

Research Article

ARTIFICIAL INTELLIGENCE EFFECTS ON STRATEGIC INNOVATION: THE MODERATING ROLE OF STRATEGIC FLEXIBILITY

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ABSTRACT

In the evolutive context of Artificial Intelligence, we investigate the relationship between AI adoption and strategic innovation. We propose a new conceptual model through which we analyse the effect of AI capabilities, governance and data analytics on renovating business models. We also propose an analysis on technological innovations. This is a conceptual article based on multiple recent scientific literatures and focused on research gaps identified on the field at the intersection of AI and innovation. We propose within this article a conceptual framework to be tested by a quantitative study with a focus on organizations that implemented Artificial Intelligence in their strategy to see the reflect on its strategic innovation. We anticipate that AI capabilities and Strategic Flexibility can help organizations redesign their business models or create a new one. An advanced AI capabilities lead to competitive new business models with high effects on new products and processes. Therefore, the results of this study will help current and future organizations effectively improve AI integration, define an adequate AI strategy and use AI technology to serve the strategic innovation.

Keywords: Digital Transformation, Artificial Intelligence, Strategic Innovation, Strategy, Data Analytics, Information Technology Management, Strategic Flexibility, Governance.

INTRODUCTION

In recent decades, there has been a growing focus on technological advancements in businesses, as companies are quickly learning to leverage technology to improve their creativity and efficiency [1, 2]. In particular, Artificial Intelligence (AI) has emerged as a revolutionary technology influencing different industries. More specifically, AI is allowing firms to constantly innovate in the digital age. The relationship between AI and innovation has been the object of increasing scholarly attention over the last few decades [3,4,5]. Researchers recommend investigating more this relationship due to its high importance.

Despite the growing use of AI in organizations, its precise impact on strategic innovation remains unclear. Strategic innovation has been described as the fundamental reconsidering and revamping business strategies, models, and approaches in order to generate substantial new value for a company, customers, and stakeholders [6,7]. The impact of AI adoption on strategic innovation is little addressed in the literature especially in a dynamic environment where strategic flexibility plays a critical role [8, 9]. Our research aims to understand AI adoption in relation to strategic innovation outcomes by addressing the following research question:

How artificial intelligence affects strategic innovations with the moderating role of strategic flexibility?

To answer these questions which represent interesting research gaps that we want to investigate in this work, we conducted a literature review of existing research linked to our research questions and the objectives are to analyze and conceptualize the relationships between AI adoption, strategic innovation and strategic flexibility. Based on recent literature review, we propose a new conceptual

model that describes how AI adoption impacts strategic innovation through the development of Hypothesis between variables and the study of the moderating effect of strategic flexibility.

The rest of the paper is organized as follows. In the next section we introduce the relevant literature around AI adoption in organizations through investigating AI capabilities, AI governance and AI analytics in scientific literature as well as the impact of AI adoption on strategic innovation within strategic flexibility influence. Next, in Section 3, we describe the proposed conceptual model with the definition of new variables and new hypotheses and an analysis of the relationships between these variables. The paper then discusses the theoretical and practical implications of this research, as well as some important limitations and future research recommendations.

LITERATURE REVIEW

AI adoption in organizations

AI Capabilities

AI capabilities in scientific literature are mentioned as relevant and at the same time the definition of what are AI capabilities differs between academics. Commonly, it refers to technological functions and methods that enable systems to perform tasks involving learning, reasoning, decision-making, and interaction. In this study, we will focus on 3 concepts of AI Capabilities: AI ambidexterity, AI conceptualization and AI resource orchestration.

- *AI Ambidexterity:*

Artificial intelligence in firms can be used differently: as a routine tools with the same inputs and outputs or as a creative application with innovative effects. This is the ambidexterity of AI capabilities. Both AI modes are utilized concurrently by businesses to analyze extensive amounts of real-time data, recognize customer demands and

behaviors, uncover trends, identify patterns, and extract crucial information for decision-making [10,11,12]. AI ambidexterity streamlines how businesses can organize and harness their resources, expertise, and previously separate abilities [13,14]. Moreover, it provides companies with the tools necessary to transform their operational procedures by leveraging advanced smart technologies and algorithms [15].

