Chapter 10
Revolutionizing the Techno-Human Space in Human Resource Practices in Industry 4.0 to Usage in Society 5.0

Aditi V. Aljapurkar and Satyajit D. Ingawale

1 Introduction: What is Artificial Intelligence?

INTELLIGENCE BECOMES A UTILITY……SIRI!

This tagline by Apple Inc. for its voice virtual assistant embedding artificial intelligence in a machine opens a gamut of comprehension to be done for the AI technology today. Artificial Intelligence (AI) can deliver a tool for change. AI is a concept defined as a system's ability to correctly interpret external data, learn from such data, and use that learning to achieve specific goals and tasks through flexible adaptation [1]. Inferred from this statement is, intelligence embedded in a machine that reflects human thinking with rationality as a predictor for decision-making. AI is based on the development of autonomous agents that can reason and plan towards their goal without any built-in knowledge base of their environment [2]. Organizations, communities, societies today can look around, find, and observe the usage of machines involvement to help them orient towards a knowledge-driven agenda to reach their goals. AI holds the promise of making us healthier, wealthier, and happier by reducing the need for human labor and by vastly increasing our scientific and technological progress [3]. The field provides us with a human-technology-driven fraternity that reduces our human efforts to drive out more effective and efficient in what we do.

A. V. Aljapurkar (✉)
Faculty of Human Resources Management, Dr. D. Y. Patil B-School, Pune, India
e-mail: aditi.aljapurkar@dpu.edu.in

S. D. Ingawale
Faculty of Productions and Operations, Ramchandran International Institute of Management (RIIM), Pune, India
e-mail: satyajitingawale.riimpune@gmail.com

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1.1 Literature Review

This chapter has focused on different kinds of literature for review purposes to find out gaps in previous research. It has also covered the gap under four categories, artificial intelligence, artificial intelligence in HR, artificial intelligence usage in urban planning using IoT, challenges. The researchers have considered the past work done on artificial intelligence. For this purpose, the researcher has considered the journals in which the articles related to artificial intelligence are published by eminent researchers. The internet articles are considered for the review purpose with the view to understand the present situation in the different countries regarding usage of artificial intelligence in different sectors viz: urban development as smart cities. The researcher has tried to find the gap in different articles, books, and research work considered here for the review. It is also found that there is a shortage of literature regarding collaborative artificial intelligence. Table 1 shows the works of literature considered and the gap identified.

1.2 The AI Present Scenario

AI realm today holds the idea of developing intelligent systems algorithms that work and act like humans. With most systems focusing on decision making today's application span speech recognition, natural language processing, translation, learning, reasoning, inferring, visual perceptions, intelligent agents thus characterizing Industry 4.0. Industry 4.0 will irrevocably change how we interact with technology and each other. The interaction of technology has even touched businesses and industries. The inclusion of artificial intelligence is now a significant part of the business model e.g., Google AlphaGo beating Go world Champion, KFC restaurants Baidu's assistant taking orders in China. Artificial intelligence has evolved in three different stages: Artificial narrow intelligence (ANI), Artificial general intelligence (AGI), and artificial superintelligence (ASI). The time for transiting from phase 1 to phase 2 has been the longest and now the technology has moved to the third and final stage where humans and machines are the same.

1.3 Racing to AI in Business

The racing of usage of artificial intelligence in business is evident as it unleashes many financial opportunities. It will provide the industry players, the corporates, government bodies a technological power unparallel with any other. Across the globe, some economies endeavor in sustaining the birth of different industries. These industries in the twenty-first century are disrupted with new-age technologies leading to industrial convergences. With the background of digitization and hyper-connectivity,

Table 1 Literature review

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
1	A Framework for Collaborative Artificial Intelligence in Marketing	Ming-Hui Huang and Roland T. Rust 2021	Theoretical model development of Artificial intelligence and human intelligence	NA	1. different levels of Ai and Hi must be identified. 2. Human intelligence and artificial intelligence are supporters of each other. 3. AI will help Human Intelligence by replacing the HI when the system-defined intelligence is reached. 4 It is necessary to apply Ai to tasks/ processes by automating them	The model is used for consumer consumption wherein AI will help marketers to comprehend at what stage/level the consumer's behavior can be modeled through the combined nature of human intelligence and artificial intelligence. There is a requirement of identifying the skills/ competencies needed by the marketer to make use of the collaborative intelligence

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
2	Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence	Andreas Kaplan Michael Haenlein 2019	Literature review	NA	1. There is an incremental growth in the type of AI and today has reached Artificial superintelligence. 2. The growing field of AI has helped to have collaborative artificial intelligence systems where human and machine power can work hand in hand. 3. Applications can extend to universities, governments, and corporations 0.4. There is a need to evolve the business environment as per technology changes 0.5. There is a need to have proper rules, legislations, and control over AI usage design and implementation	The authors have not considered the risk factor while proposing artificial intelligence usage and the case-based approach is also lacking

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
3	Evolution of Artificial Intelligence Research in Human Resources	Mariana Jatobá et al. 2019	Quantitative and descriptive analysis	Literature review analysis and drafting of selected variables (AI in management, recruitment, and selection, Application of teams), Neural network analysis for recruitment and selection data retrieved from Online Knowledge library for 2000–2018 period	There have been different cycles in which research for AI in HR was conducted	The current paper has not researched the growth of AI in HR and the factors that have shown either increase/decrease in the usage in a period format
4	Collaborative Intelligence A Blueprint for a New Artificial Intelligence Institute	André Corrêa d'Almeida Adam Ingle 2020	Round table discussions amongst stakeholders	Primary survey of Academicians, industrialist industrialists' policymakers, AI practitioners, AI users communities across the US economy	There is a huge gap between the demand and supply of AI competency holders. The AI training bodies (institutions/ foundations lack a broad practical approach to imparting skills and competencies There is a need for collaborative cross-sector research engagement involving all stakeholders Ethical and governing practices for AI should be well documented	The current paper has not put forth the skill set, and competencies requirement needed to work in the AI ecosystem 2. For usage of society 5.0, there is a lack of ethical and governing practices approach to be used by industries while focusing on training designs to acquire AI competencies

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
5	Stifling artificial intelligence: Human perils	Gonenc Gurkaynak et al. 2016	Literature review	NA	Usage of AI is inevitable in the coming future It is necessary that we adopt, adapt, assimilate the presence of AI in a friendly manner. There is a need to regulate the usage of AI by laws made to safeguard against misappropriating usage. Copyrights and IPR would be the platforms for AI regularisation	The current paper has not included the laws surrounding the usage of AI and how to safeguard against collaborative actions by humans and machines, especially for HR practices. While developing society 5.0 through IoT based interventions the laws are not considered, making sure there is no harm at the data level, information level, and human level
6	Book chapter-Universal Artificial Intelligence Practical Agents and Fundamental Challenges	Tom Everitt, Marcus Hutter 2018	Literature review	NA	A framework of a universal system of AI which talks about the interaction of intelligent agents in an environment based upon mathematical statements	The current paper proposition of Collaborative systems is not validated through any mathematical modeling

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
7	How HR can create competitive advantage for the firm: Applying the principles of resource-based theory	Davis, P. J. 2017	Literature review	NA	The human resources do not contribute to competitive advantage, but they are the competitive advantage	A theoretical framework for human resources contribution or responsibility is not considered while the application of AI In HR is being proposed
8	A machine learning-based method for the large-scale evaluation of the qualities of the urban environment	Lun Liu et al.	SIFT histograms and convolutional networks (AlexNet), Correlational analysis model	Machine learning models- and secondary literature	The paper provides a model for city profiling, to understand through the algorithm up-gradation and decaying of the areas. Real-time updating of Geospatial pics of the city could help in tracing the changes 3	In terms of smart city development, the current chapter lacks propositions through algorithm and relational modeling of the city area development and capturing images through sensing technology
11	What makes Paris look like Paris?	Doersch, Singh et al.	Google VIEW street database	K-Nearest neighbors for normal correlational analysis	1. geoinformatics survey can be used to find out the characteristics of city spaces	The current paper does not include algorithmic execution over database information retrieved from any source for smart city and application of IoT

