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Transformations of Scientific Research in the Social Sciences in the Age of Artificial Intelligence: An Analytical Approach to Methodologies, Applications, and Epistemological Boundaries

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Abstract:

The contemporary world is witnessing a profound transformation in the structure of human knowledge due to the rapid advancement of artificial intelligence (AI), which has expanded beyond the fields of technology and engineering to become a decisive factor in the social and human sciences. AI has reshaped the core questions of social research, transforming its methods from descriptive and interpretive approaches to algorithmic and data-driven analyses.
This study aims to analyze the methodological, epistemological, and ethical transformations produced by AI within social research, while examining its practical applications and limitations. Using an analytical and comparative approach based on recent Arabic and international studies, the paper concludes that AI represents a revolutionary tool for social inquiry but simultaneously imposes epistemic and ethical challenges that demand the reconstruction of the social sciences' knowledge paradigm on a new foundation of human–machine integration.

Keywords: Artificial Intelligence, Social Sciences, Research Methodology, Digital Transformation, Human Knowledge.

Introduction:

The digital revolution has become one of the most influential phenomena in the development of contemporary human thought. It has not only transformed modes of

communication, work, and production, but has also reshaped patterns of scientific thinking and its methodologies.[1]

Amid this revolution, artificial intelligence (AI) has emerged as the driving force of cognitive transformation, transcending the boundaries of technology to become a multidimensional field of knowledge that blends computation, logic, philosophy, language, and the social sciences.[2]

With its ability to algorithmically process massive amounts of data, AI is now regarded as a tool capable of "simulating" human thought—and even contributing to the formulation of social concepts themselves. In this context, the social researcher is no longer merely an observer of societal phenomena, but an active participant interacting with intelligent systems that share in analysis, interpretation, and prediction.

The central problem of this paper lies in the following key question: **How has artificial intelligence transformed the structure of research in the social sciences in terms of methodologies, tools, and concepts—and what are the epistemological and ethical limits of this transformation?**

The significance of this study stems from its attempt to link the digital transformation with the epistemological one—that is, the transformation in the very structure of knowledge production itself. It also seeks to anticipate the future of the social sciences in light of the accelerating development of AI, which has begun to infiltrate every stage of scientific research—from data collection to analysis and publication.

First: Theoretical and Conceptual Framework of Digital Transformation and Artificial Intelligence

1. The Concept of Artificial Intelligence

Artificial intelligence is generally defined as the ability of digital systems to perform tasks that require human intelligence, such as understanding, learning, planning, and decision-making.[3]

[1] **فريد موسلي، جمال فرفار**، *مناهج بحث وتحليل العلوم الاجتماعية في ظل تكنولوجيا الذكاء الاصطناعي*، مجلة الزيتونة الدولية، العدد 20، 2024، ص142.

[2] **ibid,** p 144.

[3] **Juan Ramos-Martín & Carlos Barreneche,** ***Artificial Intelligence***, SAGE Publications, USA, 2020, p.2.

This concept was formally established during the Dartmouth Workshop in 1956, led by John McCarthy and Marvin Minsky, who emphasized that intelligence could be simulated by machines capable of self-learning.[4]

However, in the twenty-first century, artificial intelligence has evolved beyond being a mere programming algorithm or a tool for information processing. It has become a cognitive system that produces meaning and contributes to the construction of social reality itself.[5]

2. Artificial Intelligence as a New Epistemological Framework

From the perspective of the philosophy of science, artificial intelligence is considered one of the most prominent manifestations of the shift from "experimental objectivity "to "computational objectivity."[6] Knowledge is no longer produced solely through human observation or experimentation, but through quantitative analysis of vast amounts of data extracted and restructured by machines.

This raises a profound epistemological question: Can the results produced by algorithms be regarded as knowledge in the human sense of the term?

Some thinkers, such as Juan Ramos Martín (2020), argue that artificial intelligence does not produce knowledge per se, but rather generates epistemic probabilities based on statistical patterns rather than interpretive understanding.[7]

This makes the integration of artificial intelligence into the social sciences a double-edged challenge, as it touches upon the very essence of the interpretive act upon which these sciences have been founded since their inception.

