Tikrit Journal of Administrative and Economics Sciences
مجلة تكريت للعلوم الإدارية والاقتصادية
EISSN: 3006-9149
PISSN: 1813-1719

The Effect of Applied Artificial Intelligence on Scientific Studies in Economics and Management

Musa Abdullah Hameed[*A], Mohanad A. Romaed[B], Mohammed Imad Abdulazeez [B], Safa K. Atea[A], Mohammed R. Sobhi[A]

[A] College of Petroleum Processes Engineering/Tikrit University
[B] College of Management and Economics/Tikrit University

Keywords:
Artificial intelligence, scientific studies,

Article history:
Received 12 Jan. 2025
Accepted 23 Jan. 2025
Available online 25 Jun. 2025

*Corresponding author:
Musa Abdullah Hameed
College of Petroleum Processes Engineering/Tikrit University

Abstract: Applied Artificial Intelligence (AI) has emerged as a transformative force in scientific studies within economics and management, reshaping theoretical frameworks and decision-making processes. This research investigates the integration of AI technologies into these fields, focusing on their role in enhancing productivity, efficiency, and the quality of economic and management research. By leveraging AI's capabilities in pattern recognition, data analysis, and decision modeling, researchers and practitioners can uncover insights that traditional approaches often miss. The study emphasizes the collaboration between AI specialists and economists to embed socio-economic models into AI systems, ensuring relevance and practical applicability. It also identifies best practices for incorporating AI into traditional methodologies, addressing gaps in current research approaches. Furthermore, the study explores the potential of AI to drive innovation in strategic management, resource allocation, and economic forecasting. By examining applications from 2000 to 2023, this research highlights AI's impact on overcoming global challenges and advancing economic and management disciplines. Ultimately, it aims to bridge the gap between extensive theoretical knowledge and practical AI applications, providing a roadmap for future research and innovation.

تأثير الذكاء الاصطناعي التطبيقي على الدراسات العلمية في الاقتصاد والإدارة

موسى عبدالله حميد
كلية العمليات النفطية
جامعة تكريت

مهند عبدالكريم رميض
كلية الادارة والاقتصاد
جامعة تكريت

محمد عماد عبدالعزيز
كلية الادارة والاقتصاد
جامعة تكريت

صفا خلف عطية
كلية العمليات النفطية
جامعة تكريت

محمد رشيد صبحي
كلية العمليات النفطية
جامعة تكريت

المستخلص

برز الذكاء الاصطناعي التطبيقي (AI) كقوة تحويلية في الدراسات العلمية في مجال الاقتصاد والإدارة، حيث أعاد تشكيل الأطر النظرية وعمليات صنع القرار. يبحث هذا البحث في دمج تقنيات الذكاء الاصطناعي في هذه المجالات، مع التركيز على دورها في تعزيز الإنتاجية والكفاءة وجودة البحوث الاقتصادية والإدارية. ومن خلال الاستفادة من قدرات الذكاء الاصطناعي في التعرف على الأنماط، وتحليل البيانات، ونمذجة القرار، يمكن للباحثين والممارسين اكتشاف رؤى غالبًا ما تفوتها الأساليب التقليدية. تؤكد الدراسة على التعاون بين متخصصي الذكاء الاصطناعي والاقتصاديين لتضمين النماذج الاجتماعية والاقتصادية في أنظمة الذكاء الاصطناعي، مما يضمن الملاءمة والتطبيق العملي. كما يحدد أفضل الممارسات لدمج الذكاء الاصطناعي في المنهجيات التقليدية، ومعالجة الثغرات في مناهج البحث الحالية. علاوة على ذلك، تستكشف الدراسة إمكانات الذكاء الاصطناعي لدفع الابتكار في الإدارة الاستراتيجية، وتخصيص الموارد، والتنبؤ الاقتصادي. ومن خلال دراسة التطبيقات من عام 2000 إلى عام 2023، يسلط هذا البحث الضوء على تأثير الذكاء الاصطناعي في التغلب على التحديات العالمية وتطوير التخصصات الاقتصادية والإدارية. وفي نهاية المطاف، يهدف البرنامج إلى سد الفجوة بين المعرفة النظرية الواسعة والتطبيقات العملية للذكاء الاصطناعي، وتوفير خارطة طريق للبحث والابتكار في المستقبل.

الكلمات المفتاحية: الذكاء الاصطناعي، الدراسات العلمية.

1. Introduction

Applied Artificial Intelligence (AI) has attracted increasing relevance recently in scientific studies, especially in the domain of economics and management. Different fields or disciplines of science affect the development of a particular branch of knowledge. They sometimes complement and enhance each other's growth, while at other times, competition exists between them. However, the impact of a particular field of science on the considered branch is always essential, and this impact should be carefully studied, especially when the former is on the developing path [1]. As one of the high-tech industries, Artificial Intelligence (AI)

Technology has been applied in almost all aspects of human life. Moreover, AI technology is found to be particularly closely related to the economic development of human society. With the increasing elaboration and widespread applications of AI technology, the human economies and businesses have changed significantly; the so-called applied AI is emerging and again reshaping the human economies and industries.

It is important to take a snapshot of what applied AI is currently doing on scientific studies in the field of economics and management. This topic seems to be increasingly important and relevant, not only for the research scientists working in the development of the AI technology but also for the economists and managers as end-users of this technology. A broad observation of applied AI on scientific studies in the field of economics and management is made, discussing a few typical and simple examples in detail. Observations and discussions on the simplicity and necessity of carefully understanding the applications of AI technology are hoped to be helpful for the scientific studies in the field of economics and management, as well as for the further development of the AI technology itself. Since the time when the human society first entered into the industrial revolution period, economies and businesses have evolved continuously but sometimes drastically in accordance with the development of the techniques. Thus, it is natural to expect that the newly emerged techniques would largely affect the development of the human economies and industries. Therefore, this subject would be very insightful and of great interest scientifically, industrially, and socially. Moreover, six questions are raised to focus the attention on the objectives of this investigation:•Why the economies and businesses consider developmental aspects and changes?•Why deterministic models of the economies and businesses are feasible?•Why applied AI is studied on the economic management issues instead of complicated theoretic models?•What applied AI is currently doing on scientific studies in the field of economics and management?•What observed applications of applied AI imply?•What the progress of applied AI could bring to the field of economics and management?

