HUMAN MACHINE COLLABORATION –THE EMERGING BUSINESS PARADIGM

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Abstract-Automation and Artificial Intelligence (AI) are the buzzwords today. Irrespective of Industry, job loss due to Automation and Emergence of Artificial Intelligence is the current threat. Automation refers to repetition of monotonous work by machines and Artificial intelligence is the next step where machines have the capability to think, reason, learn and adapt as like humans. Automation is not new and machines were used to perform mundane tasks for several decades. AI is relatively new and companies are investing in the research and development of AI Systems as it has become a competitive necessity. AI offers numerous benefits and is finding its applications in several industries like automobiles, retail, entertainment, medicine, education, etc., We are currently in the Narrow Artificial Intelligence Phase and Companies like Google, Microsoft, IBM, Accenture, etc., are investing heavily on AI and are gearing for the next phases of AI – the General Artificial Intelligence and Super Artificial Intelligence Phases. Currently business transformation is happening and intelligent machines have become indispensable in workplace. Cobots have already started assisting humans in Hyundai, Mercedes Benz and Alexa, Cortana are assisting humans in day to day operations. With Intelligent machines becoming the key contributor in today's and tomorrow's business world, Management thinkers at Harvard and reputed institutes/companies have started exploring whether Intelligent machines will be replacing humans or will they be augmenting humans in performing certain tasks. Research articles in Harvard Business Review, Indian Management and other referred journals on this topic are being posted for some time now. The common forecast and prediction is that there is no need to panic of Intelligent Machines and they will be augmenting humans in workplace and humans will be guiding the intelligent machines and predominantly involved in innovating products/processes/services. So, it is imperative for tomorrow's business managers to manage humans and machines in a collaborative environment. In this context, this paper provides an overview of the emerging business paradigm – 'Human-Machine Collaboration', highlights the key roles performed by humans, machines in the future, captures the key insights suggested by intellectuals and experts in getting an organization ready to transform itself to manage human-machine collaboration effectively and also highlights the efforts taken by Government of India to make India ready for the next business paradigm.

Keywords: **Artificial Intelligence, Machine Learning, Human Machine Collaboration**

Introduction

Business Environment is very dynamic and highly competitive. Globalization is one of the key drivers for intense competition and this has helped customers to get quality products/services along with variety of offerings. 'Continuous Innovation' and 'Continuous Quality Improvement' of products/processes/services are the two key focus areas of any Business Enterprise. As said by Clayton Christensen [1], the American Academician and Business Consultant in his exemplary books 'The Innovators Dilemma' [2] and 'Competing against Luck: The Story of Innovation and Customer Choice"[3], Companies have started understanding the key features/capabilities expected by customers in their products/services and are investing their innovation efforts to improve those identified capabilities of their offerings. As Innovation is one of the critical success factors for businesses, companies are attempting to automate repetitive tasks by employing machines so that humans can be utilized for innovating and performing intellectual work. It is also to be noted AI is also driving Business Innovations.

Automation of repetitive tasks using machines is already in practice for the past several decades. The machines involved in automation were performing routine tasks and they were not able to think and learn. But today, Intelligent machines which are able to think, reason and learn have emerged. With the efforts of Father of Artificial Intelligence, John McCarthy [4] and other eminent scientists, today we have intelligent machines employed in several business applications which not only performs monotonous work but also have the capability to think and learn like humans. Intelligent Machines and Humans are working side by side to accomplish the goals of an enterprise. Today and tomorrow is the world of Human-Machine Collaboration with humans predominantly involved in Innovation and guiding intelligent machines performing mundane tasks employing their cognitive capabilities.

This paper is organized into three sections. The first section introduces the concept of Human-Machine Collaboration, provides details of companies which have already started managing Human-machine collaboration and elaborates on the role of humans and machines in Human-Machine Collaboration era. The second section details the steps involved in transforming a business to manage Human-Machine Collaboration effectively. The third section 'Getting India ready for AI Wave' discusses the efforts taken by Government of India to make India ready to successfully leverage the Human-Machine Collaboration era.

I. Human –Machine Collaboration: The Emerging Paradigm

In the past decade, Peter Senge [5] put forwarded the concept of Learning organization [6] in his book the Fifth Discipline [7] and emphasized that an organization has to create a learning environment for its employees to learn and grow. Many companies started adopting digitalized technologies and offered e-learning courses to facilitate learning of their employees and implemented knowledge management systems to capture learning's of experienced/expert people and made it available to other employees to encourage learning. Some of the company's successful in building Learning organization include Toyota, Xerox, General Motors, IBM, etc .