- *AI Conceptualization*

Although the limited scientific published research on the use and the application of AI in organizations, some studies identified that the development of AI projects faces many obstacles [16]. For example, Ransbotham *et al.*, [16] finds that a lack of technology competence is one of the biggest inhibitors of deriving value from AI. Some other research explored AI driven business model, organizational decision-making related to AI, and ways in which companies can build trust in successful AI integration. For Mikalef and Gupta [17], enhancing AI capabilities is linked to human talents, tangible resources, and intangible resources that can enhance organizational innovation and performance, based on an extensive survey study. Furthermore, based on studies about AI capabilities, companies must possess specific essential resources to build the capability necessary for implementing AI and benefiting from improved performance and innovation opportunities [17,18,19]. Then, it is important for businesses to understand AI capabilities by defining, categorizing, and measuring the various functions AI systems can perform. This structured understanding is essential to use AI and benefit from its contribution to innovation, performance and efficiency.

- *AI Resource Orchestration*

Resource orchestration involves efficiently arranging a company's resources, combining existing resources to create new capabilities, and utilizing them to improve business and customer value [20]. The manner in which a company organizes its collection of resources impacts both the tangible and intangible assets it possesses, ultimately influencing the potential value it can generate at any given moment [21]. AI resource orchestration is essential to create new skills, new methods, and new revolutionary products. In AI deployments, developed AI capabilities must be effectively coordinated and integrated with other organizational capabilities to implement the leveraging strategy successfully and generate value and innovation outcomes [20].

Responsible AI Governance

Despite not having a precise definition, there is an increasing agreement on the importance of responsible AI governance [22]. It is a function that outlines the different ethical guidelines that pertain to AI. It could also be defined as a process that covers all stages of AI project life cycles by following the principles of responsible use [23]. Examining the influence of responsible AI governance on businesses' ability to implement changes in products, procedures, and services, and comparing performance gains with competitors is essential [24]. Various strategies can be employed by companies for regulating AI[25]. This consists of structured systems connecting business, IT, data, model, and machine learning functions, structured procedures and processes for decision-making and monitoring, and additional practices promoting stakeholder engagement and collaboration [26]. According to literature on IT governance, governance methods can be categorized into three types: Structural, procedural, and relational.

- *Structural Mechanisms*

Structural governance processes define reporting frameworks, governing bodies, and accountability [27]. They involve delegating decision-making power along with specific responsibilities and tasks. The creation of AI systems requires expertise in various fields [28]. To handle the complex relationship between model outputs, training data, and regulatory and business requirements, it might be essential to establish an interdisciplinary AI governance council as suggested for AI [29]. These mechanisms ensure that AI integration is aligned with strategic objectives, properly resourced, and capable of delivering value consistently and ethically.

- *Procedural Mechanisms*

Procedural governance mechanisms aim to ensure that AI systems and ML models operate effectively, securely, and in compliance with all relevant laws, regulations, and company internal rules regarding explain ability, fairness, accountability, security, and safety. Procedural methods also aim to guarantee the relevance of data, model, and system features [28].

These procedural mechanisms focus on how AI initiatives are executed and controlled on a day-to-day basis. According to EU AI Act, published in the Official Journal (OJ) of the European Union on 12 July 2024, the AI Office will be established, sitting within the Commission, to monitor the effective implementation and compliance of AI model providers and investigate systemic risks, particularly following a qualified report from the scientific panel of independent experts [30]. This constitutes the first set of worldwide rules on AI.

