Artificial intelligence and Human resource management

: New perspectives and challenges

Professor Woosung Park

Kyung Hee University

School of Management

pwoosung@khu.ac.kr

Introduction

Artificial intelligence(AI) takes ground rapidly in our life and management. The world was startled when Alpha-Go defeated Isedol, worldly famous professional go players in 2016. And it took win over Chinese go player Kerzey, considered as the number one of the world in 2017. DeepMind, subsidiary of Google Alphabet who developed it, invented AlphaGo Zero to fight with AlphaGo who had no human opponent after consecutive victories. It was a match between two artificial intelligence programs, and turned into a sweeping victory for AlphaGo Zero, who learned to play go by itself through reinforcement learning method.

This was an impressive and dramatic event that made people all around the world to feel the impressive rise of the artificial intelligence. What makes the artificial intelligence the hot agenda of our day is, however, the report at the World Economic Forum in 2016 speculating 510 million job loss till 2020 due to the new technological revolution mainly consisting of the artificial intelligence and big data (World Economic Forum, 2016). And this was not the first warning of the destructive effect of the artificial intelligence. In 2013, Frey and Osborne estimate that 47% of the jobs in USA are highly risky to be replaced by computers during 10 to 20 years coming (Frey and Osborne, 2013).

This fear is shared in the book "the Rise of the robots" written by Martin Ford depicting the near future where AI robots take human place (Ford 2015). The fear and anxiety are not just related to the massive job loss, but also result from the scary scenario that humankind is dominated and eventually become extinct by AI robots. Stephen Hawking, Elon Musk, Bill Gates are some of the well-known leaders who represent this view of dystopia. The idea that AI and robot dominate humankind one day was a main theme of scientific fiction movie, but has become more serious topic nowadays(小林 雅一, 2017; 前野隆司, 2018).

Everybody do not share the same point of view. Many researchers think that doom-laden fatalism is too much exaggerated and is not true, and result from a misunderstanding of cur rent state of technologies. For example, Autour(2015) rejects the job loss argument by saying that automation technology may destroy jobs but work still exist, and this perspective is shared by m any economists (野村直之, 2016). Regarding the domination of humankind by AI, AI researchers leading the research do not agree to that scenario. If that become true, AI need to have a f ree will or self-consciousness, and it is not possible at least under current period. According t hem.

Only history will tell us who are right, but it is certain that AI and robots fundamentally change our society and our work. What AI is trying to do is not to play go but to do more efficiently what human do, or what human even cannot imagine to do. Many authors are busy describing changes brought by this new technological revolution. Human resource management is not an exception. AI and robots will destroy or transform what employees do in the workplace, and require another form of organization in the future. And all the system and practices we are used to now to manage people, would not be necessary in the near future. Compared to this urgent situation, this area is still characterized by a lack of academic examination on the relationship between AI and HRM. It is because that HR academicians are lagging to understand and catch up with new technological change. A small number of publication exist, but mostly they can't answer logically why HR must be changed to the predicted direct. It is, therefore, time to examine the impact of the new technology including AI, big data, and robots on the human resource management.

There is not only artificial intelligence in this new technological revolution, and but also IoT, Cloud, 3D printer, biotechnology and gene engineering etc. However, AI plays a central role integrating this all technologies and that is why we want to concentrate our examination on AI. New digital technology is distinguished from the precedent one by its hyper-connectivity and AI is a linking pin of them. For example, big data need to be analyzed by AI to be fully exploited and machine and robots requires AI to function efficiently. In this sense, AI represents all digital transformation we are observing now.

This study has a purpose to explore new direction of the HRM that the AI technology demand for afterwards. It will be based on the technological impact on employees and organization. And more specifically, it is to find an appropriate HR strategy to cope with this technological revolution. It is to understand what kind of insight on the future the theoretical frame of strategic human resource management can give to us.

