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Examining the Feasibilities of Industry 4.0 for the Hospitality Sector with the Lens of Management Practice

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Abstract: Industry 4.0 and its impact in the manufacturing sector are well documented. However, the service sector is understudied, and it is also facing the challenges of mass customization, digital enhancement, smart work environment, and efficient supply chain. The aim of this study is to fill this research gap by exploring the issues of Industry 4.0 in the service sector, with cases in the hospitality industry. All the challenges of Industry 4.0 require continuous innovation and learning, which is dependent on people and the enterprise's capabilities. Appropriate management approaches can play a vital role in the development of dynamic capabilities, and an effective learning and innovation environment. This paper proposes a framework of management practices which can promote the environment of innovation and learning in an organization, and hence facilitate business to match the pace of Industry 4.0 by facilitating technology acceptance e.g., digital enhancements and implementation of cyber physical systems (CPS). This study integrates the literature with logical beliefs to suggest the appropriate management practices for Industry 4.0. It represents one of the initial attempts to draw research attention towards the important role of management practices in Industry 4.0, as most of the recent studies have been restricted to the technological aspects. Semi-structured interviews of hospitality employees are conducted to explore the management practices suitable for meeting the challenges of Industry 4.0, specifically for informing the service sector.

Keywords: Industry 4.0; management practices; learning; innovative capability; information; knowledge management; hospitality

1. Introduction

Due to the recent technological leaps and pace of innovation, industry faces paradigm shifts, also known as industrial revolutions [1]. The first three industrial revolutions are characterized by mechanization, high electric energy usage, and automation and electronics, respectively [1]. Today's economy is heading toward the fourth industrial revolution, characterized by the use of cyber physical systems, smart factories, and service innovations [2,3]. Germany is playing a leading role in planning the next paradigm shift, and they came up with an idea of Industry 4.0 for the fourth industrial revolution [2]. The concept of Industry 4.0 originates from a German government project to promote digitalization or computerization. It is expected that implementation of the Industry 4.0 strategy can give a boost of 267 billion euro to the German economy [4]. It does not mean that this concept is only

applicable for Germany; in fact, Industry 4.0 is becoming a general strategy for the fourth industrial revolution, and it is being discussed by a number of researchers in different contexts and economies, e.g., [5,6].

Industry 4.0 is a subclass of digital transformation in existing businesses and processes [7]. It is characterized by the implementation of cyber physical systems (CPS), and smart production [3]. The main triggers of Industry 4.0 are the social, technological, political, and the economic deviations [3]. Major challenges for businesses in the Industry 4.0 environment are mass customization, effective and efficient supply chain, getting timely information of customer needs and wants, smart work environment, and the right combination of products and services [7]. Industry 4.0 requires flexible processes and high efficiency of the supply chain structures. It further needs better management of products, just in time production, and a more efficient time to market [8]. No doubt, these are very challenging and real issues for Industry 4.0, but another challenge which is ignored by the researchers is the development, training, and the management of people according to the Industry 4.0 environment and requirements, as most studies only discuss the technological aspects [3]. Furthermore, in the existing literature on Industry 4.0, most of the studies focus on only manufacturing firms, but the service sector is ignored by the researchers investigating the issues of Industry 4.0. The issues like supply chain efficiency, internet of things (IoTs), digital enhancement, smart work environment, and mass customization of services are also there in the service sector. This study addresses both of these issues by considering the Industry 4.0 concept and its impact in a people management perspective with the focus on the service industry, specifically the hospitality sector. In the hospitality sector, customer expectations are increasing, and the hospitality firms need to match these expectations, maintain the level of customer satisfaction and loyalty, and improve the service quality [9]. In this scenario, the concept of Industry 4.0 is very useful for the hospitality sector, as personalised service, efficient supply chain, agility, smart work environment, use of big data for up to date information of customer preferences, highly customized services at lower cost, and digital enhancement can really affect the customer satisfaction, loyalty, and the perceived service quality.

In an uncertain environment like Industry 4.0, the key to success is training, learning, and innovation capability [1]. Organizational training, learning, and innovations are heavily dependent on the role of employees [3,9]. Organizations need to devise strategies according to what they want and expect from their employees. In an environment like Industry 4.0, which is characterized by a high rate of changes, innovations and uncertainty, firms have to be extremely sensitive towards the changing needs and wants of their customers [3]. It is also a challenge for the employees to match with the pace of Industry 4.0. To enable employees to work at this pace, firms need to develop and maintain a climate of training, learning, and innovations to facilitate creative and learning work behaviour [10]. The main objectives of this study are to highlight the suitable management practices for Industry 4.0 to facilitate learning, knowledge management, and innovative capability, by integrating the literature and logical beliefs, and to present a case study of the hospitality sector in this context.