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
12	The power of social media analytics	Gu, Y., Qian et al. 2016	Data acquisition through Twitter server RESTAPI, Iterative NLP	Twitter analytics (data mining), Binary vector analysis for tweet mapping	The analytical tools helped to find out incidents to handle the accident rate and nature, planning for road development and up-gradation, hazard, and weather management	the author's written paper has not mentioned any analytical tool and platform of social media from where data sourcing and analysis can be executed
13	A Cyber-Physical Systems architecture for Industry 4.0-based manufacturing systems	Lee et al. 2015; Palazzeschi et al. 2018; Savaget et al. 2019	Architecture proposition for cyber-physical systems	Sensing techniques, image capturing through machining systems, and prediction techniques	Architecture that will help efficient machine usage by data capturing data conversion, data mining, d decision-making at the cognitive level through simulation and diagnostic analysis for required actions	The current paper has not proposed an in-depth system architecture of how to apply the sensing, capturing, and diagnosis for smart cities under IoT technology
14	On the way from Industry 4.0 to Industry 5.0: from digital manufacturing to digital society	Skobelev et al. 2021	Literature review	NA	Society 5.0 is the convergence of science and technology—robotics, dealing with big data with multiagent systems, helping the technology people in one system leading to IoA (Internet of agents)	The chapter lacks the multiagent framework as an important component of the Industry4.0

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
15	Organizational responsibility: doing good and doing well	Aguinis, 2011; Kish-Gephart et al., 2019	Literature review	NA	I/O practitioners have a huge responsibility to enhance organizational performance. There is a difference between organizational and corporate responsibility There is vast scope for strategic responsibility management to be taken up by the organizational members	The written chapter has not focused on technical aspects of IoT and CAI stakeholder's responsibility in the organization and society especially when technology and industry processes are brought on one platform for convergence
16	Society 5.0 co-creating the future	Keidanren, K. 2018	Literature and expert opinions	NA	The world must adapt to changing technologies like AI, Robotics, and IoT and economies must have plans to assimilate into the business industries and everyday life of humans. The adoption must be done keeping in mind the world's sustainable development goals. Society 5.0 embraces an environment where people have freedom of will and are creative to live and pursue a happy life	The current chapter has focused on the application of IoT over smart city development, the sustainable development goals are not explored

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
17	The Future of Retailing	Grewal, Roggeveen, and Nordfalt 2017	Literature review	NA	1. Tools and technologies facilitating decision-making to retailers 2. Apps and drones to be used for understanding consumer behavior. 3. IoT to comprehend buying behavior	Applications like app development for city/ location-specific information seeking and analysis are not considered. Also, for a smart city, the component analysis for city planning and urban development through drones is not included
18	Natural Language Annotations for Question Answering*	Katz and Felshin 2006	Literature review	NA	Natural language processing through START Information system facilitates in answering complex questions posed	For locating the data from different locations only sensing data and machine learning techniques are proposed. Use of NLP is not included
19	Conceptualizing the future of HRM and technology research	Tanya Bondarouk 2016	Literature review	NA	There is an interface between HRM and technology. The impact of HR on stakeholders is needed to be analyzed. Those organizations whose technology interventions are high would qualify as 'smart' organizations	The current chapter has lacked in providing the stakeholders and society as in large with technological interventions

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
20	Talent acquisition due diligence leading to high employee engagement case of Motorola India MDB	Srivastava, P. and Bhatnagar, J. 2008	Secondary data	NA	1. Changing technological aspects makes it imperative for organizations to have niche talent acquisition strategies 2. Recruitment strategy should ensure person and cultural fit to increase engagement and reduce attrition amongst the employees. Changing environmental aspects should be aligned with a talent acquisition strategy, like what the Motorola company did while choosing India as a market for their product and business expansion	A case-based approach is not being considered by the authors, for defining HR strategies by an organization for the Industry4.0 scenario especially in recruitment and training and development practices to be designed and implemented

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Table 1 (continued)

Article number	Title	Author name	Methodology used	Analytical tools used	Findings	Gap identified
21	Artificial Intelligence adoption-AI readiness at firm level	Sulaiman Alsheibani et al. 2018	TOE framework	Online survey data analysis to test TOE framework	An organization's technological, organizational, and environmental aspects should consider the readiness of AI adoption. Businesses must see the impact of AI adoption in business processes	To have AI in the business process, the current paper has not used any framework that would help to understand the human resources skill requirements to use AI which will then be a part of the recruitment strategy of the organization
23	What happens when industries collide?	EY 2019	Secondary information	NA	The report mentioned the industry convergence and how smart cities surges as a concept from this	The business and societal challenges are not covered fully solving business, governmental aspects

the disruption caused even convergence of many unrelated industries together. For example, the 2,000% growth of the use of private and commercial robots from 2015 to 2030 could create a US$190b market is an example of unrelated industry convergence. The example here infers that convergence leads to the opening of new markets or opportunities for different stakeholders like companies or governments. Industry convergences shake up the workplaces too. The industry trend today looks for human resources to be the differentiator for the firm's competitiveness. Employees do not just contribute to competitive advantage; they can themselves be a direct source of competitive advantage [4]. To achieve this, it calls for the Business leaders and HR to capitalize the disruptive technology to reshape the workforces by having greater insights into the organizational functioning, outcome, and variables. Artificial intelligence as a disruptive technology seems to be unfolding the realms of opportunities in redefining the business process. AI has also been disrupting the human resources nature and practices at the workplace. The real challenge is how many businesses or executives are ready to adapt, adopt this technology? Do they think that this technology is a solution to everyday workplace problems? The adoption of Artificial intelligence had its own pace across industries and sectors in the context of revolutions happening in the technology. It has already been applied to self-driving cars, media and entertainment, healthcare, and smart cities. However, this has not been the case for AI readiness factors for preparing organizations to adopt AI [5]. Economies and business houses should ready themselves for the adoption of AI, as according to the PwC report AI offers the biggest commercial opportunity helping the GDP to higher by 14% by 2030 equivalent to %15.7 trillion. As economies are set to unearth the usage of AI in business, it is also significant to comprehend the interventions in business functions too. Though the statistics reflect a developing notion, still, there are many facets like Human Resources Management in Business which is far yet to experience the full potential intervention of AI!! The scope of technology intervention and its impact on workplaces today covers the objective of Society 5.0. This is crafted with the need to numerically express the work done at the organizations, replacing the routine work with the technology/automated processes/intelligent agents, etc. also demanding that the industry changes with calling the workplace structure to change too.

1.4 The HR World

With evolving business goals, structure, and technology the world of HR faces a dearth of talent—mainly in acquiring the right talent in the organization. To deal with this, organizations' recruitment and culture need fit, an environment is created at the workplace where employees feel more passionate about their work and exhibit the behavior that organizations need to drive better results [6]. Organizational strategies, systems, policies, and procedures help but even then, the problems persist in the talent acquisition process.

- Candidate power to define the job role makes it challenging for the company and recruiters how to meet this demand (Is there a need for intervention that involves a collaboration of humans and technology to make online job search easier?).
- During the candidate assessment process there would be a need felt to know real competitiveness by a candidate (Is there a need to change psychometric test by job simulation models?—with a simulated environment employers can assess the job performance of the candidate, without the support of Interview responses and personality testing tools like a questionnaire).
- The Lighthouse Research 2017 Talent Acquisition Priorities study found that talent acquisition leaders were focused heavily on improving their relationship with the business and improving their practice, but the primary areas of hands-on recruiting that they wanted to fix were onboarding and sourcing.
- Can technology help in deciding how and where to invest the training budget?
- Do technology interventions help organizations to transact from employee engagement to employee experience?

1.5 Technology and HR

To answer the questions and to solve the problem, Business houses can take help of the technology like Artificial Intelligence and mature systems like collaborative intelligence to mark the HR functionalities' which is essentially an open system consisting of people, technology, organizations, and management processes [7]. Technological growth and enhancements thus form a significant pillar. The HR industry is transforming and is absorbing technology at a brisk pace. The rationale for this is the different challenges like employee engagement, talent retention, competitive compensations across operating markets and cross-industries, and leadership development. These challenges have sparked innovation to be brought in HR departments. So, the interest now is in comprehending technologies like artificial intelligence, collaborative intelligence Virtual and augmented reality, IoT, Autonomous agents, and things, Wearables, etc. changing the way HR departments will function in the coming future. There has been an increase in the research of artificial intelligence in AI. From 2000 to 2018, 71.4% of the research was applied to the topics of recruitment and selection, activities involving attraction, and more adequate choice of workers, as a support system for the companies. It thus becomes significant to comprehend what encompasses the AI ecosystem and how it can impact the HR environment.

