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AI and Its Impact On Society: Challenges and Transformation in Household Sector

Nivedita Sharma

Assistant professor
School of Management, Bahra University

"The pace of progress in artificial intelligence is incredibly fast. Unless you have direct exposure to groups like DeepMind, you have no idea how fast—it is growing at a pace close to exponential."
— Elon Musk

Abstract

The study examins the increasing impact of Artificial Intelligence (AI) on the household sector, focusing on both the transformative potential and the associated challenges of integrating it into daily life. With AI increasingly embedded in domestic tasks—from smart appliances and home security systems to elder care and childcare—households are experiencing significant shifts in convenience, efficiency, and autonomy. Using qualitative research and secondary data from academic sources, industry reports, and global organizations, this study investigates the extent of AI adoption, its social and behavioral implications, and the disparities it may exacerbate. The analysis reveals that AI contributes to time savings, personalized living experiences, and improved safety, yet it also raises concerns regarding privacy, emotional dependence, digital inequality, and gender bias. The paper concludes with policy recommendations advocating for ethical design, inclusive access, data protection regulations, and increased public awareness to ensure that the benefits of AI are equitably shared and responsibly implemented. This research aims to provide a balanced understanding of AI's dual role as a facilitator and disruptor in modern household life.

Keywords:
Artificial Intelligence (AI), Household, Transformation, Challenges, Automation.

1. INTRODUCTION

1.1 Context

Artificial intelligence as the name suggests simulation of human intelligence processes by machines, especially computer systems. It is a well-established technology such as machine learning.AI is important for its potential to change how we live, work, and play.[1] Despite the different definitions, the common understanding of AI is that it is associated with machines and computers to help humankind solve problems and facilitate working processes. In short, it is an intelligence designed by humans and demonstrated by machines. The term AI is used to describe these functions of human-made tool that emulates the "cognitive" abilities of the natural intelligence of human minds.[2] Nowadays, AI is

everywhere; we cannot deny its presence in our day-to-day life. Somehow we all are involved in AI. In a recent study by researchers from the University of Oxford, AI experts predicted that up to 40% of households chores-primarily housework like cooking, cleaning, and doing laundry- will be automated within the next 10 years. Toyota Research Institute is using diffusion (a generative AI technique used for popular text-to-image applications) to each robot to peel vegetables, among many other tasks. In the past two years, there has been a wave of general-purpose, humanoid robots such as those from Agility, Boston Dynamics, Figure, Prosper, Sanctuary, and Tesla. Prosper claims that it is making a robot called Alfie, a robotic helper for the home or office. Alfie can clean, organize your things, and take care of small chores, such as watering plants.[3] Carnegie Mellon University robotics researchers have already enabled robots to learn household chores by watching videos of people performing everyday tasks in their homes.[4]

1.2 Evolution of AI

AI is not only associated with fiction movies or science or mathematics but also plays a more prominent role in the present world that was unexpected in the past. Alan Turing founder of the theory of modern computing proposed the concept of a machine that could simulate any other machine in the 1930s. He also proposed the turing test in the 1950's, challenging whether machines could mimic human intelligence. IN 1955 John McCarthy founded AI as an academic discipline and called it Artificial intelligence and also developed a programming language called LISP in the late 1950s, an important contribution to AI development. In the 1990s Deep learning started evolving and then in 1997 AI won during a chess game a historic moment that demonstrated the capabilities of AI in strategic games and logical thinking.[5]

The 1990s and 2000s were phenomenal for AI with more data and computing power, machine learning techniques flourished and assisted in web searches, online ads, and spam filtering, dramatically improving user experiences and system efficiencies[6]. In 2010, deep learning enhanced with more computational power and availability of data. Then, in the 2020s, deep learning dominated and reshaped aspects of human life. Even larger datasets enabled deep learning to perform tasks beyond human intelligence, like image recognition.

