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## Examining the Incorporation of AI in Academic Research: The Case of Higher Education in the Marrakech-Safi Region

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### ABSTRACT

This paper examines the incorporation of Artificial Intelligence (AI) technologies in academic research within the Marrakech-Safi region of Morocco, specifically regarding their use by university academics. This research investigates the prospects, obstacles, and ethical considerations related to AI adoption in Moroccan higher education institutions through semi-structured interviews with academics at Cadi Ayyad University. The research indicates that AI is significantly improving research productivity, promoting interdisciplinary collaboration, and providing novel answers to rising academic difficulties. Nonetheless, other challenges persist, including deficient infrastructure, poor training, and the absence of comprehensive policies to govern AI use. The article concludes with policy recommendations aimed to enhance the efficient implementation of AI for the optimisation of research methods in the region.

### INTRODUCTION

Artificial Intelligence (AI) is rapidly developing as a transformational influence in higher education, offering solutions to persistent difficulties in education, research, and administration globally. The incorporation of AI technology into academic research has tremendous prospects for boosting productivity, fostering diverse collaboration, and encouraging creativity in research methodology. In Morocco, including within the Marrakech-Safi region, the adoption of AI in higher education is nascent. Although institutions in this region are starting the exploration of artificial intelligence (AI) tools for better studies, issues concerning facilities, faculty training, and policy development remain prevalent.

The present research attempts to examine the integration of AI technology by academic researchers in higher education institutions in the Marrakech-Safi region. The article examines the use of AI, the opportunities it presents for enhancing research productivity and quality, and the challenges that researchers encounter in employing these technologies. The study examines the ethical and policy issues related to AI use in academic research and offers practical recommendations for its effective and responsible implementation in universities across the region.

### Conceptual Background

From a global perspective, the use of AI in research has brought a new revolution, driving new methods and breakthroughs in countless fields. Here in Morocco, this technological shift is still pending. In universities like Cadi Ayyad University (Marrakech-Safi Region), scientists are adopting AI for improved research. Nonetheless, the localised implementation of AI within these academic settings has unique obstacles, especially regarding

infrastructure, resource distribution, and the development of suitable rules.

### Research Problem

Although increasing number of international literature examining the AI's contribution to enrich the academic research process, the interface of AI within Moroccan academic institutions particularly within the Marrakech-Safi region, is under-studied. As a result, there are few studies regarding the unique challenges or opportunities within this regional context. This paper aims to close this gap by analyzing the current status of AI adoption in the country's universities, its effects on research practices and the challenges that should be fixed for its effective embedding.

### Research Objectives and Questions

#### Hypotheses

- First hypothesis: The use of AI tools in academic research in Marrakech-Safi region has a significant influence on the research productivity and interdisciplinary collaboration among researchers.
- Second hypothesis: The integration of AI in universities within the Marrakech-Safi region encounters substantial obstacles, including limited infrastructure, insufficient faculty training, and a lack of comprehensive policies governing AI utilisation in academic research.

### Research Question

Based on the previously stated hypotheses, the main research question is:

1. How does Artificial Intelligence currently impact teaching and research at universities in the region of Marrakech-Safi, as well as the emerging opportunities, challenges and ethical issues facing its introduction?

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This study aims to elucidate AI adoption in higher education institutions within the Marrakech-Safi region and to propose policy recommendations for enhancing its incorporation into academic research.

### LITERATURE REVIEW

#### AI in Higher Education: Global and Local Contexts

Artificial Intelligence (AI) technology have gradually become integrated into international higher education institutions, transforming various areas of academic research. The implementation of AI allows institutions to optimise procedures, improve academic efficiency, and develop new study methods. Applications of AI in higher education include data analysis, personalised learning, digitisation of administrative tasks, and the promotion of substantial collaborative studies (Luckin *et al.*, 2016). In addition, AI is improving the ability to quickly process and examine large datasets, hence increasing the rapidity and accuracy of research findings (Brynjolfsson & McAfee, 2014).

The global impact of AI on the academic sector is widely documented, with several studies highlighting its importance in raising productivity and fostering diverse methods for addressing complex academic challenges.

AI-driven methods in academic research have facilitated expedited data processing and enhanced prediction models, especially in disciplines such as healthcare, engineering, and social sciences (Chui *et al.*, 2016). This global perspective on AI's influence highlights its capacity to transform academic research and enhance general productivity.

