses. Finally, in section 4 we discuss about the ways future research can extend this theoretical framework and how practice can apply it to formulate an adoption plan. We close the paper with the conclusions that can be draw as well as some key limitations.

2 Background

2.1 The Resource-Based View (RBV)

The Resource-Based View (RBV) of the firm has been one of the most influential theoretical frameworks to describe the types of IT resources firms need to consider when deploying their investments in the organizational context [12]. The main premise upon which the RBV is based is that the competitive position of organizations depends on the types of resources they posses or have under their control [13]. According to this view, not all resources can generate equal value, but rather, the competitive positions that firms are able to achieve as a result of utilizing their resources depends on certain characteristics of the resources themselves. Specifically, resources that are valuable, rare, non-inimitable, and not easily transferable can be the source of business value if leveraged appropriately [14]. One of the main assumptions that the RBV builds on is that these resources will be orchestrated and deployed in an optimal manner, thus enabling firms to outperform their competitors. Despite this underlying assumption, the RBV is a strong theoretical framework as it unites several dissimilar resources, which in turn can be combined to generate a competitive advantage [15].

The RBV provides an appropriate theoretical basis since knowledge about what AI specific resources a firm has to manage is a core part of attaining a competitive advantage. Furthermore, the ability to integrate the frameworks with other theoretical perspectives (e.g. dynamic capabilities, absorptive capacity) makes the RBV an attractive approach to explain business value stemming from IT investments [9, 16]. Past research in the broader IS domain has applied the RBV extensively. For example, Melville, Kraemer and Gurbaxani [17] recognize that the RBV can allow empirically testable hypotheses, which help advance our knowledge regarding the role of IS resources in organizational performance. Similarly, Gupta and George [8] recognize that it is an appropriate theoretical framework to categorize the different types of resources relevant to big data analytics. Overall, the RBV is a well-established theory for theoretically and empirically examining the relationship between different types of organizational resources and performance. Since the objective of this study is to isolate several key resources that will enable organizations to create AI capabilities, which in turn will result in performance gains, the choice of the RBV as the theoretical framework for this study is deemed as appropriate.

2.2 Towards the development of an Artificial Intelligence (AI) capability

Despite the fact that published research on AI is still very limited, there are several studies that have identified challenged associated with the success of AI projects. These studies range from large-scale empirical research studies, to case studies and surveys with industry professionals published in practitioner journals. We use the distinction provided by the RBV to categorize types of resources into three main types, tangible (e.g. physical resources and data), intangible (e.g. organizational culture), and human skills and knowledge (e.g. employees competencies and skills) ac-

cording to Grant [18]. Regarding the first type of resources, i.e. tangible, literature on AI places a heavy emphasis on the data required to enable AI and the technology to support it [19]. Data is widely regarded as the foundation for AI, with the quality of data being the key aspect in regard to the value of the AI it is applied towards [20-22]. According to a study by Ransbotham, Gerbert, Reeves, Kiron and Spira [23] pioneers in the use of AI develop more sophisticated data management systems and decentralized data lakes. Furthermore, being able to integrate data from several channels and streamlining operations of sharing and cleansing data so that it can be readily used in AI applications is repeatedly noted as being a key element [24]. Nevertheless, being able to perform such operations regarding data sharing, cleansing, and processing to support advanced AI techniques also requires that there is an appropriate technological infrastructure to support it. Such infrastructure includes cloud-based technologies for processing data [25], computational power by state-of-the-art CPUs and GPUs [26], as well as enterprise networks that support efficiency and scale.

Apart from the tangible resources related to AI, there has also been considerable focus on the human factor [23]. This discussion revolves typically around two areas, the human skills required to develop and train AI applications, and the foresight and managerial capacity to apply such methods to business problems [27]. This issue about the importance of skills in the AI landscape is also noted by public bodies including amongst others the European Commission, that has placed increased emphasis on the importance of developing such skills. Wilson, Daugherty and Bianzino [28] in an influential article highlight the different jobs AI will create in the near future. These include three main profiles, and several other sub-profiles, with roles such as trainers, explainers, and sustainers. Trainers will be needed to teach AI systems how they should perform, Explainers, will be required to bridge the gap between technologists and business leaders by providing clarity, while Sustainers will be in charge of making sure AI systems operate as designed and that unintended consequences are addressed appropriately.

