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Winning AI Strategy: Six-Steps to Create Value from Artificial Intelligence

Completed Research

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Abstract

As part of industry 4.0, many organizations feel the need to explore the possibilities artificial intelligence may provide for their businesses. Still, not every organization that implements or makes use of AI benefits in this way let alone extracts value from them. This paper aims to investigate the challenges associated with AI business value creation. Through a comprehensive analysis of the top AI actual use cases across 7 industries and a systematization of the existing literature, we formulated the challenges in deploying and reaping business value from AI at the organization-level. Six challenges of AI at organization-level have emerged from our analysis. They are AI business case, Relative benefits of AI, Top management support, Effective use of data, AI talent, and AI compatibility. Our work aims at contributing to the body of knowledge on AI technology at organization-level, and at guiding practitioners in identifying and overcome various challenges of AI.

Keywords

Artificial Intelligence, Business Value, AI Challenges, AI adoption.

Introduction

Artificial intelligence (AI) has emerged as a transformative technology across various sectors of industry. AI technologies arise as one of the significant sources of change due to the continuously accelerating rate of innovation (Bundy, 2016). The rise of AI-powered digital transformation has become an important driver of change in various industries (Rai et al., 2019). Further, AI is the underlying technology behind the Fourth Industrial Revolution or industry 4.0 (World Economic Forum, 2018), which has been named “the most change-inducing technology of our time.” At the corporate level, AI is shifting from science fiction to a commercial body that is essential in allowing companies to stay profitable (Bundy, 2016).

Oxford University defines AI as the “theory and development of computer systems able to perform tasks normally requiring human intelligence” (Stevenson, 2018). This definition reflects our suggestion of creating AI value in such a way that AI represents a complex technical system, in which both AI capability and organizational elements need to be considered, in order to improve organizational performance (Alsheibani et al., 2020). This intelligence plays a crucial role in strategic planning and has been used by organizations to gain a competitive advantage over their rivals (Varian, 2018).

In recent years, AI has emerged as an essential phenomenon in organization strategic research (Evans & Gawer, 2017) as well as for practitioners (Purdy & Daugherty., 2017). Moreover, AI involves fundamental developments taking place at the institutional level and impacts on the roles of decision-makers and policy experts through the application of advanced technology (Alsheibani et al., 2020). A recent study by MIT Sloan Management Review and Boston Consulting Group found that 90% of executives agree that AI represents a business opportunity and view it as critical to their company’s success (Ransbotham et al.,

2020). With the ability to raise the world economy between \$13 trillion and \$15 trillion by 2030, AI is considered one of today's most important trading prospects (Rao & Verweij, 2017). Additionally, AI technology promises several advantages in terms of business value, including increased revenue, reduced costs and improved business efficiency (Gartner, 2019), allowing organizations to gain a competitive advantage (Agrawal et al., 2018).

Despite this growing trend, many executives and investors are still unsure about how AI technology can translate into revenues for organizations that adopt intelligent commerce (Varian, 2018): AI has many of the same problems and concerns as other technologies (Alsheibani et al., 2019). However, other challenges, such as confusion regarding AI functionality, have separated it from other emerging inventions (Ransbotham et al., 2019). Organizations, therefore, frequently underestimate the complexity of AI technology and fail to implement fully solutions within the specified timeframe (Davenport, 2018). Consequently, its value creation might vary. Therefore, the underlying AI challenges that lead to organizational adoption, as well as the necessary conditions and potential opportunities, deserve closer investigation. In order to benefit from AI, the challenges associated with AI development have to be addressed. Thus, we pose the following related research question: *Why do some organizations succeed in deploying and reaping business value from AI while many others fail?* We rely on a two-step research approach: reviewing the existing literature on information system (IS) innovation and AI adoption at the organization level, followed by the use of secondary data from several use cases to obtain the findings. The remainder of this paper is structured as follows: we describe our findings based on the existing literature on the research background section. Then we present our research design and the cases that we have investigated in detail. Next, we discuss the key findings from the analysis and, finally, the paper closes with a discussion and suggestions for further work.