The National Strategy for Digital Education (2018) in Morocco established the foundation for the integration of AI tools in educational environments, emphasising the enhancement of digital infrastructure and the deployment of AI in universities (El Khamlichi, 2019). Nevertheless, notwithstanding these endeavours, Moroccan institutions, particularly in less urbanised areas like Marrakech and Safi persist in encountering difficulties. This encompasses limited access to sophisticated AI tools, inadequate infrastructure, and a deficiency in specialised training for teachers and researchers (Benmansour *et al.*, 2021). Nonetheless, promising indications of advancement are surfacing. Institutions such as Cadi Ayyad University in Marrakech have commenced the integration of AI technologies into research methodologies, specifically in order to improve research output and promote cross-disciplinary cooperation.

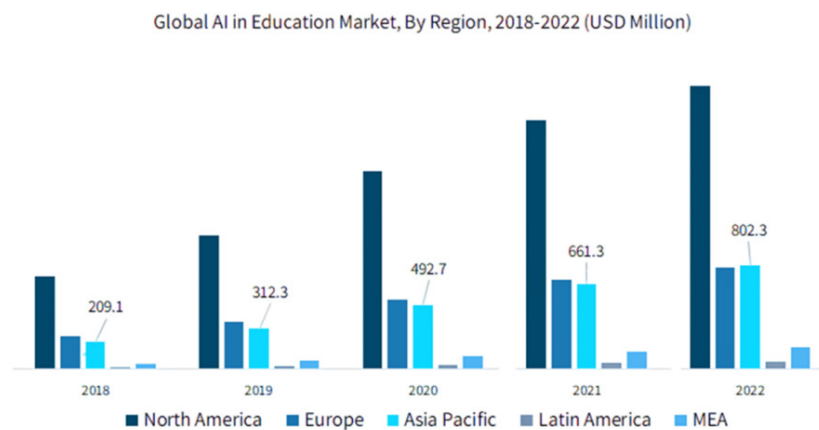


Figure 1: Global AI Adoption in Higher Education

#### Opportunities for AI in Academic Research

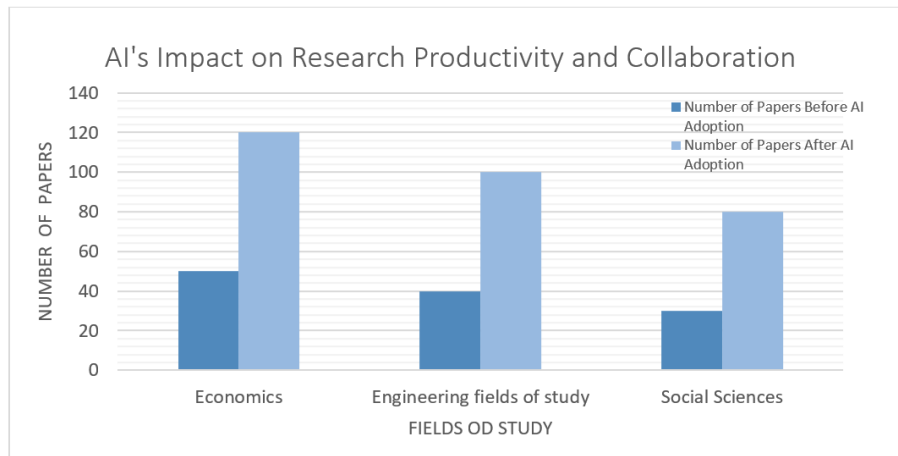
Artificial Intelligence offers numerous opportunities to improve both the effectiveness and the quality of research at Moroccan universities. Machine learning (ML), natural language processing (NLP), and data mining are essential AI technologies used to automate repetitive processes, analyse extensive datasets, and support in literature review and data interpretation (Chui *et al.*, 2016). These tools allow researchers to efficiently analyse complicated datasets, reveal concealed patterns, and obtain insights that would otherwise be laborious or challenging to identify through conventional methods.

Researchers across various disciplines, including engineering, economics, and social sciences, are utilising AI to achieve expedited insights and generate more dependable and significant study results. AI applications

in economics facilitate the analysis of extensive economic data, thereby informing policy decisions. In the social sciences, AI is employed to assess sentiment in social media and historical data, providing significant insights into the community patterns.

Furthermore, AI's capacity to break down disciplinary boundaries enables interdisciplinary collaboration, with AI technologies serving as bridges connecting diverse academic fields. Researchers are gradually implementing AI to tackle intricate social issues, like climate change, public health, and urbanisation (Brynjolfsson & McAfee, 2014). By automating data analysis, AI systems liberate academics from mundane chores, enabling them to focus on more intellectual and inventive dimensions of their work.