Understanding Artificial Intelligence

Before starting to examine the impact of AI and robots to organization and person working inside, it will be necessary to review briefly an artificial intelligence, more exactly what it is. Unfortunately there is no shared definition on AI, and everybody has his own definition (野村, 2016: p.57). This problem is understandable in that it is a research area where everything is rapidly developing, and

constantly evolving with an accelerating speed. However, it is also true that this lack of shared definition makes it difficult to study the impact of AI on people and organization.

What is an artificial intelligence? In spite of different definitions, we can define it *AI* as *a programmed algorithm with a learning capability, aiming to be human-like but to surpass human in its ability*. It is a preliminary definition but can capture an important characteristics of AI. The most basic nature of the artificial intelligence is that it is a programmed algorithm specialized on computing and analyzing, and it has a huge power of computing, analyzing and predicting. But it is now extending its application area, and evolve to the more general AI where experts diverge on the possibility and methods which leads to different definition of AI.

In fact, there are different type of AI as we can see in the table. AI begins from specialized to the rational computing (weak AI) and evolve into more human-like capacity, called strong AI. Strong AI is distinguished from AI in three aspects. First, it has a learning capability like human. Machine learning is a method to make AI learn by itself and deep learning is one of the machine learning, considered the most efficient way of training AI. There is still a hot debate if AI can really think autonomously like human and have a consciousness, but it is true that some experts are pursuing that direction.

[Table 1] Different Artificial Intelligence: Types and evolution

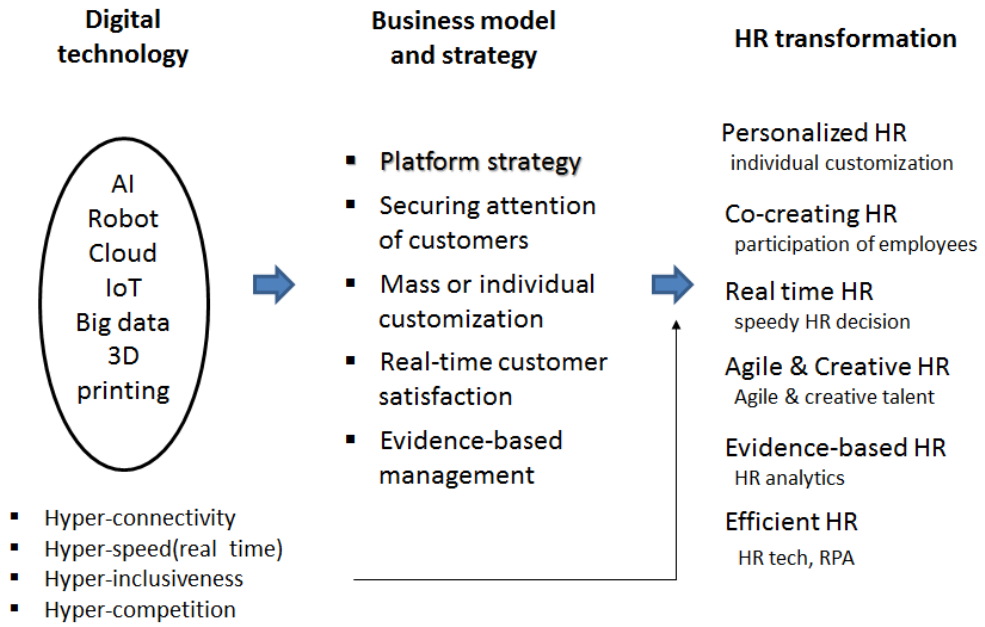
	Rational computing (weak AI)	**Similarity to human (strong AI)**
Thinking and inferring	Rational thinking (fixed algorithm) Charniak McDermott, 1985 Winston, 1992	Human-like thinking (self-learning) (autonomous thinking) Haugeland, 1985 Bellman, 1978
Acting AI + hardware (robot, IoT)	Rational acting Pool et al., 1998 Nilsson, 1998	Human-like acting Kurzweil, 1990 Rich Knight, 1991

Frame of understanding for Change in Human Resource Management

Digital technology brings about new business model and strategy. For example, many leading firms in IT industry have already opted for the planform strategy, and other firms are also desperate to find a platform where they can get so precious personal data of customers. They are not just contented to have the information but to secure their attention to understand their preferences and tastes they don't know themselves. Using these information, the firms do their best to customize their service or products and offer them on real time base. For doing so, they decide on data using AI algorithm.

