Management and Development for Resherche and studies

Volume: 14/N°: 02 December (2025), p 412-429

Assessment of the Adoption of Artificial Intelligence Tools in Scientific Research by Faculty Members of the Faculty of Economic Sciences at Hasiba Ben Bouali University: An Analytical Field Study

Mohammed Nacef[1*]

[1] University of Chlef (Algeria), M.Nacef@univ-chlef.dz

Received: 15/09/2025 Accepted: 04/11/2025 Published: 01/12/2025

Abstract:

This research aims to analyze the extent of AI tool adoption by faculty members at the Faculty of Economic Sciences, Hasiba Ben Bouali University, in scientific research, focusing on usage levels. The study employed a descriptive-analytical approach, collecting data via an electronic questionnaire distributed through a census method, with a theoretical sample size of 243 individuals. A total of 151 valid responses were used for analysis. The results revealed a moderate level of adoption, with increasing awareness of AI's significance, alongside challenges related to insufficient training and a lack of institutional support. The findings suggest the potential to leverage these tools in developing supportive university policies and enhancing professional training programs, which could contribute to effectively integrating AI into academic research practices. The study recommends strengthening continuous training and creating a supportive organizational environment to accelerate the adoption of these tools and maximize their potential in advancing scientific research.

Keywords: Artificial Intelligence, Scientific Research, Higher Education.

Jel Classification Codes: I23 , O33

1- INTRODUCTION

In recent years, the world has witnessed a significant transformation across various fields of knowledge, largely driven by rapid advancements in artificial intelligence (AI) technologies. These technologies have become a vital force in enhancing scientific research practices and improving their effectiveness and quality. AI tools are increasingly being used to support various stages of research, from generating ideas and formulating hypotheses, to collecting and analyzing data, and even drafting and publishing results. Despite this global momentum, the pace of adoption of these tools varies across academic environments,

* Corresponding author

influenced by factors such as cognitive awareness, digital infrastructure, and the level of training and education available.

In light of these digital transformations, it has become essential to assess the current state of AI use within university settings, particularly among key actors in the research process, such as faculty members at the Faculty of Economic Sciences at Hassiba Ben Bouali University. These faculty members represent an intellectual elite that contributes to the production and direction of economic thought. Tracking the extent to which these faculty members rely on AI tools is a crucial step in understanding the new dynamics shaping their research practices and how well they integrate with modern technologies, especially considering the rapidly evolving cognitive and digital challenges of the present.

1-1-Research Problem:

Despite the noticeable advancements in AI technologies and their increasing presence in academia, the degree to which they are adopted in scientific research remains uneven across different institutions and researchers. In this context, questions arise regarding the extent to which faculty members at the Faculty of Economic Sciences at Hassiba Ben Bouali University use these tools and how they apply them in various stages of research. Thus, the research problem is to understand the actual adoption of AI tools, the factors influencing their use within the Algerian academic environment, and their integration into research practices.

1-2-Main Research Question:

Based on the above problem, the main research question is:

To what extent do faculty members at the Faculty of Economic Sciences at Hassiba Ben Bouali University adopt AI tools in scientific research?

Sub-questions:

• What is the level of AI tool usage among faculty members in the various stages of scientific research?

• Which stages of the research process see the most significant use of AI tools by faculty members?

• Does the degree of AI adoption in scientific research vary based on demographic factors such as gender, academic rank, years of experience, and age?

1-3-Hypotheses:

Based on the research problem and objectives, the following hypotheses were formulated:

• **Hypothesis 1:** The level of AI tool usage by faculty members at the Faculty of Economic Sciences will be moderate across various stages of scientific research.

• **Hypothesis 2:** The stage of drafting and revising is the most frequently employed stage for AI tools by faculty members.

• **Hypothesis 3:** Statistically significant differences exist in the degree of AI adoption in scientific research, attributed to demographic variables (gender, academic rank, years of experience, age).

1-4-Study Objectives:

This study aims to:

• Identify the level of AI tool usage among faculty members at the Faculty of Economic Sciences in scientific research.

• Analyze the extent of AI tool application at each stage of the research process.

• Study the differences in AI usage based on demographic variables such as gender, academic rank, years of experience, and age.
• Identify the main weaknesses or limitations in adopting these tools within the local academic context.
• Propose mechanisms and recommendations to enhance the effective use of AI in university-level scientific research.

1-5-Significance of the Study:

The significance of this study lies in several academic and practical aspects, which can be highlighted as follows:
• It is one of the few contemporary studies addressing the use of AI in the Algerian academic environment, a topic that remains in its early stages in terms of exploration and analysis.
• It contributes to guiding decision-makers in university institutions toward the development of policies that support and encourage the use of AI tools in scientific research.
• It enables university departments and research units to identify training or technical gaps that hinder the optimal use of these tools, thus aiding in the development of targeted training programs.
• It provides valuable insights to faculty members and researchers by shedding light on the opportunities available through AI to improve the quality and efficiency of scientific research.
• It forms an initial database that can be built upon for future studies extending across other universities or academic institutions.

1-6-Scope of the Study:

- **Spatial Scope:**

This study is limited to faculty members at the Faculty of Economic Sciences at Hassiba Ben Bouali University in the province of Chlef, due to the specific academic context under investigation and the availability of favorable conditions for data collection from the targeted group.

- **Temporal Scope:**

The study was conducted and field data were collected during the first quarter of 2025, which provided the framework for analyzing the state of AI tool adoption in scientific research during that period.

