Using Artificial Intelligence in Qatar's Brokerage Firms

Opportunities and Challenges

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Abstract

This study investigates the use of artificial intelligence (AI) in Qatar's brokerage firms (QBFs) and its potential to enhance investment decision-making in the securities market. Dynamic capabilities theory was used as the theoretical framework, focusing on how companies change, maintain, and build competitive advantage. The main contributions of this study include identifying the organizational prerequisites essential for successful AI deployment and assessing AI's potential in rationalizing investment choices. The study faced limitations such as relying solely on qualitative methods and focusing on a specific sector and country. The key results indicate that while AI has the potential to improve decision-making, QBFs are still in the early stages of adoption due to lack of dynamic capabilities.

Keywords: Qatar Brokerage Firms; artificial intelligence; Qatar Stock Exchange; investment decisions; securities market

استخدام الذكاء الاصطناعي في شركات الوساطة المالية في قطر
الفرص والتحديات

الملخص

تهدف هذه الورقة إلى تحديد البحث عن تقنيات الذكاء الاصطناعي المناسبة وتفعيلها في الأعمال الأساسية لشركات الوساطة القطرية.

يمثل اعتماد الذكاء الاصطناعي لشركات الوساطة المالية في قطر تغييرًا جذريًا في طريقة إنشاء أوامر الشراء والبيع حيث يجلب الذكاء الاصطناعي المخاطر والفرص التي تميل إلى تعظيم عوائد الاستثمار وفي نفس الوقت تقليل المخاطر. وهذا بدوره يمثل حافزًا إضافيًا للمستثمرين لربط محافظهم الاستثمارية مع شركات الوساطة التي اعتمدت أفضل نماذج الذكاء الاصطناعي لاتخاذ القرارات الاستثمارية. إن عدد الطرق التي يمكن من خلالها استخدام الذكاء الاصطناعي لا حصر له، وهي تحت الابتكار المستمر ويؤدي الى الحد من التدخل اليدوي الذي يحرز وقتًا ثمينًا للمستثمر للبحث عن فرص الجيدة للاستثمار. ان تطبيق الذكاء الاصطناعي غير مستكشف بشكل كافٍ في إدارة الاستثمار مثل التنبؤات وصنع القرار ولا يوجد سوى القليل من الأبحاث المتاحة حول اعتماد الذكاء الاصطناعي على المستوى الجزئي والحصول على الأنظمة القائمة على الذكاء الاصطناعي في قيادة المحركات لبيئة سريعة التغير مثل بيئة البورصات. ومن أجل فهم وفحص واستيعاب الذكاء الاصطناعي في توجيه قرارات الاستثمار في شركات الوساطة، ليس من المهم فقط فهم المعرفة التقنية فحسب، بل أيضًا قدرة المنظمة على التبني واستعدادها ووعيها ومدى قدرة المجتمع الحديث على فهمها مقاومة التغير.

ومن ثم، سينصب تركيزنا الأساسي على فهم ومعرفة القدرات المطلوبة من قبل المؤسسات للسماح بالاستشعار الناجح لفرص الذكاء الاصطناعي، واغتنام الذكاء الاصطناعي، والسماح باعادة تصميم الناجح للذكاء الاصطناعي.

سيتم استخدام إطار القدرات الديناميكية (الاستشعار والاغتنام وإعادة التصميم) جنبًا إلى جنب مع النهج النوعي لفهم استجابة ومعرفة كيف يمكن تحليل هذه النتائج من أجل ابتكار الصناعة واستدامتها.

الكلمات المفتاحية: شركات الوساطة القطرية، الذكاء الاصطناعي، بورصة قطر، قرارات الاستثمار، سوق الأوراق المالية.

1. Introduction

Artificial intelligence (AI) has brought transformative changes to the traditional landscape of securities trading, revolutionizing the industry by enabling rapid transactions and efficient analysis of trading patterns. The evolution of AI technologies, particularly machine learning (ML) and neural networks (NN), has paved the way for financial services companies to leverage intelligent algorithms and sophisticated computational systems (Zamagna, 2018). Defined by Chan et al. (2019) as specialized software and hardware that mimic human intelligence, AI in finance focuses on learning from experiences, processing new inputs, and executing human-like operations (Hunt et al., 2020). In this dynamic context, this study delves into the specific realm of Qatar Brokerage Firms (QBFs), exploring how they integrate AI to enhance management and investment decisions.