This study consists of two parts. The first part integrates the literature with logical beliefs to offer a viewpoint on the appropriate management practices for compatibility with Industry 4.0 in general. The second part focuses on the service sectors, and presents a case study of the hospitality industry, which is based on interviews of hospitality employees. In the second part, issues of the hospitality sector in the context of Industry 4.0 are explored. Furthermore, this study examines the management practices in the hospitality sector and compares it with what is needed for the implementation of the Industry 4.0 strategy by interpreting the interviews of hospitality employees.

2. Part 1: Management Practices for Compatibility with Industry 4.0

2.1. Management Practices for Industry 4.0

It is established that to be successful in the environment of Industry 4.0, organizations need to pay attention to training, learning, knowledge management, and innovation capability [1,3].

This can be about the implementation of cyber physical systems (i.e., computer networks, embedded actuators, sensors, etc.), differentiation, product or service reengineering, or making the supply chain more effective and efficient. In order to sustain smartness, innovative capability, and performance, organizations need creative and innovative employees who are capable of working in smart, uncertain, and competitive environments like Industry 4.0 [3]. Development of the workforce according to the requirements and conditions of Industry 4.0 needs relevant management practices. In a broader perspective, management means getting things done by the people [11], but it is not very simple. Managers need to adapt the managerial practices according to the environment and desired outcomes. In the context of this study, the environment of Industry 4.0 requires learning, knowledge management, and innovation capability which can facilitate the technology acceptance as broader outcomes [12,13], e.g., digital enhancements and the implementation of CPS. It is understandable that in Industry 4.0, organizations are facing many social, technological, and economic challenges. Dynamic capabilities and innovative employees are needed to face these challenges [3].

This study builds its arguments on the basis of assumption that the environment of Industry 4.0 is unstable and uncertain, which requires a high level of technology acceptance for digital enhancements and implementation of CPS, and technology acceptance can be enhanced by learning, effective knowledge management, and innovative capability, both at the individual and organizational level. This phenomenon is presented in Figure 1.

Therefore, this study aims at suggesting the managerial approaches which are more suitable for learning, and the knowledge management and innovation capabilities of both organizations and their individual employees. These management approaches are discussed below:

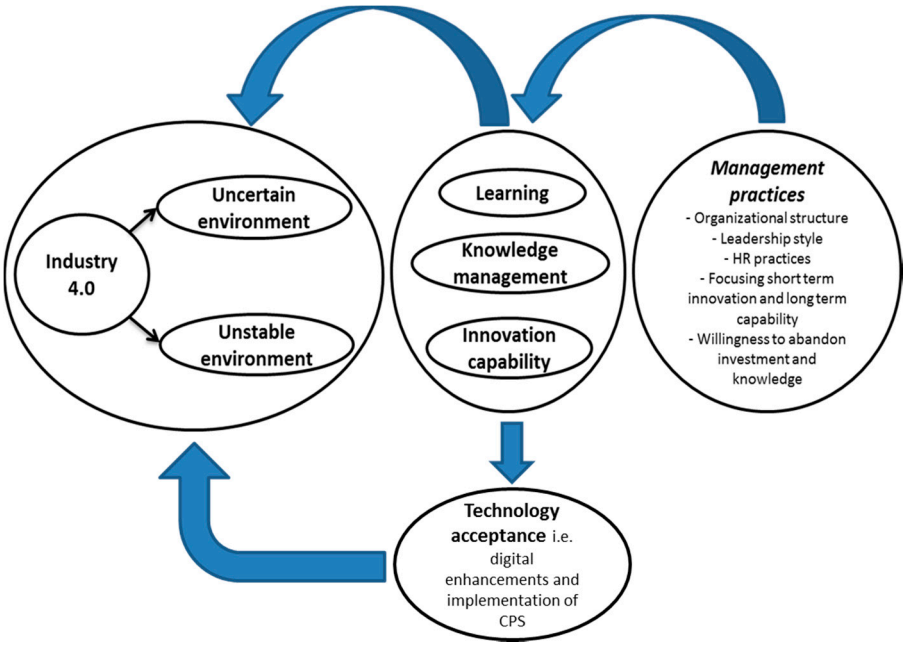

Figure 1. The conceptual framework.