The evolution of AI from theoretical exploration to widespread practical application marks one of the most significant technological narratives of the 20th and 21st centuries.[7]

1.3 Objectives of the study

1. To explore the extent of AI adoption in the household sector.
2. To identify the challenges posed by AI in the household sector.
3. AI is transforming household tasks and daily life.
4. To suggest policy recommendations and ethical considerations.

2. Literature Review

(Gammo AI 2023)[8] explain that there are three main stages in the advancements of AI. First is artificial narrow intelligence second is artificial general intelligence and third is artificial superintelligence.

Artificial narrow intelligence is the form of AI we are using nowadays in our day-to-day life. The second stage talks about a machine that is capable of understanding the world as a human being. The third stage is artificial superintelligence, basically, it is a hypothetical agent and one which is decades away. AI is a tool for humans' better existence. Advancements in artificial intelligence mean the sky is the limit. But positives and negatives are also present.

(Marr 2024)[9] discussed the changes, positive as well as negative impacts on society. Also mentioned are challenges faced by society as people can face loss of jobs. Also, benefits are efficiency at the workplace, increased happiness and job satisfaction, and improvements in healthcare. Uncovering criminal activity and solving crimes more effectively.

(Skare et,al.2023)[10] **P**ioneer the research by focusing on the intersection of AI and economic development. Specifically, they adopted a two-step methodology. In the first step, analyzed 2211 documents in the AI&ED field using the bibliometric tool Bibliometrix, presenting the internal structure and external characteristics of the field through different metrics and algorithms. In the second step, a qualitative content analysis of clusters calculated from the bibliographic coupling algorithm is conducted, detailing the content directions of recently distributed topics in the AI&ED field from different perspectives. The results of the bibliometric analysis suggest that the number of publications in the field has grown exponentially in recent years, and the most relevant source is the "Sustainability" journal. In addition, deep learning and data mining-related research are the key directions for the future. On the whole, scholars dedicated to the field have developed close cooperation and communication across the board. On the other hand, the content analysis demonstrates that most of the research is centered on the five facets of intelligent decision-making, social governance, labor and capital, Industry 4.0, and innovation. The results provide a forward-looking guide for scholars to grasp the current state and potential knowledge gaps in the AI&ED field.

(Craig, laskowaski &Tucci 2024)[11]The Article explained the meaning and workings of AI and machine learning. Also, AI focuses on cognitive skills like learning, reasoning, self-correction, and creativity. AI's potential to changing our lives; effective use in business automation of tasks traditionally done by humans more accurately. The Advantages of AI are excellence in detail-oriented jobs, efficiency in data-heavy tasks, time saving, and productivity. Whereas disadvantages include high costs, technical complexity, talent gap, job displacement, environmental impact, etc. they also explained different categories of AI. Also implications of AI in different areas like health care, education business, banking, etc. Also, ethical use of AI is required but AI has many challenges like govt. regulations etc.

(Gupta & parker 2024)[12] Explained generative AI which can create novel and realistic content. Also, AI helps with tasks that involve machines and robots such as watering our house plants or assisting with industrial manufacturing. According to Oxford University, research this will almost be possible within the next 10 years. The concept of LXMs. These models will accelerate advancements in these areas. With these models, robots can better understand their environments. This enables the opportunity for more realistic human behavior resulting in the execution of small automated tasks. But the road to this transformation is long and winding.

(Li, Zhang et al 2024)[13]An empirical analysis is conducted using data from the China general social survey. They found that AI reduces energy consumption by lowering household income and increasing their financial fragility. AI impacts negatively on those who do not have access to energy subsidies and households with poor energy security and stability. Improving labor protection can help alleviate its adverse consequences on energy consumption. This paper provided evidence on the impacts of technological disruption from a demand-based perspective. It highlights the need for better policies on energy, social security, income distribution, and labour protection to weaken AI's effects on household energy consumption and prevent them from falling into energy poverty.