The diagram above depicts the function of Artificial



**Figure 2:** AI's Impact on Research Productivity and Collaboration

Intelligence (AI) in augmenting research productivity across several academic disciplines. The bar chart illustrates the quantity of academic articles published prior to and subsequent to the adoption of AI in disciplines including economics, engineering, and social sciences. It illustrates a distinct rise in research productivity, particularly in economics and engineering, where AI tools have presumably facilitated more efficient data analysis, expedited research cycles, and enhanced collaboration. This visual depiction emphasises the revolutionary impact of AI on research productivity and illustrates its potential to foster innovation in academic disciplines.

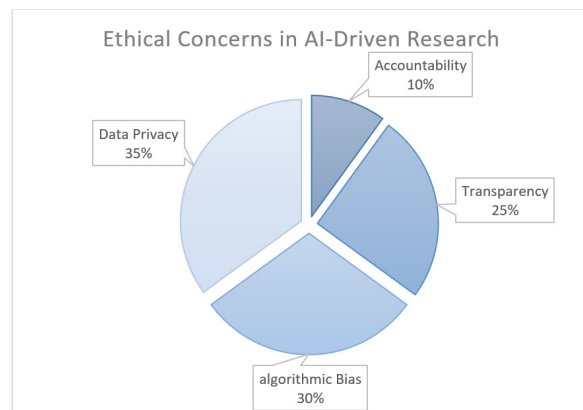
**Ethical and Social Implications of AI in Research**

Although AI provides considerable advantages for academic research, it simultaneously presents various ethical and social challenges that require resolution in order to ensure its responsible use. A major issue is data privacy. Artificial intelligence tools frequently depend on extensive datasets, some of which may include sensitive or personally identifiable information. Researchers employing AI must guarantee that their data collecting and processing methods adhere to ethical norms and privacy rules, thereby preventing the potential misuse of personal data (O'Neil, 2016).

Another issue is the possibility of algorithmic bias, in which AI systems may accidentally reinforce existing societal biases that exist in the data. AI techniques employed in social science research may yield biased outcomes if the training data is inadequate or distorted (O'Neil, 2016). This concern is especially critical in fields such as education and healthcare, where biased algorithms may yield substantial societal and policy consequences.

The necessity for ethical transparency and accountability in AI development is critical. Concrete standards must be developed for AI implementation to guarantee that research methodologies employing AI tools are both responsible and equitable. Researchers and entities must establish comprehensive frameworks to tackle issues such as bias, transparency, and the ethical utilisation

of data (Gasser *et al.*, 2018). Moreover, the enduring societal ramifications of AI-driven research necessitate ongoing scrutiny to guarantee that the technology serves all stakeholders equally, without intensifying gaps.



**Figure 3:** Ethical Concerns in AI-Driven Research

The pie chart above illustrates the allocation of principal ethical issues recognised in AI-driven research. Data privacy (35%) and algorithmic bias (30%) are the predominant concerns, highlighting the increasing focus on protecting sensitive information and ensuring equity in AI systems. Transparency (25%) and accountability (10%) are significant concerns, underscoring the necessity for clear, accessible information on AI systems and the significance of ensuring accountability for AI-driven activities. These findings highlight the imperative to establish comprehensive ethical frameworks to govern the responsible application of AI in academic research.

**MATERIALS AND METHODS**

**Research Approach**

This study employs a qualitative research methodology, through a case study design to investigate the incorporation of Artificial Intelligence (AI) in academic research at two universities: Cadi Ayyad University and

Safi University. This study's qualitative nature facilitates a comprehensive knowledge of the utilisation of AI technologies in academic research, highlighting both the benefits they offer and the limitations they confront. This method facilitates a detailed examination of the ethical and policy ramifications of AI implementation, as viewed by academic experts.

The semi-structured interview method served as the principal data collection instrument, providing participants the flexibility to articulate their perspectives on AI integration in research, while maintaining coherence with the study's major themes.

### Data Collection

A defined questionnaire has been created and delivered over Google Forms to collect data. This approach allowed extensive access and effective gathering of both quantitative and qualitative data. A total of 204 respondents from Cadi Ayyad University and Safi University completed the questionnaire. The comments provide a thorough analysis of AI implementation and its obstacles within these institutions.

The questionnaire comprised eight theme components, detailed as follows

1. General Information: Demographic data, including gender, age group, academic level, and prior AI training, were self-reported. For AI adoption, participants indicated which tools they used from a predefined list (ChatGPT, Bard/Gemini, Claude, Microsoft Copilot) and could also specify additional tools.