- *Relational Mechanisms*

Relational governance frameworks facilitate cooperation among stakeholders. They include communication, training, and coordinating decision-making [31]. An interdisciplinary AI team should utilize a collaborative development platform to enhance communication. According to Mikalef and Gupta [17], having technical and business knowledge are essential competencies in the field of AI. These mechanisms are crucial for promoting trust, knowledge sharing and alignment with the business strategy. Developing AI applications responsibly and in collaboration among different stakeholders involved in AI initiatives offers ethical and moral benefits, along with the opportunity to provide organizations with a competitive advantage in the medium to long term [32].

AI Analytics

AI and big data analytics are closely connected in both academic research and real-world use cases. Literature reviews in this field highlight the importance of AI methods in obtaining practical information from large data sets, processing data and predicting new insights. The combination of AI and big data analytics has sped up, allowing organizations to analyze vast amounts of real-time data for better decision-making and predictive insights. Machine learning and deep learning methods are being more commonly used on unorganized data in industries like healthcare, finance, and retail. In fact, AI-powered analytics utilizing big data has transformed uses in different sectors such as personalized healthcare, immediate financial trading, and predictive maintenance within manufacturing. AI models can achieve higher accuracy in detecting patterns and predicting outcomes by processing large datasets effectively [33]. Despite the vast potential of AI and big data analytics, there are still major challenges related to data governance, privacy, and the interpretability of AI models. The complexity of merging various datasets and meeting regulatory standards adds to these

challenges[34]. AI and big data analytics field continues to evolve, driven by advances in AI algorithms, data processing technologies, and ethical considerations and it represents a good line of research.

AI adoption and Strategic Innovation

Recent research emphasizes that the integration of AI has a major influence on innovation by speeding up processes, boosting creativity, enhancing customer focus, optimizing research and development, and revolutionizing business models [35,36,37,38,39,40]. In this study, we will focus on three major categories of strategic innovation consequences: product innovation, process innovation, business model innovation.

AI and Product Innovation

According to some recent literature reviews, AI plays a crucial role in advancing product innovation across industries [41,42, 43]. Indeed, AI deployment helps companies understanding market potential for new products/services. AI facilitates innovation analysis which aids companies in leveraging and exploring product innovation, ultimately enabling quick product launches to the market. In addition, AI and analytics help businesses reduce risk associated with innovation and enhance innovation objectives. Furthermore, AI can reduce the costs of product innovation, which improves the quality of existing products and allows firms to create new products [44,45]. Empirically, we find that firms with larger AI investments see increased product innovation[46]. Then, we conclude that AI has a transformative impact on product innovation across multiple dimensions.

AI and Process Innovation

Integrating AI into operations assists companies in revamping their processes for innovation, alongside other digital technologies, aiding in product/service adaptation or replacement, enhancing value creation, and boosting technological capabilities [47,48,49,50,51,52,53,54,55]. In fact, AI based technologies helps firms in understanding their actual processes, detect imperfections, predict possible risk and by consequence act to correct actual processes or renew them. Moreover, AI promotes the adoption of more sustainable practices within business operations [51], and aids companies in revamping their processes to make a significant impact in the business sector. The utilization of AI technology enhances company performance as businesses quickly adapt to market needs, resulting in a higher competitive edge [49].

AI and Business Model Innovation

AI is a strong catalyst for business model innovation, leading to shifts in how companies generate, provide, and benefit from value. In fact, A business model innovation is described as a significant alteration to a company's value proposition, impacting the way value is created, appropriated, or delivered [56]. According to literature research, several prosperous companies have integrated artificial intelligence into their processes and established innovative AI-driven business strategies [57,58,59 ,60,61,62,63,64,65]. AI-powered analytics offer immediate insights into customer behavior, industry trends, and operational effectiveness. By utilizing data for decision-making, businesses can constantly improve their strategies, uncover new growth possibilities, and adapt their business models faster than ever. By consequence, businesses that effectively incorporate AI into their business models and operations can generate significant innovation that changes their entire value chains, according to Wamba-Taguimdje *et al.*, [64]. Furthermore, multiple thriving companies have integrated AI into their processes and crafted original business

models based on AI technology [60], generating fresh value for interested parties [59]. By conclusion, AI helps firms innovate their business models and generates value in two ways: The improvement of the actual business model or the renewal of it based on AI capabilities.