The primary objective of this study is to unravel the intricacies of AI assimilation within QBFs. By doing so, it aims to elucidate the organizational prerequisites essential for successful AI deployment and assess AI's potential in rationalizing investment choices concerning securities listed on the Qatar Stock Exchange. This study acknowledges that the integration of AI transcends mere technical adaptation; it influences organizational awareness, willingness, and adoption capacity. What sets this study apart is its concentrated focus on a distinct sector and country, coupled with the fluid nature of AI technology, limited prior exploration in this specific context, and its strategic importance for the economy. Furthermore, this study recognizes the policy implications and the potential for practical uses, making it invaluable for knowledge dissemination to a wider audience.

The backdrop of this study is enriched by an in-depth analysis of the existing literature. In the accounting sector, AI tools have found applications in fraud detection, bankruptcy prediction, data mining, expert systems, and financial audits, prompting researchers to examine their impact on accounting functions and automation processes (Ayad and El Mezouari, 2022; Chukwudi et al., 2018; Kumar Doshi et al., 2020). Similarly, in the securities market, AI technologies, including ML, deep learning, and neural networks, have not only automated tasks but also enhanced market predictions and sentiment analysis (Heaton et al., 2016; Hunt, 2020). Recent literature has further explored the challenges and prospects of AI adoption in financial services (Li et al., 2023), highlighting issues such as regulatory concerns, data quality, and ethical considerations (Bahri et al., 2023). Gomber et al. (2022) provide a comprehensive review of digital finance and FinTech research, underscoring the potential impact of AI on the industry. López-Robles et al. (2022) offer a bibliometric analysis of AI research in finance, identifying key trends and emerging topics. Recognizing the behavioral intricacies of investors, this study addresses the integration of non-financial information into AI systems, despite challenges related to

data accuracy and updates (Xiao and Ke, 2021; Kim, 2005).

This study significantly contributes to the existing literature by exploring the implications of AI adoption in QBFs, particularly focusing on investment decision-making processes. In Qatar's brokerage firms (QBFs), AI-powered applications such as automated trading systems and predictive analytics are being explored to enhance investment decision-making. However, challenges such as high implementation costs, lack of knowledge, and regulatory barriers hinder widespread adoption. This study aims to elucidate the organizational prerequisites for successful AI deployment and assess its potential in rationalizing investment choices in QBFs. By critically assessing the risks associated with AI adoption in investment management, this study provides a robust theoretical foundation for future research in the domain of AI adoption within investment management practices.

In conclusion, this study addresses critical gaps in understanding the adoption of AI within QBFs, emphasizing the pivotal organizational skills necessary for successful integration. Furthermore, it explores how AI can streamline investment choices within the context of securities trading.

2. Methodology

2.1 Theoretical Framework

The dynamic capabilities theory was used as the basis of the theoretical framework in this study. This theory is the only approach that focuses on how companies change, maintain, and build competitive advantage (Ambrosini and Bowman, 2009). To justify the use of the dynamic capabilities theory, we provide information on other theories in Table 1.

Table 1. Theoretical backgrounds used to study the subject of AI adoption

Theory	Description	Application	Reference
Contingency Theory	This theory is based on the assumption that the adoption of AI technologies depends on environmental contingencies that .vary from case-to-case	Organizational adoption and the use of AI	Eriksson et al. ((2020
Dual Process Theory	This theory focuses on developing precise AI-based forecasts by testing the mental processes that underlie the decision-making .process	Decision-making process	Dellermann et (al. (2017
Resource-Based (View (RBV	This theory focuses on the resources organizations should obtain to achieve competitive advantage from their AI investments.	AI-business value	Wamba-Taguimdje et al. ((2020
Technology Organization Environment (TOE) Framework	This framework focuses on AI adoption's technological, organizational, and environmental .contexts	AI adoption	Demlehner and (Laumer (2020
Organizational Learning Theory	The basis of this theory is the relationship between AI-based learning and organizational .learning	Organizational learning through AI projects	(Afiouni (2019
Theory of Artificial Knowledge Creation	This theory focuses on enhancing the knowledge held by individuals and organizations by expanding AI-enabled knowledge.	Knowledge creation in AI projects	Quinto et al. ((2017
Network Effect	This theory focuses on how networks expand their intelligence using the data collected from .their users	AI platform value	Gregory et al. ((2020

It is not only resources that matter, but also the mechanisms by which firms learn and accumulate new skills and capabilities and the forces that limit the progress and direction

of this process. Teece and Pisano (1994, p. 537) stated that the RBV could not explain how some successful firms demonstrate timely responsiveness and rapid and flexible product innovations, along with management capability to coordinate and redeploy internal and external competencies effectively.

