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The Impact of Artificial Intelligence Capabilities on Objective Firm Performance

Research in Progress Paper

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Abstract

A considerable number of firms are investing in AI technologies as a growing field in industry and research, expecting them to boost revenues, lower costs, and improve business efficiency. However, recent research shows mixed results for AI project adoption. Besides, recent studies highlight the importance of using objective performance indicators to minimise self-reporting bias, but few studies show how to measure AI capability's impact using objective metrics. This research will bridge gaps in previous studies by objectively quantifying AI capability's impact on company performance. This study will explore how to acquire objective data in China, which has distinct open data potential yet differs from Western countries in data accessibility. The resource-based view (RBV) and recent literature are used to conceptualise AI capabilities and company performance in a proposed model. This study expects to contribute to AI capability research by investigating how AI capabilities influence firm performance by combining self-report and objective measures.

Keywords *AI capabilities, firm performance, objective measures, value of AI, value of IS*

Introduction

Research and industry alike view artificial intelligence (AI) as a promising new area of study (Enholm et al., 2022; Mikalef & Gupta, 2021). Recent literature has shifted its attention to how to realise the value of AI capabilities (Abou-Foul et al., 2023; Madanaguli et al., 2024). According to recent literature, Artificial intelligence refers to the systematic identification, interpretation, inference, and learning of data to achieve organisational and societal goals (Enholm et al., 2022; Mikalef & Gupta, 2021). Artificial intelligence is expected from AI-adopting firms to realise multiple benefits to organisations, including increased revenues, reduced costs, and improved business efficiencies (Babina et al., 2024; Mor & Gupta, 2021), thus enhancing the overall competitiveness and sustainability of organisations (Wamba et al., 2024; Enholm et al., 2022). A recent study by Accenture (2024) found that nearly 75% of companies have incorporated AI into their business strategies, with a growing recognition that AI is critical to achieving competitive advantage. As a result, many organisations actively invest in AI technologies to achieve these goals. However, AI-adopting firms face many insurmountable barriers and challenges (Mikalef & Gupta, 2021), making it difficult for them to fully realise AI's value as expected (Fountain et al., 2019). Relevant studies revealed that one of the main reasons why AI has not yet achieved the desired results is that organisations have underestimated the complexity of AI technology (Alsheiabni et al., 2020) and are lagging in implementing and reorganising their resources (Mikalef & Gupta, 2021). Other research found that, to fully and effectively apply AI, organisations need to integrate multiple resources and build appropriate AI capabilities, AI technology alone is insufficient (Wamba et al., 2024).

This study adopted the definition of AI capabilities from Mikalef and Gupta (2021) and defined it as a firm's ability to build, bundle and utilise its AI resources, which includes AI-specific tangible, intangible, and human resources, which are essential for realising the full strategic potential of AI (Enholm et al., 2022). Furthermore, recent empirical research has shown that companies that have developed an AI strategy and focused on enhancing their organisation's AI capabilities have begun to reap the performance benefits (Mikalef & Gupta, 2021; Wamba et al., 2024). However, given many studies highlight the importance of adopting objective performance measures to reduce bias from the self-report approach, few studies have fully explained how to adopt objective firm performance metrics in measuring the value of AI capabilities (Enholm et al., 2022). To fill gaps in previous research, this research will explore appropriate objective methods for measuring the impact of AI capability on firm performance. At the same time, this work seeks to present an objective assessment approach for open data in China, which differs from Western countries in terms of data accessibility but offers a unique open data potential. To achieve this

objective, this study develops a research model with related hypotheses based on the resource-based view (RBV) and conceptualises AI capabilities based on recent studies (Enholm et al., 2022; Mikalef & Gupta, 2021). This study will adopt a survey research methodology to measure AI capabilities using primary data. Then, secondary data (financial indicators from two stock exchanges in Shanghai and Shenzhen, China) will be used to assess firm performance. Therefore, this study attempts to answer the following one research questions:

RQ: How do AI capabilities affect objective firm performance?