(Mishra, Pareek et.al., 2024)[14]The integration of Artificial Intelligence (AI) into the management and building sector has witnessed significant advancements in recent years. Traditional methods can fall short in meeting these demands, prompting the exploration of AI solutions. This review aims to identify existing gaps, assess the efficacy of current AI applications, and provide insights into potential areas for further development. A comprehensive literature review was conducted, encompassing peer- reviewed articles, industry reports, and case studies. The analysis focused on AI applications such as machine learning, robotics, and data analytics in the context of project management, resource optimization along sustainable building practices. The review identifies key AI applications in project planning, risk management, and construction processes, demonstrating their potential to streamline operations and improve decision-making. The analysis reveals successful implementations of AI-driven technologies, highlighting their impact on cost reduction, time efficiency, and sustainability practices. Additionally, emerging trends such as generative design and smart buildings indicate promising directions for future development. The integration of Artificial Intelligence in the management and building sector demonstrates substantial benefits in efficiency, cost reduction, and sustainability, while ongoing research as well as adaptation to emerging technologies is crucial for sustained progress.

(Kaplan& Haenlein2019)[15] Artificial intelligence (AI)——defined as a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation——is a topic in nearly every boardroom and at many dinner tables. Yet, despite this prominence, AI is still a surprisingly fuzzy concept and a lot of questions surrounding it are still open. In this article, we analyze how AI is different from related concepts, such as the Internet of Things and big data, and suggest that AI is not one monolithic term but instead needs to be seen in a more nuanced way. This can either be achieved by looking at AI through the lens of evolutionary stages (artificial narrow intelligence, artificial general intelligence, and artificial super intelligence) or by focusing on different types of AI systems (analytical AI, human-inspired AI, and humanized AI). Based on this classification, we show the potential and risk of AI using a series of case studies regarding universities, corporations, and governments. Finally, we present a framework that helps organizations think about the internal and external implications of AI, which we label the Three C Model of Confidence, Change, and Control.

(Cheong 2024)[16] The rapid integration of artificial intelligence (AI) systems into various domains has raised concerns about their impact on individual and societal wellbeing, particularly due to the lack of transparency and accountability in their decision-making processes. This review aims to provide an overview of the key legal and ethical challenges associated with implementing transparency and

accountability in AI systems. The review identifies four main thematic areas: technical approaches, legal and regulatory frameworks, ethical and societal considerations, and interdisciplinary and multi-stakeholder approaches. By synthesizing the current state of research and proposing key strategies for policymakers, this review contributes to the ongoing discourse on responsible AI governance and lays the foundation for future research in this critical area. Ultimately, the goal is to promote individual and societal wellbeing by ensuring that AI systems are developed and deployed in a transparent, accountable, and ethical manner.

3. Research Methodology

This study is based on qualitative research using secondary data sources. Thematic analysis was employed to interpret data from:

- Peer-reviewed academic journals
- Industry reports (e.g., McKinsey & Company, Deloitte)
- Government documents (e.g., NITI Aayog, OECD)
- International organizations (e.g., WHO, UNESCO)
- News media and case studies

The qualitative approach allows for an in-depth understanding of societal and behavioral changes brought about by AI in households.

4. Future relevance & Scope of AI

With the use of AI-enabled machines, things have now become much more efficient, this is the reason that innovators have started incorporating AI into every field. AI can bring revolutionary changes[17]. There are some major areas in which the future application of AI is going to take place:

4.1 Teaching and AI

In present times, from teaching to exams almost all things are being held digitally and AI is a powerful tool for resolving problems in teaching and learning. A number of courses are available on AI and this is going to change the old-school education system. This would facilitate people to approach learning as per their interests and capabilities. This could help in nation-building as well as development in the economy.[18]

4.2 Transportation and AI

In automobile industries, automation is still in progress. In the present time we see that the adaptability of automatic vehicles is high, this gives us clues about the future of AI in transportation is possible and can help reduce mishaps. Some benefits of automation of vehicles could be more sophistication of rules to be followed on roads and also reduction of traffic.[19]

4.3 Healthcare and AI

AI will perform a very crucial role in healthcare by performing various functions in healthcare Live chat, enhancing patient engagement and streamlining the process, automation in billing and appointment scheduling etc[20].