In this decade, we are witnessing the rise of Artificial Intelligence (AI) Systems and its applications in various business sectors. With Artificial Intelligence being identified as one of the potential and promising technologies of the future, companies are now investing on creating an ecosystem where humans and intelligent machines can work together in the future [8]. World's reputed companies like Apple, Microsoft, Google, Amazon, Facebook, etc., have already invested their research initiatives on AI [9]. Artificial Intelligence has now entered into its General Intelligence Phase [10] and many products/services are being made available with the help of AI class of technologies which include Speech recognition systems, face recognition systems, intelligent robots, neural networks, etc.,
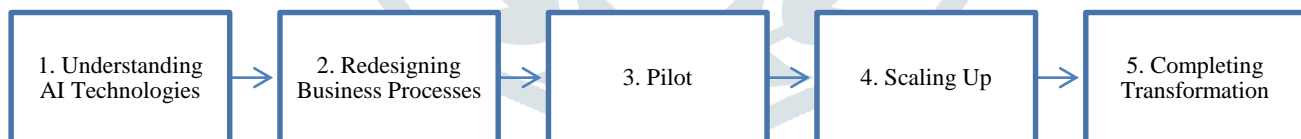
Hyundai has implemented Cobots working along with humans. Amazon's Alexa, Microsoft's Cortana and Apple's Siri and Google Assistant are assisting humans [11]. IBM's Watson is finding its applications in healthcare, agriculture and other areas [12][13]. Broadly, applications of Artificial Intelligence are categorized into three – Robotic Process Automation (RPA), Cognitive Insight and Cognitive Engagement. Typically, Robots are used for automating digital and physical tasks and RPA is less costly to implement and gives high Rate of Returns. Cognitive insights help in analyzing huge volumes of data and predict patterns. Chatbots and Intelligent agents are used for performing cognitive engagements and have the capability to interact with customers/employees.

With AI being extensively adopted, a study made by Harvard [14] revealed that AI is predominantly used to improve the features and performance of products and free up workers from doing monotonous tasks. Another publication from Harvard acknowledges that companies are realizing the benefits of human machine collaboration and results of performance are measured quantitatively. The authors suggest that humans can assist intelligent machines and intelligent machines can assist humans in the emerging paradigm of Human-Machine Collaboration.

The authors further document that Human –Machine team can complement each other by capitalizing their relative strengths [8]. Social Skills, Teamwork, Leadership and Creativity of humans and speed, scalability and quantitative capabilities of machines can augment each other in the emerging era of Human – Machine Collaboration. Humans assist machines by training them, explaining the outcomes generated by them and sustaining them from not performing activities that endangers society. Machines assist humans in performing physical tasks, process data with its analytical capabilities, enhance creativity by providing multiple solutions and also interact with customers to free up humans to perform innovative work. We are already witnessing this transformation in specific areas and in near future, this transformation will become mainstream.

II. Transforming business to manage Human-Machine Collaboration effectively:

With Human–Machine Collaboration (HMC) as the upcoming business paradigm, it is imperative for companies to be future ready for imbibing this transformation. The various phases by which a company can get transformed itself to HMC era is given as below [15]:

1. Understanding AI Technologies	→	2. Redesigning Business Processes	→	3. Pilot	→	4. Scaling Up	→	5. Completing Transformation

1. The Initial step is to understand the various AI Technologies and decide which of them will help the company in improving its performance. Today, several AI Technologies including chatbots, intelligent agents, virtual assistants, etc., are available and companies should pick the right technology for their needs.

2. Once the technologies are ready, the company has to redesign their existing business processes that are in tandem with HMC era. When we say HMC oriented business process, the processes should clearly identify the activities that can be performed by machines and humans respectively. The newly designed processes should be flexible and should also be scalable as per the requirement.

3. Once the new business processes are designed, a pilot run is made to clearly understand whether the process is apt and appropriate modifications are to be made to make the process more robust and adaptable.

4. The pilot phase is to be followed by full-scale implementation so that the newly designed processes become main stream. The workforces are to be trained and tuned to the new style of working.

5. Once the company is transformed to the new way of working, machines can be used for better decision making, personalization and scaling along with humans augmenting their work.

Some of the companies which have started implementing the transformation include Mercedes Benz, Hyundai, Accenture, etc.

III. Getting India ready for AI Wave:

In June 2018,' NITI Aayog - the Policy Think Tank of India' has rolled out a discussion paper titled 'National Strategy for Artificial Intelligence' [18] to harness the power of AI in India. In this paper, the impact of AI on India in terms of Economics, Social Issues and using India to develop & implement AI solutions are discussed. The document clearly mentions the Current AI

adoption in India and predicts Future AI investments by Sector. It ranks Healthcare, Agriculture and Education as the top three sectors for AI Investments.