2. AI Adoption and Use: Participants were inquired about the AI tools employed in their research (e.g., ChatGPT, Google Bard/Gemini, Claude, Microsoft Copilot), their usage frequency, and the perceived advantages (e.g., data analysis, writing support). Challenges including insufficient training, restricted access, and ethical dilemmas were also analysed.

3. Opportunities for AI in Research: This section examined participants' perceptions regarding the potential of AI to enhance research productivity and quality in Moroccan universities.

4. Policies and Institutional Support: Participants inquired about the existence of AI-supportive policies and initiatives within their institutions, encompassing training, research funding, and access to AI tools.

5. Ethical and Social Implications: Participants emphasised their ethical apprehensions regarding AI in research, encompassing data privacy, algorithmic bias, and transparency challenges.

6. Future Prospects: This section examined participants' perspectives on the future of AI in Moroccan higher education and research, along with suggestions for enhancing AI integration.

7. Open Comments: Participants had the option to offer supplementary feedback, discuss experiences, or propose suggestions regarding AI in academic research. Data were gathered electronically through Google Forms, facilitating an organised and efficient approach.

The survey's voluntary and anonymous format fostered honest feedback, while the broad representation of academic levels and disciplines guaranteed a variety of viewpoints on AI adoption.

### Semi-Structured Interviews

In addition to the questionnaire, semi-structured interviews were conducted to further explore the key themes identified in the literature and from survey data. The semi-structured format allowed for flexibility, enabling participants to elaborate on their experiences and insights while addressing predetermined questions on:

### AI Adoption and Use

1. What AI tools do you use in your research (e.g., ChatGPT, DeepSeek, Google Bard/Gemini)?
2. How do these tools enhance your research practices?
3. What challenges have you encountered in adopting AI tools?

### Opportunities for AI in Research

1. Do you believe AI can improve research productivity and quality in Moroccan universities?
2. Can AI tools help solve specific research challenges in your field?

### Policies and Institutional Support:

1. Are there AI-supportive policies at your university?
2. What resources (e.g., training, funding, AI tools) does your university offer to support AI adoption?

### Ethical and Social Implications:

1. What ethical concerns do you associate with AI in research (e.g., data privacy, algorithmic bias)?
2. How do you address these ethical concerns in your own research?

### Future Prospects

1. How do you envision the future of AI in Moroccan higher education and research?
2. What steps should universities take to promote responsible and effective AI integration?

### Data Analysis

The data collected through interviews and the survey were subjected to thematic analysis, an approach appropriate for qualitative research. This study discovered reiterating concepts and trends, which have been divided into principal categories comprising AI adoption challenges, ethical considerations, and institutional support. The thematic analysis provided significant insights on the barriers and prospects associated with AI integration in Moroccan higher education, hence influencing the study's recommendations for improved AI adoption.

## RESULTS AND DISCUSSION

### AI Tools in Use

The findings indicate that researchers in multiple fields in

the Marrakech-Safi region are steadily embracing artificial intelligence (AI) methods. Researchers at Cadi Ayyad University are employing machine learning algorithms and advanced data analysis platforms to analyse and interpret enormous datasets, especially in the fields of

economics, engineering, and environmental sciences. At UCA University, artificial intelligence technologies are used for many administrative and academic purposes, such as automating grading procedures, simplifying student exams, and handling research data effectively.