5. Stages of Artificial intelligence

I -Artificial Narrow Intelligence- also called as weak AI, is already embedded in our daily lives as a super humans performing specific singular tasks. It will master singular tasks beyond human potential with incredible consistency. Think of AI as hundreds of interns capable of highly specific tasks more efficiently than humans. ANI has already transformed the way we live; people are unknowingly interacting with ANI on a daily basis. Siri or Alexa on smart devices, or the facial recognition that unlocks the phone when opening it

II -Artificial General Intelligence- machine that would be capable of understanding the world as well as humans. All while maintaining the same capacity to learn how to carry out a huge range of tasks. AGI is not yet among us. It is a hypothetical form of AI. The potential is there but some believe it to be decades away. According to a study by Muller and Vincent C., the top-cited 100 AI researchers have a collective 90% confidence that AGI will be among us by 2070.

III-Artificial Super Intelligence-Super-Intelligence is quite self-explanatory. Oxford Philosopher Nick Bostrom describes ASI as: “any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest.” Again, this is a hypothetical agent and one which is decades away. ASI has huge potential but it also has huge risks. Stephen Hawking feared its development could be the worst event in the history of our civilization, and even ‘spell the end of the human race’. If we create super-intelligent machines we may put our existence at risk.

In a nutshell, AI is a tool for humans to better our existence. Advancements in artificial intelligence would be infinite but negatives and positives will go hand in hand. Also, there will always be concerns about ethics, assurance of equality, bias minimization, and privacy protection.[21]

6. AI & Transformations in the Household Sector

6.1 Automation of Domestic Tasks

AI-enabled devices reduce the time and physical effort spent on household chores. For example Robotic vacuum cleaners, AI-powered washing machines, and dishwashers. These transformations will Increase efficiency and be particularly beneficial for dual-income households. McKinsey & Company (2023) reported that households using AI-enabled appliances saved 20–30% more time on chores than traditional households.[22]

6.2 Smart Home Management

Smart assistants manage household tasks using voice recognition and connectivity. For example Amazon Alexa & Google Assistant. These will lead to the enhancement of convenience by providing

Centralized control of lights, alarms, appliances, and daily reminders.[23] According to Statista (2024), 45% of U.S. households with AI assistants experienced improved time and task management.[24]

6.3 Personalized Routines and Recommendations

AI adapts to user behavior to suggest and automate preferences. Now- a-days Smart fridges, personalized meal planners, and home climate control facilities are surely going to provide more comfort, health, and time management. Deloitte (2023) notes that personalization features in AI homes are driving higher adoption among tech-savvy families.[25]

6.4 Enhanced Home Security

AI-powered cameras and alarms offer intelligent surveillance and alert systems. Like facial recognition doorbells, AI motion sensors are improving home safety and peace of mind. AI-based home surveillance significantly contributes to crime deterrence in urban households.[26]

6.5 Elderly and Disability Support

AI promotes independent living for the elderly and differently-abled. AI-enabled fall detectors, voice-controlled home systems & health monitors, etc. It reduces caregiver dependency and enhances safety of the needy persons.[27]

6.6 Childcare and Education Support

AI helps monitor, educate, and entertain children. For example, AI educational apps, virtual learning companions, and smart baby monitors are trending in present times. This will help in assisting parents in managing children's learning and safety at home. AI has the potential in improving home-based early education and parenting support.

1. **Kasisto:** Kasisto is an AI-powered virtual assistant that helps parents stay organized and better manages the needs of their family. It can be used to set reminders for doctor's appointments, track immunizations, find nearby daycare centers, and more.

2. **BabySparks:** BabySparks is an AI-powered app designed to support parents of children aged 0-3 years. It provides personalized activities and games for each child based on their age, as well as growth tracking, analytics, and advice from child development experts.

3. **Nannybot:** Nannybot is a virtual assistant designed to help parents with tasks like scheduling, food preparation, and housekeeping. It can also remind parents of doctor's appointments, track immunizations, and provide advice on child care.