2.2. Organizational Structure

In the situation where changes are very frequent, the organizational structure can play a vital role to develop the climate for innovation and learning [10]. Organizations can range from an organic design to a very mechanistic organizational design, on a broader continuum [14]. Characteristics of mechanistic design are specialized task, centralized authority, and decision making; more formal rules and rigid policies; top down communication; and many levels of hierarchy and authority. These kind of systems are more suitable in a stable environment where changes are not very frequent [15]. The environment of Industry 4.0 is not stable, so these types of organizational designs are not suitable

for it. In fact, Industry 4.0 needs an organic organization design which is not very formal; prefers flexible rules and policies; decentralization; empowerment of employees; collaborative team work; and horizontal communications [15]. Innovation capability in a changing environment is more compatible with an organic design of organization [14]. So it is rational to be in the organic paradigm of organizational design while deciding about the organizational structure for Industry 4.0. Thinking of a single type of organizational structure for Industry 4.0 is not a rational thing to do. Industry 4.0 needs flexibility in the organizational structure, according to the needs of the situation. No single structure is suitable for every organization. Every organization is different and accordingly needs a different structure [3]. Some of the suitable types of organizational structures for Industry 4.0 are discussed below:

***Matrix structure*:** In this type of organizational structure, activities are associated with more than one line of authority [16]. This kind of organizational structure groups the resources and people by product and function at the same time, through dual reporting arrangements [16]. This type of structure can respond to changing situations and uncertainty very promptly [11]. Each employee in this system normally reports to two bosses, i.e., one line manager and one product manager [11]. This system can also facilitate the formal linking mechanism in the organizations through joint problem solving by functional and product managers [10]. When an employee receives the guidelines from two experts, i.e., one line manager and the other product expert, in this scenario there are more opportunities for learning and thinking in a different ways. In this way, this system can be an effective source of interdepartmental knowledge sharing as well. This is very well established in the management literature that learning and knowledge sharing can lead to innovations, and enhance the innovative capability of organizations and individual employees as well [17,18]. Innovativeness, knowledge, and learning have the potential of influencing technology acceptance [12,13], so it can also facilitate the digital enhancements and implementation of CPS. On the basis of these arguments, it is logical to argue that the matrix structure can help the organization to match with the pace and requirements of Industry 4.0.

***Team based structure*:** A team based structure can be useful for Industry 4.0 settings, because it put multiple functions and processes in a single group heading towards common objectives [16]. It facilitates organizational learning by breaking the interdepartmental barriers, which leads to enhanced generalist skills, and a speedy decision making process [19,20]. Project based teams can especially be a really good facilitator of learning and innovation capabilities of organizations and individual employees [10,21], which are required in the uncertain and unstable environment of Industry 4.0. New routines and new knowledge are essential for innovations. Frequent technological changes are expected in Industry 4.0 and technological developments demand new technical solutions and also the reuse of existing ones [22]. Project teams create a learning environment which facilitates knowledge sourcing and the reuse of knowledge [23], which leads to organizational innovativeness [18] and technology acceptance among employees [13]. On the other hand, the innovation capability of a project team also depends on the learning goal orientation of team members [23]. So it is important for the project managers to motivate their group members for learning. They can do so by tolerating their mistakes, and by adopting a capability oriented supervisory style [9,24]. Therefore, it can be argued that a team based structure can facilitate the organization to match the requirements and pace of Industry 4.0.

***Flat hierarchy*:** Hierarchy in any organization refers to the chain of commands and it specifies the manager's authority at different organizational levels [11]. In a flat organization, normally there are fewer levels of hierarchy, but a wider span of control [11]. It means that there is a less number of managerial levels but the number of subordinates reporting to a manager is usually high, as compared to a tall organization. The flat structure of an organization suits an unstable and uncertain environment because it facilitates quicker decision making due to the closeness of top management to employees [11]. This closeness also increases the participation of employees in the decision making process and other business discussions [3]. This phenomenon of closeness and participation facilitates employee learning.

Furthermore, in the flat horizontal structure, feedback from top management is normally quicker and noise free [14]. On the basis of these arguments, it is very much logical to say that a flat organizational structure is more compatible with Industry 4.0, because it aids learning and innovation in organizations by facilitating employee participation in discussions and decision making, and through quicker communication [3].

***Decentralization*:** In a system characterized by decentralization, the responsibility and authority for decision making is usually transferred to the lower staff levels. This system is typically applied where it is believed that employees have better knowledge of the activities as compared the to top level management, due to very frequent changes in the business environment, and there is a need for quicker decision making. In decentralized organizations, the authority to take a decision normally lies with the lower managerial or sometimes even non managerial staff [11]. Employees do not need approval from the top management for ordinary matters. In the uncertain and unstable environment, which is likely to be faced in the implementation of Industry 4.0, decentralization can be fruitful for organizations. It enables employees to make decisions on time, and change strategy and direction according to the change in business situations and environments. This phenomenon also provides ample opportunities for learning for the employees, which facilitates innovation and technology acceptance in the organization [3,13]. So it is logical to say that decentralization is suitable for the implementation of the Industry 4.0 idea.