2.2 Research Methods: Approach and Strategy

This study addresses the research gap in understanding the adoption of AI within QBFs, emphasizing the pivotal organizational skills necessary for successful integration. Addressing this gap is crucial for practice and the academic community to guide effective AI implementation strategies. This study used a qualitative research design to investigate underlying motivations and opinions and to obtain deep insights into the adoption of AI technologies (Denzin and Lincoln, 2005). Qualitative research offers adaptability and enables a deep understanding of individuals' thoughts, emotions, and uncharted subjects (Creswell, 2007). Its purpose is to impart significance to, interpret, and comprehend various phenomena (Denzin and Lincoln, 2011). Multiple case studies are included in the research strategy because they offer a comprehensive understanding of organizational processes and enable the development of theories (Yin, 2008). Case studies provide opportunities for the comparison, pattern recognition, and justification of intricate real-world interventions (Yin, 2003). The qualitative research methodology allows for a thorough investigation of judgments, viewpoints, and attitudes (Saunders et al., 2000).

2.2.1 Data Collection and Analysis

An outline of the procedures followed during data collection was developed based on Yin's (2003) recommendation. First, brokerage firms in Qatar were identified as the primary unit of analysis; the goal was to investigate the adoption of AI technologies in these companies. In total, n=16 semi-structured interviews were conducted over two months in 2022 with personnel and managers from these companies at their work premises or virtually to explore their organizations' dynamic capabilities to adopt AI technologies. Table 2 lists the interviews conducted.[1]

1 The names of organizations and exchanges and interviewees' positions have been anonymized.

Table 2*: Interviewee Profiles*

Job Title	**Company Name**
Chief Executive Officer	Wasata Brokerage
Operations Manager	Ahli Brokerage
Chief Executive Officer	Aventicum Capital Management
CEO and Chairman	The Group Securities
Trading Manager	CBQ Financial Services
Operations Manager	Dlala Brokerage
Business Manager	QNB Financial Services
Head of the Asset Management	Qatar Investment Authority
Head of Strategy & Investments	Qatar Stock Exchange
Trading manager	Qatar Securities Company
Director - PMD	Qatar Stock Exchange
Director of Asset Management	Al Rayan Investment
President	the CFA Society
Assistant Manager	Aventicum Capital Management
Current) CEO) Previous) CEO) Previous) Country Director)	Qatar Stock Exchange QInvest Goldman Sachs
Chief of Financial Sector Office	(Qatar Financial Center (QFC

Using a purposive and convenience sampling strategy (Gray, 2016), the interviewees were chosen because of their relevant background knowledge of the trading, IT, and decision-making environments and the researchers' access to these professionals. The

researchers approached various professionals and decision-makers in QBFs and other related sectors and provided insights into the topic of research.

This study employed semi-structured interviews as this allowed the researchers to weigh the credibility of the responses and to generate rich, in-depth data, as the interviewees were allowed to express their opinions beyond the scope of the questions. Such interviews also allow the interviewer to ask additional questions to better understand the issue (Braun and Clarke, 2006). Open-ended interview questions were coupled with informal discussions to obtain essential insights on the subject. The specimen of the interview questions is part of the Appendix I

To enhance the accuracy of the data collection process, the interviews were recorded with the explicit consent of the participants. This recording served as a valuable tool, allowing for the meticulous analysis of responses and ensuring the integrity of the qualitative data. Despite these benefits, the sole reliance on semi-structured interviews with 16 personnel and managers limits the generalizability of findings.

To ensure the ethical conduct of these interviews, informed consent was a fundamental aspect of the methodology. Before the interviews, participants were provided with clear and comprehensive information about the study, its objectives, and the nature of their involvement. They were informed about the voluntary nature of their participation, emphasizing their right to withdraw at any stage without consequences. Additionally, participants were assured of the confidentiality and anonymity of their responses, reinforcing a safe environment for open dialogue.