The moderating effect of Strategic Flexibility

Many academics contend that strategic flexibility develops a portfolio packed to implement a variety of contingent strategies and motivates the organization's IT and business resources to be renewed in order to achieve operational capability-level efficiencies, business/IT alignment, quality improvement, and innovativeness [66,67,68,69]. To begin with, strategic flexibility refers to a company's ability to effectively manage risks in order to react proactively to external changes such as opportunities and threats [70]. Sanchez [71] breaks down strategic flexibility into two components: resource flexibility and coordination flexibility, which consider the flexibility of firm resources themselves and the flexibility in how these resources are coordinated. Additionally, strategic flexibility encompasses a company's capacity to adapt its available resources (resource flexibility) and effectively employ them (coordination flexibility) [71]. Resource flexibility is defined by a firm's resources being versatile, shareable, and adaptable. Organizational flexibility involves the capacity of organizations to distribute and modify their internal assets. Both resource and coordination flexibility enable firms to restructure and improve operational practices and capacities and accelerate the adoption of digital technologies [7]. Moreover, strategic flexibility enables organizations to create the best possible business strategies and the skills required to implement the core strategy. Furthermore, it might improve their operational ambidexterity or a dual digitalization framework to operational capabilities, or their operational exploration and exploitation capability [72,73,68,9]. Therefore, companies need to be strategically flexible because they must reassess their current operating models and adapt as quickly as their environment [69,74,75,76].

DEVELOPMENT OF HYPOTHESIS AND CONCEPTUAL MODEL

In this study, we had a focus on the relationship between Artificial Intelligence and strategic innovation through analyzing the adoption of AI in firms and its impact on innovation. We investigated through a rich recent literature review this relationship from different points of view especially from a strategic perspective. As a result, we tried to conceptualize the theoretical findings of our research, define some hypothesis based on our analyzing and propose a new conceptual framework.

- **Definition of variables:**

To start with, we studied the AI adoption through 3 variables: AI capabilities (AICA), AI Responsible Governance (AIRG) and AI Analytics (AIAN) as an independent variables. Then, we conceptualize the strategic innovation as a dependent variable named Innovation Outcomes (IO). Finally, we had a particular interest in analyzing the relationship between AI adoption, strategic flexibility and innovation outcomes, so we defined the variable Strategic Flexibility (SF). The following table summarizes our model variables:

Variable	Type	Items
AI capabilities(AICA)	Independent variable	AI Orchestration
		AI Ambidexterity
		AI Conceptualization
AI Responsible Governance(AIRG)	Independent variable	Structural Mechanism
		Procedural Mechanisms
		Relational Mechanisms
AI Analytics(AIAN)	Independent variable	Data Collection
		Data Processing
		Data Prediction
Innovation Outcomes(IO)	Dependent variable	Business Model Innovation
		Product Innovation
		Process Innovation
Strategic Flexibility(SF)	Moderator variable	Resource Flexibility
		Coordination Flexibility

Fig.1. Variables definition (Own elaboration)

• **Development of hypotheses**

According to literature review, technological advancements and especially the integration of AI are key drivers of innovation outcomes in organizations. In this study, we propose to investigate more the relation AI-Innovation through the following hypotheses.

Hypothesis 1 (H1) :

There is a positive relationship between AI capabilities and innovation outcomes.

AI Capabilities allow companies to examine large volumes of data, forecast patterns, and streamline repetitive responsibilities. This enables businesses to discover fresh possibilities, streamline R&D procedures, and improve decision-making. For example, AI Ambidexterity offers businesses the necessary tools to revolutionize their operational processes through the utilization of advanced smart technologies [15]. In addition, AI conceptualization allows the structured understanding of AI integration and by consequence foster innovation outcomes [17,18]. Furthermore, AI resource or chest ration is essential to create new products, new processes, and revolutionary business models [20].Then, we state that AI capabilities influence positively innovation outcomes.