2.3. Leadership Style

Leadership is the art of influence others. It is inspiring, motivating, and providing the directions to achieve the desired outcomes [11]. According to the situational theories, leadership goals and behavioral outcomes of employees can be achieved by adapting the appropriate leadership style according to the situation [3,25]. The importance of leadership can also be witnessed in industry; for example, Apple Inc. is among the most innovative companies and according to many case studies it was due to the exceptional leadership skills of Steve Jobs, instead of his technical skills. Steve Jobs knew how to get the maximum output from his employees [26,27]. Adapting the appropriate leadership style according to the requirements and situation of Industry 4.0 can really boost innovations and learning in an organization both at the organizational and employee level [3]. Researchers have discussed a number of leadership styles in relation to employee and organizational innovativeness, learning, and knowledge management, but the most commonly discussed style is the transformation style of leadership [28–31]. Other prominent leadership styles for innovation and learning are authentic leadership [32] and transactional leadership [31,33]. To implement the concept of Industry 4.0, there is a need for a more specialized construct of leadership for promoting learning and knowledge management, which ultimately enhances organizational innovativeness and employee innovative work behavior as well [3]. Transformational leadership consists of idealized influence, providing vision, intellectual stimulation, and inspirational motivation [34], and it is a very well accepted construct having several positive outcomes. Industry 4.0 needs something more than the transformational leadership style, which should be primarily designed for learning and knowledge management, which leads to innovativeness [3]. The initial effort to design the specialized construct for learning and knowledge management is the development of knowledge oriented leadership [18]. Knowledge oriented leadership is basically a combination of the transactional and transformational styles of leadership [9]. However, the current construct of knowledge oriented leadership can be further extended to enhance the impact and compatibility for Industry 4.0 by adding a few more factors such as stimulating knowledge diffusion, innovative role modeling, mentoring, delegation, consulting, and supportive behavior [3]. These leadership behaviors appear as predictors of innovation in several studies e.g., [18,30,31]. This extended construct of knowledge oriented leadership can further facilitate the organizations and individual employees to accelerate the strategy of Industry 4.0 in order to face the fourth industrial revolution with more learning, knowledge, innovation capability, and technology acceptance.

2.4. Human Resource Practices

In order to achieve their organizational goals, companies need to develop the required skills, capability, attitudes, and behaviors among its employees. One of the major sources of shaping the capabilities, skills, attitudes, and behaviors of employees in any organization is its human resource (HR) practices [35]. So, if managers want to enhance learning, knowledge management, innovativeness, and technology acceptance, they need to design their HR strategy accordingly [36]. In a knowledge based economy, appropriate HR practices can provide a competitive advantage to organizations. The main HR practices are staffing, training, performance appraisal, job design, and compensation [36,37]. In order to successfully implement the concept of Industry 4.0, organizations need to design HR practices suitable for promoting learning and innovations in the organizations. These practices are discussed in more detail below:

***Staffing*:** To implement the idea of Industry 4.0, managers should seek a variety of knowledge and skills during the screening of candidates for hiring [3]. Extensive efforts should be made in the recruitment and selection process to select the right and desired candidate for a job [38]. In the context of Industry 4.0, innovative capability, learning, knowledge management, and technology acceptance are the critical factors. So, during the recruitment and selection process the focus should be on the candidate's attributes linked with innovative behavior, knowledge management practices, and technology acceptance [3], for example learning goal orientation and openness to experiences [12], cognitive ability, and creative self-efficacy. These employee attributes can facilitate the implementation of the Industry 4.0 concept, because these attributes can predict innovative capability, learning, and knowledge management. Learning goal orientation is characterized by engagement in challenging tasks, eagerness for self-improvement, and developing new skills, to achieve mastery [17]. Openness to experience is a personality trait and employees who are open to new experiences normally have an active imagination, prefer variety, their inner feelings are attentive, and they are intellectually curious, creative, and flexible in thinking [39,40]. Cognitive ability refers to the ability of knowing, thinking, and information processing [41], and creative self-efficacy is the self-belief that one has the ability to do a creative task [42]. All these factors are predictors of innovativeness, learning, and knowledge management, and should be given special attention while hiring employees in the environment of Industry 4.0.

***Training*:** Industry 4.0 organizations need to plan their training activities accordingly, to enhance the innovative capability, knowledge management, and learning [3]. Focus of the training activities should be to enable their employees to multitask. Training programs should not be limited to employee job activities only; in fact, it should focus on increasing the skill variety among the employees [37], for example, training for enhancing problem solving skills in general; and to enhance the technology acceptance among employees, in order to facilitate the digital enhancements and implementation of CPS. Team building should also be the prominent part of training programs, as it can lead to knowledge sharing and learning [19,20]. Continuous mentoring is also essential, and special trainings for managers are also important to enhance their ability to act as mentors, because effective mentoring has the potential of influencing learning, knowledge management, and innovativeness [43,44]. These kinds of trainings can help to prepare employees for the implementation of Industry 4.0, as a strategy to face the fourth industrial revolution.