3. Digital Transformation in Social Research

Digitization is a social phenomenon before it is a technological one; it reshapes relationships and meanings within an interactive virtual space. Farid Mousli and Jamal Ferfar (2024) point out that digitization is not merely a research tool, but a new epistemic environment through which social phenomena themselves are produced.[8]

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[4] **Ibid, p 3.**

[5] **Ibid, p 4.**

[6] **توفيق حناشي**، التحولات الرقمية في الدول العربية، جامعة العربي التبسي، تبسة، المجلد 5، العدد 2، 2022، ص3

[7] **Ramos-Martín & Barreneche**, op.cit. p 6.

[8] **موسلي وفرفار**، Op,cit, p150

Digital behavior—such as interaction through social media—has become both a subject of research and a source of data at the same time. In this sense, digital transformation has created a *"data society"* based on the interaction between humans and algorithms, compelling researchers to reconsider key concepts such as the sample, the field, observation, and objectivity.[9]

Second: Artificial Intelligence and the Epistemological Structure of the Social Sciences

The introduction of artificial intelligence into social research has represented an epistemological revolution comparable in impact to that produced by modern physics at the beginning of the twentieth century. Just as relativity and quantum theory shifted physics from determinism to probability, artificial intelligence has shifted the social sciences from an interpretive approach to a predictive one.[10]

1. From Interpretation to Prediction

In the classical approach, the goal of social research was to explain phenomena through the laws or values that govern them. In the algorithmic approach, however, the goal has become to predict the future behavior of phenomena by identifying patterns within data. [11]

This shift—from asking "why" to asking "what will happen"—reflects a transformation in the very nature of the scientific question itself and raises a challenge concerning the human role in the production of meaning.

2. Redefining Research Concepts

Artificial intelligence has reformulated several fundamental concepts in social research:

- **Sample:** No longer limited, but comprehensive—based on *Big Data.*
- **Field:** No longer geographical, but digital and network-connected.
- **Observation:** Has become automated, relying on the analysis of digital interactions.

[9] ibid, p 152.

[10] **إميل دوركهايم**، قواعد المنهج في علم الاجتماع، ترجمة محمود قاسم، دار الفكر العربي، القاهرة، 1995، ص15

[11] ibid, p**20 .**

- **Objectivity:** No longer measured solely by the researcher's non-intervention, but by the degree of algorithmic neutrality.[12]

3.The Limits of Algorithmic Knowledge

- Artificial intelligence operates by extracting patterns rather than meanings, which makes its results prone to the quantitative reduction of human phenomena.[13]Algorithms do not grasp cultural or symbolic contexts in the way human researchers do, which can sometimes lead to a "loss of social sensibility" in interpretation.[14]
- A 2023 study on the use of artificial intelligence applications in scientific research indicates that the greatest threat to social knowledge in the age of AI lies in the risk of replacing human understanding with automated digital description.[15]

Third: Artificial Intelligence and Modern Social Research Methodologies

- The integration of artificial intelligence into the social sciences represents a critical turning point in the evolution of research methodologies. While classical social research was associated with observation, description, and theoretical analysis, artificial intelligence offers new possibilities to expand the scope and precision of studies through the analysis of large-scale data and the use of algorithmic techniques to uncover social patterns.[16]

1. Traditional Research Methodologies and Their Limits

In traditional models, social researchers relied on quantitative and qualitative methods, whether through observation, interviews, or surveys. However, these tools faced limitations in terms of time, space, and sample size.[17]

For example, direct observation is confined to a narrow field, surveys depend on the honesty of responses, and interviews are influenced by power dynamics between the

[12] **براك، خضرة، وبوخريص، أزهار**، *دور تطبيقات الذكاء الاصطناعي في مجال العلوم الاجتماعية، مجلة ابتكارات للدراسات الإنسانية والاجتماعية، المجلد 2، العدد 1، 2024*، ص4

[13] **ibid,** p 7.

[14] **سباغ عمر،زعابطة سيرين هاجر**، استخدام تطبيقات الذكاء الاصطناعي في البحوث العلمية في ميدان العلوم الاجتماعية والإنسانية المزايا والحدود، مجلة البحوث الإنسانية، جامعة الجزائر 2، 2023، ص9 .

[15] **ibid**, p 11.

[16] **ibid**, p 13.

[17] **موسلي وفرفار**، op, cit, p.154

researcher and the participant. These factors often rendered social knowledge partial and limited in its generalizability.