The remainder of this study is structured as follows: Section 2 articulates the literature review and research model. Section 3 describes the development of the research model and hypotheses. Section 4 describes the research methodology adopted to conduct this research. Finally, Section 5 describes the expected results and contributions of this study.

Literature Review and Research Model

Resource-based View

The firm's resource-based view (RBV) is the central theoretical perspective for understanding how the deployment of investments by firms in the organisational environment generates a competitive advantage and benefits the firm (Mikalef & Gupta, 2021). The RBV argues that a firm's competitive advantage is primarily determined by the types of resources it owns or controls (Barney, 1991). However, not all resources are the sources that can formulate competitive advantage. Competitive advantage only arises when resources are simultaneously valuable, scarce, difficult to imitate and not easily transferable (Barney 1991). The two core concepts of the theory are resources and capabilities. In this context, resources are what a firm can use to achieve its goals, while capabilities are specific resources that increase the productivity of other resources owned by the firm (Kozlenkova et al., 2014). Previous AI studies suggest that RBV is superior in explaining the relationship between organisational resources and capabilities and firm performance (Mikalef & Gupta, 2021; Mikalef et al., 2019; Wamba et al., 2024). Therefore, this study considers RBT as a theoretical foundation for this study.

Artificial Intelligence Capability

As AI has become an increasingly important asset for organisations in recent years, more and more researchers are exploring how these technologies and approaches can be used to achieve organisational goals. For instance, Mikalef (2019) presented a theoretical framework for exploring the business value of AI capabilities. Wamba-Taguimdje et al. (2020) proposed AI capabilities should consist of AI management capability, AI personal expertise and AI infrastructure flexibility. Mikalef & Gupta (2021) further categorised the resources that makeup AI capabilities into tangible, human, and intangible resources to capture enterprise AI capabilities. Other scholars have provided different insights into what constitutes AI capabilities, e.g., Wamba et al. (2024). This study defines AI capabilities as "the ability of firms to build, bundle and utilise their AI resources" (Mikalef & Gupta, 2021). Like previous studies (Mikalfe et al., 2023), this study adopts works from Mikalef and Gupta (2021) and conceptualises AI capabilities, including tangible, human and intangible AI resources.

Year	Author	Theory	Firm performance	Data source type		National
				Primary	Secondary	
2020	Wamba-Taguimdje et al.	RBV	✓	✓	-	Multinational
2021	Mikalef & Gupta	RBT	✓	✓	-	USA
2023	Mikalfe et al.	TOE framework	✓	✓	-	Norway, Germany, Finland
2023	Mikalef & Altwaijry	N/A	✓	✓	-	Norway
2023	Abou-Foul et al.	DCT	-	✓	-	USA & EU
2024	Wamba et al.	RBV	✓	✓	-	USA
2024	Sahoo et al.	STS	✓	✓	-	Multinational

Table 1: Relevant Empirical Research on AI Capability

Firm Performance

Although perceptual measures (self-reported) are commonly used in AI studies, recent studies recommend using "objective metrics" to provide a more precise assessment of the impact of AI capabilities on firm performance, such as "return-on-investments, profitability, and gross profit margin after the introduction of AI. (Enholtm et al., 2022, p. 1723). This research, citing Andrews et al. (2006), defines objective performance measures as metrics that correctly represent the actual world of organisational performance and are unbiased, independent, and separated from the unit of analysis.