***Compensation*:** The compensation structure for Industry 4.0 should be designed in order to promote knowledge management, learning, and innovativeness. Employees should receive additional or a part of their compensation based on their contribution and performance towards learning, knowledge management, and innovations. In the given situation of Industry 4.0, it is beneficial to give rewards for performance at the individual level, group level, and for organizational performance [3,38]. Profit sharing and incentive pay can link rewards with the performance at all levels [36]. This type of linked compensation structures can facilitate a climate suitable for innovations, learning, and knowledge management at both the employee and organizational level, which is required for Industry 4.0.

***Performance appraisal*:** The performance appraisal system of organizations has the ability to influence learning, knowledge management, and innovations [36]. In situations like Industry 4.0, the performance appraisal system should concentrate on employee development, behavior based, and the result based approaches [3,36]. Feedback on the employee performance should be a routine activity of managers. Objectivity of the performance appraisal system can motivate employees for any particular outcome as it makes it clearer for the employee on what basis he/she is going to be evaluated, for example, quantitative evaluation by using matrixes [3]. So, the HR managers should devise the mechanism that links their performance with learning, knowledge management, and innovation in a more objective manner, as these are the requirements of Industry 4.0. Establishing the performance standards is not the only important thing, but the communication of performance standards, performance measurement, performance comparison with the set standards, discussion of appraisal with the employee, and taking the corrective action where required is also very important for the effectiveness of the performance appraisal system [45]. There are different approaches for performance appraisal in different organizations. Management by objective (MBO) is one of the most effective and popular approaches. In this approach the objective setting and evaluation is mutual, i.e., both employee and the manager/boss participate in the process [45]. In this system, objectives are usually concise statements reflecting the desired outcomes. Decision making in this system is participative, and managers normally do not assign the objectives unilaterally. They do not impose goals on the employees. In the MBO system, managers and employees sit together and decide the ways to achieve objectives by mutual consensus. There is a very well defined timeline for each objective and feedback is usually ongoing, which facilitates the regular monitoring of actions and timely corrective action where required [3,45]. This kind of performance appraisal approach can really help the organization keep pace for Industry 4.0.

***Job design*:** This refers to the way that tasks are organized in any position and job. It also includes the mechanism of when and how the tasks should be done, and what are the factors having the potential to influence the task completion process. Furthermore it also includes the condition and climate of the task completion process [45]. Job design can play a healthy role in promoting the climate of learning, innovations, and knowledge management in the organization [36]. So in order to facilitate Industry 4.0, job design should be structured accordingly. Keeping in mind the importance of employee skills variety for Industry 4.0, job design should include extensive job rotation, flexible assignments in different areas, and extensive delegation of responsibility and authority [3]. Furthermore, it is also important for job design to aid team building and a collaborative work environment [38]. These kind of job designs can help the organization to adjust with Industry 4.0.

2.5. Long-Term Capabilities and Short-Term Innovations

Due to rapid technological, political, social, and economical changes, the environment for Industry 4.0 is very uncertain and unstable. In such an environment, projects are normally planned for a shorter developmental period [1]. Along with these short term projects, organizations should not ignore the longer term perspective, because it is also crucial. Innovations are not expected to last for a long time in such an unstable environment. So innovations should be taken as part of the organizational routine, by developing longer term dynamic capabilities, both at the organizational and employee level. It is possible by applying appropriate management tools according to the needs of the situation [46]. To implement the concept of Industry 4.0, employees and the organizations should have the capability of changing their direction as per changes in the environment, which can be facilitated by focusing on short term innovations and long term capabilities.

2.6. Willingness to Abandon Current Investment and Knowledge

Due to a highly uncertain and unstable environment caused by frequent changes in technology, economy, political, and social norms, the style of investment needs to be very flexible and ready to be changed and abandoned [47]. In order to strengthen the process of innovation in organizations,

there needs to be willingness to abandon outdated investment and knowledge, where required. Organizations should strengthen their core competencies by acquiring the latest knowledge and then converting this knowledge into core competencies. Learning and innovation sometimes need to abandon the existing knowledge, skill, experience, and investment, in order to be altered by new technologies [47], which requires acceptance among the employees. In uncertain and unstable environments, if organizations tend to save the current knowledge and investment, in this way they might ignore the latest methods of working and technology, which can be a major cause of business failure [47], especially in the environment of Industry 4.0.