The final category of resources revolves around intangible elements that require firm-wide development. Specifically, several studies note that developing an AI-oriented culture is a key part of succeeding [29]. In fact, in a recent study conducted by Ransbotham, Gerbert, Reeves, Kiron and Spira [23] one of the main barriers to AI adoption was the cultural resistance to AI approaches, as well as the competing investments priorities. These results indicate that embracing an AI culture and developing a strategy to support it are critical resources in realizing performance gains. Adding to the AI-oriented culture, several researchers also indicate that promoting organizational learning is important in the age of AI. Being able to search, acquire, assimilate and exploit new knowledge as it emerges is key in being capable to be within the group of pioneers and outperforming competition [30]. Collectively, these resources comprise a firm-wide AI capability and require that attention is attributed to each. This necessitates that there is a strategy regarding AI deployment and use and a roadmap for such deployments.

3   A Research Framework for AI and Business Value

Building on the foregoing discussion around the constituent elements of an AI capability and the emerging literature regarding the business value of such technologies in the organizational context, the question is to examine if an AI capability can lead to business value and through what mechanism that can be realized. Overall, literature recognizes that AI can produce value in four different ways, 1) *Automation*, 2) *Decision support*, 3) *Marketing* and 4) *Innovation.* By automatizing several manual tasks AI can enable the human workforce to perform other activities that require more creative skills and critical thinking. For instance, the use of chatbots to interact with customers or citizens, or applying AI to perform checks on reports, documents and financial statements can significantly increase the efficiency of organizations. Nevertheless, AI can also be used to enhance the judgement and decision-making of humans in a stream termed augmented intelligence [31]. The main premise here is that AI can help humans sense external stimuli and assist in decision-making by enabling analysis and offering advice and implementation support [32]. In terms of marketing, AI has been applied to identify unique personas of customers, and offer tailored-made marketing campaigns, or even special offers and services. In this way, AI replaces human action in developing marketing approaches as it bases selection of methods and approaches on fine-grained information and can improve its precision based on different performance metrics [33]. Finally, many creative professions are now deploying AI to support innovation projects, as for instance biomedical applications or uses of AI to help in design or creativity. For instance, many designers now use input provided by AI to come up with new ideas for their work-related activities [34]. The figure below presents a schematic representation of the business value-adding relationships that underpin AI. The objective of this research framework is to provide a structure to the internal organizational resources that need to be leveraged in order to generate value, and to comprehend the areas where AI can be applied to realize such performance gains.
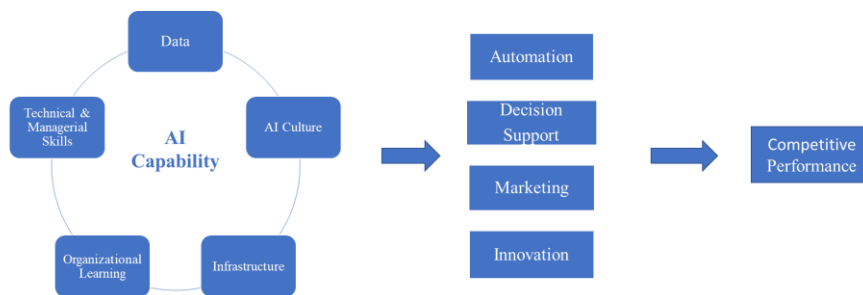

Fig. 1. AI Capabilities and competitive performance framework

4   Discussion

While AI is still at an early stage of deployment in organizations, it has already become a topic of discussion regarding implementation and use in the business realm. Several studies have already started to look at potential business cases for AI and have explored what challenges and opportunities executives perceive during such attempts. Despite the research still being quite fragmented and scarce, a consensus is developing around the areas that firms must take into account if they want to realize performance gains from such investments. Building on the increasing rate of AI use in private and public organizations, this study sought to examine what elements contribute to developing a firm-wide AI capability. This notion is argued to be critical for contemporary firms in order to avoid costly investments without any actual competitive or financial returns.

The objective of this study was to develop a theoretically grounded definition of an AI capability and to extract the core resources that comprise it. We built on the RBV of the firm as an appropriate theoretical framework and distinguished between resources based on the classification of Grant [18]. Guided by this categorization and based on relevant literature we defined and discussed the dimensions and what aspects of them are important in realizing business value from AI investments. Similar to past empirical studies looking at IT investments within the organizational sphere, our goal was to examine what aspects managers should consider when deploying AI solutions. Having defined then the constituent components of an AI capability, we proceeded to identify the business areas through which AI can produce value and competitive performance gains [35]. Our analysis revealed that AI can produce value in four different ways, through automation, decision-support, marketing, and innovation. We expanded briefly on each of these and how AI can be used to support them.

While this study is still on a theoretical level proposing a framework for analysis and performance gains, it is a first attempt to do so in a theoretically guided way. The next steps in this research will be to develop a set of items to quantitatively assess the maturity of all the underlying dimensions and as a result the total level of AI capability. By doing so we can examine if AI produces business value, and if so through what mechanisms [36]. The research framework can also be used by academics and practitioners in order to define the types of value AI can create and identify the specific elements that lead to successful outcomes.

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