2. The Shift Toward Smart Methodologies

With the development of artificial intelligence, a new trend has emerged toward what can be called *"smart methodologies in social research"*—approaches that rely on AI tools to collect and analyze data in non-traditional ways.[18]

Several techniques are used in this context today, including:

- **Big Data Analytics:** To uncover hidden relationships between social variables.
- **Machine Learning:** To identify recurring patterns and predict future behavior.
- **Sentiment Analysis:** To understand collective attitudes through language and interaction in digital spaces.
- **Computational Sociology:** To study the networked structures of human communication through algorithms.

These smart methodologies have made it possible to study complex phenomena—such as extremism, symbolic violence, and public opinion—by analyzing millions of digital data points that reflect real-world practices.

3. Toward an Algorithmic Sociology

The convergence of artificial intelligence and sociology has led to the emergence of what is known as "algorithmic sociology", an approach that relies on deep statistical analysis conducted by intelligent systems.[19]

In this approach, data becomes a source for theorizing rather than merely a tool for it, as the researcher analyzes the results produced by the machine and interprets them in light of social concepts.

However, this form of sociology still requires intellectual oversight, because the risk lies in reducing human phenomena to mere numerical equations, thereby stripping them of their symbolic and human dimensions.

4.ntegration Between Human and Machine

[18] براك وبوخريص. op, cit, p 8.

[19] **Rezaev, Andrey V. & Ivanova, Anastasia A.,** Studying Artificial Intelligence in Natural and Social Sciences, WMSCI, 2018, p.3.

Khadra Barak and Azhar Bokhrees (2024) argue that the new role of the researcher in the age of artificial intelligence is no longer to produce data, but to interpret it critically and philosophically.[20]

While the machine handles the computational aspect, the human researcher retains authority over analysis, interpretation, and connecting results to their cultural and social contexts.

Therefore, the success of social research in the digital age depends on the researcher's ability to manage the interaction between the human and the machine—that is, between philosophical insight and algorithmic logic.

Fourth: Practical and Field Applications of Artificial Intelligence in the Social Sciences

Today, the academic and social fields are witnessing widespread use of artificial intelligence in analyzing human phenomena. These applications can be divided into four main areas: scientific research, higher education, social management, and public policy foresight.[21]

1. Artificial Intelligence in Scientific Research

Artificial intelligence has revolutionized researchers' tools by facilitating access to and organization of information. Applications such as *ChatGPT*, *Elicit*, and *ScholarAI* can analyze and summarize scientific texts, saving time and effort during the preparatory stages of research.[22]

In social data analysis, AI software is used to examine relational networks, study group dynamics, and track public discourse in digital spaces.

A 2023 study on the "Use of Artificial Intelligence Applications in Scientific Research in the Field of Social and Human Sciences" found that 72% of researchers using AI tools noticed an increase in the accuracy of their research results, while 40% expressed

[20] **ibid,** p5.

[21] **Matthew N.O. Sadiku et al.,** Artificial Intelligence (A.I.) in Social Sciences: A Primer, International Journal of Engineering Research, Vol.7, 2021, p.2.

[22] **سباغ . زعابطة سيرين هاجر** op,cit, p 15. **عمر**

concern over the potential decline of critical thinking in favor of automated dependency.[23]

This highlights the importance of balancing technical efficiency with a human, critical perspective.

2. In Higher Education

AI has contributed to improving the quality of university education by designing intelligent educational systems that account for students' individual differences and assist professors in evaluating performance objectively.

AI applications are also used to train students in research skills, helping them analyze data, select appropriate methodologies, and draft scientific reports.[24]

However, Barak and Bokhrees (2024) warned against over-reliance on these tools without critical awareness, as it may threaten academic independence.[25]

3. In Managing Social Phenomena

Governments and social institutions increasingly employ AI to analyze societal issues such as unemployment, domestic violence, migration, and extremism.

By analyzing large-scale databases, AI systems can propose practical solutions based on statistical models.[26]

Nonetheless, these applications face criticisms regarding their ethics and transparency, especially when the data involves individuals' lives and privacy.

