

Artificial Intelligence as a Driver of Operational Efficiency in Service Organizations: The Case of Higher Education

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Abstract:

Today's world is undergoing profound technological transformations that are reshaping societies and organizations worldwide. Among the most significant developments is Artificial Intelligence (AI), which has emerged as a major cross-cutting technological revolution. AI has profoundly influenced various aspects of everyday life as well as organizational activities.

The impact of AI on marketing, particularly within service organizations operating in the higher education sector, is reflected in the enhancement and personalization of the overall marketing approach. From market research to the development and implementation of marketing mix strategies, AI creates both significant opportunities and potential challenges for professionals in the sector.

This study first establishes a theoretical framework for the use of AI in the higher education sector. It then examines the transformations in consumer behavior and the ways in which AI contributes to improving operational efficiency and, consequently, the services and offerings provided by universities in the era of artificial intelligence.

Keywords: *Artificial Intelligence, technological revolution, higher education, service marketing*

I. INTRODUCTION

Today, the academic world, like many other aspects of contemporary society, is experiencing profound technological transformations, with artificial intelligence representing one of the most prominent examples. The impact of AI is increasingly evident across all types of organizations, including service-oriented organizations and, more specifically, institutions operating in the higher education sector.

This impact is reflected in the improvement and personalization of the overall marketing approach, ranging from market research to the selection and implementation of marketing mix strategies. While these developments create significant opportunities, they also present new challenges and potential threats for professionals operating within the sector.

This study first establishes a theoretical framework for the use of artificial intelligence in higher education. It subsequently examines changes in consumer behavior and explores how AI contributes to improving operational efficiency and, consequently, the range and quality of services offered by universities in the age of artificial intelligence.

II. ARTIFICIAL INTELLIGENCE IN MARKETING

A. Historical Background and Definitions of Artificial Intelligence

From a historical perspective, the concept of artificial intelligence emerged during the 1950s. The origins of the field can be traced back to Alan Turing, widely regarded as one of its pioneers and founding figures. In his seminal article, *Computing Machinery and Intelligence*, Turing raised the fundamental question of whether a machine could possess the ability to "think."

In response to this question, Turing proposed an experiment that later became known as the "Turing Test," designed to determine the conditions under which a machine could demonstrate behavior comparable to human intelligence (Alan Mathison Turing, 1950, *Computing Machinery and Intelligence*).

Although Turing's work laid the conceptual foundations of the field, the term "Artificial Intelligence" itself did not emerge until 1956. At that time, the primary objective was to develop machines capable of reproducing certain aspects of human intelligence.

Initially, the concept of artificial intelligence sought to combine the study of the human brain with that of machines. Over time, this convergence, referred to as artificial intelligence, evolved into an established technological reality, as emphasized by Pierre Mounier-Kuhn.

Consequently, it became necessary to define the concept more precisely. One of the simplest definitions describes AI as “the set of theories, tools, and techniques used to design machines capable of simulating intelligence.” However, this definition remains relatively broad, as it encompasses numerous concepts and techniques that are often confused with artificial intelligence itself, such as machine learning and data science.

In an attempt to address this conceptual ambiguity, Marvin Minsky (1961), considered one of the pioneers of artificial intelligence, defined AI as the construction of computer programs that perform tasks which, for the time being, are accomplished more satisfactorily by human beings because they require high-level mental processes such as perceptual learning, memory organization, and critical reasoning.

Similarly, Accenture Technology Vision (2017) defines artificial intelligence as a set of processes and techniques that enable machines to demonstrate intelligent capabilities and reproduce certain aspects of human behavior. These technologies encompass several techniques, including machine learning, chatbots, deep learning, facial recognition, and speech recognition.

In this regard, Minsky's theoretical perspective (1976) has influenced numerous researchers by defining artificial intelligence as the construction of computer programs that perform tasks which, for the time being, are accomplished more satisfactorily by human beings because they require high-level mental processes.