4. **Totbot:** Totbot is an AI-powered robot designed to help parents with tasks like meal planning, buying groceries, and managing household chores. It can also provide personalized learning activities for children, track their progress, and provide real-time feedback.[28]

6.7 Energy Efficiency and Sustainability

AI tracks and adjusts energy usage to minimize waste. Smart thermostats (e.g., Nest), energy-monitoring plugs and also promotes sustainability & cost savings. AI-integrated homes cut energy use through smart consumption patterns.[29]

6.8 Redefinition of Gender Roles

AI has the potential to address and mitigate various challenges faced by women, such as gender bias and discrimination. AI algorithms can help eliminate biases in recruitment processes, performance evaluations, and decision-making systems, leading to fairer outcomes and increased opportunities for women in education, employment, and leadership positions. AI can also enhance women's economic empowerment by providing access to new markets, entrepreneurship opportunities, and flexible work arrangements. AI-powered tools can also assist in skills development and training, enabling women to participate in emerging fields and industries. AI applications have the potential to improve women's access to quality care and address gender-specific health issues. However, it is important to recognize and address potential challenges and risks associated with AI. Gender bias in training data and algorithmic decision-making can perpetuate existing inequalities and further marginalize women. To harness the full potential of AI, it is necessary to adopt inclusive and ethical practices, while actively engaging women in AI development and decision-making processes. By doing so, AI can be a powerful tool for achieving gender equality and creating a more inclusive and empowered society for all.[30]

5. Challenges of AI in Household sector

5.1 Energy Consumption And Sustainability

Virtual Assistants and AI devices require the power to work 24/7. It Is required to make eco-friendly devices. Sustainability is the biggest challenge for making and using AI devices.
Hire AI developers to make efficient AI devices that consume less power and work efficiently.

5.2 Reliability and System Failure

Electronic devices have the risk of system failures. The AI devices can fail due to errors and bugs during the coding. System failure can be the worst for the users, it creates inconvenience and also ruins the trust of the user in AI technology.

Expert AI developers can make accurate AI devices with proper testing and quality assurance. So, you can enjoy the AI-integrated smart home with an efficient virtual AI.

5.3 Data Privacy and Security

The AI tracks all your daily activities and controls your home security. In such a situation, users might be concerned about the safety of their private data. Data privacy is the biggest challenge as not all users are not comfortable with handing over control of their home appliances and security to AI.The challenge with AI processing sensitive data is putting strong security measures in place to safeguard user privacy and stop illegal access.[31]

5.4 Lack of transparency and accountability in AI systems

Achieving transparency in AI governance is not easy, Because one of the biggest challenges is the complexity of AI systems. They are often black boxes, meaning that it is difficult to understand how they arrive at their decisions. This complexity makes it challenging to achieve transparency. Another challenge is the lack of standards and regulations around AI transparency. There is currently no universal standard for AI transparency, which makes it difficult for companies to know what they need to do to be transparent. Moreover, AI systems are constantly evolving, which makes it difficult to maintain transparency. As AI systems become more complex, it becomes harder to understand how they arrive at their decisions.[32]

5.5 AI technologies and inequality

Defining inequality in the context of AI involves understanding how artificial intelligence technologies intersect with various social, economic, and ethical dimensions to produce or perpetuate disparities among individuals or groups. In this context, inequality can manifest in several ways:

8.5.1 Economic Inequality

AI technologies can impact economic inequality by influencing access to employment, income distribution, and wealth accumulation. Automation driven by AI may lead to job displacement, disproportionately affecting workers in low-skilled or routine jobs and widening the gap between high-skilled and low-skilled workers. Additionally, AI-driven innovations may concentrate wealth and power in the hands of tech companies and affluent individuals, further exacerbating economic disparities.

8.5.2 Opportunity Inequality

AI can create disparities in opportunities for education, employment, and advancement. Access to AI education and training programs may be limited, leading to unequal skill development and job prospects. Furthermore, biased AI algorithms used in hiring, lending, and other decision-making processes can perpetuate systemic inequalities by disadvantaging certain groups, such as women, minorities, or individuals from low-income backgrounds.