2 AI Ecosystem

Every technology that exists today has its ecosystem which helps it get evolved and improve on its utility factor. So, in these aspects, every technology like TV, Phones, satellites, Internet, Computers have all made exponential growth interim of

the platforms, content, tools used, accessibility, and the experience it provides. There is a need for an ecosystem for this growth. On similar grounds, we do observe that Artificial intelligence as a technology is evolving.

John McCarthy who gave birth to the concept of AI hailed from the United States and was a computer and cognitive scientist. McCarthy was a pioneer in the field of artificial intelligence. To his credit is coining the term artificial intelligence in his research paper he co-authored for. He holds the credit to create a programming language named 'LISP' and is a significant contributor to the design of the ALGOL programming language. However, interest in technology waned significantly during the 70s–80s decade and then disappeared. The concentration in A.I. reappeared through the tech industry's positive explosion, as hardware technologies advanced, providing more opportunities for the usage of A.I. *Google made technological advances in 2012 by developing a machine that could recognize cats.*

In recent years, the Ecosystem of AI has become more comprehensive and hence needs to be explored at a higher level. This ecosystem is built with capabilities that connect all our technologies, devices in its environment. In the coming years, the interrelationship of A.I., the Internet of the Internet, and data could unravel boundless potential in terms of outputs with high metrics, enhanced standard of living, and a society characterized by better aspects. However, with so many parts in an AI ecosystem, it can be difficult to keep track of everything. Machine learning, deep learning, and artificial narrow intelligence are examples of concepts that can be found in an A.I. ecosystem. Table 2 ecosystem of AI reflects the components in the ecosystem and the utility factor with an example.

Table 2 Ecosystem of AI

Sr. no.	Ecosystem component	Example	Utility
1	Artificial narrow Intelligence (its focus on one task at a time)	Siri, Alexa, Facebook's newsfeed, Email spam filters	An everyday usage technology system
2	Machine learning (Systems with self-learning ability without being programmed)	Speech recognition, problem-solving, learning, and planning	With no human interventions, these systems are self-learned systems that are equipped to adapt also
3	Deep learning (a subset of machine learning)	Self-driving vehicles, Healthcare, etc.	Utilizes both structured and unstructured data for training

2.1 Trends in the AI Ecosystem

Of the industries studied, information and communication, manufacturing and financial services are the three sectors that will see the highest annual GVA growth rates in an AI scenario, with 4.8%, 4.4% and 4.3% respectively by 2035 [8]. The market is huge and growing with different trends. Amongst this cloud-based, AI is trending. Cloud computing and artificial intelligence (AI) are inseparable. The latter is a supporter in enhancing the utility factor of the other in terms of data management, uncovering acumen, and optimizing the flow of work. Cloud-based services standardize AI, thus, provisioning it to increase the efficiency of organizations, thus helping them to stand out in the market, that have faced a high entry barrier. Investing in AI has traditionally required top technical skills, massive computing power, and a massive amount of capital. However, because of the cloud-based AI service, businesses can implement it and benefit too. Both applications benefit at large the combination of AI and cloud services allows businesses to maximize the benefits. The cloud-based service offers a profitable alternative to costly on-site hardware and software. Simultaneously, AI assists the cloud in managing data and gaining insights into information. A business organization can opt for any trend for its ecosystem depending on the need, strengths, and limitations of the information technology infrastructure, the skills amongst the human workforce, and the financial feasibility. The decision-makers in the organization can set a strategic plan to develop the roadmap for AI addressing key business aspects.

2.2 AI Roadmap Development

An AI guide is an arrangement of checked AI openings focused on accomplishing key business objectives over the short and long haul. It's the initial step to having a strong system for AI, yet it's anything but a complete arrangement to change the entire endeavor. All things considered, it starts off the grouping of work spread out in the four mainstays of wise AI reception: Strategy, Data and Technology, People and Organization, and Governance. The roadmap would include 3 phases in it as shown in Fig. 1.

The AI utility value for the business can be be-folded in the three terms that are stated. Every stage renders value to business either effective or efficient business operations.

Discover Stage, the result is to construct an arrangement of AI use cases to assess in the ensuing stages. For example, Fig. 2 shows the used case for Amazon company. The business decision-maker in this stage can use the following.

"***What can your business improve by utilizing AI?***"

1. *Organization can focus on a process, program, or structure, that shall be impacted in terms of bringing a change in the value chain of the company.*

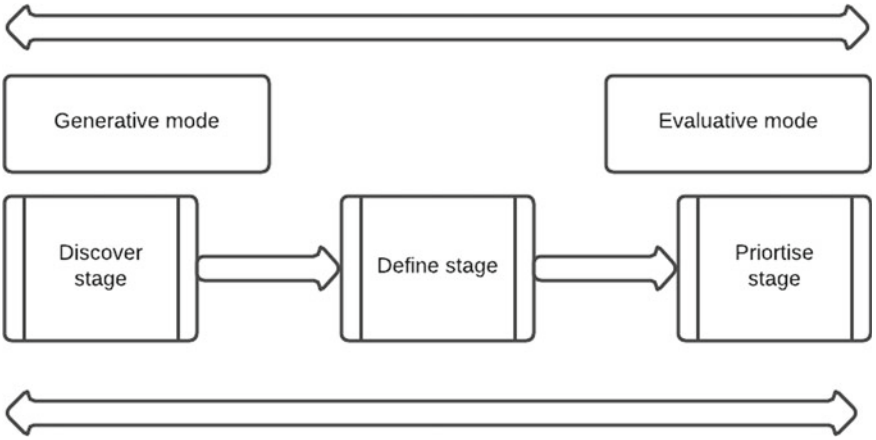

Fig. 1 AI roadmap development

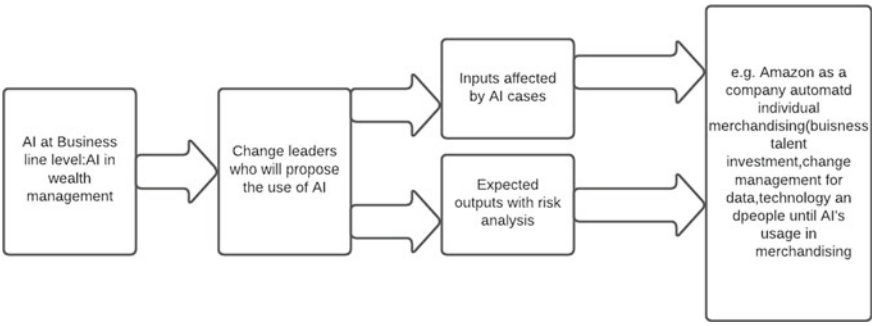

Fig. 2 Example discovering AI used case

How would it be able to respond that is new?

1. *Are organizational feasibilities being checked for AI adaptation?*
2. *Are change management strategies for people and structure in place to mitigate the resistance to change?*

What worth would it be advisable for you to make straightaway, and why?

1. *Financial feasibility and returns over the usage of AI in business lines or processes must be analyzed by the decision-makers.*

Define stage Decision-makers in the organization should pay special attention to Artificial intelligence capabilities internally present and that which can be reused in manifold scenarios. This stage qualifies to comprehend the used cases and proficiencies. When a used case viz. ***timesaving*** is considered, it is significant to observe and record how it impacts incrementally to improve business efficiency or process efficiency, or resource efficiency.

E.g., for a recruiter in the human resources domain, usage of NLP—natural language processing in an enhanced automated interview environment would help in determining the Person–Job (P–J) fit and Person-organization (P-O) fit through words, speech and facial analysis. Person–job fit is defined as the degree of alignment between the individual and the job [9]. Each of these requires a certain roadmap of how to go ahead with the development of the function with an AI base, then to integrate the technology in the process and drive change management practices in the organization to mitigate the resistance to change and improve the adaptability index. So, this stage of the ecosystem requires that sufficient data is available to validate that AI usage is safe, reliable, accountable, and trustable. There must be enough evidence to ensure that the system possesses no harm to physical, psychological, and economic harm to organizational stakeholders.