Research Background

AI in Organization – Opportunities and Challenges

In this research, our main argument for investigating the challenges in deploying and reaping business value from AI at the organization level are based on: (1) the literature and empirical evidence on the impact of AI on business value; and (2) the emerging body of evidence from AI use cases on the challenges and benefits of AI. First, with regards to the impact of AI on business value, investments in AI around the world have grown at a staggering rate over the last four years. Although AI technology has existed since the 1950s, it has only recently been applied to business, following advancements made in computer hardware, computer network speeds and data processing algorithms. Researchers and practitioners often refer to a range of related terms such as “machine intelligence”, “intelligence agents”, “intelligent behavior”, “intelligent systems” and “algorithms” when referring to AI. The term “machine intelligence” describes a machine that can demonstrate one or more aspects of human intelligence (De Silva, 2018). Nilsson (2014) uses the term “intelligent machine” to refer to an activity that makes machines intelligent, and Barr and Feigenbaum (1981) define AI as “computer intelligence”. More recently, Sunnersjo (2016) distinguishes AI as “computer intelligence” from traditional computers in terms of its “efficiency”, “maintainability”, “reliability” and “transparency”. However, the term AI has moved beyond this realm to include a number of behaviors. For example, “intelligent behavior” is another term coined by Schalkoff (1990).

Moreover, a few studies also focus on case studies and anecdotal evidence from studies of best practice and AI technology scenarios funded by vendors or consultants (Alsheibani et al., 2018; Brynjolfsson & McAfee; Chui, 2017; Gentsch, 2019; Pumplun et al., 2019; Ransbotham et al., 2018; Thompson et al., 2019). Nevertheless, most recent AI studies at the organization level merely concentrate on a technological understanding of AI adoption (Popa, 2019; Pumplun et al., 2019) rather than identifying the strategic and business value challenges associated with its implementation. We argue that, while these AI studies address the perspectives of AI technological development and functionalities, research on AI challenges and business aspects, along with the discussion on how to adopt it successfully, is needed urgently. As Alsheibani et al. (2019) point out, there is little rigorous evaluation-based research, and there is a need for a comprehensive analysis of AI implementation to unveil ways in which it enables business value creation.

Furthermore, despite its novelty, AI has already had a substantial economic impact (Brynjolfsson and McAfeeand, 2017) and has become an active area of research in numerous areas and industries. The potential benefits and challenges associated with AI are an important topic for organizations in all

industries. The organization is seeking to take advantage of the opportunities that AI promises, and expect a wide range of benefits through the introduction of AI technologies. Given the nature of AI, organizations continue to face many challenges in terms of applying AI, such as a lack of talent with the appropriate skills, or organizations being unclear about what AI can do for them. Tarafdar et al. (2019) argue that AI technologies do not deliver value by the organization merely processing data and delivering outputs, but also by changing their behavior, procedures, policies, and practices. Many companies face significant challenges when it comes to acquiring and recruiting AI, skilled employees (Kaplan and Haenlein, 2019). AI challenges business owners to rethink their business model, to embrace it as a driving force for economic success, and to adapt their business strategy and culture to digital age requirements. Such changes require organizations to develop and enforce their strategies in a different way. A recent study by Alsheibani et al. (2019) has found that top management support has emerged as one of the strongest determinants of AI adoption. This is consistent with a McKinsey Global Institute study which indicates that top management understanding and engagement have a significant positive influence on AI implementation (Chui, 2017). Therefore, we argue in line with previous studies, that organizational readiness and top management support is critical for successfully addressing the changing business environment that AI poses to organizations.