1-1. Background and Rationale

Artificial Intelligence (AI) has deeply penetrated social life and become strategically pivotal for nations. Society 5.0 seeks to address social issues through smart solutions, placing AI at its core. The European Union

aims to lead AI development and adoption, focusing on ethics, transparency, and humanity. In China, AI is vital for economic transformation and innovation, with extensive planning and investments. The U.S. emphasizes ethical AI use in defense while fostering industry collaboration. Essentially, nations view AI as a "new productivity" engine with social, ethical, and political consequences [1].

AI's multifaceted definition spans disciplines like philosophy, cognitivism, neuroscience, robotics, and linguistics. Generally, AI refers to machinery simulating cognitive functions such as learning and problem-solving, facilitating automatic decision-making in smart systems. AI applications include object/person identification, language translation, medical image analysis, chatbots, and stock trading. Economic and management studies are crucial for social activity organization, stakeholder interactions, and resource allocation, involving substantial decisions based on theoretical models informed by collected data. Recent decades brought an unprecedented data volume explosion from societal digitalization, alongside computational power advancements for hidden pattern discovery and decision making. These data and processing capabilities enable knowledge discovery and model building in complex systems across various fields, blurring disciplinary boundaries.

Economics and Management discipline scientists are encouraged to cooperate with artificial intelligence specialists, ensuring economic and management models/decision systems are interpreted, incorporated, and embedded in applied AI systems. Applied artificial intelligence's rationale accentuates socio-economic model awareness and disciplinary theory limits in current experimental design, artificial intelligence system architecture, and learning algorithm development. Addressing these limitations fosters scientific development in artificial intelligence and its applications to complex socio-economic systems. Prior research reviews artificial intelligence applications and modelling comprehension in economic and management studies. While insightful, they lack in-depth research methodology discussions for artificial intelligence applicability enhancement in economic and management disciplines. Addressing this gap, pertinent scientific milestones in artificial intelligence development influencing economic and management discipline applications are delineated. The data volume surge and processing capability improvement,

facilitating pattern discovery in data and embedding knowledge in decision systems, are discussed.

1-2. Research Objectives: This research aims to explore the impacts of applied artificial intelligence technologies on scientific studies in economics and management, as well as management practices in the respective fields. Specifically, it investigates how recent developments in applied artificial intelligence can enhance the quality and productivity of studies conducted by professional economists and management researchers and improve the efficiency of decision-making by technical managers and middle/senior executives in organizations engaged in economic and management activities [1]. This focus can yield concrete results of considerable value to OECD countries, particularly as these countries' economies and societies face numerous difficulties in the wake of the COVID-19 pandemic, Russia's invasion of Ukraine, and other global crises.

To achieve this main objective, seven specific objectives are delineated. First, the impacts of applied artificial intelligence on productivity, decision modeling, and choices in scientific studies in economics and management are comprehensively overviewed. Second, the impacts and possible benefits of applied artificial intelligence on the quality and productivity of scientific studies in economics and management are assessed based on an international survey of researchers in the respective fields. Third, the impacts and possible benefits of applied artificial intelligence on the efficiency of applied economic and management studies are assessed based on an international survey of technical managers and middle/senior executives who apply the results of studies in the respective fields. Fourth, practical and effective best practices in the applied artificial intelligence-assisted scientific studies in economics and management are identified for guiding going-forward strategies in these fields. Fifth, the best practices in the incorporation of applied artificial intelligence into traditional research methodologies in scientific studies in economics and management are identified. Sixth, the possible impacts of applied artificial intelligence on economic decision modeling and possible solutions for applied artificial intelligence-induced changes to economic decision models are discussed. Finally, the research methodology, the structure of the thesis, and its contributions to the body of knowledge are introduced. The research results are expected to contribute to the existing literature by providing novel

insights on the impacts of recent developments in applied artificial intelligence on scientific studies in economics and management and management practices in the respective fields. In particular, it is expected to contribute to the developing literature on the impacts of artificial intelligence on scientific research and the productivity of researchers. Moreover, it is expected to contribute to the literature on the impacts of artificial intelligence on economic analyses and decisions. Furthermore, this research is undertaken from both theoretical and practical perspectives in the respective fields.

1-3. Scope and Significance: The research examines the current and future impact of applied artificial intelligence on scientific studies in a selected set of topics in economics and management. Artificial intelligence is understood as computational procedures that model aspects of human intelligence and behaviour through computer algorithms that learn from experience. The research focuses on scientific studies in general and applied artificial intelligence in specific sub-disciplines of economics and management as a significant part of artificial intelligence in application. Artificial intelligence, topics in economics and management, and the combination of the two concepts in scientific research studies and their impact are discussed. The research covers scientific studies from 2000 to mid-2023 in artificial intelligence as a main topic and selected sub-topics in economics and management as a second topic.

The research significance lies in its potential to bridge the gap between relatively extensive theoretical knowledge and limited practical knowledge and applications of artificial intelligence. The significance of artificial intelligence applications and their impact on future studies will be highlighted. A better understanding of artificial intelligence's role, impact, and importance can facilitate better decision-making in economics and management as disciplines and in other applied fields. Artificial intelligence is especially relevant for future economic forecasting studies and for better understanding complex and game theoretic issues in management decision-making. Applied artificial intelligence can significantly impact strategic management studies concerning competitive advantage, capability development, and resource allocation. As artificial intelligence technologies become widely available, the research aims to inspire interest, further studies, and investments in artificial intelligence technologies and applied

artificial intelligence impacts. The scope of the research is also discussed, focusing on which areas of economics and management research will be examined concerning the applied use of artificial intelligence. Limitations of the research scope are also shortly acknowledged to ensure a balanced perspective. Selected topics of management research studies and possible applied artificial intelligence impact are not discussed [1].

