DOI: 10.20472/EFC.2024.021.008

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KEY INHIBITORS OF ARTIFICIAL INTELLIGENCE IMPLEMENTATION IN GREEK SYSTEMIC BANKING

Abstract:

Artificial Intelligence (AI) is fast becoming an integral determinant of digital transformation in banking. Its successful implementation can influence overall progress or stagnation for the institution's technological advancement. This paper presents a TOE structured assessment framework for key inhibitors that determine the AI implementation potential on Greek banking institutions. Despite facing various pressures, the Greek banking system is progressing in its digital transformation and AI implementation, although still at early stages. The study utilized empirical case study approach, literature review and market observations. The paper identified and reviewed seven inhibitors within technical, organizational and extremal environments that shape and influence AI pace of implementation. The practical implications of this study can assist bank leaders in assessing their current position in the AI digital journey and planning for the future. SEM or similar research will help strengthen the belief in the findings

Keywords:

Artificial Intelligence, TOE framework, inhibitors, banking

JEL Classification: M10, L21, O32

Introduction

There is an ever-increasing interest in AI among academia, industry and governments, but, still, there is no universally accepted working definition of what the term AI includes. The paper adapts the Samoili et al (pp 20-21, 2020 in European Commission AI Watch) basic definition that “Artificial Intelligence refers to systems that display intelligent behaviour by analysing their environment and taking action — with some degree of autonomy — to achieve specific goals." Although not fully descriptive of its technical parameters and reach, it can well serve as a working definition. Integrating AI into an organization's broader digital transformation can be a challenging experience. Despite the necessity of business transformation, the evidence suggests that the outcomes often fall short of initial expectations, with only a third of transformations succeeding (Messenböck et al., BCG, 2021; Allchin, 2020). Realigning a company's strategy and operational model to match the digital era requirements, is a lengthy effort, impacting various aspects such as value proposition, capital structure, organizational structure and strategy, human resources, systems, and culture. Yet, the relevant technology is still in its early stages, and several challenges and threats need to be addressed (Rahman et al, 2023;). Infrastructure challenges, increased technical complexity, training and retention of staff, regulatory and ethical issues, cybersecurity risks, integration with existing processes and platforms as well as cultural aspects are all determinants that are to be addressed.

The financial sector is the largest sector contributing to AI investment and development (Rahman et al, 2023). As per Accenture estimates, the baseline growth of the finance sector with AI technologies will be at $4.6 trillion until 2035 (Kruse, 2019). This comes to no surprise as AI plays a crucial role in modern banking, revolutionizing how financial institutions operate and serve customers. By employing AI technologies, banks can automate processes, detect fraudulent activities, personalize customer experiences, reduce workforce costs and make better risk and data-driven decisions, saving $447 billion by 2023 (Fares et al, 2023). As also Kruse et al (ibid) mention, the financial services sector presents significant opportunities for leveraging AI primarily because it relies heavily on data, especially customer and transaction data, which banks and insurance companies continuously gather, organize, process, and link. The paper will be using the Technology-Organization-Environment (TOE) frame-work to evaluate the position in which the Greek banking systems is, in relation to the introduction and employment of Artificial Intelligence. Data will be collected via case study analysis including secondary sources, publications, web search, official statistics (Tomaszewski et al, 2020).

Research Methodology and Objectives

In principle, the business models of financial institutions can be fully transformed through digitization. Successful digitization and the related introduction of AI can provide banks with the competitive edge that will ensure their business continuity and progress. To that end, the paper sets two objectives, seeking to:

O1. Identify the key inhibitors in the adaptation of artificial intelligence in the Geek bank industry