The questions asked during the interviews were aligned with Kump et al.'s (2019) pattern matrix of 14 items for measuring sensing, seizing, and transforming capacities, which forms a standard scale for measuring dynamic capabilities (see Table 3). The scale assessment points incorporated into the interview questions are as follows:

Table 3. Assessment points of dynamic capabilities

Dynamic Capability	Item
Sensing	Being aware of the best practices
Sensing	Keeping up-to-date with industry developments
Sensing	Constantly searching for information on current industry developments
Sensing	Acquiring knowledge of how to access new information
Sensing	Observing competitors
Seizing	Responding swiftly to new knowledge available in the external environment
Seizing	Utilizing new information
Seizing	Developing the ability to transform new technological developments into process and product innovations
Seizing	Using current information to develop new products or services
Transforming	Successfully executing revised plans by defining clear responsibilities
Transforming	Regularly pursuing decisions on planned changes in the organization
Transforming	Achieving outstanding success in executing changes
Transforming	Executing projects related to changes in conjunction with daily operations

The interview data were analyzed using a thematic approach. To explore the research issues, thematic analysis entailed locating, examining, and reporting patterns during data collection. Data were gathered through interviews, dialogue transcription, keyword and concept identification, data coding, and theme and sub-theme construction. The researchers familiarized themselves with the data, manually coded the themes using components from the dynamic capabilities theory, and checked whether any quotes or

sub-themes matched the themes. The dynamic capabilities theory provided theoretical guidance for the study to obtain a deeper understanding of and address the research issues. The main themes were as follows:

1. Themes related to sensing capabilities: the ability to identify opportunities and threats by exploring environmental changes (e.g., Shafia et al., 2016) and the capacity to obtain information that feeds into market intelligence (e.g., Day and Schoemaker, 2016; Mikalef and Pateli, 2016).
2. Themes related to seizing capabilities: the capacity to respond to insights with informed decision-making (Teece, 2007).
3. Themes related to transforming capabilities: the capacity to reconfigure the asset base and operations of an organization (e.g., Shafia et al., 2016; Mikalef and Pateli, 2016).

3. Results and Discussion

Industry experts were interviewed using open-ended questions to understand the level of dynamic capabilities in QBFs. In addition, the interviewees were asked various questions regarding the capabilities required by Qatari firms to implement AI to understand the factors that managers should consider when planning to adopt AI-based technologies.

In this qualitative study, we explored how incumbent firms in Qatar's capital market build dynamic capabilities to adopt AI, which entails using new technologies to enable significant business improvements and create new business models.

3.1 Sensing

Adoption of AI

When asked whether their companies use AI-focused technologies or plan to adopt them, most interviewees indicated that they were not using AI technologies despite their belief in the importance of such technologies in their company's operations. For example, one of the managers stated,

> *We are still in a very early stage of adopting AI systems, as our company is in the process of exploring the concept and researching the market while keeping an eye on AI and how we can improve and benefit from that.*

The overall perception of the respondents indicated an adequate understanding of the benefits of AI systems in terms of forecasting market movement, increasing liquidity, supporting trading schemes (such as margin trading and liquidity provision), profiling potential customers, filtering the vast amount of data available on social media platforms, and supporting risk assessment functionalities. Most interviewees indicated their organizations had adequate sensing capabilities.

Operations Manager of Ahli Brokerage and of Dlala Brokerage mentioned that their companies have constituted teams to research on relevance of AI to the firm. When asked about the sensing capabilities implemented by an organization, another manager stated that their company continuously updated its software and modules to avoid mistakes and areas of conflict. They also noted that certain software applied to the liquidity provision scheme was abandoned upon observing a negative effect on trading.

CEO of another brokerage firm showed confidence in his team on research reports that provide insights about AI use cases for the business. Overall, the responses indicated that most managers understand the importance of using AI but are still resistant to change and have limited knowledge regarding where and how AI can be used to make these changes.