Furthermore, the lack of access to quality data has dramatic adverse effects on an organization's production of active AI (Tarafdar et al., 2019). It can be challenging to develop AI applications without access to quality training data. Data quality is crucial for providing reliable insights and building confidence. Increasing a stable data storage system is not something you can improvise, but data readiness and planning must be a top concern for all AI applications (Chui, 2017). The lack of access to quality data has dramatic adverse effects on an organization's production of active AI. It can be challenging to develop AI applications without access to quality training data. We argue that business leaders can play a crucial role in identifying and evaluating the potential impact of opportunities and threats within their organizations and improving future capability. Given the challenges, it is no wonder that, at the beginning of 2019, most organizations are still gathering information about whether or not to adopt AI, and questioning its business impact and benefits.

In comparison to existing studies, this literature review shows that a number of IS research have studied the success factors associated with AI adoption at the organization level. However, AI drivers, challenges, and benefits from an organization's perspective have not been systematically explored. Moreover, to the best of our knowledge, there is very little academic research on the topic.

Research Design

To achieve our research objective, we made use of a two-step research approach based on (Fay et al. 2018; Wang et al. 2014). The first step involved a thorough and extensive review of existing AI studies and consultant reports. As a preliminary step and in line with (Krippendorff, 2018), in developing a theoretical foundation for conducting investigations into new IS phenomena such as AI, a concise analysis of the current literature body with the aim of contributing to clarification building was undertaken (Webster and Watson, 2002). As a result, we are reviewing AI factors from the relevant IT innovation literature at the organizational-level. The keywords used to scan for related papers included 'AI factors,' 'AI diffusion,' 'AI challenges' and their variations. A review database composed of a variety of high-level IS journals/conferences was used, along with online professional AI papers. A wide base of journal and AI conference papers was considering from the existing literature to review underlying AI dimensions or factors that lead to organizational adoption. Furthermore, we rely upon AI whitepapers and consultant industry reports (Accenture, 2019; ACS, 2019; Gartner, 2018; Infosys, 2017; MIT Sloan, 2019; McKinsey, 2019) to understand the characteristics of AI technology (Fay et al., 2018). Based on the findings, we identified five challenges that have been described as major determinants of the organization's implementation of AI technologies: AI business case, relative benefit, top management support, effective use of data, AI talent, and AI compatibility.

The second step involves the collection of evidence regarding several AI application scenarios by various companies in order to provide a sound basis for addressing the research questions (Fay et al., 2018). Therefore, we analyzed the top 100 AI organizations listed by the CB Insight consulting company. In line with Molla et al. (2009) the attention was on determining exactly how the organizations deal with AI adoption and if there are any commonly-encountered barriers. To further inform our data, we use the

Crunchbase and LinkedIn.com databases in order to identify the roles of individuals Information System (IS) in the organizations, and to enable the outcomes to be more generalizable (Riasanow et al., 2018). In IS literature, data obtained from CB Insight, CrunchBase, or LinkedIn are increasingly used in research. For example, Marra et al. (2015) and Riasanow et al. (2018) used Crunchbase database to derive the roles of blockchain in the ecosystem and identify its value propositions. Alsheibani et al. (2019) utilized the LinkedIn.com database to reach a large number of respondents who are highly diverse in terms of their characteristics such as position, educational level and geographical location within Australia. We use Crunchbase for obtaining a description of such organizations. The Crunchbase provides access to complete organizational structures and information on company acquisitions. The LinkedIn database profile provides information on each case, consisting of the organization’s size, its location, and its primary role (firms, group, investor). We excluded 10 companies because we were unable to obtain sufficient information as the listed companies’ websites could not be found in the Crunchbase database. The final dataset includes 90 companies founded between 2009 and 2018. Next, we employ content analysis as the research approach to analyze our cases and to generate insights and valid references from the data sources (Krippendorff, 2018). Content analysis is a research technique for the systematic and quantitative description of unorganized material, and one which can cope with large volumes of data (Huang, 2007; Fay et al., 2018). Besides, we also rely on content analysis from multiple sources such as practical journals, case collections, and company and consultants' reports to analyze AI cases. In order to structure the content analysis, we developed coded information of the top AI cases in terms of key drivers, barriers, success factors, and business benefits based on Fay et al. (2018) and Riasanow et al. (2017).