All these change in business model and strategy require an important transformation in human resource management. Like they approach customers, they need to take care of employees on the individual base on the real-time base. To succeed in their new strategy, they have to foster more creative and agile human resource. On the other hand, they need to make use of human resource more exactly and efficiently. That's why HR analytics and HT tech using robotic process automation become so important for them. Figure 1 shows this channel of change in technology, business strategy and human resource management.

[Figure 1] Frame of understanding for HR change



Individually customized HRM

As I briefly mentioned earlier, business model of firms evolves into mass customization or individual customization. Data bank and credit scoring can evaluate personal credit score and genome based medical system treat patients on their individual genome characteristics. Customized production is gaining ground and Mercedes-Benz began to produce car according to customer's demand. Customer specifies his or her preferences in terms of sport, food or living, and receives a proposal for a Mercedes model which he or she will certainly like.

To be competitive in pursuing customization strategy, the firms need to take advantage of their human resource on individual base, which is enabled by AI. In this respect, HR decision has to be based on personal competence, needs or potential. HR practices for the high potential are already done in this direction. Rigid employee grading system tend to give way to individually customized HR system, like what Japanese サイボウズ or Korean NAVER did. Training also take that direction. IBM replace traditional collective development by the individually customized training and development.

HRM done on the real-time basis

Due to constant change in the environment, it become more important to take fast action than perfect decision. And to serve customers and win the competition, it is crucial to apprehend customers' needs and behavior on real time through SNS and platform, and suggest immediate solutions. This is exactly what Youtube, Facebook and Amazon do using their platform. In other firms, real time data can secured by IoT, analyzed immediately by AI, and take preventive action. GE try to transform their engine manufacturing business into maintenance solution business through this method.

Real-time intervention and decision making can be applied to human resource management. It takes often real time feedback and evaluation in the firms. Many companies are replacing relative evaluation with absolute one, and reinforce real time feedback. Adobe, IBM, GE, Microsoft are some examples, and they use IT applications for that purpose. Data analysis and real time decision can also be done for real-time recognition and spot bonus, or promotion or change of role and responsibility.

Evidence-based HRM

Thanks to the rapid increase in the complexity of environment, there are too many variables to consider to take a business decision, and it has become too risky to rely on intuition of management or personal gut. More and more CEOs acknowledge the necessity to use more data or fact-based decision making (Pfeffer and Shutton, 2006). And that is called as evidenced-based management. This can also apply exactly to human resource management, and examples are not scarce. The most well-known case is the oxygen project carried out in Google (Bock, 2015). Google examine a very simple but important question whether good leader makes difference, and support it with abundant result of data analysis.

This kind of evidence-based approach is found in other firms like IBM and Hitachi. IBM show clearly that employee engagement explains two thirds of customer satisfaction. The case of Hitachi is more interesting. It succeeds in demonstrating that happy employee and organizational vitality lead to high performance. For this, Hitachi invented some wearable device that employees keep on their body, and it collected all the data including bio-physiological ones they are not even conscious, and analyzed them using AI (矢野和男, 2015).

Efficient HRM based on RPA

It is a matter of course that routine HR activities have to be done efficiently while all the new direction of HRM are groped for. Divers method using AI are often called HR tech, and robotic process automation (RPA) is the most popular among them. Nissay(日本生命) adopted an employee of RPA ロボミ and 三菱東京UFJ銀行 go further using a collection of diverse RPA, called robot mansion. These RPA aim to reduce working time and workforce which allows employee to concentrate more valuable work. It is not rare now to see robot to conduct a job interview to job applicants like what have done at Softbank. At Strange Hotel(変なホテル), robot loaded with AI even serve at the front desk.