- **Subject Scope:**

The study focuses on the adoption of AI tools by faculty members at the Faculty of Economic Sciences in scientific research, measuring the level of usage, identifying which research stages see the greatest application, and examining differences based on demographic variables such as gender, academic rank, years of experience, and age.

- **Human Scope:**

The study is limited to faculty members at the Faculty of Economic Sciences at Hassiba Ben Bouali University – Chlef, including both permanent and temporary faculty, with an estimated total of approximately 243 faculty members.

1-7- Review of Previous Studies

The reviewed literature in this study addressed various aspects of artificial intelligence (AI) usage in scientific research. Some studies emphasized AI's significant role in enhancing productivity and research accuracy, in addition to automating multiple phases of the research process—such as idea generation, data analysis, and text composition. Other studies focused

more on the ethical challenges and academic policy implications of integrating AI into research.

Khalifa and Albadawy (2024) highlighted AI's role in six key stages of the research process: idea generation and research design, content enhancement and text structuring, literature review and synthesis, data management and analysis, text editing and revision, and finally, publication, communication, and adherence to ethical standards. The study recommended the effective integration of AI tools, with a strong emphasis on ethical usage, intensive researcher training, and the importance of balancing AI use with human critical thinking.

Tejedor-Estupiñán (2024) explored the application of AI in scientific research—particularly within the field of economics—through eight core dimensions: automating literature reviews, collecting and processing data, economic modeling and forecasting, sentiment and textual analysis, economic scenario simulation, fraud and financial misconduct detection, enhancing research decision-making, and addressing ethical considerations. The study stressed the need for clear academic policies to ensure the effective and responsible use of AI while preserving scientific integrity.

In another study, Toner-Rodgers (2024) found that AI significantly contributed to improving research accuracy, accelerating productivity, and fostering innovation. AI-assisted researchers discovered new materials 44% more frequently, resulting in a 39% increase in patent registrations and a 17% rise in product innovation. AI also automated 57% of idea-generation tasks, freeing up researchers to focus more on analysis and development, ultimately leading to more advanced inventions with novel chemical compositions. Thus, AI has improved research precision, boosted the efficiency of experienced scientists, and accelerated the achievement of more innovative scientific breakthroughs.

Despite the significance of previous studies examining AI integration across various stages of the research process, most of them primarily focused on technical applications or evaluated the overall impact on research quality. However, they often lacked empirical analysis of how widely university faculty members adopt these tools in their actual research practices. Additionally, these studies did not adequately contextualize the academic environment, particularly within Algerian universities. Moreover, few studies explicitly linked AI use to the classic stages of the scientific research process as described in the methodological literature.

To address this gap, the present study offers a field-based analysis of the extent to which faculty members at the Faculty of Economic Sciences at Hassiba Benbouali University adopt AI tools in their academic research. It also connects this adoption to different phases of the research process and offers practical recommendations to enhance AI integration in Algerian university settings.

2- An overview of Artificial Intelligence and its applications in scientific research.

2-1- The Concept of Artificial Intelligence

The concept of artificial intelligence (AI) has been defined in various ways by researchers specialized in the field of AI, as well as by other writers and enthusiasts of this relatively modern science. The World Intellectual Property Organization (WIPO) defines

artificial intelligence as "a branch of computer science aimed at developing machines and systems capable of performing tasks that are considered to require human intelligence, whether with limited human intervention or without human intervention." Contemporary AI, as it stands today, is considered a field within computer science, although its beginnings were pioneered by neuroscientists and psychologists. However, it is also classified because, with technological advancements, it has become associated with computing systems and algorithms. AI encompasses all technologies aimed at simulating the cognitive abilities and behavioral patterns of humans and animals without pre-programming those behaviors, with key features including reasoning ability and self-learning (Al-Asad, 2023, p.167).

Others view "Artificial Intelligence (AI) as the scientific and technological stream that encompasses methods, theories, and techniques aimed at creating machines capable of simulating intelligence." Additionally, AI is defined as "the study of directing computers to perform tasks that humans do better." It is also defined as "the science capable of building machines that perform tasks requiring a level of human intelligence when performed by humans" (Al-Asad, 2023, p.167).

Artificial Intelligence (AI) is a field of computer science aimed at creating technological systems capable of executing tasks resembling human intelligence, such as learning and decision-making, using data and algorithms, based on a set of data and algorithms.

2-2- Aspects of the Application of Artificial Intelligence in Scientific Research

In this section, we will list some applications of artificial intelligence in scientific research.

- **Economic Research :** Artificial intelligence is increasingly utilized in economic research to analyze big data, allowing researchers to identify patterns and trends that shape economic decision-making. Machine learning techniques enhance market forecasting and risk assessment, aiding policymakers and investors in making informed choices. Additionally, AI-driven economic models simulate various scenarios, providing deeper insights into the potential impact of policy changes. Natural language processing tools are also employed to analyze financial news and economic reports, offering valuable market intelligence. These applications improve the accuracy and efficiency of economic research, ultimately supporting more effective economic policies and strategies (Tejedor-Estupiñán, 2024).
- **Information Science :** Deep Learning (DL) improves network modeling, design, and security. It aids in network feature extraction, decision-making, and resource allocation across network layers. DL can classify packets for security purposes and integrate with machine learning for anomaly detection (Xu et al., 2021, p.p.4-5).
- **Mathematics :** Machine Learning (ML) constructs nonlinear models for function approximation. The Universal Approximation Theorem supports neural networks in modeling complex functions. AI connects to numerical algorithms, such as CNNs linking to multi-grid (MG) methods for image classification (Xu et al., 2021, p.p.5-6).
- **Medical Science :** AI enhances cervical cancer detection by improving screening efficiency and diagnostic accuracy. ML-based prognostic models predict post-surgery recurrence and mortality rates, aiding in treatment decisions. AI also plays a role in cancer data mining (Xu et al., 2021, p.8).
- **Materials Science :** The Materials Genome Initiative (MGI) integrates AI for material discovery and design, accelerating research through computation, data analysis, and

