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A systematic review on the impact of artificial intelligence on innovation

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Abstract- *The main purpose of this paper is to review how artificial intelligence has impacted innovation. Artificial intelligence will considerably improve the current technological advancement. As a new general-purpose "technique of innovation," it has the power to completely revolutionize how companies innovate and how research and development departments are organized [1]. There has been a "change" in the prominence of application-oriented research studies since 2009, and delineate between automation-oriented technologies like robots and new advancements in "deep learning" that might operate as a general-purpose innovation approach. Consequently, we believe that a considerable shift away from more repetitive and routine labor-intensive work with the emphasis shifting to research that takes advantage of the interaction of passively produced huge datasets with improved prediction methods [1]. As a result, a period of racing is expected to be ushered in by enormous incentives for individual businesses to acquire and manage essential huge datasets and software algorithms as they strive to achieve commercial success via mastery of this form of research. According to our findings, policies that promote openness and data sharing among public and private players, as well as between public and private actors, may be key instruments for increasing research productivity and innovation-driven competitiveness moving ahead.*

Keywords: *Artificial intelligence, innovation, automation, robotics, algorithms, deep learning, information technology*

I. INTRODUCTION

There is no debate about the fact that many technologies have altered the landscape of many industries [1–2]. Human people have been conserving information from the beginning of history when they first started expressing their thoughts on the walls of caves using crude instruments [3] and painting on them. This was the first step in the process of disseminating and transmitting individual knowledge to the general public [3]. The evolution of multiple writing systems, which began with the introduction of letters inscribed on scattered sheets and in books [4], was an important step in the preservation and dissemination of information later on. The introduction of digital documents, which are attributed to the creation of knowledge management tools, marked the beginning of a seismic shift in information systems in the 20th century.

Information Management appears to be more advanced in technology in the twenty-first century, as a result of the advancement of information technology and artificial intelligence technologies. Many academic and commercial scholars have been studying and discussing knowledge management for a long time, owing to the importance of this topic for the success of companies in both the public and private sectors [5]. In addition, many prominent firms throughout the globe have used a variety of knowledge management methods to guarantee that they stay one step ahead of their competitors in today's highly competitive business environment, including, As a result, organizations are always looking for methods to enhance their knowledge management strategies [5,6]. There have been many studies undertaken to get a more in-depth grasp of the most current research trend in knowledge management procedures and best practices in businesses. This issue, on the other hand, demands deeper examination from a variety of angles.

Rapid advancements in the area of artificial intelligence have far-reaching repercussions for the economy as well as for society as a whole, according to experts. Products and services from a broad variety of industries might benefit from these advancements, which could have substantial ramifications for the economy, employment, and competitiveness. Nonetheless, as significant as these impacts are expected to be, artificial intelligence also can alter the innovation culture itself, with implications that may be just as significant and which may eventually outweigh the direct impact in prominence. Consider the instance of Atomwise, a start-up company that is developing revolutionary technologies for finding possible medication candidates (as well as insecticides) by utilizing neural network models to

identify the bioactivity of probable drug candidates [7]. According to the business, its deep convolutional neural networks "significantly outperform" the performance of traditional "docking" methods by a wide margin. Following extensive training on massive amounts of data, the company's AtomNet product is advertised as being able to "recognize" the fundamental building elements of organic chemistry and as being capable of making very accurate predictions about the results of real-life physical tests. With such discoveries, there is the possibility of significant increases in the productivity of early-stage drug screening [7].

Although Atomwise's technology (as well as those of other firms employing artificial intelligence to boost drug development or medical diagnostics) is intriguing, no new medications have yet been developed using these new techniques. Even if Atomwise fails to live up to its expectations, its innovation represents an ongoing effort to construct a new technological "playbook," one that uses big data sets as well as machine learning algorithms to make exact predictions about biological occurrences and then use those predictions to drive the development of useful treatments [7]. In the case of Atomwise, this method is now being used in the exploration and design of novel insecticides and agents for the treatment of crop diseases. AI developments, like those shown by Atomwise, have the potential to spur new forms of creativity. Even though the roots of artificial intelligence lie in computer engineering, and its widespread commercial implementations focused on specialized fields like robotics, the evolutionary computation now being explored indicates that artificial intelligence might have a wide variety of potential uses in the future [8]. When looking at the economics of innovation, there is a clear gap between developing technologies with a restricted area of practice, like robots tailored for specific functions, and even those with diverse applications, like advancements in neural network models or machine learning [8,9]. This is especially true as neural networks and machine learning continue to grow rapidly. It is thus necessary to consider the following question: to what extent do advancements in artificial intelligence represent not just emerging innovations, but also the types of "general-purpose innovations". In addition to cheaper costs and greater quality contributions into many current industrial operations (causing worries regarding huge job displacements), many uses of artificial intelligence, like deep learning, promise not just increased productivity across a broad range of disciplines, and also a shift in how those areas innovate. Innovation might have a significantly higher economic effect than creating a single new product [10]. As a result of the recent developments in machine learning and neural networks, we believe that innovation and growth will be impacted significantly. As a result, economic research should focus on the benefits and constraints which may impact the process and dissemination of new inventions, and policymakers should be concerned with identifying the circumstances under which diverse prospective innovators might obtain access to and make use of these resources in a competitive sense [11]. As a starting point, this paper explores the major impact of artificial intelligence in creating efficient incentives for innovation, proliferation, and competitiveness in this field.