Results

With this two-step method, the development of each the challenges we identified, were either predefined due to conceptual preliminary criteria, or originated from a recurrent text pattern (Nischak et al., 2018). Table 1 shows the results of the content analysis of companies relying on AI technologies and covering various application scenarios. Due to the paper length limitations, we have presented only two cases to illustrate the type of data gathered from the 90 companies in the data set. In addition, these two-steps help us to achieve preliminary findings that will serve as the basis for key research questions.

The geographic distribution of the 100 AI organizations chosen represented organizations from 17 different countries. Records from CB Insight (2018) showed that \$3.8B of funding for these 100 emerging companies has been raised. Based on the technologies used, we notice that organizations are applying AI to customer service, marketing, research and development. As we observe from the initial content analysis, every organization's AI driver is unique, as is its application of AI. Generally, there is no “one best solution for AI adoption.” Almost every AI use case indicates that there is a demand for different mechanisms, data, and training processes and that every organization is at a different place in terms of its AI development. Clearly, with AI, the technical challenge aspect is just one part of the task, and arguably this is the most straightforward part to address. In terms of AI implementation drivers, we observe that many of them are related to increased efficiency in the context of increasing competitive pressure, or the need to improve customer satisfaction to increase business, e.g. by identify users' needs and create the right digital experience for them in real-time. Among the most common platform functionalities is machine learning, computer vision, and smart robotics.

Categories	BloomReach	Tempus
Industry	E-Commerce	Healthcare
AI business case	Improved personalized search and connected content, providing a dynamic back-end experience to create relevant brand experiences at scale (e.g. Building forecast models to deliver seamless experiences at scale, new business platform to powering connected experiences for people and business)	Empower physicians to make data-driven decisions, redefine how genomic data is used in a clinical setting and find new drugs based on previous data and medical intelligence (e.g. Provide patients with personalized cancer care through their interactive analytical and machine learning platform, building the world’s largest library of molecular and clinical data and a platform to battle cancer)
Relative benefits of AI	Improve the customer experience, identify users' needs and create the right digital experience for them in real-time.	Improved business efficiency by identifying new ways of automating business and bring customers closer to the organization.

Top management support	Put a team in place, including data scientists, AI experts, operational managers, and commercial leads. The clear goal where you want to create value.	Ensure that the right people have access to the right data, establish authority and governance to allow AI technology to be embedded across business units and functions.
Effective use of data	Relevance collector interface collecting and analyzing visitor data.	Analyze molecular and therapeutic data.
AI talent	Building capabilities in-house	Certifying capabilities from large technology firms and hiring external talent.
AI compatibility	Clear process to links data science competence to business value.	Crating business rules that shape how the outputs from the algorithm are handled by the AI application.

Table 1. AI application case description

Discussion of AI Challenges

This study examines the challenges of AI technology at the organization level. While each organization is different, our analysis of AI case studies demonstrates the many successful organizations rely on a set of AI capabilities. We identified six AI challenges (Figure 1), namely AI business case, relative benefits of AI, top management support, effective use of data, AI talent, AI compatibility. By collecting the data with regard to several publicly-available descriptions of cases, we formulated our findings in a series of questions related to overcoming these AI challenges, and systematically assessing and identifying the strategy needed to utilize AI benefits.