3. Part 2: A Case of the Hospitality Sector

3.1. Industry 4.0 and the Hospitality Sector

In this section, Industry 4.0 is discussed in the context of the service sector, by presenting a case study of the hospitality industry. As explained in the previous section, learning, knowledge, and innovation are crucial for successful implementation of Industry 4.0. The hospitality sector is facing the problem of high employee turnover. When an employee leaves the organization, the skills, knowledge, and experience of the employee also goes with the employee who quits [48]. In this way, high turnover affects intellectual capital and the innovative capability of the organization because of knowledge loss [49]. In this scenario, it is very logical to argue that hospitality firms need to have special arrangements for knowledge retention, which is possible through the promotion of knowledge management activities [9,46], which is among one of the key requirements of Industry 4.0, along with learning and innovation capability [3]. It is also important for the hospitality sector to enhance customer experience. Knowledge management and innovation have the ability to positively affect service quality, which leads to customer satisfaction and loyalty [46].

The upcoming fourth industrial revolution also affects the hospitality industry because the challenges of mass customization, smart working, and digitalization are also there in hospitality firms. Every customer is different and demands personalized service, and it is the duty of hospitality employees to provide customized service [50]. This study investigates these issues in the hospitality sector, and also discusses the management practices in the context of Industry 4.0.

3.2. Methodology

To evaluate the hospitality sector in the context of Industry 4.0, semi structured interviews of four and five star hotel employees, working at different levels were conducted. It was done by using the snowball sampling technique; in simple terms, it is also known as chain referral sampling, in which one participant refers to the other potential participant. Initially, 77 hotels were contacted to request employee participation by sending the request letter by email and also by personal visits. Due to the very low response rate, one of the authors then personally visited four and five star hotels in Bournemouth and London to directly contact employees. After getting positive responses from several employees, the snowball sampling technique was applied. In this way, 10 interviews were recorded with the permission of participants from five hotels. Among the participants, four are front line employees, four are shift managers, and two are senior managers. On the request letter, the purpose of the interview was well explained, and the statement of anonymity of information was also there in the request letter.

The concept of Industry 4.0 was explained to each participant before asking any questions. Then questions related to the challenges of Industry 4.0 and the management practices were asked, to evaluate the preparedness and compatibility of the current situation in the hospitality sector with Industry 4.0. Each question leads to several sub questions, and the exploration of important factors in the given context. The interviews are interpreted by using the descriptive approach. The summary of the participants is presented in Table 1.

Table 1. Interview participants.

Hotel ID	Hotel Category	Number of Interviewees	Front Line Employees	Shift Managers	Senior Managers
Hotel 1	Four star	1		1	
Hotel 2	Four star	2	1		1
Hotel 3	Five star	4	2	1	1
Hotel 4	Four star	2	1	1	
Hotel 5	Five star	1		1	

3.3. Findings

With the help of the semi structured interviews of hospitality employees, firstly the main issues and challenges of Industry 4.0, which are also relevant to the hospitality sector, are examined. Mainly, these issues are mass customization, efficient supply chain, and digitalization. These are explained in detail below:

3.3.1. Mixture of Customization and Standardization

Based on the findings from the interviews, it should not be argued that the hospitality industry is focusing solely on customization or standardization. They are actually doing both. Most of the international chains are following a uniform approach globally, for example, the very formal style of communications. On the other hand, there are highly customized packages for the corporate customers. However there are situations when employees provide customized services due to other factors. For example one of the interviewees said: "When my boss is absent, I can provide customized service more easily".

Similarly, several other interviewees argued that the empowerment of taking decisions helps them to alter services according to the customer and current situation. The delegation of responsibility and authority makes the employee feel more empowered, which is actually motivating them to provide customized solutions. This is also one of the needs of Industry 4.0, to provide customized services. On the basis of these findings, it can be argued that the delegation of responsibility and authority, less monitoring by supervisors, together with empowerment encourages employees to do the random customization of service.

Customization exists in the hospitality sector, like providing different types of rooms, food, and other facilities to customers. For example, customers are asked at the time of booking about preferences like the type of room, food, and other room services. These are arrangements of providing different hospitality experiences to different customers, but it cannot be called mass customization. In fact, it is a sort of standardized customization.

Figure 2 summarizes the discussion and shows how the delegation of authority along with less monitoring can empower the employee and promote random customization of services. It suggests revisiting the supervision level and intensity in the hospitality firms in order to foster customization of services.

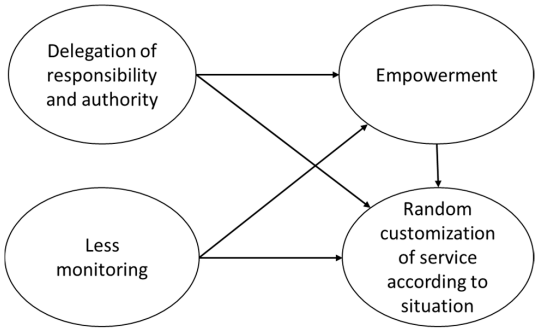

Figure 2. Facilitators of the random customization of service.