O2. Identify overall framework and opportunities for further research

Case Study based research

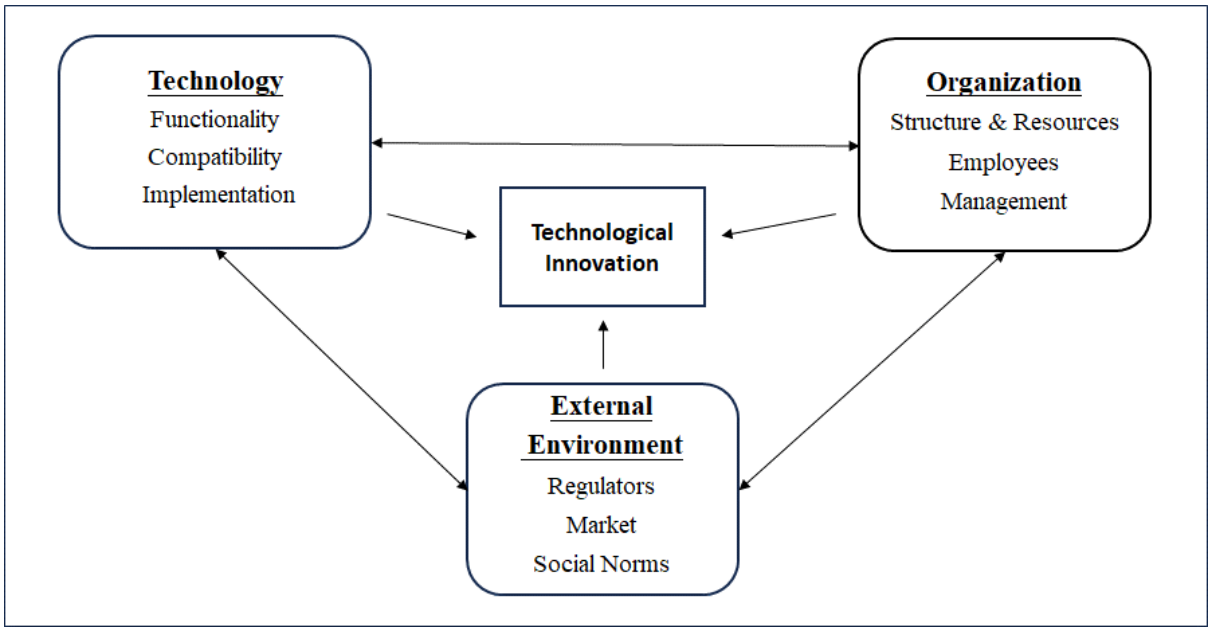
The study employed qualitative methods, specifically a case study approach, supported by informal interviews and conversations, observation, and data search (Tranfield & Starkey, 1998). Researchers have used the case study research to develop theoretical propositions based on empirical evidence within a specific context (Eisenhardt & Graebner, 2007, as cited in Patsiotis et al., 2013). The classic case study involves an in-depth investigation of a specific and complex phenomenon (the ‘case’) within its real-world context (Yin, 2013, p. 321). To that end, we gathered and integrated documentation from secondary information sources such as industry reports, financial magazines, and relevant internet publications. Data sources included field observations, the bank's background characteristics, organizational charts, public interviews with the CEO and executives, third-party evaluations, and informal

interviews.

Technology-Organization-Environment (TOE) frame-work

The Technology-Organization-Environment (TOE) framework, introduced by Tornatzky and Fleischer in 1990, offers a robust theoretical foundation for understanding how various factors influence technological adoption within organizations. It's worth mentioning that TOE investigates higher level traits instead of the individuals' behaviours within the organization, thus keeping personal view points out of the equation (Awa, et al, 2017). The framework identifies three essential contexts: technology, organization, and environment, (figure 1). The technological context covers both the existing and emerging technologies available to the organization, assessing their potential benefits and challenges. The organizational context considers the internal characteristics of the organization, such as its size, structure, resources, and culture, which can facilitate or hinder technology adoption. The environmental context encompasses external factors, including industry characteristics, competition, regulatory environment, and socio-economic conditions that impact the organization's technology adoption decisions. By integrating these three dimensions, the TOE framework provides a comprehensive model that captures the complexity of technological adoption processes in various organizational settings; (Oliveira & Martins, 2011).