B. Approaches and Techniques in Artificial Intelligence

According to Soudoplatoff (2018), artificial intelligence is based on three major approaches:

1. The Human Approach: This approach is based on the imitation of human intelligence and relies on advanced technologies capable of translating natural language into a form that can be processed and understood by machines.
2. The Analytical Approach: This approach relies on statistical tools and methods, particularly those based on the factor analysis of data.

3. The Algorithmic Approach: This approach primarily focuses on the development of sophisticated algorithms and the modelling of the human brain in order to solve different types of problems.

In this regard, Rousseaux (1990) argues that the capabilities of designed systems can contribute to the systematic optimization of available solutions by continuously integrating abilities related to natural language processing, advanced knowledge acquisition, learning, and automated reasoning.

Through these different approaches, artificial intelligence has developed into an increasingly mature technology that has generated numerous techniques, including:

- Machine Learning: This technique is based on automated learning processes that make it possible to develop sophisticated algorithms (Cardon et al., 2018). These systems improve over time through learning and can analyse large volumes of data in order to identify patterns and anticipate future behaviors (Bhatnagar, 2018).
- Learning Analytics: Digital transformation has generated new behavioral patterns, including the extensive use of social media, the multiplication of online interactions and conversations, and the growth of user-generated content. According to Rodda (2014), these new behaviors and interactions represent a valuable source of information for organizations when they are carefully analysed through content filtering and data analysis techniques.
- Customer Journey Mapping: This technique enables organizations to visualize and analyse the customer journey by examining customers' usual behaviors across various physical and digital touchpoints.
- Text Mining: Text mining refers to a technique primarily based on the automated processing and analysis of textual content, including the identification and analysis of words and linguistic patterns (Scheid et al., 2012).
- Facial Recognition: Advances in artificial intelligence have made it possible for machines to recognize products or identify customers' faces using various types of visual information, such as photographs.
- Expert Systems: These systems make it possible to capture and integrate the knowledge and experience of experts within a particular field into a computerized system. This knowledge can subsequently be used to support decision-making processes and identify appropriate solutions when required.

- **Behavioral Retargeting:** Behavioral retargeting involves continuously adapting an organization's communication strategy to customers' expectations, interests, and needs. This technique makes it possible to identify and re-engage customers who have shown interest in a particular offer or who have initiated, but not completed, a purchasing process. According to Guerin (2013), this approach can directly contribute to increasing conversion rates through recommendation algorithms.

It is therefore evident that, through its various approaches, techniques, and tools, artificial intelligence has become increasingly developed and widely adopted across numerous sectors and fields of activity. Its global expansion reflects the growing importance of this technology, although significant differences remain across countries and regions.

The United States and China, for instance, have emerged as global leaders in this field by making substantial and continuous investments in research and development, thereby accelerating the advancement of artificial intelligence technologies. In 2022 alone, global private investment in AI amounted to approximately USD 91.9 billion.

However, investment in artificial intelligence remains relatively limited, and in some cases insignificant, across African countries. The figure below provides an overview of AI investment across the Middle East and Africa (MEA) region.

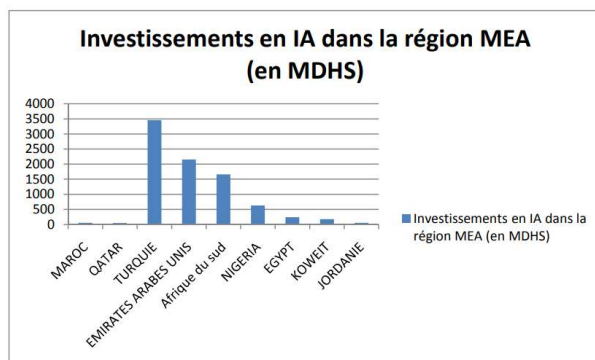


Figure 1: AI Investments in the Middle East and Africa Region

Source: AI investments in the Middle East and Africa region.