Hypothesis 2 (H2) :

There is a positive relationship between AI Responsible Governance and innovation outcomes.

While there is increasing attention on AI ethics and governance, there is limited research on how these governance practices specifically influence innovation outcomes. We state that by implementing responsible AI governance practices, innovation outcomes are improved as it builds trust, minimizes risks, and improves the social acceptance of new products and services. In fact, AI Responsible Governance through its structural, procedural and relational mechanisms provides ethical and moral advantages, as well as the chance to give companies a competitive edge through their products and services [28,29,32].

Hypothesis 3 (H3) :

There is a positive relationship between AI Analytics and innovation outcomes.

The importance of AI analytics in innovation is firmly established in theories of innovation management and decision-making.AI analytics allows organizations to identify patterns, forecast consumer actions, and enhance operations, all of which are essential for fostering creativity and innovation [33]. Research from McKinsey & Company shows also that companies utilizing AI analytics experience increased growth rates and more new product introductions in comparison to those that do not [77]. Then, we state that AI analytics have a positive influence on innovation results through offering data-based insights that improve business models, speed up product development, and streamline innovation processes.

Hypothesis 4 (H4) :

Strategic flexibility moderate positively the relationship between AI adoption and innovation outcomes.

As discussed in the literature review part, Strategic Flexibility through resource and coordination flexibility allows firms to quickly adjust and reorganize their resources, strategies, and operations based on changing circumstances [7,69,74]. AI has the potential to provide organizations with valuable insights and foster innovation, additionally if the firm is strategically flexible, the insights will be applied effectively. For example, If AI analytics show a change in consumer preferences or new market trends, a strategically flexible company can quickly innovate by changing its focus in research and development, modifying products, or expanding into different markets. For that, we state that Strategic Flexibility positively moderates the relationship between AI capabilities and innovation outcomes in a way that firms with higher strategic flexibility achieve greater innovation benefits from their AI capabilities compared to firms with lower strategic flexibility.

• **Conceptual model:**

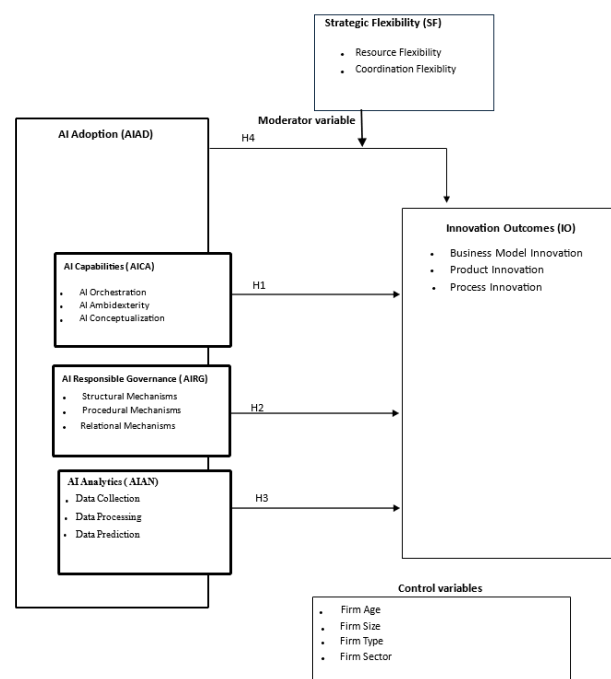


Fig.2. Conceptual model (Own Elaboration)

In this study, we propose this innovative conceptual model where we resume variables that we have defined and different relationships and hypotheses that we have investigated.

In addition to different relationships between AI Adoption variables and Innovation Outcomes, the moderating impact of Strategic

Flexibility, we propose also some control variables like Firm Age, Firm Size, Firm Type and Firm Sector that influence how AI adoption impacts Innovation Outcomes.