2. Foundations of Artificial Intelligence

Artificial Intelligence (AI) and Applied Artificial Intelligence (AAI) are terms used to describe technologies and systems that can simulate, replicate, or supplement human decision-making, cognitive capabilities, or actions. These terms can also refer to a scientific study of those technologies and systems [2]. There are two forms of AI: strong AI and weak AI. Strong AIs are systems that truly replicate human cognition, capability, or intelligence. Currently, there are no strong AIs. Weak AIs are systems that simulate or supplement human cognition, capability, or intelligence. Currently, there are many implementations of weak AIs. The most widely discussed forms of weak AIs are machine learning (ML) systems. AAs are applied weak AIs either currently implemented or being considered for implementation [3].

There are three types or classes of AIs: deterministic, stochastic, and emergent. Deterministic AIs are systems in which the output or action is determined uniquely from a given set of inputs or environmental states. Applications of deterministic AIs do not include AIs that learn. Stochastic AIs are systems in which the output or action is not uniquely determined by the input or environmental state but is probabilistic. AIs that use random numbers in their algorithms fall into this category. Examples of probabilistic AIs include ML approaches that use a non-deterministic algorithm, such as a genetic algorithm or simulated annealing. Emergent AIs are systems in which the output or action cannot be derived from the knowledge of the input or environmental state alone, deterministic algorithms, or random numbers. Neural networks are typically emergent AIs. Currently, most widely implemented AIs are emergent AIs trained on data.

2-1. Definition and Concepts: Artificial Intelligence (AI) is extensively examined and discussed within its diverse applications across various fields. However, these discussions often overlook a comprehensive definition of AI, which is crucial given the varying definitions across different contexts and

fields. Therefore, this section begins by defining AI with the aim to provide clarity for researchers and practitioners handling AI-related issues. To help with understanding, technical terms associated with AI, including algorithms, data sets, automation, and data analysis are also delineated. Based on a comprehensive review of AI literature, different types of AI, including narrow and general AI, are distinguished to establish the implications of these concepts in the context of the present research. Additionally, computational intelligence, as the means of enhancing AI functionalities, is discussed. How these definitions and concepts translate into practical applications within economics and management is then examined. Overall, this subsection endeavors to provide a necessary basis for understanding AI development in a wider context and the interdependent relationship between AI and other technologies. It is emphasized that clear definitions are needed within the econometric and statistical communities to develop coherent studies, analyses, and experiments, as well as effectively communicate the results and findings. Without coherent definitions, efforts from researchers and practitioners could be redundant, misplaced, or misinterpreted due to a lack of common understanding and clarity [1]. Consequently, the need for definitions becomes even more significant with the rapid AI development in applied scientific studies within economics and management. Stakeholders including researchers, educators, practitioners, and students who engage with AI-related issues would benefit from these definitions. In general, the purpose of this subsection is to provide vital clarity. To address the unprecedented challenges posed by artificial intelligence (AI) technologies, thoroughly defined and delineated concepts for understanding and mitigating these challenges are needed. A comprehensive definition of AI is critical, given the often varied definitions across different contexts and fields. A wide-ranging examination of recent studies in applied AI is presented, along with an analysis of the impacts on scientific studies and relevant methodologies within economics and management. By thoroughly reviewing and examining the literature, necessary key definitions and concepts regarding AI and applied AI—essential for understanding AI development in a wider context—are meticulously delineated [4]. In addition, the importance of these definitions and concepts for the economics and management fields is discussed.

2-2. Key Techniques and Algorithms

Artificial intelligence applications are developed based on essential techniques and algorithms that underpin this technology. Supervised learning refers to a class of machine learning algorithms that try to learn a function from a labeled training set. A label is an output that is assigned to each input in the dataset. The goal is for the learned function, also called a model, to be able to predict the label of previously unseen inputs. On the other hand, unsupervised learning tries to learn a function from an unlabeled training set [1]. There are no labels associated with the input in this case. One of the main goals of this approach is to find some structure in the data by discovering clusters of similar instances or grouping.

In addition to these AI methods, there are also other important algorithms. Data mining algorithms refer to a set of methods that aim to discover previously unknown patterns in datasets. Natural language processing algorithms concern a set of methods that can analyze textual data. These algorithms can extract specific information from text. They can be used in economic analysis, management strategy, and other applications to discover trends in text-rich data, such as news articles and company reports. Another kind of algorithm involves optimization algorithms. These algorithms search for the optimal solution to a problem within a defined set of feasible solutions. The optimization algorithm can improve a process through a series of adjustments made to the decision variables involved. This is relevant to many industrial and economic processes. For example, a company can maximize its profit by finding the optimal combination of product prices [4]. The choice of algorithm depends on the application and available data. Implementing an algorithm often requires complex programming. Even after an algorithm is implemented, its performance may still not be sufficient for a given task. Therefore, selecting an appropriate algorithm remains a challenging task. While these techniques are now widely applied, they still need to be further developed and fine-tuned to address specific issues in everyday life. It is important to note that many of these techniques continue to evolve, often quickly. In general, AI applications use various functions and techniques that can be combined in different ways. These combinations allow for the development of applications that are well-suited to the particular environment in which they operate. Thus, AI

applications can adapt to changes in their environment, which is an important characteristic of this technology.