AI and business strategy

Now, every firm is faced with a challenging task to secure a competitive advantage in this uncertain AI era, and to formulate an appropriate strategy to support the survival and growth. What is the business strategy that a company can choose? In the discussion of the strategy, exploration versus exploitation has been used to explain the real competitive pressure and the dilemma in which many

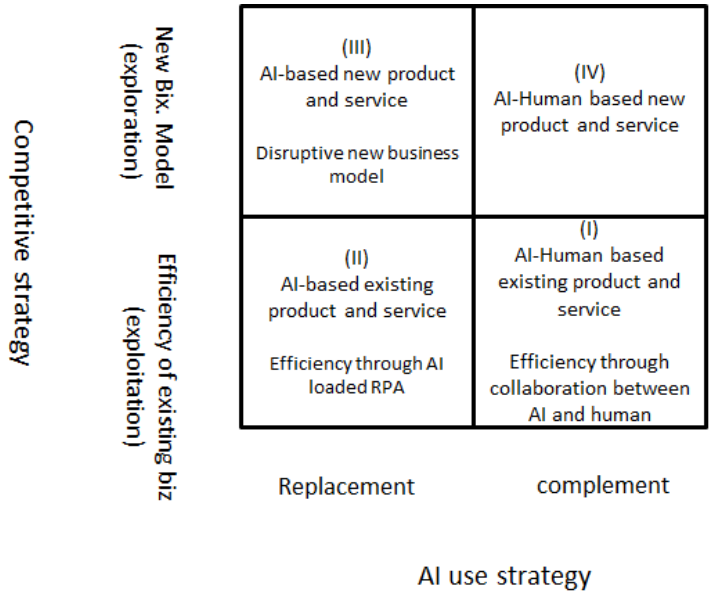
firms are experiencing (March, 1991; Uotila, 2018; Wu, 2018). Exploration means the strategic orientation or intention to make a maximum use of existing resources, and emphasize the productivity and efficiency. On the other hand, exploration is focused on the active search for the latent opportunity in the future, and its strategic direction is on the risk taking and innovative product or service.

To understand the strategic focus in a more comprehensive way in the era of AI, we have to include a strategic orientation of AI use in the firms. In the course of AI use, they have to option: replace human with AI or complement human with AI. Former consists of implementing AI actively to take advantage of the opportunity AI give. Foxconn' plan to construct human-free smart factor is a good example of former, while Mercedes' plan to make a car plant where human and AI robot can collaborate.

Different strategic orientations can be classified based on two dimensions: competitive strategy and AI use strategy. The combination of the two dimension gives us a two-by two matrix and offer 4 strategic options, as shown in the figure below. Option (I) consists of the all initiatives trying to improve efficiency through collaboration between human and AI, and smart factory operated by Mercedes-Benz is a good example of that kind. In fact, Industrie 4.0 jointly consulted and pursued by German government, business and unions is a strong proponent of this strategy.

Strategic model (II) is characterized by the active use to boost the productivity in the detriment of human workforce. The firms are more interested in making the process more efficiently by using AI than finding new business model or new product. For that purpose, robotic process automation (RPA) are fast introduced and used by many firms including Japanese ones. For example, 三菱東京UFJ銀行 reduced a lot of working time thanks to RPA introduced recently, and it plan to extend the application area of AI afterwards (日経情報ストラテジー, 2016).

[Figure 2] 4 types of different strategic option



Model (III) describe the strategic orientation of the firms aiming to get the market and customers by destroying existing technology and changing the tastes of the customers. They do the best to capitalize on the capability of the new technology. They are mainly small start-ups and just want to make a breakthrough in the established market and technology. For them, the disruptive effect of their new business model or service is not their concern. The workforce are mostly experts or entrepreneurs and number is very small, which explains why the collaboration between human and AI do not take a meaningful consideration in the strategy. Among big firm, Google Alphabet can be considered as a firm choosing this strategy.