To utilize the potential of AI, NITI Aayog recommends Indian Government to take actions under the following four broad areas to get India ready for AI Wave:

1. Research:

Though India has the required ecosystem to perform research in AI like availability of educated talented pool, world class educational institutions and number of paper publications, there are notable gaps that need to be addressed. Some of the gaps include Lack of Collaborative approach, Lack of scale for experimental validation, Lack of facilities to support large scale experimentation, Lack of connect with stakeholders and practitioners to convert outputs to outcomes, etc., To overcome these issues, NITI Aayog suggests having the following four-tiered framework for promoting research: International Centres of New Knowledge, Centre for Research on Sub-Systems, Center for Advanced Studies, Translational research and Leadership, Centre of Excellence in Technology Innovation and Transfer. To promote research, it also suggests a two-tiered simplified approach of having CORE - Centres of Research Excellence in Artificial Intelligence and ICTAI - International Centre for Transformational Artificial Intelligence.

2. Skilling for AI Age:

It is forecasted that the demand for AI will rise by 60% in 2018 in India and NASSCOM predicts that 46% of Indian workforce will be engaged in totally new jobs by 2022. It is expected that some of the traditional roles in IT-BPM sector will undergo changes and new jobs will be coming up. This change is not only restricted to IT and is expected to occur in other sectors like education, health, agriculture, etc. New Skills are required to cope up with the new jobs and NITI Aayog recommends a two-pronged approach for Reskilling – One approach for workforce and another approach for students. To help Workforce, the following recommendations are made: Creation of open platforms for learning, creating financial incentives for Reskilling of employees, Recognition and standardization of informal training institutions and Incentivizing creation of jobs that could constitute the new service industry.

For students, NITI Aayog recommends to have AI based education should be made part of primary and secondary schools. STEM – Science, Technology, Engineering and Mathematics based curricula should be rolled out in Schools. In higher education, the collaboration between industry and academia should increase and faculty can be encouraged to learn through credit based MOOCs (Massive Open Online Courses). Programmes like SWAYAM - Study Webs of Active –Learning for Young Aspiring Minds programme of Ministry of Human Resource Development should be encouraged and additional investments should be made to help skill young minds.

3. Accelerating Adoption of AI:

Worldwide, the adoption of AI is in the preliminary stage now but its adoption rate is increasing steadily. The report by McKinsey, 'The next digital Primer' states that AI Adoption is more in tech sectors and is in the early stage in other sectors. Indian IT Service companies like Wipro, TCS and Infosys have already developed their AI Platforms. NITI Aayog categorizes the major market segments of AI Adoption as Private enterprises, Public Sector Undertakings and Government. To accelerate AI Adoption, it recommends the following initiatives: Creating a multi-stakeholder market place, Facilitating creation of large foundational annotated data sets, Partnerships and collaboration, Spreading awareness on the advantages AI offers and Supporting startups.

4. Ethics, Privacy and Security of AI:

Though NITI Aayog acknowledges the potential benefits of AI, it also cautions the vulnerabilities of Artificial Intelligence. It suggests that Fairness and Transparency in adoption and usage of AI is a must. It emphasizes privacy of data should be maintained and lists the measures to deal with privacy issues as: Establishing a data protection framework with legal backing, Establishing sectoral regulatory frameworks, Benchmarking national data protection and privacy laws with international standards, Encouraging AI developers to adhere to international standards, Investing and collaborating in privacy preserving AI research and spreading awareness. NITI Aayog recommends safe AI practices and suggests a framework to ensure safety. This framework includes self-regulation by stakeholders by conducting damage impact assessment at every stage of AI development model, liability in case of harm and adoption of Actual harm requirements policy. It also suggests the formulation of a consortium of Ethics Councils at each Centre of Excellence to define the standard practice.

Conclusion and the Road Ahead:

The future is a world where humans and machines will be working together and augmenting each other. The Analogy of Team work of rabbit and tortoise can be used to compare the team work of Humans and Machines. Both rabbit and tortoise could have won the race by complementing each other's Competency – Rabbit's competency to run faster in land and Tortoise's competency to swim quicker in water. Similarly, if machines and humans can complement their relative strengths and work, they have the potential to create a better society to live and work. They will be able to build a new world of human-machine collaboration where customers will be benefitted with innovative products/services, quicker and responsive processes.

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