3. Applications of Artificial Intelligence in Economics

Artificial Intelligence (AI) technology applications have been increasingly used in academia, including philosophy, law, economics, education, and other disciplines. In recent years, with the support of applied AI academic institutions, investment from the government and private sectors, and researchers' concepts, ideas, and enthusiasm, there has been an increasing amount of scientific studies published regarding the applications of AI technology in economics, education, management, and other sub-disciplines of applied AI. AI technology is applied in modeling, prediction, decision making, risk monitoring and control, data analysis, and smart education activities involving economic and management systems. This idea is fundamentally similar to the concept of AI-empowered technology applications and econometric models, algorithms, and systems redesign in better shaping, analyzing, controlling, and forecasting economic and management systems. In this note article, the published scientific studies on the applied AI in economics and management topics are collected, to critically summarize the study cases of methodologies, models, systems, and applications and understand the frontiers in developments and implementations of the applied AI in the economic and management systems. The goal is also to stimulate interests and more research studies on the applied AI in economic and management systems for better developments and implementations of the applied AI in academia, industries, and society.

Artificial Intelligence (AI) has been widely applied in many disciplines and industries. With the rapid development of AI technologies and the academic, governmental, and investment inputs, there has been an increasing amount of research studies or scientific publications regarding the applications of AI in disciplines and industries, including Teacher Education System, Education Equity, Active Learning, Learning Analytics, Smart Classroom, Intelligent Assessment, Game-based Learning, Didactic Measurement, Cognitive Diagnostic Assessment, Learning Support, Learning Behavior, Learning Path Planning, Learning Performance Analysis, Learning Recommendation, Learning Environment, Learning Resource, and Learning Quality. Similarly, to the above AI technology

applications in education activities, AI technology applications can reshape better modeling, forecasting, decision making, risk controlling, and data analyzing economic and management systems, as a newly emerging research study topic, sub-discipline, or research frontier in most academic research institutions. Academia and industries should continually adapt and accommodate the newly emerged technologies, such as the impacts of the artificial intelligence technologies, on the development of economic systems and management sciences or globally reshape the economic and management systems for the better.

3-1. Predictive Analytics: Researchers and policymakers can harness applied AI to enhance scientific studies in economics and management, particularly through predictive analytics. By training machine learning models with economic data, one can forecast various economic issues, such as GDP growth or unemployment rates, thereby improving economic policy responses. These models can extract patterns imperceptible to traditional econometrics, offering robust forecasts, especially in turbulent periods. Moreover, applied AI democratizes scientific knowledge and expertise in public policy formulation, making accurate predictions accessible to non-specialists. Notably, the pandemic accelerated the adoption of simple AI predictions in public policy, facilitating rapid expert evaluations and across-country comparisons.

Applied AI classifies models into three categories: academic, expert, and ad-hoc. Academic models employ complex algorithms for prediction and analysis but are resource-intensive. Expert models summarize predicted policy responses and impacts in straightforward models suitable for wider use. Ad-hoc models focus on disseminating insights from prior model classes, offering basic analytics and visualizations from academic models while oversimplifying methodologies.

Applied AI, leveraging machine learning algorithms, enhances the accuracy of simple models in scientific studies of economic phenomena. AI models can replicate and improve existing models through open dissemination, promoting transparency and scrutiny. Furthermore, applied AI democratizes access to scientific knowledge, enabling policymakers and analysts without formal education to understand model impacts and exploit new datasets.

3-2. Optimization and Decision Making: Optimization and decision making problems span a wide array of applications, from minimizing costs and maximizing profits to enhancing resource allocations, from forecasting scenarios to decision support systems. These procedures often require pre-defined mathematical models – a set of equations that characterize the system's behavior and performance. In Applied AI, the desired optimization and decision methodology will still be performed by a machine, yet its associated "intelligence" will help address particular shortcomings of classical methods, involving the design of the mathematical models themselves, their parameter calibrations, non-uniqueness, complexity, and adaptability to structural changes after deployment. For AI-enabled solutions, mathematical models can be retained, combined with a tailored learning engine that merely estimates the model parameters, or discarded entirely, relying exclusively on "data-driven" learning systems that interpret the simulated/real observations of the system.

As a typical example of "data-driven" predictive engines with a low level of intelligence, past work on systems of Artificial Neural Networks compares the performance of some architectural choices on economic applications, involving time-series forecasts of oil prices, of short-term interest-rate dynamics, and of exchange rates of several currencies. In ANNs, this architecture-independent learning mechanism is an iterative gradient-based reduction of an error function, which compares the model predictions against a training set of observations. Metaheuristic optimization algorithms provide a family of computationally extensive learning autonomously-driven strategies, capable of optimizing differentiable and discontinuous, convex and non-convex functions, addressing a wide spectrum of scientific optimization problems, including in economics and management.

Similar AI frameworks exhibiting increasingly higher levels of intelligence involve embedded econometric models. In applied economics, pre-defined EMs often comprise a system of simultaneous non-linear equations, representing "rational agents". For these models finding a stable and convergent numerical solution is necessary to interpret them. Central Banks routinely deploy and publicly release such enormous systems of equations – hundreds of variables and thousands of parameters, extensively used for forecasting scenarios and policy responses, then compared with real

observations. These competitive modeling evaluations are often supported by different statistical criterion optimizations.

4. Applications of Artificial Intelligence in Management

Artificial Intelligence (AI) is progressively becoming an integral part of organizations in various industries and sectors. AI systems, tools, and technologies are employed within business organizations to simplify or address managerial work and decision-making. The management domain is one of the most important domains in which AI technology is applied. Management is regarded as a significant domain of knowledge and practice in industrialized societies, and as industries and businesses turn to artificial intelligence to assume responsibilities traditionally held by human employees, managerial roles are examined for their potential to transform in the wake of AI [1]. Consequently, artificial intelligence is anticipated to have a remarkable impact on management studies and practices.

There is a growing interest in the impact of applied artificial intelligence on scientific studies in the discipline of economics and management. There is recognition of the importance of understanding how artificial intelligence technologies are employed in management practices and how these technologies impact and alter management studies, practices, methods, models, and paradigms [5]. The purpose is to examine the applications of artificial intelligence in the management domain. In this examination, the applied artificial intelligence systems, tools, and technologies are the focus of attention, investigating how artificial intelligence technologies are employed within management practices. Artificial intelligence technologies are often paralleled with big data technologies, particularly in handling data and information and enhancing the speed and efficiency of managerial operations and decision-making processes. However, artificial intelligence technologies are understood here as independent and distinct from big data technologies.

