IMPACT OF HUMAN-MACHINE COLLABORATION ON ADOPTION OF LARGE LANGUAGE MODEL-BASED AI SYSTEMS

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Abstract

Research Objectives

The adoption of Large Language Model (LLM)-based Artificial Intelligence (AI) systems presents unique challenges beyond traditional AI adoption, requiring seamless integration with existing processes, high-quality training data, skilled human oversight, and ethical safeguards. While LLMs, such as ChatGPT, offer promising applications in business, they also necessitate human collaboration for contextual understanding, bias mitigation, quality assurance, and handling complex decision-making scenarios. Effective human-machine collaboration helps AI systems to augment their rationality with human expertise. Human intervention is necessary for AI model implementation in LLMs and further in data collection and processing, ensuring unbiased training of these models, and incorporating human qualities like empathy and intuition into its decision-making processes. Owing to the importance of human-machine teaming in the context of LLM-based AI systems and AI systems in general, this research delves into studying the impact of human-machine collaboration on the adoption and use of LLM-based AI systems in organizations. The study aims to uncover the various factors and variables that contribute to effective human-machine collaboration and define constructs that can explain the effect of human-machine collaboration on the adoption of these AI systems.

Theoretical Foundation

The study adopts a systematic literature review for its rigour and methodical nature in two tracks to delve into the extant research. The first track, *Adoption of AI systems,* studies the theoretical frameworks and constructs that have been used by researchers who have studied AI as a system or tool or have studied any underlying AI technology such as digital voice assistants or AI-based robots or Chatbots. The second track, *Role of Human-Machine Collaboration in*

AI, defines human-machine collaboration and different types of teaming that takes place between human and AI system and helps in building the understanding of the factors that drive effective human-machine collaboration and thus its role in AI system adoption. Building upon the Human-Machine Collaboration Framework by Xu & Topi (2017), this study synthesizes six core elements affecting collaboration effectiveness: User Attributes, Technology Attributes, Privacy Concerns, Ethical Considerations, Perceived Threats, and Social Influence.

Methodology & Key Findings

A survey-based experimental design was employed, where participants engaged with LLM tools (e.g., ChatGPT) in professional tasks before completing a structured questionnaire. Data analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis revealed that technology trust, perceived effectiveness, social influence, ethical considerations, and privacy concerns significantly impact human-machine collaboration effectiveness, which in turn influences AI adoption. Interestingly, traditional factors like ease of use and anthropomorphism were found to be less predictive, suggesting a shift in focus towards functional utility and task alignment in professional environments.

Contributions & Practical Implications

This research contributes theoretically by providing a structured model for AI adoption, emphasizing human-machine collaboration effectiveness as a key determinant. It underscores the importance of user privacy, ethical transparency, and social trust in fostering AI acceptance. Practically, it provides insights for technology managers and IS leaders, emphasizing strategies that enhance human-AI collaboration to drive productivity and innovation. As organizations advance their digital transformation, fostering trust, collaborative alignment, and supportive social norms will be crucial for sustainable AI adoption.

Keywords: Large Language Models (LLMs), ChatGPT, Human-Machine Collaboration, Artificial Intelligence, AI Adoption, Digitalization

Table of Contents

List of Figures

List of Tables

9. Conclusion

This research work investigates the role of human-machine collaboration in driving the adoption of AI systems based on large language models (LLMs) within organizations. By examining this relationship through the lenses of human-machine teaming, artificial intelligence in IS, and digital transformation, the study provides a nuanced understanding of how collaborative dynamics impact user acceptance and effective deployment of LLM-based AI systems.

The findings of the study emphasizes that the successful adoption of AI systems extends beyond traditional technology acceptance factors like usability and perceived ease of use. Instead, the willingness to adopt and sustain engagement with LLMs is significantly influenced by elements unique to human-machine collaboration effectiveness, including technology trust, perceived effectiveness, and social influence while keeping ethical considerations and privacy concerns pertaining to AI into account. These insights challenge the adequacy of existing IS adoption models, such as UTAUT, suggesting that AI adoption requires frameworks that accommodate the symbiotic relationship between humans and intelligent systems. The integration of human-machine collaboration, that is posited as a key contributing factor in the research framework developed herein, helps driving the AI use behaviour and provides a new lens to understand technology adoption in AI contexts, emphasizing the need of a cooperative and collaborative environment between users and intelligent systems.

From a theoretical perspective, this study advances the field of IS by integrating human-machine collaboration as a central factor in AI adoption frameworks. The study underscores the importance of considering ethical, interpretive, and adaptive dimensions of AI, which influence users' trust and reliance on these systems. It also provides a foundation for future studies to explore similar dynamics in other domains of intelligent systems, such as IoT and augmented reality, where human-machine teaming is equally critical.