experimentation. AI-powered MGI enhances autonomous experimentation and material development efficiency (Xu et al., 2021, p.p.9-10).

- **Geoscience :** AI assists in characterizing, estimating, and forecasting geoscience variables. It improves climate modeling, resource planning, and anomaly detection in Earth systems. AI-powered decision-making supports long-term environmental predictions (Xu et al., 2021, p.10).
- **Life Sciences :** AI excels in omics data analysis, smart agriculture, and genetics. Deep Learning models (e.g., PrimateAI, DeepCNV, DeepCpG) improve mutation analysis, cancer studies, and single-cell sequencing. AIphaFold2 revolutionizes protein structure prediction, benefiting drug discovery and life sciences research (Xu et al., 2021, p.12).

The preceding paragraphs clearly demonstrate that artificial intelligence is no longer merely a supplementary analytical tool in scientific research. Rather, it has become a fundamental component that contributes to the development of research methodologies, enhances analytical efficiency, and uncovers hidden patterns within large datasets. One of its most significant strengths lies in its ability to process massive volumes of data—whether economic, medical, or environmental—which enables researchers to make more accurate decisions and anticipate future trends using advanced analytical models.

2-3- Aspects of the benefits of scientific research from artificial intelligence

A wide range of artificial intelligence (AI) tools is currently being implemented in scientific research. These tools have been applied across numerous scientific disciplines and throughout various stages of the traditional scientific method. The use of these tools is expected to increase even more in the future. In fact, a recent survey published in Nature revealed that nearly 47% of researchers who currently use AI believe it will be highly useful in their field going forward, while over 25% indicated that AI will be essential to their future work (Nagar, 2024, p.1).

The growing use of AI tools holds significant promise in several key areas, three of which we highlight here. First, the introduction of novel AI tools could directly lead to improved scientific findings, which in turn may enhance evidence-based policymaking. AI tools have potential applications across a wide variety of fields. For instance, in life sciences, AlphaFold enables researchers to predict protein structures effectively. Autoencoder AI models assist materials scientists in identifying compounds with desirable properties. In environmental science, AI technologies like Google DeepMind's GraphCast show promise in predicting weather patterns, while other tools may eventually model the potential impacts of climate change more accurately. These examples, though not exhaustive, illustrate the transformative role that AI could play in advancing scientific research (Nagar, 2024, p.1).

If these new AI tools generate novel and more comprehensive findings than those currently possible, they will contribute to improved evidence-based policymaking by both businesses and governments. For example, if AI tools are capable of predicting the localized effects of climate change with greater precision, governments could use these projections to develop more effective policies aimed at mitigating the impact of climatic events on local populations. In this way, AI’s direct application in scientific research could not only result in better research outcomes but also facilitate more accurate policymaking based on that research (Nagar, 2024, p.1).

Second, AI tools may assist researchers in achieving greater scientific productivity overall. In addition to being used in modeling and screening, AI tools can support various stages of the research process. According to the aforementioned Nature survey, over 30% of scientists reported that AI currently provides significant benefits in summarizing existing literature, brainstorming ideas, and facilitating coding. Additional evidence suggests that AI tools may also be useful in drafting scientific manuscripts. By streamlining literature reviews and analyses, these tools could help researchers work more efficiently, potentially accelerating scientific advancements that could lead to lifesaving therapeutics, new materials, and more. From a policymaking and strategic perspective, an increase in scientific productivity will generate a broader range of scientific evidence for policymakers and business leaders to base their decisions on (Nagar, 2024, pp.1-2).

Third, AI tools have the potential to democratize science on a global scale. Empirical evidence indicates that one of the most common uses of AI in science today is helping researchers who are not fluent in international scientific languages, such as English. The Nature survey shows that more than 50% of scientists believe current AI tools can assist non-native English speakers in translating, summarizing, and editing scientific articles. Past research has shown that non-English speaking scientists often share their ideas less frequently at conferences, which limits their ability to contribute transformative ideas to the global scientific community (Nagar, 2024, p.2).

Moreover, in fields like biodiversity, non-English documents account for more than 30% of the literature, meaning that language barriers could restrict the dissemination of important scientific ideas (Amano et al., 2016). Therefore, the translation capabilities of AI tools may be instrumental in breaking down these language barriers, leading to more global collaboration and the sharing of ideas that can drive scientific progress (Nagar, 2024, p.2).

These three benefits are just the beginning—AI tools are likely to offer many more advantages to researchers. However, they serve to underscore the powerful impact that increased use of AI could have on scientific research (Nagar, 2024, p.2).