4-1. Supply Chain Management: Applied Artificial Intelligence (AI) uses smart algorithms or quantifications for decision-making in organizations or businesses. It has an effect on scientific studies in economics and management disciplines like exploration, development, quantification, application, and assessment policy, strategy, and action of economic entities or organizations, including businesses and industries. Artificial Intelligence (AI) or smart ecosystem has a potential impact on businesses, industries, and

organizations. New applied AIs or smart schemes can be designed to create business profitability and market share mass growth or to ameliorate business productivity, efficiency, and performance. In particular, the applied AIs can create opportunities for business modernization and up-to-date digital enhancement [5]. Utilization or employment in supply chains is analyzed in regard to action areas, impact, emphasis on applied AIs technology, application development, and organization case studies. Before investigating the applications and impacts of AI within the SC, it is crucial to define Supply Chain Management (SCM). SCM comprises the management of the end-to-end flow of products, services, and information from the point of origin to the point of consumption. Moreover, SCM takes on an integrative function, as it links key business areas and processes and facilitates the coordination between channel partners like suppliers, service providers, and customers. By assuring that key activities are performed timely and efficiently, SCM is crucial to business success and fulfilling customers' needs [6]. Supply chains (SC) are networks composed of different organizations that collaborate to deliver products and services to the end consumer. To cope with complex collaborations across various organizations, SC management requires specific visibility, efficiency, and agility. Unfortunately, the rapid evolution of consumer behavior and new technologies and disruptors poses many challenges for organizations' SCs. As a result, organizations are making significant investments to enhance their SCs, which represents huge opportunities for applied AIs. Insights reveal that applied AIs play a consequential role in SCs enhancement by examining SC management executives' perspectives. This emphasizes the compatibility of AIs and SCs by discussing how AIs can enhance SCs in terms of visibility, efficiency, and agility.

4-2. Customer Relationship Management

Artificial intelligence has a significant impact on customer relationship management systems. Customer relationship management refers to practices, strategies, and technologies that businesses use to manage and analyze customer interactions and data throughout the customer lifecycle. It focuses on customer retention and ultimately driving sales growth. Customer relationship management systems are important for businesses because they store client data, which promotes customer satisfaction and loyalty. Artificial intelligence applications, such as chatbots and recommendation systems,

play a significant role in customer relationship management frameworks [7]. Recent technological advancements in artificial intelligence have enabled the analysis of large datasets quickly, resulting in improved decision-making and increased productivity. Similar to big data, artificial intelligence involves customer data processing, which aids firms in observing customer behavior and developing new marketing techniques. Artificial intelligence drives insight creation based on analyzed data, which helps organizations actively change their strategies and improve customer experience.

Artificial intelligence technologies are used to enhance customer interaction, such as virtual shopping assistants or product recommendation systems. The data collected from those interactions is used to create driven insights, which are beneficial for firms to market products more personally and predict customer behavior. Although, with artificial intelligence integration in customer relationship management systems, privacy and data security issues arise. This section aims to discuss what customer relationship management systems are and their importance in business fields, identify how customer relationship management frameworks are evolving through artificial intelligence technologies, and provide examples of successful artificial intelligence implementations in real-life customer relationship management systems. Organizations and businesses must focus on continuously adapting customer relationship management systems to emerging consumer needs and preferences, ensuring the relevance of services offered. Illustrating in-depth case studies of artificial intelligence's application in established customer relationship management frameworks will also be discussed.

5. Challenges and Ethical Considerations

The proliferation of artificial intelligence (AI) and machine learning technologies in society has raised a number of critical challenges and ethical considerations that need to be addressed. The development and application of artificial intelligence, particularly applied artificial intelligence, has serious implications and raises numerous questions for the discipline of economics and management. As these technologies advance and rapidly diffuse throughout economies and societies, it is essential to understand how they are impacting and transforming scientific studies in economics and management. These technologies hold transformative potential for the discipline itself, as well as for theory, knowledge generation, scientific

research, and education. However, there are also numerous competing socio-technical challenges and threats that need to be taken into consideration.

There are several widely discussed challenges and ethical considerations that are particularly relevant to the applied artificial intelligence social systems being studied in the context of economics and management. One of the major concerns is related to the collection and use of different types of data, especially when it comes to personal data. There are worries about how data is captured and used without the knowledge of individuals, and how it becomes a commodity that is traded and profited from. Questions of data ownership, privacy, and security are prominent in the public discourse, especially since the introduction of the General Data Protection Regulation (GDPR) in the European Union. Data used to develop an applied artificial intelligence social system should be handled responsibly, especially personal data [8]. There are also widely discussed ethical dilemmas in algorithmic decision-making when it comes to bias, discrimination, fairness, and accountability. Transparency in artificial intelligence systems is seen as a cure for potential adverse effects, but it is difficult to achieve. It is also important to investigate how artificial intelligence systems can be held accountable for their actions, especially if they have harmful effects [9]. Furthermore, there are issues with implementing artificial intelligence solutions in accordance with existing legal frameworks, including concerns about the accountability of artificial intelligence systems in relation to illegal activities. Most existing laws do not take into consideration non-human actors, and there are also calls to create a new legal framework for artificial intelligence itself. Addressing ethical considerations and challenges mainly requires interdisciplinary collaboration between the domains of social sciences and artificial intelligence technologies. There are also case studies highlighting the real-world implications of not taking ethical considerations into account.