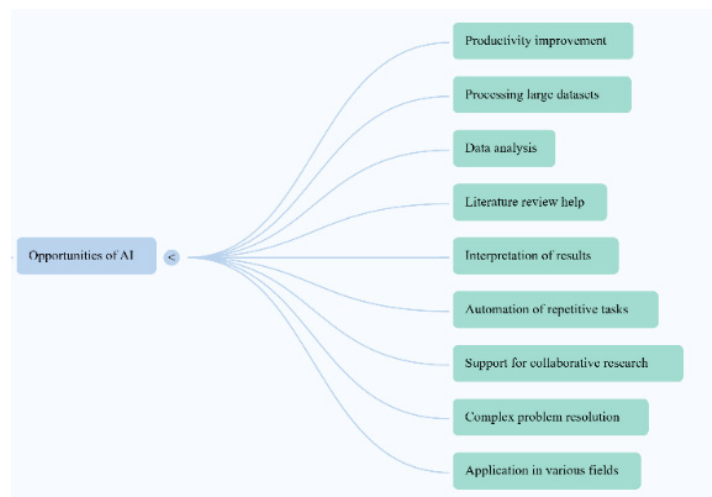
**Table 1:** Word Frequency

Word	Length	Count	Weighted Percentage (%)	Similar Words
training	8	243	4,62	training
research	8	225	4,28	research, researchers, researches
chatgpt	7	171	3,25	chatgpt
funding	7	158	3,00	funding
support	7	146	2,78	support, supportive
tools	5	139	2,64	tool, tools
centers	7	138	2,62	centers
access	6	134	2,55	access
software	8	134	2,55	software
offer	5	121	2,30	offer
create	6	117	2,23	create
help	4	116	2,21	help, helpful, helping, helps
writing	7	113	2,15	writing
saving	6	111	2,11	saves, saving
time	4	111	2,11	time
ethics	6	108	2,05	ethical, ethics
summarizing	11	108	2,05	summarizing
lack	4	105	2,00	lack
data	4	95	1,81	data
analysis	8	94	1,79	analysis
limited	7	93	1,77	limited, limites
faster	6	89	1,69	faster
deepseek	8	85	1,62	deepseek
gemini	6	81	1,54	gemini
improve	7	81	1,54	improve, improves, improving
bard	4	80	1,52	bard
google	6	80	1,52	google
results	7	72	1,37	result, results
accurate	8	71	1,35	accurate
copilot	7	71	1,35	copilot
microsoft	9	71	1,35	microsoft
workshops	9	66	1,26	workshops
collaborations	14	65	1,24	collaboration, collaborations
guidelines	10	63	1,20	guidelines
international	13	63	1,20	international
policies	8	63	1,20	policies
projects	8	61	1,16	project, projects
none	4	57	1,08	none
increase	8	52	0,99	increase, increasingly
institutional	13	52	0,99	institutional, institutions
cost	4	47	0,89	cost

issues	6	47	0,89	issues
legal	5	42	0,80	legal
concerns	8	41	0,78	concerns
challenges	10	33	0,63	challenges
technical	9	32	0,61	technical
focused	7	24	0,46	focus, focused
needs	5	24	0,46	need, needs
nothing	7	23	0,44	nothing
labs	4	22	0,42	labs
done	4	21	0,40	done
claude	6	20	0,38	claude
use	3	16	0,30	use, used, useful
academic	8	15	0,29	academic

The table above illustrates the frequency of essential terms identified in the study's data sources. These expressions highlight the key themes of the research, especially the relevance of Artificial Intelligence and AI within the realm of academic enquiry. The repeated usage of terms such as data, obstacles and adoption underlines

the study's main focus on the integration of AI into research methodologies and the associated barriers to its implementation. This frequency analysis elucidates the principal problems and focal points of interest within the academic community regarding AI in the Marrakech-Safi region.



**Figure 4:** Textual Analysis of AI Opportunities in Research

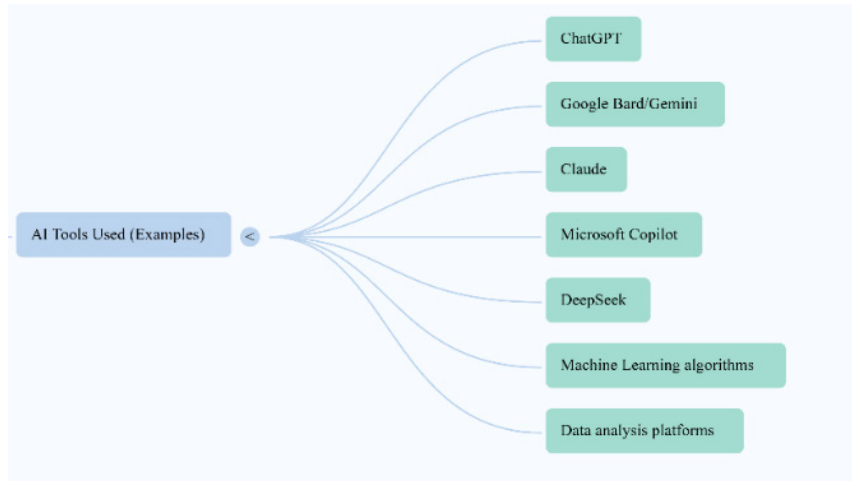
The figure above depicts one of the main themes identified via the textual analysis of participants' responses concerning the potential of AI in academic research. The analysis identifies multiple persistent opportunities, such as increased research productivity, interdisciplinary collaboration, and expanded data analytic skills. The graphic portrayal underscores the prevailing views of AI as a mechanism for expediting research processes, enhancing data management efficiency, and encouraging collaboration across diverse academic disciplines. The study highlights the increasing optimism over AI's capacity to foster innovation in methods of research (Figure 5).