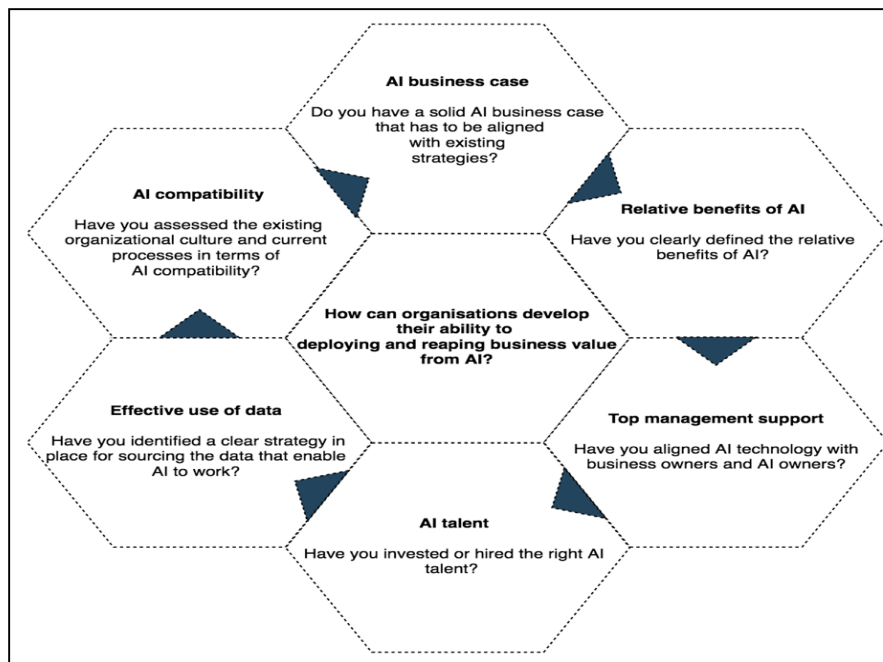


Figure 1. Six-steps AI Challenges Framework

AI business case: Do you have a solid AI business case that has to be aligned with existing strategies? A solid business case provides a precise determination of what an AI technology will do and demonstrates how its algorithms will enhance the execution and outcomes of a business process or set of processes. According to a MITSlan report (2019), an AI business case typically includes a description of the application that sets out how the organization is going to use it, what data is going to be required, and the existence of an AI expert to identify which algorithm to use. Gartner’s (2019) study finds that a significant relationship between defining the type of problem and determining if it is compatible with the use of AI techniques is essential for AI adoption success. With regard to developing a realistic AI use case, we observe that most realistic AI cases from the top 100 companies were based on a clear business problem that was aligned with

existing strategies to demonstrate the value from the use of AI. For example, Freenome Holdings Inc. suggested a new drug based on previous data and medical intelligence, which enabled early diagnosis (Freenome, 2019); BloomReach Inc. developed an AI-driven site search to improve customer service response suggestions using target audiences with regard to the best products (BloomReach, 2019), and Shape Security leveraged autonomous AI security systems to defeat attackers and prevent fraud. Organization leaders need to understand their processes and the challenges that exist, and then classify opportunities where AI can play a role (Gartner, 2019).

Relative benefits of AI: Have you clearly defined the relative benefits of AI? Understanding what AI does and knowing what AI performance benefits exist is one; understanding whether to apply or benefit from the use of AI principles is much more complicated. An early observation of the implementation of AI technology indicates that such technologies can deliver no results, or uncertain or unpredictable ones, and raise new challenges and questions about the long-term effects of AI investments in organizations. Strategic benefits include preparing for the company-wide effects identified by AI technologies. We observe that many organizations have introduced new services around conventional products to enhanced customer service and not to lose market share. Moreover, as we observe from the initial content analysis of several available description cases, AI enables advantages such as accelerating conversions in order to increase revenue, improving asset utilization and providing real-time insights in terms of business goals. For example, according to Kenny Daniel, Algorithmia co-founder, “The future is already invented; it just happens to be stuck in a research paper somewhere.” Algorithmia started as a platform for algorithms used exclusively by independent users and then evolved to a more integrated network solution for large organizations (D’Onfro, 2019). In addition, our findings suggest that organizations implement AI in practical environments where they are expected to have existing computing applications in their environments of service.