This study aims to examine contemporary research on artificial intelligence (AI) in order to gain insights into the generally employed metrics. Additionally, it seeks to provide an objective measure approach that gathers objective performance data from secondary sources, namely financial indicators sourced from two stock exchanges in China, the Shanghai Stock Exchange and the Shenzhen Stock Exchange. This study proposed to use the following indicators from both China Stock Exchange. First, the firm-level performance indicators from the stock exchange will be used: the average growth rate of revenue the respondent's firm in the prior three years, the average growth rate of net profit the respondent's firm in the prior three years, the average growth rate of return on equity (ROE) the respondent's firm in the prior three years, the average growth rate of return on asset (ROA) the respondent's firm in the prior three years, and the average growth rate of Price-to-Earnings (P/E) Ratio the respondent's firm in the prior three years. Second, the industry-level performance indicators will be used to compare with the firm-level indicators so that the competitive advantage of a firm can be calculated. Industry-level performance indicators will include *the average growth rate of revenue in an industry in the past three years, the average growth rate of net profit in an industry in the past three years, the average growth rate of return on equity (ROE) in an industry in the past three years, the average growth rate of return on asset (ROA) in an industry in the past three years, and the average growth rate of Price-to-Earnings (P/E) Ratio in an industry in the past three years*. Third, the competitive firm-level performance will be calculated by firm-level performance over industry performance.

Research Model and Hypotheses

Recent studies using RBV have shown that AI capabilities can improve firm performance by effectively deploying resources to achieve a competitive advantage (Wamba et al., 2024; Mikalef & Gupta., 2021). Artificial intelligence (AI) capabilities are considered a special collection of resources with the potential to enhance company performance because they possess the characteristics of valuable, rare, imitable, and organised (VRIO), as RBV indicates (Mikalef & Gupta, 2021). This study conceptualises AI capabilities and competitive advantage in accordance with current research, using the resource-based view (RBV) as a theoretical framework. Along these lines, this study proposes the following five hypotheses:

- H1: AI capability has a positive and significant effect on the Revenue of a firm over the industry average.
- H2: AI capabilities have a positive and significant effect on the Net Profit of a firm over the industry average.
- H3: AI capabilities have a positive and significant effect on the Return on Equity of a firm over industry average.
- H4: AI capabilities have a positive and significant effect on the Return on Asset of a firm over industry average.
- H5: AI capabilities have a positive and significant effect on the Price-to-Earnings Ratio of a firm over industry average.

The research model is shown in Figure 1, where the AI capability is constructed as a higher-order structure.

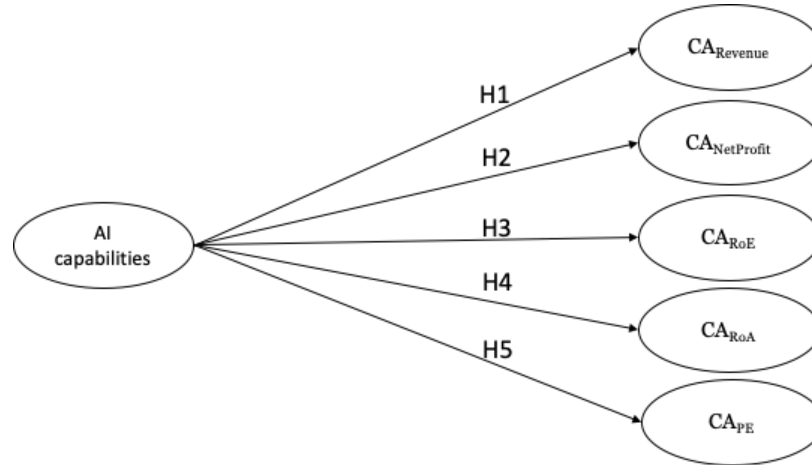


Figure 1. Conceptual model

Note:

CA_{Revenue} : the competitive advantage on the growth rate of revenue of the firm over the average of the industry in the past three years
 CA_{NetProfit} : the competitive advantage on the growth rate of net profit of the firm over the average of the industry in the past three years
 CA_{RoE} : the competitive advantage on the growth rate of return on equity (ROE) of the firm over the average of the industry in the past three years
 CA_{RoA} : the competitive advantage on the growth rate of return on asset (ROA) of the firm over the average of the industry in the past three years
 CA_{PE} : the competitive advantage on the Price-to-Earnings (P/E) Ratio of a firm of the firm over the average of the industry in the past three years