The procedures and practices for adopting AI technologies are critical for determining the capability of a company to perceive market trends. The interviewees showcased remarkable expertise and comprehension of the essential requirements for implementing AI in QBFs. For example, a manager stated, *"All brokerage firm policies, procedures, compliance, and IT are effectively managed and operated by the Credit Swiss Asset Management."* He also noted,

> *Now, typically, in many public markets, there are probably three or four service providers/ aggregators that we will utilize to make price discovery, such as Bloomberg and Reuters. In addition, there are many service providers that we fall behind in terms of peer analysis and benchmarking, like S&P, FTSE, and MSCI. As the data are considerable, their filtering is certainly done by AI-based systems.*

Meanwhile, another executive noted that the IT division where this executive worked was responsible for defining the procedures related to exploring AI opportunities. This indicates an issue regarding selecting the right business and investment models, which is typically done through coordination between the investment, operations, and IT divisions under the executive management's supervision, especially when mobilizing AI systems through dynamic capabilities. Managers of two brokerage firms cited that AI is a permanent agenda item in meetings of senior executives.

These responses showed that the views of the interviewees vary regarding the prerequisites for adopting AI in Qatar's financial service firms. However, through the interviews, it was found that the companies, to some extent, were aware of the preparations, assessments, studies, and comparisons required to adopt AI technologies.

In response to a question about the mechanisms available in QBFs to assess their readiness to adopt AI technologies, the interviewees indicated that they frequently assessed the readiness of their companies to adopt AI technologies. As outlined in the theoretical

framework in section 2.1, the interviewees indicated that their organizations had adequate sensing capabilities. Such capabilities enable them to consistently obtain strategically relevant information on market trends, best practices, and technological developments.

The results indicated that most QBFs in Qatar are still experimenting with AI technologies and are scouring the market for possibilities and areas of improvement. Sensing talent is essential for spotting market possibilities and challenges and reacting to them. Strong sensing skills allow QBFs to compete more effectively in a rapidly changing environment (Teece, 2007).

Sensing abilities necessitate the constant monitoring of an organization's environment to collect and filter data on technological advancements and client needs. With the aid of these data, QBFs can predict how technology, consumer needs, and market responses are most likely to develop. QBFs can find the technology best suited to their needs, increase their flexibility, and become more adaptable by monitoring market developments and keeping abreast of industry trends (Teece, 2014).

All interviewees showed a strong awareness of the reasons for their desire to implement AI technologies, as well as the associated preparations, assessments, and studies, although the levels of sensing activities differed among the QBFs. They claimed to have adequate assessment processes in place to determine whether their businesses were ready to utilize AI. They also understood the importance of time and regulatory ease to ensure a smooth transition for investors and brokerage businesses.

Overall, the interviewees demonstrated a sufficient degree of sensing abilities, including understanding best practices, keeping abreast of industry trends, constantly searching for information, knowing how to acquire fresh information, and observing rivals. QBFs' understanding of AI technologies and their potential advantages are aided by these sensing activities.

3.2 Seizing

The interviewees provided insights into the steps and difficulties involved in choosing new technologies and investing in AI for brokerage firms in Qatar. Although the interviewees agreed that integrating AI-based technologies was crucial, they also said that their organizations had not taken sufficient steps to acquire these technologies. An interviewee stated that their organization uses an organized strategy involving the purchase committee, software providers, and a regulatory requirements team as catalysts for implementing AI.

In terms of responding to the developments in the field of AI, the interviewees revealed that their companies had a low-level response to such advancements, particularly in

incorporating AI systems into their trading operations. They mentioned the challenges and barriers related to adopting AI technologies, including high implementation costs, lack of knowledge among stakeholders, data quality and availability, and regulatory compliance. However, some interviewees highlighted the importance of continuous learning and awareness of advancements in neighboring markets and among competitors. These factors empower organizations to innovate, compete effectively, mitigate risks, adapt to changing environments, foster collaborations, and attract top talent, all strategic imperative factors in the fast-paced world of AI technology.

The interviewees expressed little interest in the idea of testing AI technologies on a modest scale and claimed that they were still in the early stages of AI adoption and had not fully realized the potential of this technology. To increase operational efficiency, they emphasized the significance of establishing a vision or strategy to progressively incorporate AI and begin with straightforward implementations.

The interviewees showed little enthusiasm for adapting their business models to incorporate AI approaches in response to rapid changes in the environment. They identified issues such as cultural hurdles, including client preferences for traditional techniques over technical improvements, and awareness gaps among stakeholders regarding AI. This suggested a lack of intentionality and the ability to recognize the need for change and implement a plan of action.