Figure 1: Adaptation from the Technology, Organization, and Environment conceptual framework (Tornatzky and Fleischer 1990)



Source: Tornatzky and Fleischer 1990

Literature Support

Given the recent introduction of AI to firms, academic literature hasn't still reached maturity in its view of the subject, but it definitely shows a growing appetite. The theoretical development of the essay and its conclusions is supported by a number of papers that study the TOE framework, the process of digital transformation and its phases and the concept of artificial intelligence in banking. The TOE framework remains a pivotal model for evaluating the adoption and progress of artificial intelligence (AI) in contemporary organizational settings Oliveira & Martins. (2011). Recent studies have reinforced the relevance of the TOE framework in understanding advanced technology -such as AI- and its implementation. Oliveira et al (2014) explored the technological dimension by assessing advancements in AI capabilities such as natural language processing and predictive analytics or Kulkarni et al (2020) who based their study of blockchain on TOE. The organizational context has been

highlighted by Sharma et al. (2020), who examined how organizational culture, structure, and resources impact AI adoption and integration. The environmental context, including regulatory pressures, market competition, and socio-economic factors, has been extensively discussed by Horani et al (2023) and Chatterjee et al., (2021), who even extended the model, providing insights into how external factors influence AI progress.TOE framework offers a comprehensive approach to measure AI progress, ensuring that technological, organizational, and environmental factors are systematically considered. This holistic perspective is crucial for developing effective strategies for AI implementation and achieving sustainable competitive advantages (Wang et al., 2018). The case study approach employed, was based on the work done by established scholars such as Yin (2013) with its extensive work as well as Harrison's key elements (2017), Henderikx, (2022). Useful insight was also taken by the work that Venkantraman (2017) and Panzarino (2021) have made on looking into the components of the institutions' digital transformation journey. The study draws also from two connected papers (Papathomas & Konteos, 2022 & 2023).

Overview of Greek Financial Institutions

Having expanded rapidly in the 90s and then having suffered strongly from the 2008 world crisis (Papadopoulos, 2021; Hardouvelis 2023) the sector underwent a major metamorphosis from a universe of 43 major financial intuitions in 2004 to the current significant consolidation of banks and assets into four major players: Alpha Bank, Eurobank, Piraeus Bank, and the National Bank of Greece. These institutions collectively hold 95% of the market share, following a series of mergers and consolidations that streamlined operations in a nearly equal distribution of assets under management, market shares, branch networks, core banking systems, and staff numbers (BoG 2020, 2024). Given the small number of banks and the similarities among the major players in the Greek market we opted for an in-depth case study research. The similarities of these institution are evident from their financial statements (table 1), National Bank of Greece, with assets totaling approximately €65 billion, aims to lead in digital banking by investing in cutting-edge technology and improving its digital platforms. Piraeus Bank, holding assets worth around €70 billion, focuses on creating a seamless customer experience through its innovative digital services and extensive branch network. Alpha Bank, with assets of about €63 billion, emphasizes strategic initiatives in digital transformation, including the launch of new digital tools and services designed to meet the evolving needs of its clients. Eurobank, which manages assets of approximately €55 billion, has set a clear vision to become the most digitally advanced bank in Greece, maintaining a dedicated digital transformation unit and upgrading leadership roles to drive its digital agenda. They have all similarly declared visions centred on becoming digitally driven, customer-centric capable of providing superior banking experiences, (Mitsakis 2023).

Table 1: Key comparable ratios for the four systemic Greek banks (>90% market share)

	NBG	**Piraeus**	**Alpha**	**Eurobank**
	2023E	*2023E*	*2023E*	*2023E*
€, m				
Performing Loans	34400	36500	36000	42000
Deposits	55600	58600	47300	57200
Net Revenues	358	233	211	287
NPE ratio	3,7%	3.50%	5,9%	3%
….				
Cost to Income (%)	35,9	31	40	36
FTEs (#)	6700	7700	6538	6323
Branches (#)	314	404	313	299

Source: Own estimates based on publicized Annual Financial Statements

Assessment of Artificial Intelligence adaption to Greek Financial Institutions based on TOE framework

Scholars have examined digital transformation, and the interrelated artificial intelligence introduction, at financial incumbents employing a number of structural frameworks and determinants. Some examples stand by strategy, structure, and technology (Gregory et al., 2019), use of digital resources, organizational set up, growth strategies (Verhoef et al., 2021), strategic-centric, customer-centric, organizational-centric, and technology-centric perspectives of Loonam et al. (2018) as summarized in Papathomas & Konteos (2022). As explained, the present study opted for the Technology-Organization-Environment model of Tornatzky and Fleischer of 1990 (Figure 1), that has a large-enough scope, as Zhu and Kraemer explain (2005), and, as per Baker (2012), it “aligns "too well" with other technology adoption theories”. The paper followed the same qualitative research methodology, as per the one employed by Jöhnk et al., (2021).