An examination of investment data across countries in the Middle East and Africa reveals that Morocco remains among the countries with relatively low levels of investment in artificial intelligence, with only USD 57 million invested across seven transactions.

Among other countries in the region, Qatar invested USD 52 million across several transactions, a relatively modest amount compared with Türkiye, which recorded investments of USD 3.459 billion across 252 transactions. The United Arab Emirates invested USD 2.151 billion across 160

transactions. Similarly, South Africa recorded investments of USD 1.658 billion across 134 transactions, while Nigeria invested USD 630 million across 87 transactions. Kuwait and Jordan recorded investments of USD 177 million and USD 100 million, respectively.

Based on these observations, it can be argued that Morocco has taken initial steps toward the development of artificial intelligence. Nevertheless, these efforts remain relatively limited, and AI technologies have not yet reached a fully mature stage within the country.

Indeed, Morocco is still largely positioned at the “Data Engineering” stage. Many organizations currently focus primarily on collecting, processing, and digitizing data in order to facilitate subsequent analysis and decision-making. This stage represents an important prerequisite for the broader development and implementation of artificial intelligence.

Nevertheless, the future remains promising. In Morocco, certain sectors have already made considerable progress in their technological transformation, particularly financial institutions such as banks and insurance companies. Telecommunications operators occupy a second position, followed by selected industrial companies and public administrations.

Furthermore, in September 2019, Morocco inaugurated Africa's first school dedicated to artificial intelligence: the Euromed School of Digital Engineering and Artificial Intelligence (EIDIA), affiliated with the Euromed University of Fez (UEMF).

In addition, the Kingdom has organized a number of initiatives, events, and conferences aimed at highlighting the importance of artificial intelligence and promoting its potential applications across various sectors of the national economy.

C. Artificial Intelligence and Big Data

Big Data primarily refers to the ability of organizations to manage, process, and analyse large volumes of data in order to improve their performance. This explains why Big Data has become a major subject of interest among both researchers and managers (Wamba & Carter, 2016).

The rapid development of mobile technologies, e-commerce websites, social media platforms, search engines, and other digital technologies has encouraged organizations to seek solutions capable of analysing large volumes of data rapidly and efficiently (Surbakti et al., 2020).

Big Data provides organizations with the capacity to generate and capture data characterized by the three well-known Vs: Volume, Variety, and Velocity (Russom, 2011).

- Volume: This refers to the quantity of data held or generated by an organization.
- Variety: This refers to the different types and formats of data, which may be structured, semi-structured, or unstructured.
- Velocity: This refers to the speed at which data are generated, processed, analysed, and transmitted.

The concept of Big Data generally applies to datasets whose size exceeds the processing capabilities of traditional database management tools and software. However, it is important to emphasize that the quantity of data alone does not create value (Mayer-Schönberger & Cukier, 2013). Rather, value emerges from the ability to analyse these data and transform them into meaningful and high-quality information.

Data must therefore be properly processed and analysed in order to generate information that can support organizational decision-making. Without such analysis and interpretation, large volumes of data remain largely unusable.

III. ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION

A. The Rise of Artificial Intelligence in Education

For several years, artificial intelligence (AI) has attracted growing interest within educational and scientific communities. This interest has intensified as technological performance has improved, opening new perspectives for higher education, including within the Moroccan context.

Artificial intelligence contributes to strengthening university governance and improving institutional efficiency.

According to Zawacki-Richter et al. (2019), AI applications in higher education are diverse and include:

- Student profiling and prediction of academic trajectories;
- Intelligent tutoring systems;
- Adaptive learning and assessment methods;
- Personalization of educational content.

HALI and ELHAOUD (2023) define artificial intelligence as a set of computer-based systems capable of reproducing human cognitive processes, such as learning, adaptation, and data synthesis. Its potential applications extend to all stakeholders within the higher education sector, including researchers, teachers, students, and administrative staff.