Top management support: Have you aligned AI technology with business owners and AI owners? Gaining advantages from AI innovation involves not only the organization-wide introduction of these innovations, but also through the dedication and engagement of top-level AI implementation management (Yao et al., 2018). Business owners explore AI technology can’t leave these solely to the technologists; these issue require industry expertise cooperation with business owners. A study by Tarafdar et al. (2019) states that having the right AI expert and data skills isn’t sufficient for success. Our preliminary results show that the chief executive officer (CEO) or business owner comes out strongly in favour of AI initiatives for successful implementation. Furthermore, business owners have shown a significant role in prioritizing and making sound decisions about how, when and where to deploy AI. For example, Stuart Frankel is the Founder and CEO of Narrative Science. He said “...the next frontier for AI is getting it into everyone's hands” (Narrative, 2019). Chih-Han Yu is CEO and co-founder of Appier and said: “We believe artificial intelligence can solve many challenges faced by today’s enterprises.” (Appier, 2018). This is supported by Google, Amazon, IBM, Apple, and others, all of which have leveraged AI to prioritizing AI organization-wide. The Google CEO, Sundar Pichai, stated, “we will move from mobile-first to an AI-first world” (Donfro, 2016). Most successful AI companies typically have outstanding business leadership and financial in the area of the introduction of AI vision with regard to their projects. According to the Deep Knowledge Analytics study of the top AI-100, leaders are usually characterized by their ability to incorporate high-level interdisciplinary expertise between both technical and life sciences. We observed from case analysis that the interaction between senior executives, AI experts, data scientists, and operations team are necessary when it comes to driving AI success. Therefore, we argue that top management and business owners have determined that finding the right approach to AI is in their organization’s best interests. To ensure the effective and pervasive adoption of AI, organizations need to actively align AI (data, techniques) with the support of business owners and AI owners.

Effective use of data: Have you identified a clear strategy for sourcing the data that enable AI to work? AI Data refer to “containing both the amount and structure of the data to getting AI systems to work by enabling high-velocity capture, discovery or analysis” (Alsheibani et al. 2019). Looking at AI technologies and data use, organizations are adopting AI in parts for which they already have some data in place. Most successful AI companies have built most of their models based on some input data. We observe that many organizations rely on AI technology to benefit from their data to embedded system data or perform real-time analysis that is being collected and integrated on one platform. For example, Tempus has structured thousands of data records, laboratory documents, pathology photographs, and radiology data to identify

treatment options tailored to each patient. The Mazdak Rezvani CEO, Mazdak Rezvani, said, “One of the big challenges in AI is that the data you want is never in one place, it’s in 12 different places.” Moreover, Tamr, an enterprise data unification company, applies an AI algorithm and machine learning to clean and organize “dirty data” that is incomplete or inconsistent. The system automatically detects data sources across an organization that might be useful and brings them together and then marks the code to instruct employees on how to implement them. With regard to data types, we observe a number of types of data used for AI, including structured data (e.g. Tempus), images (e.g. Socure Inc.), video (e.g. Mobalytics), and text (e.g. Text IQ, BloomReach).

AI talent: Have you invested or hired the right AI talent? With regards to organization skills to evaluate, build and deploy AI solutions, the AI companies prioritize technological capabilities and algorithms rather than the effects and benefits of the business. AI talents refer to all those individuals within or outside an organization that is involved in creating AI technologies. Our analysis of the LinkedIn data found that most organizations have identified clear role when it comes to developing AI from individuals with responsibility for implementing the data. Most commonly, organizations are more focused on developing internal AI capabilities that require internal talent with the right skills. In cybersecurity, Co-founders George Kurtz of CrowdStrike realized that speed and scale matter. He said, “This is exactly where AI adds a significant advantage to corporate security methods.”(CrowdStrike, 2018). CrowdStrike combines the most advanced endpoint protection with expert intelligence to identify the attacking opponents, not just malware. Organizations need to align AI to their core business, understanding the right techniques for any problems that exist and managing AI application learning. It is recommended that any successful strategy for acquiring AI skills, aimed at the adoption of AI within an organization must include a wide range of different roles and departments.