The interviewees revealed that their organizations had not established formal methods to assess their capacity to adjust to regional and global technological advances. They discussed the need for effective risk management systems and hazards related to cybersecurity. There was a general reluctance and fear of deployment due to concerns about AI producing undesirable consequences or errors, even though some interviewees acknowledged the potential benefits of AI, such as faster data processing and forecasting market movements. Interviewees' statements about lack of formal mechanisms to measure adaptation to technological advancements may reflect unawareness of benchmarking techniques and maturity frameworks commonly used in technology adoption assessments.

As adopting AI in QBFs is a complicated process in which an organization is likely to face many technological challenges, top management support is a determinant factor in successfully adopting AI technologies (AlSheibani et al., 2020). The senior executive management's role in adopting AI technologies can be crucial in exploring opportunities and not relying solely on specialized personnel (AlSheibani et al., 2020). For example, the top management plays a significant role in enforcing the deployment of AI technologies in QBFs by making strategic decisions and allocating the required resources and budgets (AlSheibani et al., 2020). Thus, the commitment of top-level management is considered one of the main enablers of AI deployment.

The process of developing seizing capacity starts from the formulation of a strategy that enables the recognition of valuable knowledge. However, the interviewees stated that QBFs do not have a formal mechanism to measure how they can adapt to global advancements in technology and elaborated on the challenges and barriers related to adopting AI technologies. For example, the President of the CFA Society said:

> *The cost-benefit analysis is the determinant for the adoption of AI. Measuring the costs does not just cost in terms of how much money the company will be spending, but also time and effort. Similarly, the benefit is not just in terms of how much money we will be able to save, but in how it will help the company be more efficient and improve its operations and business model.*

This response suggests that some interviewees may simply be not aware about the benchmarking techniques and maturity frameworks. This lack of knowledge should be taken into account when drawing conclusions about formal adaptation mechanisms.

Organizations should develop strategies to reap the benefits of AI (Finch et al., 2017). The strategy should include written procedures and instructions on how organizations can utilize AI. The formation of a strategy is essential for seizing and transforming capabilities, as indicated by the dynamic capability's literature summarized by Ridder (2013). The deployment of creative solutions and knowledge transfer within an organization are part of its seizing capabilities (Teece, 2007; Zollo and Winter, 2002). These two dimensions cannot be realized without an explicit strategy statement, which provides specific processes, plans, and timeframes for actualizing AI adoption.

3.3 Transforming

Interviewees plans to develop work procedures indicated a weak transformation capacity, lacking consistent plans and responsibilities related to change management. For example, the head of an organization noted that their procedures were only based on continuously obtaining investors' feedback and auditing their systems through third parties to detect system defects and prioritize acquiring the best specialists. The challenges faced by QBFs in developing transforming capabilities align with recent research emphasizing the need for responsible AI adoption practices in finance (Ryll & Walker, 2022). Establishing effective governance mechanisms, addressing ethical concerns, and building stakeholder trust are crucial for successful AI integration.

Most interviewees believed that genuine and practical requirements or challenges that an organization faces should be the determinant of adopting and renewing policies. In the context of adopting and renewing policies related to AI implementation, understanding this actual need means identifying the precise issues or opportunities within the organization that can be effectively tackled or leveraged through the use of AI technology. For example, a manager stated,

The most important question is, how we can exploit AI according to our needs because if this technology does not give us a solution for all our problems, it will be unfeasible. Thus, we should have a strategy that explains exactly what we want from this technology and how it will benefit us. Then, the benefit will outweigh the cost.

An executive noted that lengthy bureaucratic procedures, including debates, meetings, and correspondence, are among the main barriers to developing the securities market, which requires instant decisions (fill or kill).

Based on the above statements, there is clear disagreement among the interviewees regarding budgets because some consider adopting AI technologies as a viable investment, while others consider it a financial burden. The reasons for this disagreement could be attributed to the differences in views regarding AI's significance or different approaches toward the requirements to adopt AI technologies.