3.3.2. Supply Chain Efficiency

In the service sector, supply chain refers to the sequence and arrangement of processes to provide services. It is another challenge for Industry 4.0, which exists in the hospitality sector. According to the information provided by the participants, the hospitality sector is doing well in this context through incremental innovations and technological advancements. Due to advance technologies and the Internet of Things (IoTs), the supply chain process is becoming very efficient and smart. Hospitality firms now have their own mobile apps for booking and other services. Hotels are linked with different third party booking websites offering different options and packages for different hospitality firms, for example www.booking.com, and www.skyscanner.com, which is actually a collaborative supply chain, and makes the supply chain process more smart and efficient. Many customers who are comfortable with the use of technology, are adopting the smart self-service options provided by hospitality firms, for example in hotels, controlling everything with your phone, like the electronic key in a mobile app that eliminates the need of going to the reception and asking for keys.

3.3.3. Digitalization

Digitalization is happening in the hospitality sector, and it is also being rewarded in different ways. Digitalization at the work place refers to the integration of digital technology in routine work. It is the conversion of information to the digital format. Based on the findings of the interviews, the hospitality sector is focusing on digitalization to generate long term capabilities for more effective and efficient business intelligence. Information systems are given considerable importance in this context. According to the information provided by participants, firms are using multiple information systems. Customer information is entered and updated in the system. Firms try to collect the maximum information of clients which helps in many ways, for example with supply chain issue, as there is no need to repeat certain processes in the case of a repeat customer, because the system automatically generates everything on the customer app. It saves time for both employees and customers and enhances supply chain efficiency. The style of information presentation in the system is also important, as effective and clear presentation motivates the employees to understand multiple sources of information. For example, one of the participants said that: "Availability of information in shape of a graphical form helps her to learn new knowledge by understanding the patterns of information".

In this way, the effectiveness and efficiency of information systems is helping the hospitality employee to learn new things. Some of the participants also acknowledged the role of information availability in idea generation and innovative thinking. It is also acknowledged by interviewees that the availability of such a system helps them to be prepared for any type of customer query and they feel more proactive and confident due to the availability and clarity of information. In this way it can be argued that the availability and clarity of information enhances the effectiveness of a system, which ultimately leads to employee learning, innovative capability, and technology acceptance, e.g., digital enhancements.

Figure 3 presents the summary of the idea how the availability and clarity of digital information influences learning; and innovation capability through information system effectiveness, and how this phenomenon ultimately enhances the compatibility with industry 4.0. If hospitality firm ensures the availability of clear digital information and information system effectiveness, they can enhance the learning experience of employees which increases the innovation capability.

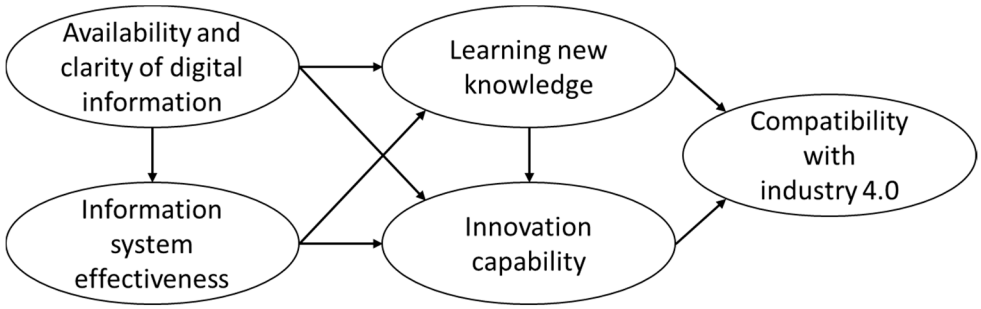

Figure 3. Availability of clear information and compatibility with Industry 4.0.

3.4. Management Issues of the Hospitality Sector in the Context of Industry 4.0

On the basis of information provided by the participants in interviews, the descriptive approach is used to identify the major management issues in the hospitality sector. As mentioned earlier, this study builds its arguments on the basis of the conjecture that the successful implementation of Industry 4.0 concepts depend on learning, knowledge management, and innovative capability, so the factors affecting these key variables for Industry 4.0 are discussed below with the help of interviews of hospitality employees.

3.4.1. Providing Vision

One of the common factors among hospitality employees found in this study is the lack of vision. On asking the question about the use and interest in different types of information and knowledge, most of the employees are interested in the information and knowledge relevant to their own department and job in the broader perspective. For example, employees working in the marketing department are not interested in financial information and knowledge. On asking why they are not interested in financial information and knowledge, they said that it is not relevant to them. On asking follow-up questions on this, it is found that their vision for their career growth is limited to a high position in the marketing department, and they are not expecting themselves to be among the top management of the organization in the future. In this case, it is the lack of vision which is hindering the interest of employees for gaining knowledge which can be helpful in the future. As visionary employees, they should consider themselves as potential candidates for some top organizational positions in the future. This problem is very much related to leadership in the organization. As discussed earlier in part 1 of this study, leadership plays an important role in providing vision, especially the transformational style of leadership. Providing vision is one of the main factors in the construct of transformational leadership [50]. This problem indicates some leadership issues in the hospitality sector. Based on these findings, it can be argued that due to the lack of providing vision from the leadership, employees are not very visionary and hence do not show interest in additional interdepartmental information and knowledge, which ultimately hinders innovative capability.