Prioritize stage This stage looks in for aligning business requirements with AI strategy keeping in the return expected out of AI projects.

2.3 Utilizing the AI Roadmap

In the beginning, organizations should try to deploy AI to the business line—and not the whole business nor a single task or process. Within the financial organizations, for instance, we would see use cases in which AI interventions are seen in the ***wealth management operations*** **or** ***the credit lending procedure*** **enhancements**.

1. In the wake of picking your center, teach change pioneers (from top management-middle management) on the most proficient method to perceive a decent AI use case. A utilization case ought to have information that portrays both the info and expected yield for a business task—like the definite item portrayals accessible in various dialects that empowered eBay to practice the execution of its machine interpretation AI utilizing to and for models.
2. At last, work across groups to plan additional opportunities, coordinating with AI capacities, (for example, regular language handling) to utilize cases, (for example, interpretation of item postings).
3. Thoughts do should be pragmatic, for instance: what forecast will be made, utilizing what information, and how might the expectations be applied to make it more effective and efficient.

Nonetheless, creative mind and aspiration pay off, as well—among early adopters of AI, over 60% detailed finding another plan of action as indicated by an IDC overview. To create the best thoughts, balance hierarchy, and base up experiences. Meetings with workers and clients, for instance, can assist with making an early purchase in just as a more profound comprehension of on-the-ground business tasks. At the finish of the Discovery stage, your group ought to have a bunch of utilization cases assessed to be of high effect that requires itemized approval.

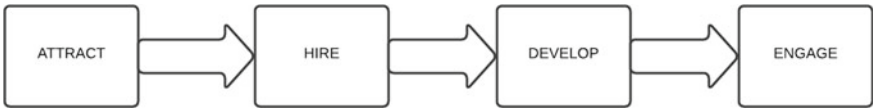

Fig. 3 Human resources management functions

For example, the usage of the IBM Watson cognitive system. The Watson portfolio is intended to make it simple for you to utilize information from different sources, trust the proposals and forecasts from your AI models, and get more worth from your AI, quicker. With Watson, you approach the most complete arrangement of AI abilities for business, regardless of whether it's instrumented for building your models, prefabricated applications to speed up an ideal opportunity to esteem, or admittance to a powerful environment of accomplices across various enterprises. As a cognitive computing system, it allows creating value, finding answers and insights that are locked in bog volumes of data. Be it the healthcare industry using the system for diagnosis or be a wealth manager using it for a client to propose a retirement plan, or a chef who wants to make a new recipe. All these new approaches put together the voluminous data at hand to provide new insight and add value.

2.4 Enhancing the HR Processes Using AI

Automation of any business process is inclined towards the experience the end-user gets.

The same analogy applies to human resource management processes too. AI applied to HR helps the HR team of the organization to extract understandings from the sources data and to provide real-time recommendations.

2.4.1 How Can AI Be Used in HR?

AI helps in analysis, prediction, and diagnosis helping the HR team to make better-informed decisions for the organizations. Every HR functional process as shown in Fig. 3 can be automated and facilitated by artificial intelligence. Table 3 enlists the companies that have used AI in HR functional processes enhancing the recruitment and selection process.

The evolution of artificial intelligence to Artificial superintelligence (ASI)[1] puts forth a platform where automation through self-aware and vigilant machines start comprehending human intelligence and behavioral characteristics. Even though this is in the nascent stage of its design and implementation there have been exemplary developments like IBM Watson and SIRI. However, there have been fewer amount

[1] Computer's capability surpassing human capabilities would qualify for artificial superintelligence.

Table 3 Landscape for AI recruitment

Sr. no.	Recruitment buckets	Description	Example
1	Pre-Hire assessments	Usage of Game-based as a pre-assessment tool to check and evaluate the skills of candidates to provide a rich and engaging experience. Video-based assessments	HireVue company uses a team of experienced organizational psychologists that use this tool to identify the competencies best suited for each role
2	Candidate rediscovery	Supports with analyzing the database to rediscover who would be a job fit to the declared job positions	IDEAL, Leverages candidate pool, re-engage with qualified candidates that have expressed interest in joining your organization
3	Job description optimization	Enhancing the job description wherein recommendations for wordings and phrases make it more inclusive	Recruitment process data is analyzed by machine learning by the Tool. The tool is efficient as it 'learns' the organization's identity and language. Helps in effective hiring Augmented writing then helps the HR staff to create more effective job descriptions
4	Ad automation	The organization can optimize the spending on Ads. The automation helps in placing and testing the job Ads on a variety of platforms	Reveal Bot: It automates analyses and launches strategies for media Ads using different metrics that help in strategic decisions rather than reactive actions
5	Job market forecasting	Job market forecasting software gives insight into available pools of talent for different job types, experience levels, or locations	The tool can predict which employees will leave a job. This accuracy is 95% accurate
6	Candidate relationship management	These tools provide personalization services to the candidate, also may help in re-engaging those previously applied	ADP workforce now: Manages—payroll function, HR function, time management, talent management, and benefits management—in a single database
7	Resume sorting	These tools help in the process of screening	Newton: ATS with resume parsing tools to add, organize, and discover. These a impact the recruitment data value and are insightful, for recruiters, HR directors, and the candidate

machines that simulate in full capacity what a human can do. We propose to think about a system that has the capacity of what humans and machines can do. This introduces a concept of collaborative artificial intelligence wherein humans exhibit

machining capabilities and machines exhibit few human capabilities-collaborative artificial intelligence.[2]

2.5 *Collaborative Intelligence in Recruitment Function: All About Estimations!*

The potential of the AI effect on the business process is a huge and recruiting function of HR is no exemption. Talent procurement succeeds when it predicts the best contender for a task and assembles the connections that convert them to potential employees. Man-made intelligence can scale and deal with an enormous part of this forecasting work. At its best, AI reasoning strengthens the extraordinary ability of recruitment specialists and supervisors, surfacing the best fit to role and organization, paying little attention to work experience, competencies, and sector they have worked. This is essential to remember when beginning a discussion with any AI seller. It very well may be enticing—and fascinating—to examine the specialized subtleties of a seller's AI arrangement, yet this shouldn't be the concentration. Appropriately carried out, AI can convey sensational upgrades in nature of recruit, time to fill recently added team member variety, and other basic enlisting measurements.

When organizations venture into finding vendors for providing features of AI-based Recruitment tools, the features may be similar across many vendors. Significantly, every organization focuses on the impact on the enhancement of the recruitment metrics and its ROI. The table description talks about the humanistic abilities of AI-based tools/bots. Collaborative intelligence would require and has features that will complete the hiring process using the AI tools/Bots and then human interventions to complete the other remaining steps like background verification, etc.

There are numerous examples of usage of AI in the corporate environment

- JPMorgan Chase performs legitimate checks of business advance concurrences with AI, opening 360,000 h of lawful survey each year.
- The Associated Press robotizes profit detailing, distributing 4400 AI-composed stories per quarter.
- Hilton utilizes AI to assess competitor interviews, further developing meeting to-enlist rates by 40% while diminishing the opportunity to fill 90%.

Table 4 describes a few other examples of how different companies are using tools and enhancing the recruitment process.

[2] Collaborative intelligence traces its roots to the Pandemonium Architecture proposed by artificial intelligence pioneer Oliver Selfridge as a paradigm for learning.

Table 4 Tools used for recruitment process enhanced by AI

	Name of the tool	Core features	HR area	AI interventions
1	XENOSTACK	Revolutionized recruitment platforms Skill matching recruitment Self-assessment tool for career growth and development	Recruitment-applicant tracking systems, candidate reach management, candidate experience management, online job postings, interview recording through video conferencing recruitment forecasting	Assisted intelligence by human decision-making augmentation De-tasking–automation of the auxiliary tasks in processes Assisting through candidate sourcing, screening, and interview conduction
2	Mya systems	Conversation recruitment platform, Automated candidate engagement and communication	Guidance in the hiring process	Uses NLP for natural conversations with recruiters and candidates in job search and onboarding, Enhanced ATS, Removal of Blackhole effect
3	HiredScore	Employee grading in finding the best fit	Hiring and employee retention	Job postings Potential job offers initiation Career trees
4	Wade and Wendy's	Automation-recruiter and job seekers	Recruitment	Ai based recruitment conversations-qualifying screening Chat conversation analysis within AI for effective scheduling Ready schedules for a recruiter for everyday routine
5	Belong (formerly known as DataEmo)	Data science enables candidate sourcing platforms	Acquisition	Profile analysis for skill and culture fit Personalized candidate conversations

2.6 AI in Learning and Development Function of Human Resources Management

An intensive awareness of Rapidly changing and developing technology and its usage in L&D process enhancement is required by the L&D specialist. The role of L&D experts/specialists should be in exploring the new techniques and strategies they could design, deploy, and evaluate accordingly. As per Gartner's report, 2020 was the year that would have witnessed the handling of customer-related services to be performed by robots and the rate would be almost 85%. In the L&D process, the

instructional material needed would also be now produced by the AI technology in hand. A $14.33 trillion annual industrial expansion would be seen by 2025, as stated by Bank of America. This expansion rate would require L&D specialists to work on training modules for existing employees and those who would be recruited in near future with AI pruned skills requirements. The experts must work on the usage of AI software to track voluminous data and make usage of machine learning techniques to have and use insights for effective learning.