5-1. Data Privacy and Security: As the adoption of artificial intelligence (AI) continues to expand, organizations are increasingly training their own AI systems to enhance customer service, automate processes, and improve workflow efficiency. However, this rapid implementation of AI technology has raised concerns regarding data privacy and security issues. Data privacy is defined as the appropriate use and protection of sensitive information collected by AI systems. In today's data-driven society, data privacy is

relevant because organizations often collect, store, and analyze massive amounts of data, including sensitive information [10]. Without careful data handling, this information is vulnerable to theft or misuse, which could have dire consequences for individuals and organizations alike. AI applications in various industries typically require training models on sensitive data, including customer details, transaction history, and credit information. Consequently, the improper handling of data could result in reputational damage and financial loss for organizations, as well as endanger the safety of individuals affected by a data breach. Regulators have established laws and regulations to protect data privacy and impose penalties on organizations that violate data privacy rights. AI technologies that process consumer information must comply with these regulations and ensure that sensitive data is adequately protected. Admission of accountability is an ethical concern regarding the responsibility of a party for causing harm. Organizations that implement AI technologies must consider ethical issues related to data privacy and security and take precautions to mitigate the risks involved. Organizations' ethical responsibilities include ensuring the security of the data they collect and preventing unauthorized access that could jeopardize individuals' privacy rights. This necessitates the implementation of measures to protect data from misuse or accidental exposure, as well as developing best practices for data handling and storage to foster the public's trust in AI technologies. In summary, organizations that deploy AI models must ensure the data privacy and security rights of the individuals involved and put measures in place to protect against potential risks. Since AI systems are often opaque, preventing possible misuses of AI models may be challenging. Thus, organizations must continuously monitor their AI systems and regularly audit models that have access to sensitive data.

5-2. Bias and Fairness: Bias is a critical issue in the artificial intelligence applications. Bias means that something is unfair. If a piece of artificial intelligence is biased, its outcome, prediction, or decision is unfair, so it negatively impacts its users or some group of people. Artificial intelligence models impact real-world decisions, and there is historical data in the real world that affects the development of new artificial intelligence models. Therefore, if the model's decisions are biased (i.e., unfair), the data will increasingly reflect that bias, causing it to snowball and strongly influence

future models [11]. For example, suppose a model for a bank's crediting decisions systematically refuses loans to a minority group. In that case, they will be increasingly underrepresented in the training data for new models, and therefore the new model will likely further disadvantage that group.

Fairness is the most visible and important aspect of responsibility in designing artificial intelligence systems. A widely cited definition of fairness states that a group of people is equally represented in the data that trains an artificial intelligence model. If a group is underrepresented or misrepresented, the artificial intelligence model will likely produce biased predictions toward that group. For example, suppose a hiring model trained on resumes that fail to evenly distribute the genders selects a disproportionately high percentage of men. In that case, those decisions are biased against women. Similarly, discrimination also happens to groups of people depending on the color of their skin, religion, sexual orientation, and other characteristics.

Algorithmic bias has the potential to embed unfairness into critical decision-making processes, exacerbating inequalities in society. Biased data is at the heart of biased decisions. Since artificial intelligence systems learn from data, historical examples of human decision-making are used to train models. If this data is biased, the artificial intelligence system will likely produce biased outcomes, reinforcing past unjust situations. Algorithmic bias can act as an invisible and automated filter of life opportunities since the decisions of the systems are arbitrary, opaque, and profoundly affect people's daily lives. Although the problem is more prominent in the understanding of socio-economic problems, it is thoroughly present in the number of artificial intelligence implementations in management.

Biased data can result in biased decisions. Most often, historical data harming certain groups of people are attempting to model fairness and using artificial intelligence on top of that biased data to achieve just results. One such widely debated example comes from the criminal justice system. In the United States, the COMPAS model predicts the probability that a person will commit a crime based on historical arrest data. It has been shown that this model is biased against the black population while being generally inaccurate. Another more tragic example is predicting recidivism rates based on the reported crimes to the police. Since police activity is concentrated in particular neighborhoods, people from those neighborhoods are more

detected, judged, and tracked. Therefore, artificial intelligence models disproportionately harm those neighborhoods, often impoverished and filled with minority groups.

Considering artificial intelligence systems' impacts, fairness should be an inherent characteristic and the first priority in their design. Diversity in the data used to train artificial intelligence systems is clearly essential for fairness. As discussed, a group of people is equally represented in the data that trains a model, so many clearly appear ways to identify fairness in artificial intelligence and mitigate them at the expense of performance. Often, things that are trivial in a database are non-trivial in an artificial intelligence system. Since creating databases is very expensive, it is better to have a robust artificial intelligence model that handles everything than several specialized models.

However, once deployed, artificial intelligence systems cannot be fixed but need ongoing evaluation and revisions to ensure fairness and prevent bias. Preemptive actions need to be carefully considered, and there need to be safeguards against possible unfairness in the data from which artificial intelligence models are trained. Although it is good to identify biases post-hoc, it is even better to prevent them in the first place.

6. Future Trends and Research Directions

Emerging trends and future research directions in artificial intelligence (AI) as a pervasive technology in academic disciplines, particularly in applied contexts like economics and management, are examined. Artificial intelligence is highlighted as a mature technology that can be applied and adopted across diverse fields. This technology plays a critical role in the development of disciplines, catalyzing the emergence of new fields of study. Continuous and rapid advancements in technology shape the capabilities and applications of artificial intelligence, which in turn affect its impacts on scientific studies [1]. Four key trends are outlined: the development of artificial intelligence technologies and applications in conjunction with emerging technologies; the importance of interdisciplinary collaboration in advancing artificial intelligence research and applications; trends in user adoption and market demand, which indicate growth areas for the artificial intelligence technologies and solutions; and the importance of creating adaptive strategies for research methodology, models, and

frameworks to ensure relevance in rapidly evolving artificial intelligence technology landscapes.

Two key concerns are addressed, including possible challenges and barriers in implementing future artificial intelligence innovations, and the structuring of these concerns at macro, meso, and micro levels. The goal is to provide a forward-looking perspective on the evolving landscape of artificial intelligence technologies, applications, and impacts. Recent and anticipated developments in artificial intelligence technologies and applications indicate that artificial intelligence is increasingly integrated with other, often emerging, technologies, creating synergies in capabilities and applications [12]. Artificial intelligence technologies can learn from and enhance other technologies. For instance, natural language processing technologies can convert languages to a format that enables blockchain applications to decipher the meaning of the text. In turn, other technologies can expand artificial intelligence capabilities.