The chief of an organization stated, *"If the stock exchange reports live buying patterns and traders categories, etc., then AI can provide real-time data. However, issuing trading reports at the end of the day will limit the ability of AI-based systems to react simultaneously and achieve competitive advantage."* This indicated that current trading practices are a barrier to seizing capacities. Furthermore, the above quote indicated the need for regulatory and operational reforms at all levels to develop innovative practices that will facilitate the introduction of AI-based solutions. The interviewees' statements about the capability of AI technologies to accommodate all the factors affecting the trading and securities investment processes were consistent. They reflected in-depth knowledge of the level of advancement attained by AI technologies.

The responses regarding how QBFs ensure that their current or future investments in AI will enhance their competitiveness in the market reflected the different views of the interviewees, indicating their belief in the value that will be added to an organization's competitiveness when it adopts AI technologies.

A manager elaborated on the importance of changing the mindset: *"AI is, in fact, work procedures rather than technological systems. Programming, servers, and networks are important; however, the ideas and work principles are still the basis, as they require much work."*

The interviewees also highlighted the information security issue in the case of transformation. For example, the manager of an organization stated, *"risk mitigation is the most important aspect. AI should be introduced in areas with the least losses in worst-case scenarios."* Such scenarios may pertain to situations where the AI system fails or behaves unexpectedly, leading to significant financial losses, reputational damage,

legal consequences, or harm to stakeholders. He added, *"We are ready to implement the algorithms in our trading if they are tested against all scenarios."* Meanwhile, only one manager provided a different response regarding the existence of transformation capacities. This may be linked to the manager's considerable resources and budget allocations. The manager said,

> *We have procedures in place to evaluate the systems in terms of their security and functionality and evaluate the team responsible for them. We hire external parties to perform these tests and audits. We also have governance and risk mitigation frameworks.*

Generally, the interviewees indicated cost to be a significant factor, mainly because AI technologies are currently similar to other commodities in need of further research and development, indicating that they have been tested at the front end of the middleware or backend. Testing should be done at both front-end (e.g., client acquisition, chatbots) and back-end (e.g., automated back-office tasks, predictive maintenance) to ensure comprehensive evaluation of AI systems. QBFs reported testing AI in areas such as customer profiling, risk assessment, and trading support.

QBFs face a deficiency in their ability to seize opportunities, resulting in a limited capacity for transformation. Nevertheless, the interviewees revealed innovative strategies for cultivating a robust vision within these firms. These insights augment the existing body of literature, which has delineated dynamic capabilities in various manners. Notably, this study introduces nuanced measurements in the realms of sensing, seizing, and transforming capabilities, setting it apart from prior research. Consequently, the absence of operational assessments of dynamic capabilities in existing studies complicates the evaluation and comparison of findings.

The interviewees' responses indicated a clear understanding of the budget allocations required to adopt AI technologies. These responses are in line with the literature and theory, which indicate that dynamic capabilities are linked to high costs because the maintenance of these capabilities is expensive and involves long-term commitments to resource reconfiguration/creation as well as substantial cognitive, managerial, and operational costs (Ambrosini and Bowman, 2009). Otherwise, manager misperceptions may lead to the deployment of undesirable and unnecessary dynamic capabilities if the decision to introduce AI is made. Organizations will then face high costs and other negative outcomes because of deploying inappropriate dynamic capabilities (Zahra et al., 2006).

4. Conclusions

4.1 Summary

This study seeks to address several unresolved issues for QBFs regarding the integration of AI technologies and building dynamic capacities to compete in the digital age. Its results highlight many significant points. To achieve performance goals related to sensing, seizing, and transforming capabilities, AI adoption first requires large financial resources and a dedicated sizeable budget. However, due to a lack of support from top management, most QBFs do not have a defined strategy for adopting AI.

QBFs are still in the initial stages of experimenting with and adopting AI. This primarily stems from a lack of strategy and support from senior management, which results in moderate sensing capabilities. This study finds that QBFs lack significant dynamic capabilities, which can be linked to the mindsets of decision-makers and external variables, including market immaturity, customer resistance to adopting innovations, and regulatory barriers. QBFs' ability to innovate in terms of processes (e.g., trading, risk management), products (e.g., AI-powered investment tools), and services (e.g., personalized recommendations) is limited. Successful AI adoption requires developing dynamic capabilities such as sensing, seizing, and transforming.