2.6.1 Role of Artificial Intelligence in Learning and Development

L&D experts need to keep steady over quickly changing innovation to upgrade the learning experience and results, growing new learning procedures and philosophies that exploit these enhancements, particularly with regards to AI. For instance, a Gartner report predicts that AI bots will control 85% of client assistance connections by 2025 and another report expresses that 20% of business content (counting preparing content) will at this point be created by AI., the Bank of America predicts that AI will drive between $14and 33 trillion yearly of monetary development by 2025.

Man-made intelligence will tremendously affect the L&D business. Organizations have an immense measure of information accessible to them, which they can dissect and use to upgrade preparing projects and learning educational programs. Gone are the days when each worker needs to gain proficiency with similar course content. Content can be customized to suit the student's necessities, center around more vulnerable spaces of the student, suggest appropriate substance dependent on past conduct, anticipate needs dependent on their job, and surprisingly auto-produce content utilizing different substance creation calculations. For AI to be used completely, associations need to tackle the gigantic measures of information utilizing AI, information experts, AI developers, and then some. The yield from this information empowers L&D offices to acquire bits of knowledge into the student excursion and assists them with making preparing programs that drive esteem and empower versatile learning.

People have different learning styles Learning styles sway the advancement of learning arrangements. An individual's learning style might be impacted by age, nationality, social foundation, and different components which should be considered in the improvement interaction. For instance, a review by the University of Georgia exhibited that "guys scored essentially higher on the Abstract Sequential channel than females, and ladies scored fundamentally higher on the Abstract Random channel than guys", showing that an alternate showing style (which could be advanced by AI) would help every sexual orientation. Employers need to perceive this and begin sending AI to prepare representatives by streamlining the content to suit the client's favored learning style. This won't just make the learning experience more charming for them however assist with information maintenance and hands-on execution.

Personalizing the learning experience an AI-fueled preparing program permits the preparation program to be versatile, where the modules are adjusted to suit the necessities of every worker. The LMS may offer video instructional exercises to specific workers, yet auto deciphers the recordings to message-based articles for different representatives. It very well may have the option to make visuals dependent on a composed substance and recommend the representative take an in-person preparing day on areas of the course they are battling with. Learning experiences additionally assist with fostering a more extensive comprehension of student conduct, prompting prescient limits. Utilizing the bits of knowledge, associations can make savvy and more brilliant, situated substance, that is versatile, natural, and receptive to a student's very own excursion.

Incorporating training into the regular work plan. Stephen Walsh, a prime supporter of Andres Pink, expresses that 93% of associations wish to incorporate learning into the normal work process. In any case, 56% of learning is exceptionally formal and conveyed vis-à-vis. Most of the students are not fulfilled either with the timetable of preparing or the configuration of data conveyance. A learning framework, controlled with computerized reasoning is the answer for this issue too and the advantages are essentially something similar: timesaving, representatives are locked in and involved, the learning system is mechanized, and the benefit of the association develops at the speed of light! When powered with AI, this framework will give a system, resources, and timetables that are produced for every worker.

Strengthening training and development. It's a well-known fact that representatives are excessively occupied and here and there lethargic to deal with their turn of events. Bryan Austin in his "Cutting edge Corporate Learner" paper claims that experts are anxious to commit just 1% of their valuable chance to learning and expert turn of events. Also, the MASIE Center, a global learning LAB, expresses those representatives finish just 15% of the learning programs that were allotted to them. Regardless of this reality, associations burn through billions of dollars on worker improvement programs all year. Artificial intelligence braced learning programs are called to take care of the issue with helpless support of preparing and advancement and can further develop your support program, including:

1. Timesaving through process automation.
2. Boosting the engagement by personalizing the learning process
3. Improving the completion rates through personalization.
4. Measurement of learning effectiveness through analytics automation.

Improving completion rates in many organizations, it is found the HR managers do find a challenge in covering up the completion rates. However, the AI platform delivery of training content is personalized and customized to the learner's format which is then followed up by stimulating methods the chances of covering the completion rates are improved. What can be done?

1. Though the organization TNA (training need analysis is more focused on the overall 'KSA' knowledge, skill, and attitude development, the training content rendered must be personalized to meet each employee's need.

2. It is important that the number of hours/trainings is kept short and is more engaging.
3. A professional approach to automate the training process must be done.
4. Learning effectiveness measurement should be in line with reward systems, once appropriate effectiveness levels are obtained, rewards should be disbursed.

Offering user-friendly accessibility Artificial intelligence-based insight things make planning programs reachable to a wide assembling of understudies, fusing people with different kinds of ineptitudes. For example, Google presented an Automatic Captions Video App in 2009, which could help hard-of-hearing people. Moreover, the App is equipped with auto-understanding convenience that helps people with liking watching accounts more than 50 vernaculars. For blind people, AI passes on undertakings and courses of action that make elective texts for pictures. Google presented Cloud Vision API that utilizes neural associations to perceive the situation and make a scholarly variation for an image. Thusly, with AI, experts will cultivate planning programs open to any understudy.

Determining the effectiveness Determining the average capability of the learning system execution is exceptionally pivotal, yet tedious. When L&D experts use AI frameworks they gather and dissect information rapidly to get specific bits of knowledge on learning viability. The experiences call attention to students' advances and accentuate students' information holes, assuming any. Then, at that point, an AI-prepared learning program proposes ways of satisfying the revealed holes. A 4–level Kirkpatrick Evaluation Model supported with AI, will perform fundamentally more reasonably to guarantee that the basic learning targets are developed.

Zeroing in on AI-based computerized mentors Artificial intelligence-based guides can supplant instructors, teachers, speakers, and mentors. DARPA (Defense Approach Research Agency) supported a review that was called to foster an advanced guide to duplicate the interaction between an accomplished subject matter expert and a student. The point was to lessen the time spent by naval force students to accomplish some super-advanced abilities. The trial uncovered that when working with AI-based computerized mentors, students got the right stuff rapidly as well as overperformed experienced specialists. It implies that conceivably AI-based guides could supplant existing specialists with time, and the learning system will be considerably more successful.

At last, applying AI in preparing, learning and advancement will permit students to get preparing content dependent on their inclinations, abilities, and individual qualities. Additionally, AI makes programs open to all students even with various kinds of inabilities. Whenever customized, AI-controlled learning courses will altogether further develop fulfillment rates and lift commitment. What's more, a learning stage driven by man-made consciousness empowers coordinators to offer to prepare choices for the workers every minute of every day, track results, examine information, measure learning adequacy, and make learning significantly more viable and proficient.

AI-based employee engagement is an extremely dynamic idea. It is the "passionate associate" that a representative feels towards its association. What causes one to feel associated with an association and persuades to convey her/his best shifts from one individual to another. It likewise changes with what's going on in and throughout the planet. With each new age in the labor force, worker commitment patterns change. Groundbreaking business pioneers and supervisors should keep themselves refreshed on these commitment techniques.

2.6.2 How Can AI Contribute to Employee Engagement Work?

Data mining and Predictive analysis: Assessing responsibility level, analyzing significant results accordingly, and giving decisions will be the unmistakable benefit that AI will drive. Advanced data assessment and AI instruments can develop running responsibility programs. Working with judicious assessment using valid/current data across factors will open useful, altered courses of action. For example, on the off chance that there is a social affair of people who are baffled and need to leave the affiliation, assessment could help with instructing HR before they decide to leave and therefore hold some of them.