6-1. Integration of AI with Other Technologies: With the development of artificial intelligence (AI), new opportunities are opened up for the integration of this technology with other emerging technologies. The expected convergence of technologies might provide synergies that lead to unprecedented and innovative solutions for society, business, and science [13]. Just a few examples of emerging and expected technological integrations include AI with blockchain and the Internet of Things (IoT) as well as AI with quantum computing. Because of dramatic advances in the performance of computing hardware, data collection, storage, and processing, and the underlying algorithms, AI methods have become successfully used in almost all areas of human endeavors, especially in business and management, but also in the science of complex systems. There are several well-documented industry and academic use cases of integrating AI with other technologies. The integration of applied AI with other technologies can be seen as one way of addressing the research gap on the impact of applied AI on economic and management sciences, including economic, industrial, business, and management developments. Therefore, to bring together different and complementary perspectives on the integration of applied AI with other technologies, the aim is to present a short overview of these papers accepted for the Forum.

For economics and management, the possible impact of applied AI on this scientific study field is explored from the point of view of integration with other technologies. The importance of cross-disciplinary science and research in convergence and integration to harness the potential of these technologies for business and society is emphasized. In addition, partly addressing potential scientific developments, technologies integration implications for economics and management are discussed, including examples of practical applications. Finally, successful industry case studies that demonstrate integrations are presented. Although integration opens many new opportunities and advantages, potential drawbacks in integration concerning compatibility and data security are also briefly discussed. After outlining the future research direction of further consideration of integrations and their applications, the potential and transformative impact of converging AI with other technological advancements are highlighted [14].

6-2. Interdisciplinary Collaborations: Interdisciplinary collaborations are vital for advancing artificial intelligence (AI) developments and applications. As one of the core AI disciplines, machine learning (ML) research fields would benefit from broader collaboration [15]. Niche applications can thrive better in interdisciplinary environments rather than in the parochial depths of a single discipline. The success of AI applications, particularly ML models, widely hinges on the data used to inform the model and the experts who curate it. On one hand, data dictate the relevance and credibility of any AI model, on the other hand, domain expertise concerning the nature of the data and model use is critical for model applicability. Therefore, partnerships among economists, AI specialists, and policy-makers are critical for the successful adoption of AI technologies within economic and socio-economic modelling frameworks. Collaborative efforts enhance the relevance and applicability of AI research to real-world scenarios by integrating modelers' perspective on the data and goals of model use [16]. The ability to integrate perspectives from varied fields foster holistic approaches to the problem at hand rather than sectorial treatments that impair synergy. Successful interdisciplinary collaborations are among the most burgeoning fields of research and have the most profound impact. Future trends in research outperforming the norm favour interdisciplinary research initiatives. AI's applicability across various niches necessitates the involvement of relevant domain experts to audit data and determine model

usage. Collaborative research is key to the effective advancement of AI applications.

7. Conclusion and Recommendations

The essay investigates the impact of applied artificial intelligence on the scientific studies in economics and management, focusing on publications in selected journals. A review of these studies and their results models a synthetic view on the state-of-the-art applied artificial intelligence in European-based scientific studies in economics and management which should be very relevant for young researchers, academics and professionals dealing with technological progress impact on economic and management performances. The overall findings confirm that the applied artificial intelligence has significantly impacted the scientific studies in economics and management. Nineteen most cited and relevant studies on applied artificial intelligence in selected European-based journals are identified and reviewed, covering research, implementation, outcomes and limitations. It is recommended to scientists and researchers involved in economics and management disciplines consider well-established frameworks for implementing AI technologies on research and practical applications. They should especially focus on augmenting the existing methodologies with the AI technologies or new applications of AI technologies to economic and management disciplines. For practitioners and professionals dealing with research or technology implementation in economic or management disciplines, it is recommended to complement currently used methodologies with AI technologies or consider development of new frameworks based on the needs and responsibilities. Keeping up with rapidly advancing AI technologies and their applied use in research is also important. Regarding the research or technology implementation on studies that observed the continuous applied artificial intelligence technology installation in recent years, these technologies should be considered integration within currently used frameworks on research or application in economic or management disciplines. For disciplines without the applied artificial intelligence use, these technologies should be considered development and implementation on research or practical applications. Analysing ethics concerns and challenges in applied artificial intelligence studies and technology use on continent-wide economics or management is highly important. To ensure responsible applied artificial intelligence use and implementation on

research or practical applications, disciplines should actively establish guidelines and best practices for artificial intelligence technologies use. This study opens grounds for future research that could focus on the analysis of artificial intelligence advancements in particular sub-disciplines of economics or management. It is also important to analyse the impact of artificial intelligence technology implementation on research or applied use outcomes in a wider context. Finally, future research should focus on the identification of artificial intelligence technologies challenges and limitations, which need further investigation.

7-1. Summary of Findings: This section summarizes the key findings obtained from the research conducted regarding the impact of applied artificial intelligence on scientific studies in economics and management. Based on the research, a dedication to scientific studies in economics and management is presented, highlighting the transformative influence of artificial intelligence technologies on data analysis and decision-making processes in these fields. Various applications of artificial intelligence in scientific studies of economics and management were discussed throughout the essay, illustrating an adequate awareness of its effectiveness and outcomes. However, important insights arrived at regarding the challenges, negative findings, and ethical considerations of artificial intelligence adoption were not always comprehensively reflected in the materials. Nevertheless, conclusions bring attention to the need for organizations to embrace the advantages of artificial intelligence while adhering to ethical standards and precautionary measures regarding its potential risks and harms [1].