3- The development of the research instrument and the procedures for fieldwork and sampling

3-1-Background of the Research Instrument

When discussing the stages of scientific research, the methodological literature generally outlines the following six steps (Abu Nassar, Mobaideen, & Obeidat, 1999):

A. Identifying the Problem: This is the foundational step where the researcher precisely defines the study's topic, ensuring it is researchable, original, and suitable for the available resources.

B. Reviewing the Literature: This stage involves collecting and analyzing previous studies related to the research problem, helping to define its dimensions, avoid duplication, and build upon past findings to formulate hypotheses.

C. Formulating Hypotheses: These are scientific assumptions that define the relationship between variables and are typically categorized as either alternative hypotheses (indicating a relationship) or null hypotheses (denying one). Hypotheses must be clear, measurable, and scientifically grounded.

D. Determining Data and Sources: Data is gathered from either primary sources (e.g., surveys, experiments) or secondary sources (e.g., books, scholarly articles) to ensure the credibility of the research outcomes.

E. Reviewing and Analyzing Data: This involves eliminating irrelevant or incomplete data, followed by applying appropriate statistical methods to analyze the remaining data for accurate results.

F. Writing and Presenting Results: This phase includes clearly reporting the findings, interpreting them in light of the existing literature, and proposing suitable recommendations.

Building on these six widely accepted steps and integrating insights from the previously discussed literature, this study was structured around eight fundamental research stages: identifying the problem and formulating research questions, reviewing the literature, choosing a research methodology, designing data collection tools, processing and analyzing data, presenting findings, and concluding with editing and publishing. This structure aims to provide a more realistic and comprehensive perspective on how AI is integrated into academic research processes, potentially contributing to practical solutions for more effective AI use within university environments.

To construct the research instrument—a questionnaire focused on the integration of artificial intelligence (AI) in the various stages of scientific research by faculty members at the Faculty of Economics, Hassiba Ben Bouali University of Chlef (Algeria)—we drew upon several previous studies that examined the use of AI in academic research, including the study by (). Additionally, we reviewed the fundamental steps of scientific research as outlined in academic methodology literature. The final version of the questionnaire harmonizes the insights from the referenced study with these traditional research stages.

Given the type of data required for this study and in line with the inductive research methodology adopted, the most appropriate tool for data collection was determined to be an online questionnaire. This decision was based on the unavailability of relevant secondary data and the impracticality of collecting the needed information through observation or interviews.

After reviewing the relevant literature and multiple prior studies and their findings, we developed a questionnaire tailored to the objectives of this research, titled: *"Assessing the Adoption of Artificial Intelligence Tools in Scientific Research by Faculty Members of the Faculty of Economics at Hassiba Ben Bouali University: An Analytical Field Study."* The questionnaire was distributed to faculty members at the Faculty of Economics at Hassiba Ben Bouali University.

The questionnaire was developed through the following steps:

- A preliminary version of the questionnaire was drafted to evaluate its suitability for achieving the research objectives.
- This preliminary version was reviewed by subject matter experts and academic peers.
- Based on their feedback, the revised questionnaire consisted of two main sections, preceded by an introductory note addressed to the participants.

The questionnaire was structured as follows:

Section One: Demographic Information

This section includes personal data such as gender, academic rank, years of experience, and age group.

Section Two: Core Research Variables

This section contains the core variables aimed at assessing the extent to which AI tools are integrated into the research activities of faculty members. A total of 24 items were distributed across 8 dimensions as follows:

- **A. Problem Identification and Research Question Formulation:** 3 items assessing the use of AI in identifying research problems and framing questions.
- **B. Literature Review:** 3 items evaluating AI usage in reviewing relevant literature.
- **C. Research Methodology and Hypothesis Formulation:** 2 items assessing AI's role in selecting methodologies and developing hypotheses.
- **D. Data Sources and Tool Design:** 3 items on AI use in identifying data sources and designing data collection tools.
- **E. Data Processing and Analysis:** 2 items measuring AI utilization in processing and analyzing data.
- **F. Results Presentation and Discussion:** 3 items assessing AI's role in presenting and interpreting findings.
- **G. Conclusions and Recommendations:** 2 items evaluating AI's use in drawing conclusions and formulating recommendations.
- **H. Editing, Review, and Publication Support:** 6 items assessing the use of AI in editing, reviewing, and facilitating publication.

Responses were measured using a five-point Likert scale: Always (5), Often (4), Sometimes (3), Rarely (2), Never (1).

3-2- Sample Selection and Data Collection

The target population consisted of all faculty members (both permanent and temporary) in the Faculty of Economics at Hassiba Ben Bouali University, totaling 193 permanent and approximately 50 temporary instructors. The optimal sample size was calculated using the statistical tool available at (www.select-statistics.co.uk), with a confidence level of 95% and a 5% margin of error. The result yielded an ideal sample size of 150.

The survey was distributed electronically using a comprehensive sampling method. A total of 151 completed questionnaires were collected. Upon entering the responses into SPSS version 26, all responses were deemed valid for analysis due to the realism and consistency of the answers provided.

3-3- Validity and Reliability of the Questionnaire

3-3-1- Preliminary Validity and Reliability

To assess preliminary validity, the questionnaire was distributed to a pilot sample of 45 participants. At a 5% significance level, the correlation coefficients between individual items and the total score ranged from 0.753 to 0.865, all with p-values of 0.000, indicating strong validity.

The Cronbach's Alpha for the pilot sample was 0.976, confirming high reliability and internal consistency, thus justifying its distribution to the full study sample.