Implementing Artificial Intelligence (AI) technology in Greek banks relies on certain inhibitors (table 2). Firstly, technology readiness is a significant barrier, as many banks lack the advanced IT infrastructure needed to support AI (Kane et al., 2015). Technology integration is another challenge; integrating AI with existing systems can be complex and costly (Reis et al., 2020). Limited resources, both financial and human, further inhibit AI adoption, as banks may struggle to invest in new technologies and skilled personnel (Rahman et al, 2023). Additionally, the organizational culture in many Greek banks is resistant to change (Amarantou et al, 2018; Antoniou et al 2020), making it difficult to implement innovative technologies, a trait that is not exclusive to geek institutions (Mueller & Renken, 2017). Leadership also plays a crucial role; without strong support from top management, AI initiatives often lack direction and momentum (Singh & Hess, 2017). Competitive pressure pushes banks to adopt AI, but it can also lead to rushed implementations without proper planning (Jöhnk et al., 2021). Regulatory requirements add another layer of complexity, as compliance with strict banking regulations (BOG, 2024) can slow down the adoption of new technologies (Taeihagh, 2021). Finally, clients' and other influential teams’ acceptance of AI-driven services are vital; without customer trust and willingness to engage with AI solutions, banks may find it challenging to justify their investments (Kelly et al., 2023).

Table 2: Summary Table of IT adoption and its variables, methodology and data to support

IT Adoption	Analysed Variables	Methods	Data and Context
Artificial Intelligence	Technology inhibitors -> technology readiness; technology integration Organizational inhibitors -> resources; culture; leadership Environment and external pressure inhibitors -> regulators; external stakeholders.	Industry Case Study	Informal interviews with middle level management in business, IT, transformation Observations of public activities, staff, leadership Press releases, annual reports, conferences

Source: Summary Adaptation from Oliveira and Martins’ table of *Studies on TOE* (2011)

Analysis

Technological context

To understand the adoption potential of AI by Greek banks, it is essential to address inhibitors that shape the technological context within any firm. This study investigated such critical technological factors: the relative advantage of information systems, data-related infrastructure capabilities, and data management challenges. They refer both to internal and external technologies relevant to the firm, and associated characteristics (Teo et al, 2006). Scholars have documented a number of technological factors that influence a firm's decision to implement new technologies. Margiono Ari (2021) identifies two paths of digital transformation. However, many companies, especially those not fully embracing digitalization, focus mainly on customer touchpoints rather than viewing it as a comprehensive journey spanning multiple functions and channels (Heavin & Power, 2018). To succeed, incumbent companies must explicitly connect the revamped customer experience with their overall operations (Barrett et al., 2015).

Organizational Context

The organizational context refers to firm inhibitors of resources, culture and top management aspects, all of which came prominent from the data evaluation. There is a good body of research that documents the importance of top management support and managerial attitudes for effective adoption and deployment of new technologies Armstrong, (1999) and Grewal (2001). Greek systemic bank management has already progressed beyond the basic stages of digitization, back-office automation, and streamlining IT initiatives with a digital focus. Furthermore, an organizational change delivery framework is being deployed across all banks, featuring centers of excellence, group-wide integrated efforts, and targeted investments. Greek banks appear to be following a defensive path, which is relatively slow and focuses on growing their own digital capabilities (Skinner & Hess, 2017). Senior management should instate and propagate a New Digital Age culture and vision for the future, aiming to establish a Digital First culture (Reichert et al., BCG, 2022). Greek banks must transition from traditional working environments to fully digitalized ones, embracing agile, lean approaches and New Ways of Working (WoW) with seamless remote work, e-signatures, and other digital innovations (Kaufman et al., 2020). This transition will also involve introducing new roles and job profiles while making older ones obsolete (King, 2019).