4.In Foresight and Decision-Making

Social prediction represents one of the most ambitious applications of artificial intelligence. Institutions seek to develop algorithmic models capable of forecasting

[23] **ibid,** p 16.
[24] **براك** op,cit, p 9. **وبوخريص**
[25] **ibid**, p 9.
[26] **براك وبوخريص**، op, cit, p 10

collective behavior, such as trends in public opinion, probabilities of conflict, or prospects for political stability.[27]

This predictive capacity opens vast horizons for social research, yet it simultaneously raises profound ethical questions:
Can machines anticipate the social future independently of cultural and historical context?
And does the human being, within this model, risk becoming merely an "indicator" within a mathematical equation?

5. Artificial Intelligence and the Arab Society

Recent studies indicate that the use of artificial intelligence in Arab social research remains relatively limited, mainly due to weak digital infrastructure and insufficient research funding.[28]

However, some Algerian and Moroccan universities have, since 2022, begun to integrate training modules on *"Artificial Intelligence in Social Research"* into their graduate programs.[29]

This trend marks an important step toward equipping Arab researchers to keep pace with global transformations in scientific research methodologies

Fifth: Ethical and Epistemological Challenges of Using Artificial Intelligence in the Social Sciences

Artificial intelligence represents a double-edged sword in the social domain: on one hand, it serves as a powerful tool for expanding knowledge and analyzing phenomena; on the other, it introduces ethical and epistemological challenges that threaten the foundational values of scientific inquiry. The most prominent of these challenges can be identified in three main areas: **privacy**, **neutrality**, and **humanity**.

[27] موسلي وفرفار، op, cit, p 156.

[28] **Matthew N.O. Sadiku et al**., Artificial Intelligence (A.I.) in Social Sciences: A Primer, International Journal of Engineering Research, Vol.7, 2021, p3.

[29] سباغ عمر . زعابطة سيرين هاجر . op,cit, p 18

1. The Issue of Privacy and Data Protection

Privacy is among the most pressing concerns in employing artificial intelligence in social studies, as the collection of massive digital data involves handling personal and sensitive information about individuals and groups.[30]

A 2023 study titled *"The Use of Artificial Intelligence Applications in Scientific Research in the Field of Social and Human Sciences"* warned that most research projects employing AI in the Arab world lack clear protocols for data protection, exposing participants to potential privacy violations.[31]

Therefore, academic institutions have become increasingly obliged to establish digital ethics codes and conduct guidelines that define how data should be collected, processed, and stored in accordance with human values and individual rights.

2. Algorithmic Bias and the Limits of Neutrality

Despite the common claim that artificial intelligence operates on digital objectivity, algorithms are built upon human-generated data that may be culturally or socially biased.[32]

Western studies have shown that some image recognition and linguistic classification systems contain biases against certain racial or gender groups, revealing that AI is not entirely neutral but, rather, tends to reproduce the structural inequalities present in society.[33]

In the Social Sciences, Bias Becomes Even More Critical

In the social sciences, such bias is far more dangerous, as it directs analytical results toward interpretations that may reinforce stereotypes rather than deconstruct them.

3. The Loss of the Human Dimension in Knowledge

Many contemporary thinkers warn against the danger of the *"dehumanization of scientific research"* in the age of artificial intelligence.[34]

[30] زعابطة سيرين هاجر . سباغ عمر. op,cit, p 20

[31] **Ibid,** p 21

[32] **ibid**, 23.

[33] **Ramos-Martín & Barreneche**, op, cit, p 7.

[34] **Ramos-Martín & Barreneche**, op, cit, p 8.

Social phenomena are not mathematical equations but expressions of meaningful human experience—symbolic and cultural in nature.

Reducing humans to mere *"digital data"* leads to a decline in interpretive understanding in favor of mechanical explanation—what Herbert Simon calls *"instrumental reason"*, which focuses on efficiency while neglecting value[35] Therefore, artificial intelligence should not be viewed as a substitute for the researcher, but rather as a tool within a broader humanistic project—one that prioritizes humanity over technology in the production of knowledge.

4. The Challenge of Scientific Responsibility

A pressing issue in modern research ethics concerns accountability: *Who bears responsibility for results produced by an algorithm?*
Is it the researcher who uses it, or the developers who designed it?