3-3-2-Post-Distribution Validity and Reliability

Following the distribution to the full sample of 151 participants, post hoc validity was tested. Correlation coefficients between the questionnaire items and the overall score ranged from 0.703 to 0.830, all statistically significant at the 0.000 level. This confirmed the questionnaire's post-distribution validity.

The reliability analysis produced a Cronbach's Alpha of 0.974, indicating excellent post-distribution reliability, making the data suitable for further statistical analysis.

4- Analysis of the collected data and discussion of the findings

4-1- Statistical Analysis of the Extent to Which Faculty Members at the Faculty of Economics, Hassiba Ben Bouali University, Adopt Artificial Intelligence Tools in Scientific Research (Mean Score Analysis)

4-1-1- Results of the Statistical Analysis of Mean Scores

The statistical analysis of faculty members' adoption of artificial intelligence (AI) tools in scientific research at the Faculty of Economics, Hassiba Ben Bouali University, yielded the results presented in Table 1.

Table 1. Statistical Analysis Results of the Adoption of Artificial Intelligence Tools in Scientific Research by Faculty Members of the Faculty of Economic Sciences at Hassiba Ben Bouali University

No.	Dimension	Mean Score	Standard Deviation	Level of Adoption
1	Use of AI in identifying research problems and formulating research questions	2.317	1.072	Low
2	Use of AI in reviewing the literature	2.238	1.077	Low
3	Use of AI in selecting research methodology and formulating hypotheses	1.771	1.087	Very Low
4	Use of AI in identifying data sources and designing data collection tools	2.143	1.113	Low
5	Use of AI in data processing and analysis	2.062	1.124	Low
6	Use of AI in presenting and discussing results	2.22	1.116	Low
7	Use of AI in drawing conclusions and making recommendations	2.255	1.154	Low
8	Use of AI in editing, reviewing, and supporting publication	2.342	1.071	Low
—	Overall AI adoption in scientific research	2.208	0.967	Low

Source: Prepared by the researcher based on SPSS v26 output.

4-1-2-Discussion of the Results

The results of the statistical analysis reveal that the level of AI adoption among faculty members at the Faculty of Economics, Hassiba Ben Bouali University, remains generally low across the various stages of the research process.

The mean score for the use of AI in identifying research problems and formulating research questions was **2.317**, indicating limited reliance on AI tools during the initial phases of research.

Similarly, the use of AI in reviewing previous studies recorded a low mean score of **2.238**, suggesting that faculty members are not fully leveraging AI tools for analyzing and summarizing prior scientific output—despite the potential of these tools to expedite review processes and extract relevant information efficiently.

The lowest adoption level was found in the use of AI for determining research methodology and formulating hypotheses, with a mean score of **1.771**. This suggests a near-complete lack of utilization of AI tools in this crucial phase, which typically demands high precision in selecting appropriate statistical methods and research design strategies.

For identifying data sources and designing data collection tools, the mean score was **2.143**, reflecting weak reliance on AI at this stage. This may be due to limited awareness of the capabilities AI offers in analyzing databases and proposing effective measurement instruments.

Regarding data processing and analysis, the mean score was **2.062**, which also indicates low adoption. This suggests underuse of intelligent tools that could help uncover hidden patterns and relationships within research data.

The use of AI in presenting and discussing results also scored low, with a mean of **2.22**, implying that faculty members continue to depend on traditional approaches when interpreting and communicating research findings.

As for drawing conclusions and making recommendations, the mean score was **2.255**, reflecting a weak uptake of AI tools in generating evidence-based insights and forecasting future trends.

In the area of editing, reviewing, and supporting publication, the mean score was **2.342**—the highest among all dimensions but still classified as low. This indicates that faculty members are not taking full advantage of available AI tools to enhance the quality of academic writing or streamline the publishing process.

Overall, the general mean score for AI adoption in scientific research was **2.208**, which denotes a low level of adoption. These findings highlight an urgent need to foster a stronger culture of AI utilization throughout all stages of the research process, from problem identification to final publication.

4-2- Hypothesis Testing of Differences:

4-2-1-Results of Statistical Analysis of Differences in Responses from Study Sample Participants:

In this section of the study, we will test the differential hypotheses to determine if there are statistically significant differences in the responses of the study sample participants.

We will test the following differential hypothesis: There are no statistically significant differences at a 5% significance level in the responses of the study sample participants regarding the adoption of AI tools in scientific research by the faculty members at the Faculty of Economics at the University of Hassiba Ben Bouali, based on personal characteristics (gender, academic rank, years of experience, age group).

- **Partial Hypothesis 1:** There are no statistically significant differences at a 5% significance level in the responses of the study sample participants regarding the adoption of AI tools in scientific research by faculty members at the Faculty of Economics at the University of Hassiba Ben Bouali, based on gender.

After conducting an independent sample t-test, we found no statistically significant differences attributed to gender. Thus, the null hypothesis is accepted.

- **Partial Hypothesis 2:** There are no statistically significant differences at a 10% significance level in the responses of the study sample participants regarding the adoption of AI tools in scientific research by faculty members at the Faculty of Economics at the University of Hassiba Ben Bouali, based on academic rank.

Regarding academic rank, we found that the ANOVA test showed statistical significance, with a p-value of 0.02, which is less than the 5% significance level. Additionally, we observed heterogeneity in variance, as the Levene's test statistic had a p-value of 0.017, indicating the presence of statistically significant differences. After

performing the Tamhane test, we found that the source of the differences was between temporary faculty members and higher education faculty members, with higher education faculty members showing greater adoption of AI tools. The mean difference was 0.602, with a p-value of 0.041.