For practitioners, this research delivers actionable insights for IS and Technology Managers seeking to foster a culture of AI use behaviour within their organizations . By focusing on factors such as collaborative effectiveness, trust-building through ethical AI practices, and the alignment of AI capabilities with task-specific needs, organizations can enhance user engagement with LLMs. Additionally, the study's findings underscore the importance of establishing supportive social norms and leveraging organizational influence, enabling companies to harness the full potential of LLMs as a key driver of digital transformation.

In conclusion, human-machine collaboration emerges as a critical enabler of LLM-based AI adoption and digital transformation. By fostering an environment where human and AI systems work together effectively, organizations can enhance productivity, drive innovation, and secure a competitive edge in the digital age. As organizations continue to explore and implement AI systems, understanding and optimizing the human-machine relationship will remain pivotal for achieving successful and sustainable AI integration.

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11. Appendix – Survey Questionnaire

Experimental Study: Impact of Human-Machine Collaboration on Adoption of Large Language Model based AI System

Section 1 – Introduction to the Survey

Hi there,

Thank you for taking your valuable time out to participate in this experimental study. The study aims to understand if a professional like you would be comfortable enough to use such an AI-based tool as ChatGPT at the workplace consistently and collaborate with it to be more productive at the workplace. ChatGPT is an AI-driven Large Language Model based chat interface that can complement your work by helping you with many of your mundane as well as your problem-solving tasks. Some examples are writing an email with a certain subject, creating a resume for a certain profile and skills, defining a marketing roadmap, creating a project plan, preparing a travel itinerary, recipe for a certain dish, etc. Thus, it can help in boosting your productivity and problem-solving abilities. The study aims to explore that if a human and AI can complement and collaborate at the workplace effectively. The study has two parts:

Part 1: You have to perform 3 tasks. Use the 'Chat' section to ask AI to help with these tasks and assess the response to these tasks, if its helpful, meaningful or not.

Part 2: Once done, you will get a survey questionnaire to answer your experience on using ChatGPT.

The entire study would take close to 15 minutes for completion and your response would be invaluable for the research community.

Note: *We will be collecting a few personal information such as name, email, age, and gender, towards the end of this study to validate if the responses are unique and done by human*

subjects. All these data would be strictly restricted to the study and would be anonymized or deleted after the research work.

Section 2: ChatGPT Tasks

Pre-requisite:

1. Open AI (ChatGPT) account: https://chatgpt.com/
2. Login if you already have a ChatGPT account or create a new account by going to the above link and signing up with an email.

Tasks to be Performed

Task 1: Write an email to client ABC Ltd' regarding a projected delay of a very business-critical project of theirs due to an unexpected political situation arising in the state.

Task 2: Create a Project Plan for a LMS mobile application development project.

Task 3: Prepare a step-by-step plan to develop a comprehensive digital marketing strategy for our company to improve its online presence and increase customer engagement

Acknowledgement of Task Completion (required prior to survey)

Did you complete all the three tasks mentioned above using ChatGPT? Please acknowledge to continue. Note that all participants are required to complete all three tasks before they proceed to the survey questions.

- Yes
- No

Section 3 – Start of Survey

Attitude

1. Do you think that you would be using large language models (LLM) like ChatGPT to complement to your professional tasks at the workplace?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
Making use of LLM based AI models like ChatGPT is a good idea	○	○	○	○	○	○	○
I like the idea of using LLM based AI models like ChatGPT	○	○	○	○	○	○	○
Using LLM based AI models like ChatGPT would be pleasant	○	○	○	○	○	○	○

Technology Trust

2. How much trust do users have in large language models (LLM) like ChatGPT for various tasks and applications?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I think that LLM based AI models like ChatGPT are reliable and would be beneficial to me	○	○	○	○	○	○	○
I am quite confident that LLM based AI models like ChatGPT would not fail me	○	○	○	○	○	○	○

I would trust LLM based AI models like ChatGPT until it gives me a reason not to trust it	○	○	○	○	○	○	○
I would give LLM based AI models like ChatGPT benefit of doubt when I first use it irrespective of the consequences of using the system	○	○	○	○	○	○	○

Ease of Use

3. How easy did you find it to use large language models (LLM) like ChatGPT for various tasks?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I find LLM based AI models like ChatGPT easy to use	○	○	○	○	○	○	○
Learning how to use LLM based AI models like ChatGPT is easy for me	○	○	○	○	○	○	○
I find it easy to become skilful at using LLM based AI models like ChatGPT	○	○	○	○	○	○	○

Anthropomorphism

4. To what extent did you perceive that large language model (LLM) like ChatGPT mimics humans and display human-like interactive behaviour?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
LLM based AI models like ChatGPT depict to have a mind of their own	○	○	○	○	○	○	○
I perceive the LLM based AI models like ChatGPT to have the same level of interactivity as a human being	○	○	○	○	○	○	○
I perceive the LLM based AI models like ChatGPT to have their own free will	○	○	○	○	○	○	○