This question raises complex legal and ethical dilemmas, especially when AI-generated results are used to make decisions that affect individuals or public policies.[36]

Hence, theorists such as Juan Ramos Martín (2020) call for the establishment of what he terms *"the ethics of research-oriented artificial intelligence"*—a new field that bridges philosophy and data science.[37]

Sixth: Future Horizons of Social Research in the Age of Artificial Intelligence

The future of research in the social sciences depends on its ability to adapt to digital transformations without losing its human essence.
While artificial intelligence has provided researchers with unprecedented tools, it has also imposed existential challenges concerning the very meaning of *"science."*

1. Toward a New Model of Research Training

It is no longer possible to train social researchers in isolation from technical knowledge. The new generation of scholars must acquire basic skills in programming, as well as statistical and linguistic data analysis.[38]

[35] **Herbert Simon,** The Sciences of the Artificial, MIT Press, 1996, p.12.
[36] **ibid, p 15.**
[37] سباغ عمر . زعابطة سيرين هاجر.op,cit, p 24
[38] Ramos-Martín & Barreneche, op, cit, p9.

Some Arab universities—such as the University of Algiers 2 and the University of Tebessa—have already begun integrating courses on artificial intelligence and its ethics into master's and doctoral programs in the social sciences.[39]

This trend reflects a growing awareness of the importance of interdisciplinary training that connects sociology, computer science, and philosophy.

2. Human–Algorithmic Interactive Research

In this context, it is proposed to adopt what may be called the *"human–algorithmic interactive approach"*—a model based on collaboration between the researcher and the machine within a single cognitive process.

In this model, the algorithm performs quantitative analysis, while the researcher provides qualitative interpretation that imbues the results with meaning and value.[40]

This integration between human reasoning and intelligent computation forms the foundation of a new, more comprehensive and realistic research methodology—one that ensures data accuracy without sacrificing the human dimension.

3. The Role of Artificial Intelligence in Advancing Social Development

In the coming decades, artificial intelligence is expected to become a central element in shaping social and economic decision-making—through the analysis of developmental indicators and real-time monitoring of social transformations.[41]

However, for Arab societies to benefit from these capabilities, they must build national research policies that promote data digitization and develop open scientific platforms for intelligent social research.

4. A Future Vision for Arab Social Sciences

Current trends suggest that the Arab world stands before two choices: either to remain a consumer of digital knowledge produced elsewhere, or to become a contributor to its creation through the development of local AI-based research.[42]

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39 موسلي وفرفار، op, cit, p157.

40 سباغ . زعابطة سيرين هاجر op,cit, p 26.

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41 براك وبوخريص، op, cit, p 11.

42 توفيق حناشي op, cit, p 5.

To achieve the latter, it is essential to:

- Support laboratories specialized in social artificial intelligence.
- Encourage collaborative research between Arab and international universities.
- Promote a culture of ethical and responsible scientific inquiry.

The future of Arab social sciences thus depends on their ability to strike a balance between technological modernity and intellectual authenticity—ensuring that artificial intelligence serves as a means to understand humanity, not to replace it.[43]

Conclusion:
The study has shown that artificial intelligence is not merely a technological development, but rather an epistemological transformation that redefines the relationship between humans and knowledge.
While it has provided researchers with unprecedented analytical tools, it has also reopened fundamental questions about the meaning of understanding, the nature of objectivity, and the limits of scientific neutrality.
The research further revealed that integrating artificial intelligence into the social sciences leads to a shift from a descriptive to a predictive approach, and from limited samples to comprehensive big-data analysis. However, it also poses the risk of losing the human dimension if not accompanied by philosophical and ethical framing.

Based on these findings, the study recommends the following:

- The need to develop courses on « **AI Ethics** » within social science training programs.
- Encouraging **interdisciplinary research** that combines social sciences with computer science and statistics.
- Establishing **national centers** to monitor and evaluate the academic use of artificial intelligence.
- Promoting a culture of « **guided human intelligence** » that balances technology and human values.
- Considering artificial intelligence as a **partner in understanding**, not a replacement for humans in the production of meaning.

The future of the social sciences in the Arab world depends on their ability to employ artificial intelligence as a tool for **liberating thought rather than constraining it**, with a critical awareness that turns technology into a means of human knowledge—not an end in itself.

[43] سباغ عمر . زعابطة سيرين هاجر.op,cit, p 27

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