8.5.3 Social Inequality

AI technologies can amplify existing social inequalities by reinforcing biases and discrimination present in historical data used to train AI algorithms. Biased AI systems may produce discriminatory outcomes in areas such as criminal justice, healthcare, and access to public services, disproportionately affecting marginalized communities and perpetuating social injustice.

8.5.4 Digital Inequality

AI adoption and access to AI technologies may vary across different regions, socioeconomic groups, and demographic categories, leading to digital inequality. Disparities in access to high-speed internet, digital literacy, and AI resources can create digital divides, limiting individuals' ability to benefit from AI-driven innovations and participate fully in the digital economy.

8.5.5 Ethical Inequality

The ethical implications of AI raise concerns about fairness, accountability, and transparency. Biased AI algorithms, opaque decision-making processes, and lack of algorithmic accountability can lead to ethical inequalities, where certain individuals or groups are unfairly treated or disadvantaged by AI systems. Additionally, concerns about privacy violations, surveillance, and data exploitation may disproportionately affect vulnerable populations and undermine their rights and autonomy.[33]

Results and Policy Implications

Results

1. **Efficiency and Convenience Gains:** AI integration in households significantly reduces time spent on domestic tasks (20-30% time savings), improves task management, and enhances comfort through personalized routines and smart home systems.
2. **Sectoral Transformation:** AI is revolutionizing key sectors like education, transportation, and healthcare by enabling personalized learning, automated driving assistance, and streamlined patient management.
3. **Improved Safety and Support:** AI-powered security devices and assistive technologies increase home safety and support for elderly, disabled, and childcare needs, promoting independence and reducing caregiver burden.
4. **Energy Optimization:** AI-enabled energy management systems contribute to sustainability by minimizing waste and lowering household energy consumption.
5. **Emerging Ethical and Social Challenges:** AI's rapid adoption raises significant concerns over data privacy, system reliability, transparency, and exacerbation of social inequalities including gender bias and economic disparity.
6. **Unequal Access and Risks:** Economic, digital, and opportunity inequalities persist, with marginalized groups at risk of being left behind or unfairly treated due to biased AI algorithms and lack of access.

Policy Implications

1. **Promote Inclusive AI Development:** Governments should incentivize AI research and applications that prioritize fairness, reduce bias, and involve diverse stakeholders, especially women and marginalized communities, to ensure equitable benefits.
2. **Enhance Data Privacy Regulations:** Strong, enforceable privacy laws must be enacted to protect users' sensitive data from misuse and unauthorized access in AI-enabled households.
3. **Establish Transparency and Accountability Standards:** Policymakers need to develop clear regulations requiring AI systems to be explainable, auditable, and accountable to build user trust and ensure ethical AI deployment.
4. **Support Energy-Efficient AI Technologies:** Funding and policies should encourage development of eco-friendly AI devices that minimize energy consumption and align with sustainability goals.

5. **Bridge the Digital Divide:** Invest in infrastructure and education to improve access to AI technologies and digital literacy, ensuring all socioeconomic groups can benefit from AI advancements.
6. **Regulate AI in Critical Sectors:** Implement oversight mechanisms in healthcare, transportation, and education sectors to monitor AI performance, safety, and fairness, mitigating risks associated with system failures or biases.
7. **Facilitate Workforce Adaptation:** Launch reskilling and upskilling programs to prepare workers for AI-driven economic changes, reducing job displacement and promoting inclusive growth.
8. **Promote Ethical AI Governance:** Formulate multidisciplinary ethics committees and international collaborations to address global AI challenges, balancing innovation with human rights and societal well-being.

Conclusion

AI technologies are reshaping household life, making it more efficient and inclusive. However, this transformation brings new ethical, emotional, and social challenges. A qualitative analysis using secondary data reveals that thoughtful policy and inclusive design are essential to harness the full potential of AI in domestic spaces without exacerbating existing inequalities.

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