Finally, strategic model (IV) is a strategic option consisting of the firms searching for a new business model by using actively AI but taking advantage of the collaboration between human and AI at the same time. The firm actually using this strategic option is rare. Maybe the firms tying to take new opportunity in the fast changing environment is so occupied to find technological solution, and do not feel the necessity to take advantage of the collaboration between human and AI.

HR strategy in the era of AI

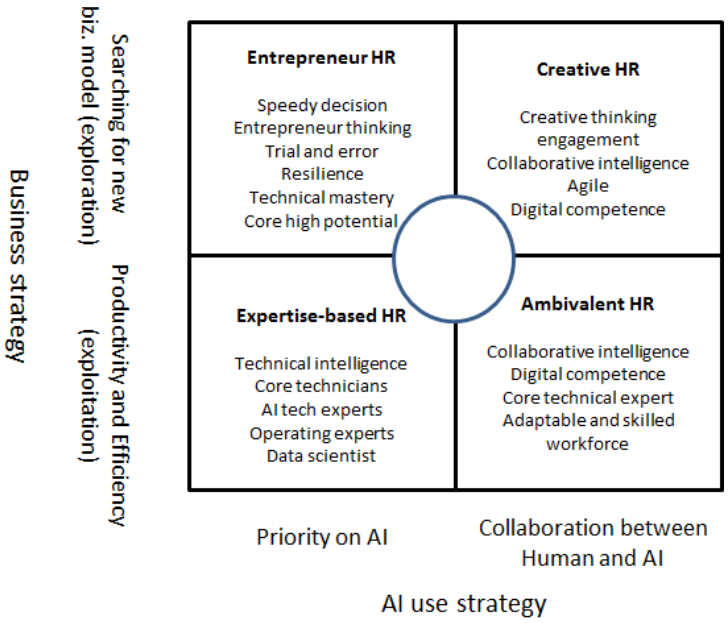
As strategic human resource theory says, HR strategy have to follow business strategy (Baird and Meshoulam, 1988; Wright and Snell, 1998). And many authors emphasize the role of the strategic

partner of business (Ulrich, 1996). Keeping in mind this theoretical discussion, we can propose some HR strategies fitting to each strategy type.

Entrepreneur HR strategy fit with a firm aiming to get the market by a new business model formulated through intensive use of AI. It can be mainly found in small start-up. Key HR challenge for these firms is to foster an entrepreneurial culture and people, because they need people capable of speedy decision making, risk-taking, and resilient to make a disruptive innovation in product and service.

Firms yearning for the disruptive innovation have another HR option emphasizing the collaboration between human and AI. They do not only rely on AI technology but also on the human creativity. Even more, they want to explore and capitalize on the human-AI collaborative intelligence. AI can assist and stimulate human creativity, and the synergy between them could be huge.

[Figure 3] HR strategy based on business strategy



On the other hand, the firms whose primary strategic focus is laid on the efficiency of the organizational activity and process have two choices for their HR. Expertise-based HR make use of the benefit from AI use and pursue operational excellence while reducing the workforce in proportion to the productivity gained. What they need as human resource is a small number of experts with good technical and digital competence. They need also engineers and data scientist to develop and introduce more efficient AI programs and solutions.

Ambivalent HR is oriented towards combining human and AI to make more flexible and efficient the existing product or service. They try to recruit and develop people who can understand machine logic and collaborate with AI. They want to introduce AI technology considering human characteristics and helping human to use their full potential. For this purpose, adaptability and digital competence is very highly considered as core skills.