The figure above shows an array of AI technologies commonly used by researchers in the Marrakech-Safi region. The apparent tools, including ChatGPT, Google

Bard/Gemini, and Microsoft Copilot, illustrate a range of applications utilised for diverse academic functions, such as data analysis, writing support, and research administration. This picture illustrates the diversity of AI tools employed across several fields, showcasing the extensive function these tools provide to facilitate academic research. The rising utilisation of these technologies highlights the escalating dependence on AI to improve productivity and effectiveness in studies.

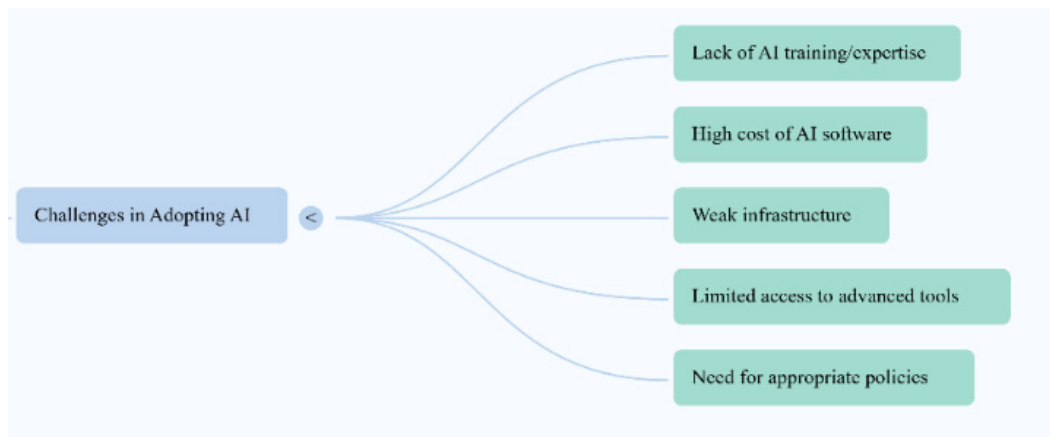
**Challenges in AI Adoption**

Despite these positive effects, many issues were pointed out by the interviewees. The major challenges are the lack of training programmes and knowledge about AI among instructors and researchers. A wide range of participants indicated a lack of formal education in AI, which impeded



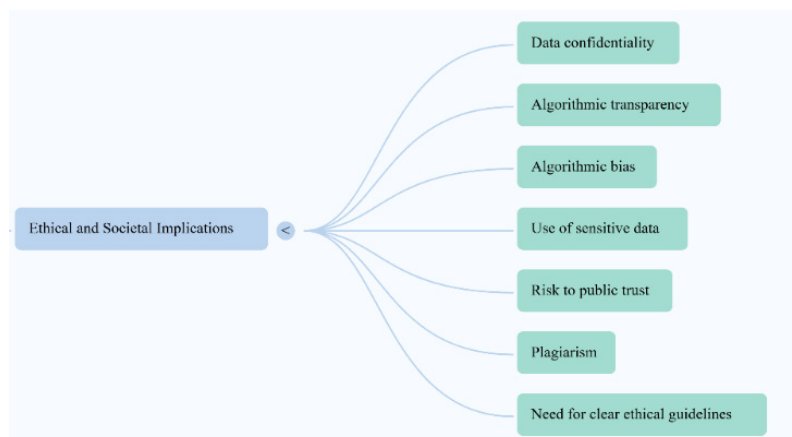
**Figure 5:** AI Tools Used

their ability to use these tools proficiently. Furthermore, the excessive expense of AI software and the inadequate infrastructure, especially in rural portions of the region, prevented substantial AI adoption.



**Figure 6:** Challenges of AI Adoption

The representation above shows the biggest obstacles faced by researchers in the Marrakech-Safi region in incorporating artificial intelligence (AI) methods into their academic endeavours. Common barriers, notably inadequate instruction, inadequate facilities, and ethical dilemmas, dominate the responses, demonstrating the challenges institutions encounter in the entire integration of AI into their research methods. The graphic depiction of these issues points out the necessity for targeted initiatives, involving enhanced training programmes, more



**Figure 7:** Ethical and Social Implications



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