Natural Language Processing and Machine learning: A ton of dissatisfaction between representatives frequently identifies with non-monetary parts e.g., absence of lucidity on professional ways, the shortfall of testing tasks, deficient thoughtfulness regarding preparing needs, inadequacy, unattended criticisms, and so forth the volumes and subjectivity in input make the errand of breaking down them massively. Advancements in NLP/ML have made opinion examination of composed/communicated in language simpler. Heartbeat reviews have become distinct advantages for estimating effects and following practices continuously.

Chatbots: Correspondence is an indispensable piece of worker commitment. Simulated intelligence devices, for example, chatbots, when utilized reasonably, offer freedoms for making the correspondence communitarian, brief, intuitive, and fun. Incorporated AI/bots in the correspondence frameworks assist with further developing execution audits and the board, designing distinguishing proof/acumen, conducting examination and expectation, etc.

2.6.3 AI Visible Footprints in Employee Engagement.

An employee lifecycle is highly impacted by the open culture that organizations carry to have a positive impact. In terms of engagement, the employee journey starts during the onboarding stage. Artificial intelligence with its strengths can positively impact the entry to exit cycle of the employee. This involves the following areas-

Remote learning and training: Skilling is a region where AI can have a checked effect. From inventive, intelligent figuring out how to genuine recreated situations

for ability evaluation, AI can be utilized to give excellent preparation and permit field staff to be directed distantly. The investigation could likewise be utilized to recognize regions/workforce where preparing/reskilling might be fundamental or convey tweaked preparing and improvement programs for representatives.

Equality and fairness: Al instruments can eliminate human biases, fabricating an impartial, various, and fair-minded working environment. With the capacity to kill human inclination, AI makes a stage for a quick, effective complaint relief framework where clashes are tended to speedily.

Managing Rewards and Benefits: Organization of Benefits and Rewards can be monotonous, especially in perplexing, progressive levels (the fuel repayment advantage is a genuine illustration of this). Perhaps the greatest gainer from the utilization of AI would be this part of the representative commitment. However, innovation has facilitated execution and the board of customized bundles, AI makes the entire interaction more proficient and enhances the advantages. With an easy-to-understand interface, simplicity of activity, opportunity, and adaptability, AI helps consistent combination of whimsical, trendy worker benefits with conventional motivating force bundles and along these lines makes an original representative encounter.

Enable better decision making: By eliminating the relentless thoroughness and empowering prescient examination, AI helps better dynamic, supported by profound information. Unencumbered by geological areas and time regions, applying AI can empower a more nuanced choice, considering far-reaching content analysis.AI is maybe one of the most invigorating disruptors in a ceaselessly advancing, innovation-driven business field. Bridling its potential for worker commitment will require a colossal change in perspective in work environment tasks. Associations will check out the compromise—Benefits of AI versus Fear of Redundancy. While offsetting the human factor with innovation empowered arrangements, AI is a certain fire method of weighty advancement in worker commitment that no association would need to be abandoned.

3 Collaborative Artificial Intelligence (CAI) Conceptual Background

Artificial intelligence opened the forums where there was a notion that it could replace the human presence. Collaborative Artificial Intelligence would involve people partnership in carrying out the work/process by reasonably delegating the tasks between humans and machines. This would imply that the machines/technology will complement and augment human capabilities and not replace them. Machines were built so that they could help humans in routine and strategic decisions. If we as humans must trust artificial intelligence in any form, we would like to know what is the premise with which the machine work and reasons out. Facts should have provenance [10]

and rationales should be transparent to human users. Through collaborative intelligence, strengths like leadership, teamwork social skills, and creativity of the human force can be enhanced. As CAI has a two-fold benefit, the augmentation will help in improving the speed, scalability, and quantitative capabilities of the machines/ technology.

3.1 Business and Collaborative Artificial Intelligence

To utilize the full potential of ***machine+ human*** **intelligence**, organizations must rethink their business processes. Companies need to reimagine how AI can be utilized to provide effective business outcomes like flexibility in operations improved speed-process, operations, decisions, etc., or in personalization of products and services. According to McKinsey report 2018, sectors like telecom, high tech and financial services lead the way in adopting AI usage in business. In an overview of the business and artificial intelligence usage in the field of human resources, High tech industry tops the table. Business integration with CAI would require organizations to have a peculiar framework (see Fig. 4).

Humanistic Machines as humans start working collectively with machines, they should be able to train(tutelage) them to do activities (the usage of machine learning

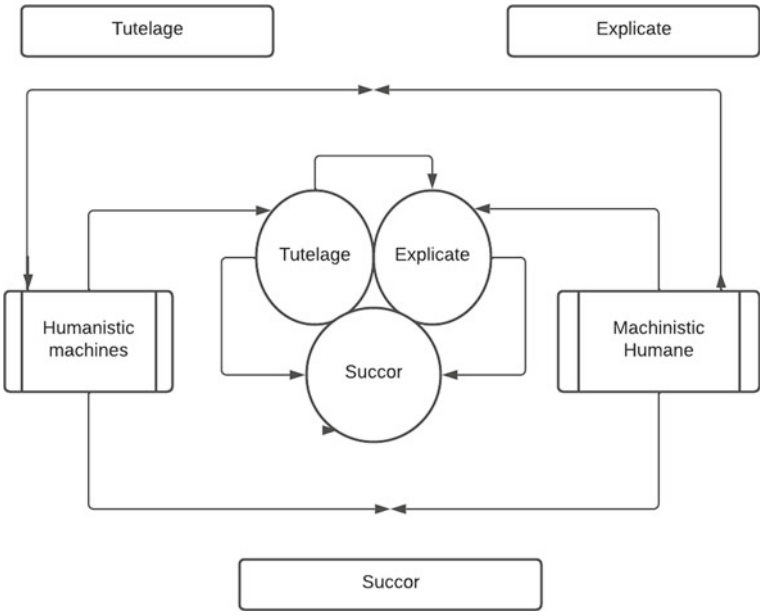

Fig. 4 Framework for CAI

approach), explain(explicate) the rationale for responding to a scenario, and succor them not to indulge in any harmful activity toward the humans.Take for example, in the human resources function, as a recruiter, you would be involved in many activities, sourcing, screening, sending mails, callings, etc. In a collaborative environment, a RecruiterBot (R_BOT) could parallel do multiple activities within the ATS (applicant tracking system) and can help individual recruiters concurrently. How does this enhance the recruitment process? Ideally, those who wait for responses after resume submissions can be dealt with by the BOT thus ensuring the candidate experience and employer branding factors for the host organization. Employer branding in the context of recruitment is the package of psychological, economic, and functional benefits that potential employees associate with employment with a particular company [11]. The R_BOT here ensues the psychological component of candidate engagement through the recruitment cycle (see Fig. 5).

In the HR realm, the collation of humans to use machines and humans expected to do machinist activities is a challenge and opportunity both. In the fraternity of Collaborative Artificial intelligence, businesses with their IT infrastructure can adapt to cognitive computing. Cognitive computing works on similar patterns wherein these systems learn and interact naturally with people. This interaction allows extending what humans or machines could do on their own. Interestingly there would be different tasks/processes which can be delivered efficiently by these systems that enhance the processes viz. HR processes in the discussion. The system would learn inhumane ways about the structured and unstructured data dealt with in the process. Since they are here a learned machine/system they can then do the tasks one by the HR administrator that is used by the organization.