II. PROBLEM STATEMENT

The main problem that this paper will address is the potential impact of advances in artificial intelligence on innovation, while also looking at how policy and institutions might provide effective incentives to promote this kind of growth. The influence of using artificial intelligence (AI) and information technology (IT) ideas and methods on the efficiency of knowledge management in contemporary businesses, in particular, has been overlooked by the majority of prior research [12]. It is the purpose of this study to systematically examine and highlight current knowledge management strategies that have depended on IT and AI processes, as well as their implications on contemporary businesses, as well as the obstacles and constraints they have encountered [12]. This review research may serve as a vital reference for academics since it fills in certain gaps in knowledge management, particularly in IT and artificial intelligence-related studies.

LITERATURE REVIEW

A. Artificial Intelligence: Its History and Development

Symbolic systems research, which dates back to the 1960s, was perhaps the most successful area of research in the early years of AI [13]. The "symbol processing hypothesis" was based on the effort to mimic the logical flow of human decision-making by processing symbols, even though founding members like Turing had highlighted the significance of educating a computer like a child (i.e. stressing AI as a learning process)[13,14].In the early stages of implementation, this technique had remarkable success in pilot programs, such as the capacity of a computer to traverse aspects of a chess game (or other board games) or participate in relatively rudimentary discussions with people by following a set of instructions.

The field of robotics has had a second, noteworthy development in AI. There have been debates about "robots" since the 1940s, however, the field of robotics only started to take off in the 1980s with breakthroughs in numerically controlled machine products and more adaptable, but were rules-based, robots that depend on active sensors in well-known surroundings to do their work well [14]. This has been the site of perhaps the most economically valuable use of artificial intelligence to date, with the widespread deployment of "industrial robots" in a variety of manufacturing-related environments. These robots have been meticulously designed to do a certain job under exacting conditions. Manufacturing and automation have benefited greatly from advances in robotics over the last two decades, particularly with the development of more sensitive robotics that use programmable response mechanisms to respond to a range of inputs [15].

This concept, which was originally pioneered by Rod Brooks, changed the commercialization and developmental emphasis of AI away from modeling human-like intelligence and more towards delivering feedback loops that would enable feasible and successful

robots for specific applications [15]. This realization paved the way for the Roomba and other human-interactive industrial robots like Rethink Robotics' Baxter, among other things. Robotics technology advancement (especially in the capacity of robotic devices to detect and interact with their surroundings) may lead to broader use and acceptance outside of automated processes in the manufacturing industry. These developments are significant, and when the word artificial intelligence (AI) is used, the most sophisticated robots continue to captivate the public's interest. Robotics advancements, on the other hand, aren't often classified as IMIs [15]. Robotics developments are (yet) not intimately tied to the fundamental manner in which scientists themselves could design methodologies to conduct innovation across different fields. In this regard, there are many counterpoints: robotic space missions have shown to be a very useful research instrument in planetary science, and the capacity of automated remote sensing devices to gather data on a vast scale or in difficult conditions has the potential to alter various disciplines of study. However, robots are still mostly utilized in specialized "production" end-use applications. Lastly, a "learning" method may be used to describe the third area of AI study that has existed since the field's inception [15]. Rather than emphasizing symbolic logic or exact sense-and-react algorithms, active learning aims to develop dependable and precise techniques for forecasting certain outcomes (physical or logical) in the detection of particular inputs. This field has benefited greatly by understanding neural networks. An artificial neural network is a computer program that translates input data into output data using a mixture of weights and thresholds, then assesses the "closeness" of the output data to reality before adjusting the weights used to reduce the difference between the two sets of data. Thus, when more inputs are fed into neural networks, they may learn [16]. While Hinton and his co-authors were developing "back-propagating multi-layer" approaches in the 1980s, they significantly refined the conceptual foundation on which neural networks are built, allowing them to be used for supervised learning.

Fig i: Bridging digital transformation and AI transformation

B. Impacts of Artificial Intelligence fields on Innovation

Understanding the types of artificial intelligence is essential for better understanding how AI will impact the innovation process in the future since each one has a different potential to be either a GPT or an IMI—or both—depending on how it is used [16]. One thing to keep in mind is that, although while most of the public conversation about artificial intelligence (AI) focuses on the potential for AI to attain superhuman efficiency across a broad range of human intellectual capabilities, the most significant advancements in AI haven't even been made using the "generic problem solver" techniques and were at the foundation of initial studies in symbolic systems [16,17]. Contrarily, recent gains are made in both robots and deep learning need considerable levels of human design and are limited to handling just a few specific problems like face recognition, or picking up a particular item. It is conceivable that future discoveries could lead to technology that can substantially duplicate human subjective intellect and feeling, but the recent advancements that have gained scientific and commercial interest remain far away from these fields [17].