Collaborative intelligence: source of competitiveness

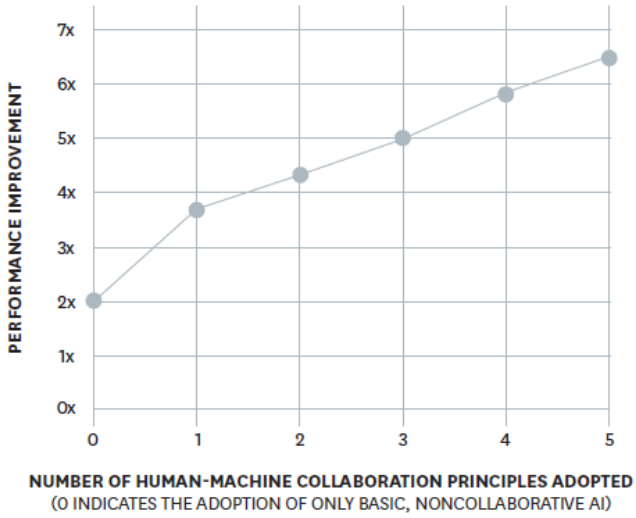
Although every firm has a choice in pursuing its business and HR strategy, it has to understand and stimulate the collaboration between human and AI. Even in the firms having AI focus strategy, they need a core people who can collaborate with AI to make an innovative change in business model. In fact, the need to promote the collaboration human and AI is a problem of degree. In a more proactive point of view, this kind of collaborative intelligence can be an important source of competitiveness now and in the future.

Before explaining the reason why collaborative intelligence can be a source of survival and growth, we have to mention the limit of AI without human strategy. If every firms use AI, then the distinctive competitiveness from the AI implementation can be disappeared. Another problem related to that strategy is a strong opposition from employees to the AI introduction, and important side effects could explode like Luddite movement we had observed in the industrialization. In addition, AI cannot replace all tasks of a job at least in the near future.

From the positive side, collaboration between human and AI can be beneficial for several reasons. First, AI's strength in speed and accuracy, big data analysis can eliminate overload of human's work like we see in the use of RPA, and allow humans to focus more fundamental and creative issues. On the other hand, humans can teach, advise AI it to interpret data, and to find solutions, using his experience and competence such as leadership, teamwork, creativity, social skill. Therefore, it is reasonable to believe that mutual collaboration between man and AI who understand and support each other leads to performance.

That's why some authors begin to emphasize that grand challenge in the new machine age for growth is to race with machine, instead of racing against machine (Brynjolfsson and McAfee, 2016). Some studies support that proposition. According to Wilson and Daugherty (2018), more the firms adopt for the human-machine collaboration principle, higher their performance level as it is shown in the figure below.

[Figure 4] man-machine collaboration and performance



There are interesting initiatives for that collaboration. Davenport and Ronanki (2018) introduce a financial firm where AI generates a financial plan, provides forecasting and minimize tax while human adviser customizes an implementation plan and serves as a behavioral coach for AI. This collaborative intelligence work well without a problem. This kind of collaboration can be observed in Mizho bank where human and AI has distinct different role. AI searches for the data and offer the exact information, and human concentrate on giving human touch to make ease and deeply communicate with clients. In the manufacturing industry, human and machine work together hand-in-hand. In the smart factor of Mercedes-Benz, AI controlled big machine work side by side with workers, and they help and teach each other. In the military field. Combination of human and machine is highly appreciated and pursued. American Pentagon's military plan is to make an ideal combination of soldier and robot complementing weakness of each other(小林雅一(2017). These examples clearly show to us that collaboration between human and AI is possible and beneficial to the employees and firms at the same time.

Theoretical perspective on the collective intelligence

The concept of collaborative intelligence is very interesting and insightful idea, and strong appeal to many practitioners and academicians. However, it is not well structured and have many unanswered theoretical questions. First, is it possible to talk about intelligence with AI? In fact, collaborative intelligence is an analogy to the collective intelligence. Collective intelligence (CI) is shared or group intelligence that emerges from the collaboration, collective efforts, and competition of many individuals and appears in consensus decision making. The term appears in sociobiology,

political science and in context of mass peer review and crowdsourcing applications. This concept has a long history in the academic tradition but it is Levy who popularized it (Levy, 1994; 1997). Collective intelligence emerges through individuals having intelligence, therefore, there is no conceptual problem. However, in the case of collaborative intelligence, we have to examine if AI can be an owner of intelligence. Surely, it depends on which AI we are talking about, but it is a fundamental question to be solved before proclaiming collaborative intelligence. Second problem which is related to the first one, is that we don't have a theoretical framework which can explain the process and outcome of that collaboration. In this regard, it has still long way to go.