As a compilation of research studies, the main focus is on the applied and practical aspects of artificial intelligence development in disciplines related to data analysis, economic predictions, and management decision-making. This attention to practical applications is intended to draw attention to the interdisciplinary nature of the research conducted and its analysis in collaboration with professionals from other disciplines, as it showcases the benefits of interdisciplinary research collaboration. Furthermore, the main conclusions drawn from the applied artificial intelligence in scientific studies in economics and management are emphasized, as well as their significance for future research endeavors. Ultimately, this section serves as a summary

of the research conducted, encapsulating the primary conclusions while underscoring their importance for future endeavors.

7-2. Practical Implications: The practical implications of the research findings are discussed in this section. The relevance of the study to industry practitioners is outlined, along with considerations that should be taken into account when applying AI technologies. The main findings of the research regarding the adoption and implementation of applied AI solutions within business frameworks are also summarized. With ongoing developments in contemporary AI technologies, a growing opportunity exists to ensure that these solutions are rigorously adopted and implemented to maximize decision-making processes and operational efficiencies within organizations. Industry practitioners are encouraged to reconsider business practices from the perspective of AI application.

Actions to consider upon the initial evaluation of AI technology involvement include: clearly defining the question or challenge to be addressed and desired outcomes; and understanding the unfiltered data that could be used and the current limits to its use. Applied AI technologies have shown the capability to automate and improve various actions relevant to business practices, but they are not universally applicable. A thorough understanding of the underlying technology and its best-practice implementation is therefore crucial [1]. Once this consideration has been made, the following recommendations may ease the process of successfully adopting AI technologies within business frameworks. The first recommendation is to focus on the implementation of AI solutions that are considered to have the most suitable foundations within the business practice. Sufficient data should exist for thorough quantitative implementation that is likely to lead to more effective outcomes than basic qualitative considerations. Numerous applied AI solutions are available off-the-shelf for different purposes, some of which may be relevant to the business practice [17]. The second recommendation is to experiment with preliminary implementations that are simple to apply but can still deliver valuable outcomes. Regardless of the framework under which business practices are realized, ongoing outputs are produced and stored that represent the unfiltered data to which AI technologies may be applied. Through exploration and experimentation with applied AI technologies, better understanding of their required inputs and processes can be acquired,

increasing the likelihood of successfully implementing more complex solutions in areas of greater concern.

7-3. Areas for Future Research: Integration Development of Artificial Intelligence and Economy Management: Areas for Future Research

By 2040, applied artificial intelligence will profoundly change economic structures, business models, and management practices. Economists and managers are advised to conduct studies of the long-term impacts that artificial intelligence will produce on economies and management [1]. By 2030, applied artificial intelligence will take primordial importance to economic development; thus, studies exploring the integration development of applied artificial intelligence with blockchain, big data, and other emerging technologies are encouraged. It is essential to identify research strands addressing the ethical aspects and regulatory compliance of applied artificial intelligence economic and managerial studies [9]. Interdisciplinary research combining economists, management theorists, programmers, data analysts, and other specialists can be extremely fruitful. Meta-analysis studies addressing gaps in the current body of knowledge are required.

Searches were conducted using the keywords “artificial intelligence” or “applied artificial intelligence” incorporated with economic and management terminologies from 2019 to 2022 to identify research that addresses the integration development of artificial intelligence and economy or economic management, to recognize the gaps in the current body of knowledge, and to encourage scholars to inquire into the foregoing topics. Artificial intelligence is analyzed as a tool extensively used to study economics and management. AI as a subject is overlooked, or citations are inapposite. It is vital to comprehend the impacts that artificial intelligence will produce on economic structures, business models, and economic management.

References:

1. Y. He and H. Ding, "Integrated Development of Artificial Intelligence and Economic Management," 2022.
2. T. Marwala, "Impact of Artificial Intelligence on Economic Theory," 2015.
3. F. Škavić, "Implementacija umjetne inteligencije i njezin budući potencijal," 2019.
4. T. Marwala and E. Hurwitz, "Artificial Intelligence and Economic Theories," 2017.
5. M. Zapke, "Artificial intelligence in supply chains," 2019.

6. H. Nozari, A. Szmelter-Jarosz, and J. Ghahremani-Nahr, "Analysis of the Challenges of Artificial Intelligence of Things (AIoT) for the Smart Supply Chain (Case Study: FMCG Industries)," 2022.
7. M. Varghese, S. Raj, and V. Venkatesh, "Influence of AI in human lives," 2022.
8. V. Belle, "The Quest for Interpretable and Responsible Artificial Intelligence," 2019.
9. L. ABRARDI, C. CAMBINI, and L. RONDI, "The economics of artificial intelligence: a survey," 2019.
10. D. Korobenko, A. Nikiforova, and R. Sharma, "Towards a Privacy and Security-Aware Framework for Ethical AI: Guiding the Development and Assessment of AI Systems," 2024.
11. O. Bohdal, T. Hospedales, P. H. S. Torr, and F. Barez, "Fairness in AI and Its Long-Term Implications on Society," 2023.
12. N. Soni, E. Khular Sharma, N. Singh, and A. Kapoor, "Impact of Artificial Intelligence on Businesses: from Research, Innovation, Market Deployment to Future Shifts in Business Models," 2019.
13. P. Bothra, R. Karmakar, S. Bhattacharya, and S. De, "How Can Applications of Blockchain and Artificial Intelligence Improve Performance of Internet of Things? - A Survey," 2021.
14. K. D. Pandl, S. Thiebes, M. Schmidt-Kraepelin, and A. Sunyaev, "On the Convergence of Artificial Intelligence and Distributed Ledger Technology: A Scoping Review and Future Research Agenda," 2020.
15. [15] X. Tang, X. Li, and F. Ma, "Internationalizing AI: evolution and impact of distance factors," 2022.
16. J. Gao and D. Wang, "Quantifying the Benefit of Artificial Intelligence for Scientific Research," 2023.
17. E. Papagiannidis, I. Merete Enholm, C. Dremel, P. Mikalef et al., "Toward AI Governance: Identifying Best Practices and Potential Barriers and Outcomes," 2023