Thus, the null hypothesis is rejected, and the alternative hypothesis, suggesting significant differences due to academic rank, is accepted.

• **Partial Hypothesis 3:** There are no statistically significant differences at a 10% significance level in the responses of the study sample participants regarding the adoption of AI tools in scientific research by faculty members at the Faculty of Economics at the University of Hassiba Ben Bouali, based on years of experience.

Regarding years of experience, we found that the ANOVA test showed statistical significance, with a p-value of 0.000, which is less than the 5% significance level. We also observed homogeneity of variance, as the Levene's test statistic had a p-value of 0.075, indicating statistically significant differences. After conducting the Tukey test, we found that the source of the differences was between the group with less than 6 years of experience and the groups with 6-10 years, 11-15 years, and 16-20 years of experience, with the latter groups showing significantly higher adoption of AI tools. The mean differences were 0.857, 0.782, and 0.905, with p-values of 0.06, 0.001, and 0.00, respectively.

Thus, the null hypothesis is rejected, and the alternative hypothesis, suggesting significant differences due to years of experience, is accepted.

• **Partial Hypothesis 4:** There are no statistically significant differences at a 10% significance level in the responses of the study sample participants regarding the adoption of AI tools in scientific research by faculty members at the Faculty of Economics at the University of Hassiba Ben Bouali, based on age group.

Regarding age group, we found that the ANOVA test showed statistical significance, with a p-value of 0.006, which is less than the 5% significance level. We also observed homogeneity of variance, as the Levene's test statistic had a p-value of 0.238, indicating statistically significant differences. After performing the Tukey test, we found that the source of the differences was between the age group under 31 years and the age groups 41-50 years and over 50 years, with the latter two age groups showing significantly higher adoption of AI tools. The mean differences were 0.947 and 0.969, with p-values of 0.005 and 0.031, respectively.

Thus, the null hypothesis is rejected, and the alternative hypothesis, suggesting significant differences due to age group, is accepted.

4-2-2-Discussion of Results of Statistical Analysis of Differences in Responses from Study Sample Participants:

According to Gender: The results revealed no statistically significant differences between male and female faculty members regarding the use of AI tools in scientific research. This reflects similar trends and research behaviors across genders. This could be explained by equal access to technology, similar academic and training backgrounds, and the nature of research work, which does not fundamentally differ between genders.

According to Academic Rank: In contrast to the gender variable, the results revealed statistically significant differences between temporary faculty members and higher education faculty members. It was found that permanent faculty members use AI tools more frequently.

This is likely due to their broader academic experience, availability of research resources, and academic requirements related to scientific publishing. This highlights the need for intensive training programs for temporary faculty members to enhance their ability to adopt modern technologies.

According to Years of Experience: The results showed that faculty members with more years of experience are more likely to use AI tools compared to their less experienced colleagues. This indicates that accumulated knowledge and continuous training play a key role in enhancing the adoption of these tools. Continuous exposure to technology and specialized training help develop the research skills of more experienced faculty members, emphasizing the importance of incorporating AI training into the academic programs for new faculty members.

According to Age Group: The results revealed statistically significant differences between age groups, with older faculty members showing higher usage of AI tools compared to younger groups. This could be attributed to accumulated research experience, gradual adaptation to technology, and the benefits older faculty members may have gained from specialized training programs in this field.

These results highlight the critical role that academic experience, academic rank, and age play in the adoption of AI tools in scientific research, while gender does not appear to have an effect. Therefore, promoting equal training opportunities, especially for new and temporary faculty members, is a crucial step to ensure broader and more effective use of modern AI tools in scientific research.

4-3-Testing the Main Hypothesis and Sub-Hypotheses Regarding the Adoption of Artificial Intelligence Tools by Faculty Members at the Faculty of Economic Sciences, University of Hassiba Ben Bouali, in Scientific Research

4-3-1- Results of Testing the Sub-Hypotheses and Main Hypothesis on Reducing Household Food Waste Among Families in the Chlef Province

We will attempt to test the following hypotheses:

Main Hypothesis: The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences in scientific research does not statistically differ from the medium level at a 5% significance level.

Sub-Hypotheses:

- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for problem identification and formulation of research questions does not statistically differ from the medium level at a 5% significance level.
- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for reviewing previous studies does not statistically differ from the medium level at a 5% significance level.
- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for determining the research methodology and formulating hypotheses does not statistically differ from the medium level at a 5% significance level.
- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for identifying data sources and designing data collection tools does not statistically differ from the medium level at a 5% significance level.

- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for data processing and analysis does not statistically differ from the medium level at a 5% significance level.
- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for presenting and discussing results does not statistically differ from the medium level at a 5% significance level.
- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for drawing conclusions and making recommendations does not statistically differ from the medium level at a 5% significance level.
- The level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences for editing, reviewing, and supporting publication does not statistically differ from the medium level at a 5% significance level.

A one-sample T-test was conducted on the study data, and the results are summarized in Table 2.