Research Design

Data collection

The data collection methodology employed in this study involves the utilisation of a survey research approach to gather information from participants in China via an online questionnaire, aiming to validate the proposed research model. All survey items utilised are sourced from existing studies and have been adapted to address various dimensions of the adoption, utilisation, and ramifications of Artificial Intelligence (AI). The target respondents will be top executives with significant expertise in AI initiatives, including CEOs, CIOs, CTOs, CDOs, IT/Digital directors, and other senior managerial positions, to determine the study's applicability and robustness (Mikalef & Gupta, 2021). Furthermore, to continue collecting objective performance data, only respondents who are employed by listed companies on the Shenzhen Stock Exchange or the Shanghai Stock Exchange will be asked to complete the surveys. Furthermore, the questionnaire undergoes a comprehensive review process in collaboration with information systems academics and industry experts immersed in AI research, ensuring clarity and coherence (Fosso Wamba et al., 2024). Before dissemination to the target sample, meticulous adjustments are made to the questionnaire to ensure the accurate capture of respondents' perspectives and experiences. Additionally, the survey instrument will provide relevant definitions or illustrative examples of AI to enhance respondents' comprehension and facilitate their effective responses to AI-related queries. This initiative aims to foster a shared understanding among respondents regarding the study's objectives and the concepts being addressed. The formal data collection is slated to commence for China in the second half of 2024. According to recent AI research (Fosso Wamba et al., 2024), this study intends to send out 2000 invitations to target respondents to participate in the study and expects to collect at least 200 samples. The objective data will then be determined and collected based on the final number of firms that target respondents work with.

Scale development and assessment

The present work aims to employ a model development method previously proposed by Mikalef and Gupta (2021). To guarantee the strength and accuracy of the questionnaire items, an assessment will be carried out by impartial academic specialists and industry leaders. According to recent research methodologies to assess AI capabilities (Fosso Wamba et al., 2023), a seven-point Likert scale will be utilised to assess individual responses of all dimensions. The scale will span from 'strongly disagree' (1) to 'strongly agree' (7). The firm performance evaluation will adhere to the methodology described in the pertinent scholarly works, utilising a seven-point Likert scale to

evaluate customer satisfaction and market effectiveness. A rating of 1 will signify a significant decline compared to competitors, while a rating of 7 will indicate a substantial improvement. Respondents qualified to work with the listed companies on the Shanghai Stock Exchange, or Shenzhen Stock Exchange will be invited to answer the questionnaires. The subsequent step involves data analysis using the SEM-PLS methodology (Fosso Wamba et al., 2024), which requires assessing measurement and structural models. As suggested in recent AI studies, the common method and nonresponse bias will be considered during the analysis for this study (Fosso Wamba et al., 2024).

Expected results

The importance of AI capability for firm performance improvement has been emphasised by academics and practitioners alike. However, limited studies show how AI capability's impact on firm performance can be measured through objective performance indicators, especially in China. This study expects to make two unique contributions to the study of AI capability. First, this study will contribute to AI studies by showing how AI capability impacts firm performance metrics through objective firm performance measures. Second, this study will provide large-scale empirical evidence from China that provides additional insights into the development of AI capability in Chinese companies. As with other studies, this study is not without limitations. First, this study explored the relationship between AI capabilities and firms' firm performance but did not explore the mediating mechanism, which future researchers could investigate. Second, this study should further explore the moderating factors that influence AI capability, such as the role of strategic flexibility (Perifanis & Kitsios, 2023). Third, the data in this study are cross-sectional and, therefore, only provide observations at a specific time, which does not allow for capturing long-term effects or assessing relevant contingencies that may amplify or inhibit their impact on firms' firm performance. Lastly, this study centres on AI-adopting firms in China. Future research may expand upon this framework by examining alternative contexts, objective measures, or sources.

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