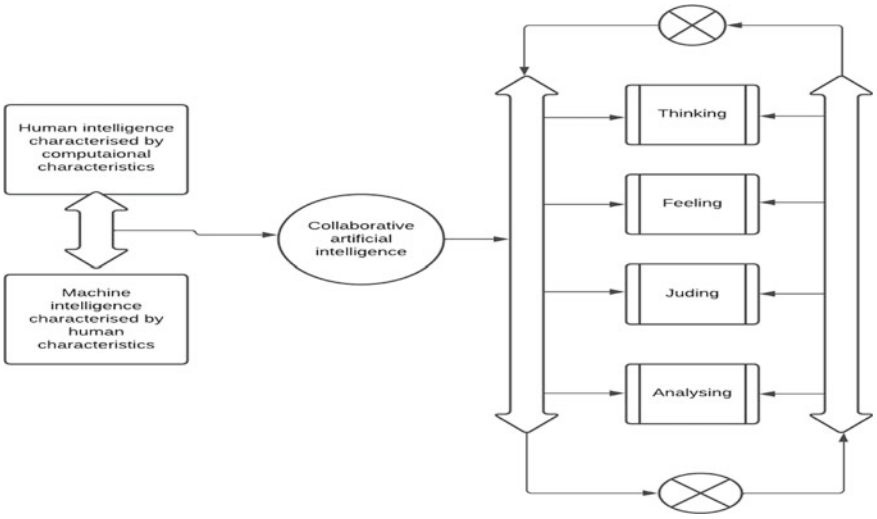

Fig. 5 Collaborative artificial intelligence framework working

3.2 Collaborative Artificial Intelligence in Business–Case 1

In the customer-centric market and economies using AI for efficiency and effectiveness is a trend and practice today. For the marketing domain, price predictions through data analytics, using robotics for customer services, decisions over personalization's over products using recommender systems usage of natural language processing for the engaging customer in the retail stores, etc. are concepts now. AI has moved retailing forward in many ways, such as making big data available for prediction, facilitating more informed retail and consumption decisions, enabling visual display and merchandise, and creating customer engagement [12].

Proposition 1 *In collaborative systems, the strengths of both humans and machines is to be capitalized. Under this, it is significant to develop a system that captures the biological characteristics of humans and the mechanical/analytical capabilities of machines. The intelligence provided by these humanistic machines is backed by non-contextual data as the machine does not comprehend what is the source of data (majorly big data is the input), models in the processing unit/system that along with algorithm knows how to learn by themselves and intelligence to predict the outcomes. If this is applied to the domain of Human resources, the following framework can be used.*

3.3 Challenge Problems in CAI Scenarios

It is significant to observe and gauge that the AI initiatives taken make it to production in business lines. The very first challenge lies in translating the data into business data, having the right data for decision making, and collaborating so that there is business value addition. All stakeholders from top to bottom must build a robust framework so that it is accepted at all levels. This helps in mitigating the bias, risks, and drifts in AI deployments across business lines and the realization that it will give in broader contributions.

1. Understand why collaboration is required and a necessity
2. Choosing the right platform for collaborative AI is significant, otherwise gaining insights is difficult.
3. It is challenging for organizations to decide what buy-in should happen and review it as possible to determine the ROI benefit to be rendered.
4. Even the organization chooses the best model for feasible solutions, AI is not perfect, so decision-makers should not expect full automation.
5. Models' effectiveness and ineffectiveness decide the measurable successful milestone an organization can achieve. Realizing this is significant in terms of cost-saving metrics for the organization.
6. Design your model to complement the strengths/weaknesses of human subject matter experts.
7. Optimizing human reviews for models' performance.

4 What is Society 5.0?

If the world looks over to prosperity it is essential that the economic and technological advancements happening should solve the problems of society. With the artificial intelligence profoundness as technological advancement, the societal problem can be identified, resolved, and mitigated using super artificial intelligence data systems. Japan, as an economy envisioned the futuristic society that Japan would have and called it Society 5.0. New development issues of modern society [13] led Japan Business Federation (Keidanren) to model Society 5.0 [14]. Society 5.0 presented a new vision of society, that follows the evolution of Society 1.0 (Pursuing society), Society 2.0 (Agricultural society), Society 3.0 (Industrial society), Society 4.0 (Information society). Society 5.0 keeps humans as the center focus creating a super-smart society that has a balanced usage of technology, nature, and social systems. This society covers AGI-Augmented general intelligence, Smart Society-Smart cities-smart government. All these systems focus on the Sustainable goals of 2030 on digital twin in cyberspace. Moreover, this super-intelligent society talks about genetic neuroscience, green economy, biohacking-multiple human development, smart cities, etc. As a pathway to this smart society, IoT (internet of things) including IIoT (Industrial Internet of Things) plays a momentous role. IoT (including industrial IoT (IIoT)) is an intensively developing technology that complements traditional and is usual to us (Internet of people) and is an automation basis in Industry 4.0 and Society 5.0 [15]. In conditions of restricted resources, severe competition, and growing globalization, organizations can improve the solving of social problems with the usage of advanced technologies, which enables connections of people, things, and technologies in cyberspace for the creation of new values for the industry in society [16].

4.1 IOT-CAI-Smart Cities

IoT is turning out to be progressively unavoidable to metropolitan conditions and giving the fundamental premise to maintainability and strength of the shrewd future urban communities. With the fast expansion within the sight of the Internet of Things (IoT) and future web innovations in the shrewd urban communities' unique situation, a lot of information (a.k.a. enormous information) is created, which should be appropriately overseen and dissected for different applications utilizing an organized and coordinated ICT approach. Frequently ICT instruments for a keen city manage diverse application spaces, for example, land use, transport, and energy, and seldom give a coordinated data point of view to manage land. Be that as it may, such data use requires proper programming apparatuses, administrations, and innovations to gather, store, examinations, and imagine a lot of information from the city climate, residents, and different land advancement offices and organizations at the city's scale to produce new information and backing dynamic.

The genuine worth of such information is acquired by new information procured by performing information examination utilizing different information mining, AI, or measurable strategies. Notwithstanding, the utilization of information examination for land improvement and the board is very wide, complex, and is quickly advancing. The intricacy in the land of the executives by information investigation is shown because of an assortment of issues:

1. Requirements of cross-topical applications e.g., energy, transport, water, metropolitan, and so on, and
2. Different wellsprings of information giving unstructured, semi-organized, or organized information, and
3. Dependability of the information.

A geo-Twitter analysis has proven to be a very successful data collection method [17]; A geo-Twitter analysis increases efficiency in analyzing many shared thoughts and opinions [18] and real-time information on ongoing social issues [19]. For instance, social media analytics has contributed to safeguarding Australian cities and their residents from the coronavirus outbreak (COVID-19) in 2020 [17]. Initially, sentiment and content analyses can be completed for the total location of the city bed example undertaken.

1. Nvivo content analysis for sentiment analysis using a year's trend data
2. Frequency analysis that measures the words repeated through the platform
3. Co-occurrence analysis that backs the usage of AI technology usage-keywords advanced keywords-expressing sentiments for urban development variables.

All these help in the spatial evidence creation for further learning-unsupervised and supervise.

4.2 IOT and Urban Knowledge

Roughly half of the total populace lives in metropolitan regions, a number which is relied upon to increment to almost 60% by 2030. For a country like India urbanization is inevitable and on record, 31% of Indians live in metropolitan regions. A consistent expansion in the metropolitan populace strains the restricted assets of a city, influences its flexibility to the expanding requests on assets and metropolitan administration faces truly expanding difficulties. Besides, supportable metropolitan turn of events, monetary development, and the executives of regular assets, for example, energy and water require better arranging and communitarian dynamic at the neighborhood level. In such a manner, the advancement in IoT and AI methods can give coordinated data knowledge to better metropolitan development. The board and administration, maintainable financial development and strategy improvement can utilize participatory cycles. As well as making a manageable modern savvy framework, defeating these difficulties can engage the residents as far as having an individual stake in the prosperity and improvement of their community life.

Therefore, city organizations can get new data and information that is concealed in enormous scope information to give better metropolitan administration and the board by applying these IoT arrangements. Such IoT empowered arrangements in this way empower proficient vehicle arranging, better water the board, worked on squandering the executives, new energy production systems, new developments, and underlying techniques for soundness of structures and successful climate. An incorporated information base has been proposed—a compartment of an assortment of detectable data required for the semantic portrayal of the metropolitan setting Fig. 6 The exploration has two interconnected goals: (1) to investigate the achievability of making a metropolitan information base and proposing an apparatus to help the development of parts of metropolitan elements and (2) to investigate how prescient demonstrating as a piece of examination can be utilized corresponding with AI innovation to improve the information needed for metropolitan advancement drives. The work of a few devices and canny procedures could uphold the method involved with catching and envisioning the recognizable appearance of conduct patterns and examples i.e., the parts of the metropolitan element. Removing subjective information from huge amounts of information is the ideal start of our quest for importance and conceivable clarification of metropolitan elements.