DISCUSSION

In order to help organizations benefit from AI integration, take advantage from innovation capacities and have an improved products, processes and business models, we conducted this research with a focus on extremely important relationships. The conceptual model proposed in this study helps firms understand AI adoption and how this technology can be used to benefit innovation outcomes. It highlights also the crucial role of the strategic flexibility for organizational adaptation and innovation using AI based technologies.

The results of the research provide a more in-depth view of the impact of AI capabilities on companies. While the relationship between AI capabilities and innovation is gaining traction and has inspired a growing number of reviews in multiple domains, there is still limited understanding of the influence of AI capabilities on innovation outcomes. Thus, we provide new insights and a more comprehensive view of the influence of AI adoption through AI capabilities. Our research proposes to shed light on AI Ambidexterity, AI conceptualization and AI resource orchestration rarely aborded as AI capabilities in scientific literature. These AI capabilities are essential for organizations to have significant competitive edge, to be able to listen to market trends and propose new products, services and improvements on their processes.

Additionally, we encourage businesses to use AI Analytics in their strategies as crucial organizational resources to enhance dynamic capabilities and fully utilize their strategic potential. AI Analytics enable the examination of large quantities of real-time data to enhance decision-making and provide predictive insights. Then, organizations using AI Analytics have a competitive advantage especially in innovation.

Furthermore, our model proposes to firms to use a responsible AI governance framework to create innovative and ethical solutions. Top management should take into account that a good AI governance has a direct impact on an organization's results and in particular innovation results by building trust, minimizing risk and by consequence improving the strategic innovation and its outcomes. Therefore, a good understanding of AI governance will be very important for businesses hoping to have ethical and social acceptance of their products and services.

Finally, we discussed in this research an important novelty. We have seen how firms can use AI to innovate their business models in two ways: Enhancing the current business model or updating it by leveraging AI capabilities especially with the positive impact of strategic flexibility. Companies that effectively utilize AI can improve their existing operations and also introduce new and innovative business models that change industries and establish new markets (eg. Uber, Netflix). The impact of AI varies based on factors such as industry environment, firm sector, firm type, firm age, firm size, strategic adaptability of the company, and the particular AI tools used. The proposed conceptual model helps companies to understand different elements needed to successfully use AI and integrate this technology to have a considerable strategic innovation advantage.

CONCLUSIONS

In this research, we study the impact of Artificial Intelligence on innovation in organizations. In particular, we investigate how Artificial Intelligence affects strategic innovation with the moderating role of strategic flexibility. We constructed a conceptual model to investigate this research question where we defined new variables and their items, different relationships and four hypotheses that has been stated based on recent literature review and personal analysis.

Our findings claim that the adoption of AI in a firm impacts positively the strategic innovation. First, AI capabilities have a positive impact on innovation results. Managers can use AI capabilities to have significant innovation competitive edge. In addition, this study encourages businesses to use AI Analytics and responsible AI governance to create innovative and ethical solutions. Furthermore, we recommend using Artificial Intelligence capabilities with strategic flexibility to allow firms quickly adjust and reorganize their resources, strategies, operations, propose innovative products, processes and renew business models or adapt it.

This study has several limitations that future research can address. First, the conceptual model proposed in this paper is theoretical. We encourage future studies to confirm this model's hypothesis using an empirical approach. Second, we studied the role of strategic flexibility in the impact of AI on innovation. Future researchers can investigate these relationships through other variables like entrepreneurial orientation and learning orientation. Third, based on literature review, certain studies have suggested that companies can choose to either create digital technologies internally or outsource them [78]. Further studies could explore different approaches to adopting AI (Internally vs. Outsourcing) and its impact on innovation. Fourth, innovation literature has emphasized that firm size and firm type matters as it influences the relationship between AI and innovation [79,80]. Future research might shed light on the moderating impact of these elements on organizational adoption of AI and ultimately on AI-enabled innovations. Last but not least, we invite researchers to investigate more this special relationship between Artificial Intelligence adoption and the renovation of firm's business models, an important strategic research field for organizations.

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Not Applicable.

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