Environmental context

The environmental context encompasses the external arena where a firm conducts its business, including the legal and regulatory atmosphere and its stakeholders. Greek banks need to develop a new model that caters to a new generation of customers and accommodates emerging players with innovative functionalities. This involves creating an ecosystem where complementors, competitors, and catalysts can thrive together (Deloitte, 2013, 2021). Local and European supervisory bodies (eg BOG, EU) are also building up on the regulatory side, with intervening regulations that aim (not always successfully) to smooth in new technology in our lives (von Solms, 2021).

Table 3: Readiness evaluation structured within the TOE framework

Technological context		
Selected Inhibitors	**Evaluation**	**Data Source**
	• Introduction of remote access banking successful but	• Institutions public releases, Branch observation

Technology readiness	Omnichannel not fully operational, although developing • Customer on boarding introduced but offering limited choice of products • Fraud & Risk functions still "old school" predictive analytics • Not ready yet for Phygital approach i.e., combine and merge branches & on-line banking. Many trxs are not as yet available in digital format	• Official web sites, Annual statements • Employees feedback/informal interviews • Employees feedback/informal interviews
Technology integration	• Agile & Design Thinking project approach implemented; Customer Journey digitized • Open & flexible system architectures with data away from old legacy systems are being envisaged but not in full operational mode as yet • IT systems are frequently out of service	• Employees feedback/informal interviews • Employees feedback/informal interviews, specialized journals • Independent organizations' observations
Organizational context		
Selected Inhibitors	**Description**	**Source**
Resources	• Average of >€100m IT investment and digital transformation by all 4players • Budget, Targets, resources commitment for digital transformation and R&D investment	• Top level announcements, Annual statements • Annual statements, public interviews
Culture	• Digital first culture is already employed but no full End to End Paperless back offices • Digital adoption and change of processes pushed throughout the organizations is visible but resistance causes delays	• Employees feedback/informal interviews, media • Employees feedback/informal interviews, media
Top management support	• Limited change of Digital upskills training for staff • Org charts still represent formats and hierarchy of older type structures • Non –customer facing Unites (Operations, Support Functions, HR, Risk) are being turned digital, albeit with delays and issues • C-level appointments eroded	• Announcements of trainings, informal interviews, • LinkedIn, official websites • Public releases of units' discontinuation, • Announced org charts have deleted position of CDO
Environmental Context		
Selected Inhibitors	**Description**	**Source**
Regulatory	• EU regulation for API, Open banking platform, PSD2-enambed capabilities • Strict and often ambiguous local	• BoG, official releases of third parties

requirements	and international rules about technology	• Regulation releases by BoG, ESM, EU, local press
External stakeholders	• Ecosystem creation & cooperation with Fintech start up underway • No public education effort on the benefits of AI for clients, general public	• Announced Fintech cooperations, Public events • Observation, lack of public announcements

Source: key structure by Tornatzky and Fleischer, 1990, adaptation from Oliveira & Martins (2011)

Conclusion

This paper reviews the key inhibitors of Artificial Intelligence implementation in Greek banks using the TOE framework and a qualitative Case Study approach, highlighting critical parameters (Table 3). It was found that all three dimensions—technology, organization, and environment—include inhibitors that can impact the successful introduction of AI. Technology readiness and integration play a pivotal role, with significant work needed in customer value offerings and onboarding, which are still in early stages. Customer information varies depending on the access medium, personal banking lacks recognition of life cycle events, and the time to approval for many products remains lengthy. Organizational inhibitors such as culture, top management, and resources also pose challenges. The prevailing company culture tends to resist change, with the need for transformation not fully disseminated throughout the organization. Roles follow outdated organizational charts, and silos hinder new approaches despite the creation of new digital job profiles. However, there has been significant progress in digitalizing internal processes, adopting Agile and Design Thinking management techniques, and, to mention also the external environment, through hackathons, open days for startups and fintechs, and API platform connectivity the external stakeholders are well prepared.

Contribution and Limitations

The ongoing adoption of AI is expected to have a profound and lasting impact on the banking industry. Any setbacks on its implementation may hinder any institution's growth. The framework deployed here, may help managers articulate better the strategy behind AI. It also contributes further to the contemporary academic research on banking technologies by identifying the key inhibitors that are identified as contributing to AI build up in Greek banks. There is a lot of scope for expansion with research for similar case studies in different countries or industries. It is suggested also that research is further expanded via different methodological approaches, qualitative but also quantitative.

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