It is to note that actor-network theory can be useful to refine concept of collaborative intelligence, because it rejects squarely the idea that intelligence is unique human nature. Human is just an algorithm, just like AI or all things related and operated around Internet of Things. In this case, human is not the only subjective being who claims sole autonomy and intelligence (Harari, 2017). It seems to downgrade human to the position of things or algorithm, but, by doing so, it paves a ground to consider human and AI as equal intelligent being communicating each other like IoT can communicate with internet protocol.

According to ANT, if we eliminate non-human in the picture, then our understanding for human and non-human is doomed to be very partial and limited(Hong, 2016). In fact, humans are living in constant interaction and influence. Non-humans like technology combined with human make a hybrid being, and offer to human new chance and constraint. They limit our free will and enforce humans to take specific position. In that sense, Non-humans are actors, and they are same full members of our society as humans. Under ANT, there is no superiority of human over things. They are equal, and more importantly they become themselves thanks to the other partner.

ANT offer us another useful clue to understand the process how the interaction between human and non-human including AI. Pure biological human does not exist. Or he can exist but cannot play any significant role. Human can take an action and exert an impact only combined with non-humans, such as computer, hand-tools, car etc. That's why all actors are networks in which every human and non-human actors are linked and interrelated. A capability of an individual is nothing less than network effect to whom he belongs. Therefore, to become more influential, every agent has to build an effective hybrid network consisting of human and non-humans (Hong, 2010). Building a network is a "translation" which are actions through them the intention of one actor become understandable to other actor (Hong, 2010). The translation consists of 4 stages, problematization, interessement, enrollment, and mobilization respectively and Callon explains them using an example of fisher and scallops in clam at St Brieuc Bay.

Challenge for HR

How to create collaborative intelligence then? First of all, the firm has to understand the anxiety and resistance of the employees to AI technology and help them to overcome it. For this happen, it is important to clarify company's strategy based on collaborative intelligence. This should not be a beautiful rhetoric but contain strong message consistently. And even more importantly, human experience and ideas have to be incorporated in designing and implementing AI system. It is better to make happen the improved performance through collaboration between human and AI as soon as possible. This 'quick-in success' can strengthen the collaboration more firmly.

Secondly, the firm need to build up digital literacy in the employees. It consists of basic knowledge of statistics, programming language. If fact, it is a basic language for communication between human and AI to understand each other. Selection criteria for hiring must include this skill and knowledge. Or digital awareness program can be offered to stimulate digital literacy for the incumbents. Company can support individually customized learning program. Make a composition of team more diverse including data scientist, functional expert and AI.

Thirdly, it is vital to cultivate and reinforce learning agility to cope with constant reconstruction of work. In fact, AI technology change constantly the content of the work, and the value of experience decrease and the future become more and more unpredictable. According to the constant change and evolution of technology, work need to be modified continuously. It is in this context that learning agility becomes crucial. The management can use learning agility as selection criteria for hiring of new comers. Or it is also used as an important element for development and selection of future leaders.

Fourthly, management need to stimulate insight and creative ideas from employees. In a sense, this is the most important human contribution. Human have to do what AI cannot do. It matters, therefore, to encourage employees to ask "why" always. It could be more important to bring out questions than to solve them. Solution can be found by human and AI through collaborative intelligence or open collaboration with collaborators outside the organization.

Last but not least, management should create open organizational culture. Managers have to take a good attention for that age or experience override over new ideas and competence. It is important to create an open and constructive atmosphere in which everyone speak up one's ideas without hesitation, in particular for the organizations that have a collective and hierarchical culture. It would be a miracle for them to survive in the technological torrents.

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