IoT and related innovations detecting advancements can clear away in a get-together, arranging, and the information however unstructured in nature from the metropolitan zones. The reasoning in choosing the zones would rely on the measures of improvement, the need for issue evolvements, and so on. What points out for the utilization of examination is the get-together of the proof and impressions of metropolitan change and besides then proposing how proficiently land advancement can be followed for future. We propose to inspect the manners by which metropolitan changes may be impacted by different segment, situational and ecological variables that portray the setting of interest. We recommend that work of smart advancements, for example, AI and information mining calculations give a likely answer for a portion of the difficulties in the metropolitan demonstrating, particularly programmed

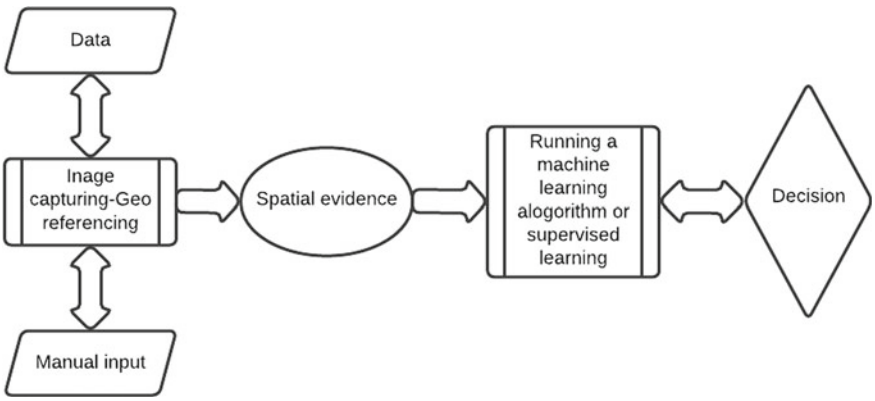

Fig. 6 Model for smart cities data acquisition and machine learning for decision making

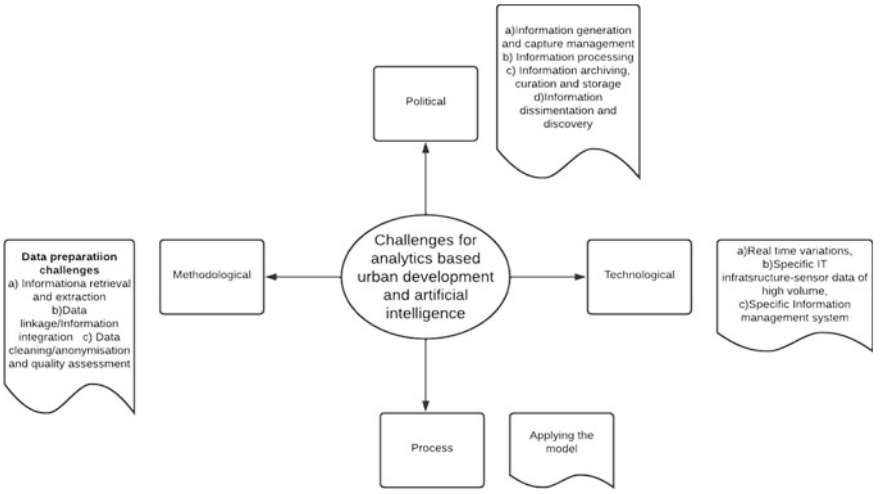

Fig. 7 AI-based Challenges through Analytics for Urban Developments

extraction, and acknowledgment of examples in immense amounts of different kinds of proof. Clarifications of patterns and signs got from the prescient model are bound to coordinate with the truth, since this records for more profound and more extravagant connections under information than oversimplified measurable investigation (see Fig. 7).

There have long been attempts in measuring a city's appearance in a consistent manner and on a larger scale [20]. The dominant method is by sending human auditors to the field to observe and record [21]. Recently, the availability of online street view images, which have unprecedentedly wide coverage of the built environment, provides a new methodological opportunity for this topic [22]. When combined with computer vision techniques, there is a possibility for the large-scale automatic evaluation of various high-level judgments on the urban built environment [23]. There is a need to preprocess information to give a reasonable structure to perform the general calculation. that shall gather the information in a structure that is valid for calculations. The system might utilize any city information which is an ideal proving ground for assessment distinguished as land prepared for improvement or it is a current created land that should have been remodified. The system proposed will link with the GIS system, and on linkage it shall send records (also called a bunch of tuples). These records are from the chosen city by the system. The structured layer and packaged layer would be the two data set tables to form where the system will initiate.

1. The First step is to group structures into a bunch of competitor regions and to carry out a basic information preprocessor for this reason. As they are delegated to be created and existing yet to be adjusted, we would initially group business structures inside a specific nearness limit. Little groups that have under 10 business structures will be sifted through in this progression.

2. The Second step is to stretch out as far as possible to consolidate nearby designs and bundles as a part of picked land to be remodified. The number of constructions in coming with regards to district contenders moved from tens through hundreds. To characterize more right gathering limits, we should join more separator data, e.g., geographic hindrances like mountains or streams, or man-made obstacles like frameworks and roads. At the point when the system had the gatherings, we used amassed data, like the typical size of constructions, as the plan of arrangements. This basis would assist with creating the pace of urbanization, accordingly, helping the emphasis on bunches characterized in the starter stage. These endeavors are coordinated toward prescient displaying of metropolitan advancement by presenting variable arrangements of the populace and financial factors—moving past the tight spotlight on actual availability and the climate—and investigating their connection and importance inside various AI calculations. The experience focuses on the significance of applying smart advances and prescient demonstrating that might help in comprehension and addressing metropolitan peculiarities. Still, in the beginning, stages of exploratory testing and model execution, the proposed coordinated information mining approach gives a promising beginning in building an establishment for the metropolitan displaying that the target is being both hypothetically and observationally based examination on the fate of this review.

5 Conclusions

Collaborative artificial intelligence as a facilitator to AI complimenting human intelligence and aptitude. It will endure advancing rapidly in the coming future. It is important to comprehend the usage and benefits this technology brings in, keeping in mind the societal dimension. This responsibility lies with the regulators, entrepreneurs, and businesses who are deploying AI solutions. In the deployment process the major challenge lies in matching the standards of innovation and demands AI talent to gear up with the expectations, this is where HR practices in organizations take a front seat. The rationale is that the AI talent supply is in deficit with the demand. There is a need for all stakeholders to bring together the AI leaders, business houses, academicians to identify the gap, find strategies to fill in the gap by goal setting with societal benefit and ease of usage and comprehension. Lastly, the AI professionals are needed who shall bear the responsibility for the solutions proposed. These professionals would be coming from any corner of the society who are well educated, strong, and diversified skill holders (technically) to create solutions for a creative society like the society 5.0.

For future scope: it is necessary to continue the investigation keeping in mind that the use, design, and implementation of AI and its types are regularized. There is a need for mathematical model development for smart city data capturing and analysis leading to the validation of the framework proposed. The technology is acting as a support to tasks and jobs, which would mean that few jobs will become obsolete.

This poses a challenge to the government, which is forming policies that would cater to the unemployed and obsolete job profile re-fillings through definite recruitment practices. As the authors propose the use of IoT for urban planning and development it is necessary that cyber security concerns are dealt with and then policies are formed.

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Dr. Aditi. V. Aljapurkar Assistant Professor at Dr. D. Y Patil B-School, Pune has 10 years of teaching and research experience. Her teaching and research orientations have roots while she worked in the State University from where she graduated towards achieving academic excellence. Apart from being a faculty at heart, she is engaged in research, training and now is venturing into writing skills. To her record, she has authored the book of HRM practices during the pandemic period across different sectors and companies. Her interest areas are Human Resource Management and Organisational Behaviour. To her credit are more than 20 research papers at the National and International levels. She is actively engaged in training for corporate roles through JD-based training in the roles of Human resources management. A vivid interest in corporate networking actively gets connected to different companies in start-ups and established setups in India.

Mr. Satyajit Ingawale is Assistant Professor at Ramchandran International Institute of Management (RIIM), Pune. He is pursuing his doctoral degree in the field of Supply chain management. He has 11 years of teaching and administration experience. He has a keen interest in research of general management, Supply chain management, and Human resources management. His other interest is in the administration field and social services. To his credit are more than 20 research papers at the National and International levels. He is actively engaged in student developmental activities and initiates them passionately.