Table 2. Results of Testing the Hypotheses on the Level of Adoption of Artificial Intelligence Tools by Faculty Members at the Faculty of Economic Sciences in Scientific Research

Hypothesis	Mean	Difference in Mean	T-Statistic	SIG
Main Hypothesis	2.208	-10.059	-0.791	0.000
Sub-Hypothesis 1	2.317	-7.816	-0.682	0.000
Sub-Hypothesis 2	2.238	-8.687	-0.761	0.000
Sub-Hypothesis 3	1.771	-13.882	-1.228	0.000
Sub-Hypothesis 4	2.143	-9.454	-0.856	0.000
Sub-Hypothesis 5	2.062	-10.241	-0.937	0.000
Sub-Hypothesis 6	2.220	-8.579	-0.779	0.000
Sub-Hypothesis 7	2.255	-7.930	-0.745	0.000
Sub-Hypothesis 8	2.342	-7.542	-0.657	0.000

Source: Prepared by the researcher based on SPSS V26 outputs.

4-3-2- Discussion of the Results for the Hypothesis on Reducing Household Food Waste in Families in the Chlef Province

Main Hypothesis: The results of testing the main hypothesis indicate that the level of adoption of Artificial Intelligence tools by faculty members at the Faculty of Economic Sciences in scientific research is statistically significantly lower than the medium level, with a mean of 2.208 and a T-value of -10.059 (SIG = 0.000). This reflects a clear deficiency in the use of these tools, suggesting challenges that hinder the adoption of Artificial Intelligence in research processes, such as lack of training, inadequate technical infrastructure, or insufficient awareness of the importance of these tools.

Sub-Hypothesis 1: The results of Sub-Hypothesis 1 indicate that the adoption of Artificial Intelligence tools by faculty members in problem identification and research question formulation was below the average (mean = 2.317, T = -7.816, SIG = 0.000). While the decrease is less severe compared to other hypotheses, it reflects a weakness in the use of Artificial Intelligence techniques in this initial research phase, which could impact the quality of problem identification.

Sub-Hypothesis 2: The results revealed weak use of Artificial Intelligence tools in reviewing previous studies (mean = 2.238, T = -8.687, SIG = 0.000). This suggests that faculty members do not rely on Artificial Intelligence techniques for analyzing scientific literature, which may be due to the lack of suitable tools or a deficiency in technical skills.

Sub-Hypothesis 3: This hypothesis recorded the lowest mean among the hypotheses (1.771), with a T-value of -13.882 at a significance level of (SIG = 0.000), indicating a severe lack of use of Artificial Intelligence tools in determining research methodology and formulating hypotheses. This result reflects a significant gap in technology adoption at this crucial stage, which could impact the accuracy and reliability of research design.

Sub-Hypothesis 4: The results indicated a low level of adoption of Artificial Intelligence tools by faculty members in identifying data sources and designing data collection tools (mean = 2.143, T = -9.454, SIG = 0.000). This suggests that Artificial Intelligence is not sufficiently utilized at this stage, despite the availability of tools that could help accelerate and improve data collection processes.

Sub-Hypothesis 5: The results showed weak use of Artificial Intelligence in data processing and analysis (mean = 2.062, T = -10.241, SIG = 0.000). This decline is concerning, especially since data analysis is one area that could greatly benefit from Artificial Intelligence techniques, suggesting the need for enhanced knowledge of these tools.

Sub-Hypothesis 6: The mean for the use of Artificial Intelligence in presenting and discussing results was 2.220, with a T-value of -8.579 and significance (SIG = 0.000), indicating low adoption at this stage. This suggests that faculty members are not fully utilizing Artificial Intelligence tools to present and analyze their research results in a more interactive and accurate manner.

Sub-Hypothesis 7: Results of Sub-Hypothesis 7 revealed a low level of adoption of Artificial Intelligence for drawing conclusions and making recommendations (mean = 2.255, T = -7.930, SIG = 0.000). This indicates that technological tools are not effectively used to extract research recommendations, which may reduce the quality of the research findings.

Sub-Hypothesis 8: This hypothesis recorded the highest mean among the sub-hypotheses (2.342), with a T-value of -7.542 and significance (SIG = 0.000), suggesting that the level of Artificial Intelligence use in editing, reviewing, and supporting publication remains below the average, although it is less pronounced compared to other stages. This reflects a need for faculty members to enhance their skills in using Artificial Intelligence tools to improve the quality of scientific output.

5-Conclusion:

The rapid advancements in the field of artificial intelligence (AI) present a genuine opportunity to reshape research methodologies and enhance the tools used in scientific inquiry, particularly amid the ongoing global developments in knowledge and technology. In this context, this study aimed to investigate the adoption of AI tools by the faculty members of the Faculty of Economic Sciences at Hasiba Ben Bouali University, through a field-based approach designed to understand the nature and levels of AI tool usage across different stages of the research process. An inductive approach was employed, supported by a questionnaire and data analysis using SPSS software, in order to collect and process data statistically in line with rigorous scientific standards. This study falls within the broader scientific efforts to assess the digital transformation within the academic community and to determine how

researchers are responding to these changes, with the goal of fostering a clearer vision of how technological empowerment can be integrated into academic research.