Assessing capabilities essential for determining whether an organization has a sound plan. QBFs have made different efforts in this area, and both formal and informal actions indicate a high degree of comprehension regarding the deployment of AI technologies. However, QBFs have weak seizing power because they are not sufficiently knowledgeable about best practices, current market conditions, or rivals' activities. They fail to use new information efficiently and react quickly to new knowledge. This study finds that QBFs' ability to innovate in terms of processes, products, and services is constrained by a lack of ongoing plans and roles related to change management.

Results from the 16 interviews show moderate agreement between the opinions of the interviewees and the literature from academia and business on the significance of dynamic capabilities for gaining a competitive edge by using AI. QBFs exhibit strong sensing, mediocre seizing, and poor transforming capabilities.

There is no one-size-fits-all approach to the use of AI; hence, it is advised that organizations assess their level of dynamic capabilities to adapt to the changing environment. This study emphasizes the value of using a dynamic capabilities framework to examine how AI affects how resources are used to maintain a competitive advantage. Further, this study analyzes the degree of dynamic capabilities necessary to purchase AI-based systems and fills a gap in the micro-level study of AI adoption. The need to comprehend the circumstances and procedures associated with adopting AI solutions within QBFs was

the driving force for this study, which is motivated by a fast-changing environment. In conclusion, this study stresses the significance of creating dynamic skills such as sensing, seizing, and transforming for effective AI adoption in QBFs.

4.2 Study limitations

The study has several limitations that should be acknowledged. First, the research strategy employed qualitative methods, specifically case studies and interviews. While these methods offer a comprehensive understanding of organizational processes, they may not capture the full complexity of the phenomena under investigation, nor can they be generalizable. Second, the study focused on QBFs, which may also limit the generalizability of the findings to other industries or contexts. Furthermore, this study did not extensively explore the regulatory and ethical considerations surrounding AI adoption in QBFs, which have been highlighted as critical factors in recent literature (Bahri et al., 2023; Li et al., 2023).

Additionally, the study relied on self-reported data from interviewees, which may be subject to biases or inaccuracies. Furthermore, the study did not address the potential challenges or barriers associated with adopting AI technology in QBFs, which could have provided valuable insights. Finally, this study did not address the sex and gender dimensions of this research, which will limit the generalizability of the data.

4.3 Scope for future research

While this study provides valuable insights into the incorporation of AI in QBFs and its impact on investment decision-making, several areas offer opportunities for further research.

Future research can explore the adoption of AI from the perspectives of regulators, banks, investment companies, and asset managers, and measure the impact of AI on supporting the dynamic capabilities of financial services companies. Conducting a comparative analysis of the adoption processes in different countries, such as Saudi Arabia, and the United Arab Emirates, could also provide insights into the factors influencing AI adoption and help identify country-specific challenges and opportunities in the region. Future research would also benefit from adding more interviews and triangulating the findings through other methods. Future research could also investigate the regulatory and ethical frameworks needed to support responsible AI adoption in QBFs, aligning with the growing emphasis on governance and trust in AI-driven financial services (Ryll & Walker, 2022). This would enhance the credibility and generalizability of the research findings.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Open AI in order to improve readability and language. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Appendix I

Snapshot of interviews questions

Sensing

- Are you currently using AI-focused technologies, and are you planning to adopt them soon?
- Do you have procedures for determining the basic requirements for adopting artificial intelligence systems? Moreover, what are these requirements?
- What mechanisms are available in your company to assess its readiness to adopt artificial intelligence techniques?
- What is the mechanism that the company has that will enable the company to identify challenges and opportunities in the field of artificial intelligence systems? Do you think that such a mechanism is essential/why?

Seizing

- What are the procedures your company adopts to invest in artificial intelligence technology?
- What are the procedures followed in your company for selecting new technology?
- How do you view your company's ability to respond to developments in artificial intelligence?
- Are you considering experimenting with AI technologies, even on a small scale? Why?
- When are you considering changing your business model to adopt artificial intelligence techniques?
- What are the circumstances that will push you to buy artificial intelligence technologies?

Reconfiguration

- Tell us more about your plans to launch new products and services.
- Tell us more about your plans to improve your services.
- What are your plans to develop work procedures in your company?
- What factors do you think AI is unable to grasp?
- How do you ensure that your current or future investments in artificial intelligence will achieve your company's competitiveness in the market?