Today, higher education institutions in both developed and developing countries are increasingly integrating AI technologies to improve the quality of education. AI-based tools contribute, in particular, to the modernization of assessment systems and skills development processes, while promoting more flexible and accessible learning environments.

However, this technological transition requires substantial investment in educational technologies and digital infrastructure.

B. The Impact of Artificial Intelligence on Moroccan Higher Education and Big Data Management

Morocco has undertaken several reforms aimed at modernizing its education system. These reforms include the adoption of the Bachelor's–Master's–Doctorate (LMD) system, the development of contractual relationships between the State and universities, and the integration of digital technologies into educational processes.

Within this context, Morocco's national digital strategy aims to:

- Facilitate access to knowledge through dedicated digital platforms;
- Expand educational offerings, particularly through distance learning;
- Modernize teaching methods;
- Enhance the attractiveness and competitiveness of universities (JMOULA & BELOUALI, 2022).

Several initiatives and projects, such as INJAZ, GENIE (2009–2013), and MARWAN, have promoted the integration of Information and Communication Technologies (ICTs) within the Moroccan education system. These initiatives have supported the development and adoption of tools such as:

- Learning Management Systems (LMS), including Moodle;
- Massive Open Online Courses (MOOCs);
- Digital libraries and online scientific resources.

This digital transformation, characterized by the emergence of Big Data, Cloud Computing, and connected devices, enables universities to collect and exploit large volumes of data in order to optimize their processes.

Artificial intelligence plays a central role in this transformation by facilitating the development of personalized learning approaches, including hybrid, online, and adaptive learning models. It also contributes to the redesign of educational programs in order to better align them with the evolving needs of the labor market (JMOULA & BELOUALI, 2022).

For teachers, AI facilitates the adaptation of courses to individual student profiles, improves classroom interactions, and enhances assessment processes. It also supports scientific research through advanced data analysis tools.

Nevertheless, the implementation of AI systems generates substantial volumes of educational data that require effective management systems in order to be fully exploited.

These “educational data” include all information generated by higher education institutions, including administrative, pedagogical, and research-related data. Their effective use requires several stages, beginning with data collection and structuring, followed by processing through analytical tools, and ultimately their use to support organizational and strategic decision-making (JMOULA & BELOUALI, 2022).

Big Data refers to the capacity to process massive volumes of structured and unstructured data in order to extract valuable insights. Within universities, Big Data can be used to anticipate students' academic difficulties, adapt educational programs, and improve institutional management processes (Picciano, 2012).

However, the heterogeneous nature of educational data, particularly data originating from social media platforms, blogs, and other digital sources, may complicate their collection, processing, and exploitation.

According to Alkhalil et al. (2021), by transforming raw data into actionable information, universities can:

- Assess their institutional performance;
- Anticipate future trends;
- Optimize their strategic decision-making processes.

IV. CONCLUSION

Artificial intelligence and Big Data are profoundly transforming Moroccan higher education. These technologies offer significant opportunities, particularly in terms of personalized learning and improved administrative efficiency. However, their implementation also requires appropriate regulatory frameworks to ensure ethical practices, equity, and the protection of personal data.

Indeed, AI technologies raise several important challenges, particularly regarding privacy and data protection. AI algorithms require substantial volumes of data, including personal information such as digital footprints, user activity, and access to online platforms.

The collection and use of such information may compromise confidentiality, particularly when data are processed without the informed consent of the individuals concerned (Collin & Marceau, 2021).

Universities must therefore ensure that stakeholders are adequately informed about how their data are collected and used. They must also provide appropriate training to staff regarding data protection and limit the unnecessary sharing of information with third parties.

These challenges are particularly complex because educational AI systems are often developed primarily by private technology companies and computer scientists rather than by educational specialists or pedagogical experts (Zawacki-Richter et al., 2019). This gap between technological development and pedagogical expertise may limit the ability of AI systems to adequately address the actual needs and realities of higher education.

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