5-1-Study Findings:

The findings of the study revealed that the level of AI tool adoption by faculty members of the Faculty of Economic Sciences at Hasiba Ben Bouali University in scientific research remains low, with a general mean score of 2.208, indicating a weak overall use of these tools across various stages of the research process. It was observed that the level of adoption varied depending on the research stage, with the lowest levels recorded in critical stages such as defining methodology, formulating hypotheses, analyzing data, and designing data collection tools. This suggests limited utilization of AI in the technical and methodological aspects of research. Furthermore, significant weakness was noted in the use of AI tools for reviewing scientific literature, presenting results, and discussing them, indicating a lack of integration of these tools in supporting the scientific analysis and systematic interpretation of research outcomes. Although the highest relative mean for AI adoption was observed in the stages of editing, reviewing, and supporting publication, this level still remained below average, suggesting weak implementation even in tasks where ready-to-use AI solutions exist.

On another note, no statistically significant differences were found between male and female faculty members in terms of AI usage levels, reflecting a relatively balanced opportunity to access and use these tools between genders. However, the study did reveal statistically significant differences in adoption levels based on academic rank, years of experience, and age group. Permanent faculty members, those with longer experience, and older age groups were more open to adopting AI, confirming the positive role of experience and accumulated academic training in enhancing AI tool adoption.

The results also indicated several obstacles preventing the effective use of AI tools, including insufficient specialized training, a lack of awareness of the potential benefits these tools offer for scientific research, and the absence of a supportive technological and institutional environment that encourages AI integration into academic research practices.

5-2-Hypothesis Testing :

- **First Hypothesis:** *The level of AI tool usage by faculty members of the Faculty of Economic Sciences at different stages of scientific research is generally moderate.*

The study's results indicate that the overall mean level of adoption was 2.208, which is lower than the assumed average, thus reflecting weak usage rather than moderate adoption. Consequently, the available data does not support this hypothesis, and it is rejected.

- **Second Hypothesis:** *The editing, reviewing, and publication support stage is the most frequently used stage for AI tools by faculty members.*

The results confirmed that the highest relative mean for AI tool usage was recorded at the editing, reviewing, and publication support stage, compared to other stages in the research process. Therefore, the data supports the validity of this hypothesis, and it is accepted.

- **Third Hypothesis:** *There are statistically significant differences in the level of AI tool adoption in scientific research attributable to demographic variables (gender, academic rank, years of experience, age group).*

The study showed no statistically significant differences between male and female faculty members, but significant differences were found based on academic rank, years of experience, and age group. Therefore, the hypothesis is partially accepted—rejected in terms of gender, but accepted in terms of the other variables.

5-3-Study Recommendations

Based on the results of the study, the researcher recommends the integration of specialized training units on the use of AI tools in scientific research into the basic and ongoing training programs for faculty members, especially in the methodological and analytical areas where the study indicated weaknesses. It is also suggested that a more effective digital research environment be established by providing software licenses and intelligent analysis tools, along with technical support services for faculty members, to facilitate the integration of AI in various research practices.

The study calls for the adoption of institutional and legislative policies at the faculty and university levels to encourage the use of AI in scientific research, by linking it to performance evaluations or incorporating it as a requirement for research projects and funding. In this context, the study also recommends providing training programs specifically targeted at temporary faculty members and those with limited experience to narrow the gap in usage compared to their permanent and more experienced counterparts.

Finally, the study proposes launching internal scientific initiatives such as study days, scientific meetings, and seminars to raise awareness about the actual potential of AI tools, and to stimulate the exchange of experiences and knowledge between faculty members and students. These efforts would contribute to fostering a more open and advanced digital research culture.

6- References :

- Abu Nassar, M., Mobaideen, M., & Obeidat, M. (1999). *Manhajiyyat al-baḥth al-ʿilmī: al-qawāʿid wa-al-marāḥil wa-al-taṭbīqāt [Scientific research methodology: Principles, stages, and applications]* (2nd ed.). Dar Wael.
- Al-Asad, S. A. (2023). *Aldakaa alistinaai: alforass wa almakhatir wa alwakia fi aldowal alarabia* [Artificial intelligence: Opportunities, risks, and realities in Arab countries]. *Additions to Economics Journal, 7*(1), 167. https://www.asjp.cerist.dz/en/article/217953
- Khalifa, M., & Albadawy, M. (2024). Using artificial intelligence in academic writing and research: An essential productivity tool. *Computer Methods and Programs in Biomedicine Update, 5*, 1–11. Article 100145. https://doi.org/10.1016/j.cmpbup.2024.100145
- Nagar, S. (2024). Artificial intelligence in scientific research: Lessons for SPIs. *Science-Policy Brief for the Multistakeholder Forum on Science, Technology and Innovation for the SDGs*, Harvard University, 1. https://sdgs.un.org/sites/default/files/2024-05/Nagar_Artificial%20Intelligence%20in%20Scientific%20Research_0.pdf
- Tejedor-Estupiñán, J. M. (2024). Artificial intelligence for economic research. *Finanzas y Política Económica, 16*(1), 9–28. https://doi.org/10.14718/revfinanzpolitecon.2024.16.1.2
- Toner-Rodgers, A. (2024). Artificial intelligence, scientific discovery, and product innovation [Preprint]. *arXiv*. https://doi.org/10.48550/arXiv.2412.17866
- Xu, Y., Liu, X., Cao, X., Huang, C., Liu, E., Qian, S., Liu, X., Wu, Y., Dong, F., Qiu, C.-W., Qiu, J., Hua, K., Su, W., Wu, J., Xu, H., Han, Y., Fu, C., Yin, Z., Liu, M., … Zhang, J.

(2021). Artificial intelligence: A powerful paradigm for scientific research. *Innovation, 2*(4), 100179. https://doi.org/10.1016/j.xinn.2021.100179