I perceive the LLM based AI models like ChatGPT to experience emotions	○	○	○	○	○	○	○

User Well-being Concern (Used as Marker Variable)

5. How concerned would you be on your wellbeing when using large language models (LLM) like ChatGPT?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
LLM based AI models make me feel stressed	○	○	○	○	○	○	○
LLM based AI models like ChatGPT makes me feel anxious	○	○	○	○	○	○	○
LLM based AI models like ChatGPT makes me feel redundant	○	○	○	○	○	○	○

Privacy Concerns in AI Systems

6. How important are the privacy concerns for you and in general for all users when using large language models (LLM) like ChatGPT?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I am concerned that the information I submit to LLM based AI models like ChatGPT could be misused.	○	○	○	○	○	○	○
I am concerned about submitting information to LLM based AI models like ChatGPT, because what others might do with it.	○	○	○	○	○	○	○

I am concerned about submitting information to LLM based AI models like ChatGPT, because it could be used in a way I did not foresee	○	○	○	○	○	○	○
I would be afraid of using LLM based AI models like ChatGPT because it might be collecting my personal information without my consent.	○	○	○	○	○	○	○

I would be afraid to use LLM based AI models like ChatGPT because it might share personal data with other firms for purposes I don't know about.	○	○	○	○	○	○	○
I would be concerned about threats to my personal privacy that may arise in future from LLM based AI models like ChatGPT	○	○	○	○	○	○	○

Ethical Considerations in AI Systems

7. How important are the ethical concerns for you and in general for all users when using large language models (LLM) like ChatGPT?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I am quite sure about the data protection in LLM based AI models like ChatGPT trusting that they would ensure basic security and reliability and that it would not be susceptible to data leaks and cyber security threats	○	○	○	○	○	○	○

LLM based AI models like ChatGPT are less likely to disclose private and secret information.	○	○	○	○	○	○	○

Perceived Threats

8. How much threat to your professional career at your workplace do you perceive from the developments of large language models (LLM) like ChatGPT?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I think using LLM based AI models like ChatGPT for a long time would lead to a gradual deterioration of my professional skills	○	○	○	○	○	○	○
I am worried that LLM based AI models like ChatGPT will be able to replace various professions including that of mine in the future.	○	○	○	○	○	○	○

I believe advances in LLM based AI models like ChatGPT would lead to unemployment for many in the future	○	○	○	○	○	○	○
I think using LLM based AI models like ChatGPT for a long time would make professionals dependent on them	○	○	○	○	○	○	○

Perceived Effectiveness

9. How effective do you perceive these large language models like ChatGPT to complement and collaborate to enhance your performance at the workplace?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I find LLM based AI models like ChatGPT useful in my decision making	○	○	○	○	○	○	○
Using LLM based AI models like ChatGPT increases my chances of making important decisions	○	○	○	○	○	○	○
Using LLM based AI models like ChatGPT helps me make decisions more quickly	○	○	○	○	○	○	○

Using LLM based AI models like ChatGPT increases my productivity	○	○	○	○	○	○	○
Using LLM based AI models like ChatGPT increases my productivity in decision making	○	○	○	○	○	○	○

Peer Influence

10. How much your peers or colleagues at the workplace do you think can affect your use behaviour towards large language models (LLM) like ChatGPT?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
Peers who are important to me suggest that I should use LLM based AI models like ChatGPT	○	○	○	○	○	○	○
I am deeply influenced by my peers who use LLM based AI models like ChatGPT	○	○	○	○	○	○	○
I am deeply influenced by my superiors who use LLM based AI models like ChatGPT	○	○	○	○	○	○	○

My superiors who influence my behaviour would think that I should use LLM based AI models like ChatGPT	○	○	○	○	○	○	○
My superiors to whom I report would think that I should use LLM based AI models like ChatGPT	○	○	○	○	○	○	○
My business partners would think that I should use LLM based AI models like ChatGPT	○	○	○	○	○	○	○

Social Norms

11. How significant are social norms and norms at your workplace that would influence your perception and affect behaviors regarding the use of large language models (LLM) like ChatGPT?

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
People who influence my behaviour think that I should use the LLM based AI models like ChatGPT	○	○	○	○	○	○	○
People who are important to me think that I should use the LLM based AI models like ChatGPT	○	○	○	○	○	○	○

The senior management of this business has been helpful in the use of the LLM based AI models like ChatGPT	○	○	○	○	○	○	○
In general, the organization has supported the use of the LLM based AI models like ChatGPT	○	○	○	○	○	○	○

Social Influence

12. How significantly do you think large language models (LLM) like ChatGPT can improve your social influence and help shape your and other users' attitudes and behaviours towards them?