For the most part, current robotics advancements are tied to very specific and end-user-focused solutions instead of the innovation capabilities themselves, and these advancements have yet to transfer into an IMI that is more widely applicable. Thus, robotics is one area in which we may examine the influence of invention (improved performance) and diffusion (broader use) on job displacement vs employment improvement. Currently, there is just a small amount of evidence to suggest that robots will be widely used outside of industrial automation, or that the level of development in robotics' capacity to perceive, respond, and change the physical world will be required [17]. The exception is "pick and place" robots and rapidly progressing autonomous cars, which allude to the likelihood of robotics escaping the industry and being much more widely utilized. Robotics advancements may show whether or not this field of AI meets the standard requirements for becoming a GPT.

Algorithm-based research tools/IMIs have revolutionized several sectors of study, but they haven't been widely used [17]. They are useful IMIs since they are built on a static set of computer instructions. However, they do not seem to have broad application outside of a particular domain and do not qualify as GPTs because of this. By creating new information and developing new paradigms and protocols for brain research, sophisticated algorithms to scan brain pictures (functional MRI imaging) have changed our knowledge of the human brain. Although fMRI is an effective IMI, it lacks the broad application associated with the most significant GPTs [17]. Deep learning, on the other hand, has recently made significant strides and has the potential to be both an IMI and a conventional GPT.

III. FUTURE IN THE U.S

Businesses and innovation management in the United States are being reshaped as a result of advances in artificial intelligence (AI). AI may force management to reconsider a company's whole innovation process because of quick technical advancements and human organization's replacement by AI. A variety of AI frameworks, such as agendas and policies, will be introduced by the United States in the next years. Predictive analytical sensors keep equipment working efficiently while AI-powered robots assist people with a restricted range of jobs like assembling and stacking. Virtual nursing assistants keep an eye on patients while big data analysis helps produce a better patient experience thanks to the relatively new discipline of healthcare AI [18]. The disease is diagnosed more quickly and precisely. Drug development is sped up and simplified. Regulatory monitoring and initiatives to prepare individuals for working with and creating AI, coupled with policies to reduce AI's potential economic and societal consequences, will be required for AI development [18]. When companies make use of new technology, productivity growth will speed up again. Consumers will benefit from lower prices as well as higher quality as a result. Middle-class salaries will remain stable if enough of the tax burden is moved from work to capital. America will be in charge of AI innovation for the remainder of this century.

IV. ECONOMIC BENEFITS IN THE UNITED STATES

AI innovation will have several economic benefits for the United States. Paul Daugherty and Mark Purdy examined the influence of artificial intelligence on 12 established economies, including the United States. They found that by 2035, artificial intelligence might quadruple the yearly growth rate in these nations' GDP. As a result of AI, the creation and administration of the US value chains have already been impacted. To better forecast future trends, such as changes in consumer demand, and to better manage supply chain risk, this technology may be employed They increase the overall efficiency of GVCs because they make it possible for businesses to effectively manage large and distant manufacturing units [18]. Artificial intelligence may be used by businesses to enhance warehouse management, demand forecasting, and just-in-time production and delivery accuracy, to name a few. Robotics has the potential to improve packaging and inventory inspection productivity and efficiency. Using AI in business may also help companies enhance the physical inspection and upkeep of assets as they move through the supply chain. On-shoring of manufacturing is becoming more popular as a result of artificial intelligence. A reduction in the requirement for long supply chains—particularly those that depend on vast pools of cheap labor—could be achieved via increased automation and scalability of 3D printing. Digital marketplaces like eBay are already using AI in this manner.

V. CONCLUSION

This paper looked at reviewing a systematic account on the impact of AI on innovation. The use of artificial intelligence (AI) may be beneficial in situations when the tried-and-true benefits of innovation management resources are overburdened, are rendered impossible due to digitalization, or when AI emerges irrefutably as the preferable alternative. According to our views, the evident promise of artificial intelligence lies in the development of a more structured approach via the integration of AI into enterprises that are seeking innovation. Our study contributes to the advancement of the literature on innovation management by providing light on the use of artificial intelligence and machine learning algorithms in the future organization of innovation. As a result of our findings, we have identified areas where artificial intelligence systems may already be used for organizational innovation, especially situations in which the creation of new inventions is predominantly limited by information processing restrictions. Artificial intelligence systems that depend on anomaly detection, for example, might be beneficial when businesses are experiencing information processing limits while searching for new prospects. At the end of the paper, we discuss recent breakthroughs in artificial intelligence algorithms that are suggestive of AI's ability to handle the most difficult difficulties associated with innovation management. These include overcoming the limitations of local search and inventing whole new concepts. I am looking forward to seeing how fresh breakthroughs in artificial intelligence technology offer up new opportunities and expand the areas in which AI may be employed to benefit innovation management.

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