AI compatibility: Have you measured AI compatibility with the internal organization structure and current processes? AI requires not only possessing the right technical knowledge to construct an AI algorithm, but also a domain specialist who knows the activities, workflows and reasoning of current business processes, and the capacity to analyze whether AI programs can enhance them (Tarafdar et al., 2019). With the power to develop itself, AI offers a new strategic approach towards business decision-making and leads to new ways of creating value that are not well known (Davenport, 2018). According to Hengstler et al (2018), radical innovation implies a high level of organizational uncertainty, technical skills and resources, which may lead to extended project maturity durations and unpredictable development. It can be anticipated that the radical innovation of AI will trigger significant organizational changes through the introduction of new process technology and organizational practices. In addition, we observe that organizations that effectively generate value from AI have invested in or trained AI expertise specialists and data scientists. For example, Tempus is a data-driven precision medicine company that has combined big data and AI teams to discover rapidly the correct integration of drugs and diseases at the system level. Tempus domain experts and data scientists have collected and analyzed thousands of medical and molecular data reports and radiology tests to gather phenotypic, therapeutic and outcome data to understand the clinical history of each patient. They also connect doctors based on their unique molecular profile and machine-learning algorithms with up-to-date treatment options and relevant insights for patients. Therefore, they were able to retrain their AI algorithms. Predicting these changes is important for determining the best strategies for coping with the problem and handling the preparation of AI applications, which can predict trends that can affect the efficiency of interconnected AI components.

Conclusion and Future Work

In this paper, we have presented findings obtained from analyzing how organizations are leveraging their capability with regard to deploying AI and reaping its consequent business value. The development of the six-steps associated with meeting the AI adoption challenge provides a preliminary answer to our research questions. It is important to highlight that this study makes a useful contribution to our understanding of what AI is and how organizations evaluate AI value creation mechanisms. Thus, the integrative research for AI used in our research will offer an insight into, and a theoretical explanation of, this ‘old’ but emerging technology area that has become widely popular. This will enable us to develop a framework with a sound theoretical foundation to conduct investigations in real-life organizational settings (Yin, 2017).

Our results identify a number of implications for practice. First, the present study proposes that the six-step approach could be appropriately used to assist organizations in adopting AI, and in allowing them to overcome the issues and challenges associated with such a process. They can also be used by decision-makers to implement measures that can support the technology infrastructure, increase an organization's readiness for AI adoption, and its ability to make use of AI benefits. Second, we provide the support that would help overcome managerial obstacles to the adoption of AI that directly influence such an introduction. More specifically, having the necessary technical resources and AI skills in place is only part of the picture. The research provides insights into factors relevant to the adoption of AI use, and the design of the economic implementation of AI technologies. These findings show that AI presents many of the same issues and challenges as other innovations; however other challenges such as uncertainty in terms of AI capability and the potential increase in business value IS have distinguished it from other digital technologies. Therefore, future research could also collect more data in this respect to provide an even richer understanding of this phenomenon. Furthermore, considering other organizational aspects such as culture would allow us to structure a more comprehensive AI challenge overview, and obtain recommendations for practitioners with regard to extracting value from AI in specific process contexts. We hope that our research will provide a fruitful foundation for further studies. With the latest insights from the related literature, this study has built the foundation for case study interview guidelines. Next, we aim to develop our research by gaining a deeper understanding of new organizational mechanisms, and their influence on successfully managing AI initiatives. To assist organizations with these challenges, we anticipate three actionable outcomes of this research. First, we will provide the foundation for business owners to understand the common difficulties that tend to stall AI initiatives, and negatively impact on the business value creation mechanisms associated with AI. Second, we will develop a framework that illustrates the typical capabilities developed through the analysis of AI cases that includes those identified as relevant within organizational contexts. The aim of this is to provide the business leader with concrete AI examples. Finally, we will share knowledge from the interviewed participants regarding their advice on deploying AI and reaping the consequent business value.

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