Figure 4 highlights the important role of leadership to provide a clear and motivating vision to the employees. Broader vision can increase the interest of the employee in additional and interdepartmental information and knowledge, and enhances the innovative capability, which is required to meet the requirements of industry 4.0.

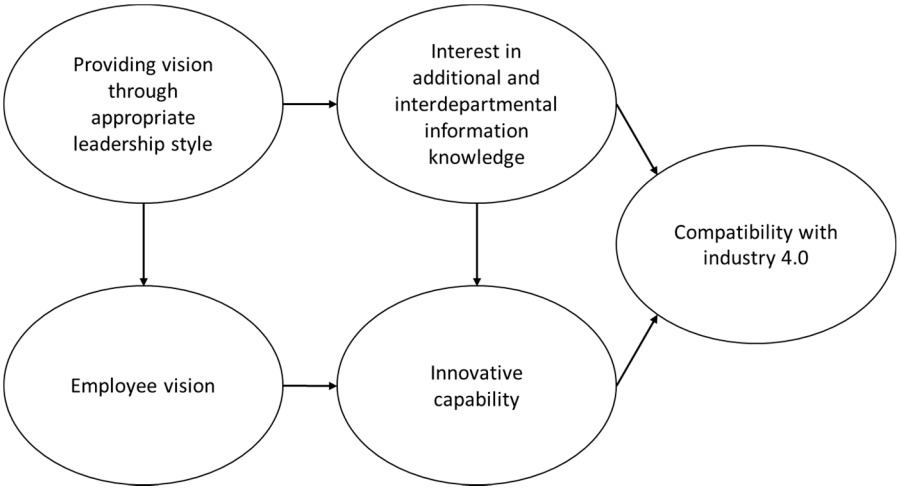

Figure 4. Providing vision leading to Industry 4.0 compatibility.

3.4.2. Not a Preferred Career Choice

Another major concern found during this investigation is that most of the employees, especially the front line employees, do not prefer a long term career in the hospitality sector. This is also reflected by the high employee turnover of the hospitality sector [48]. This problem is a major issue which is related to the HR management strategies. Due to lack of preference as a career choice, many employees do not want to learn and grow in this industry. They do not want knowledge to increase their innovation capability and problem solving skills in the industry because they do not consider it as a long term career. For example, on asking a question about gaining knowledge to enhance innovative capability, one participant said that "I do not want to do extra work and gain extra knowledge, other than required to perform my current job, because I do not want to pursue career in the hospitality sector".

On the basis of these findings it can be argued that career preference negatively affects the interest in learning and knowledge and also hinders the innovative capability of the hospitality firm and individual employee.

Figure 5 explains how the career preference affects the innovative capability by influencing the interest in knowledge and learning. A preferred career influences the tendency to gain additional knowledge and learning which leads to innovative capability, which is much needed in the environment of industry 4.0.

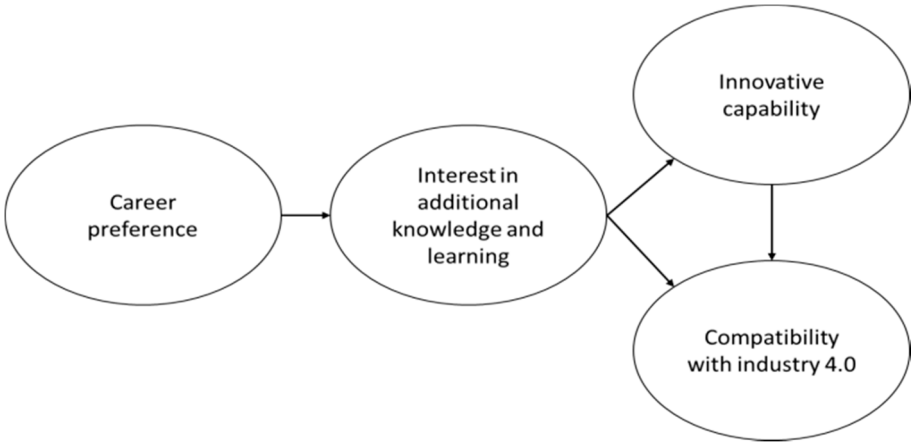

Figure 5. Role of career preference.

3.4.3. Non-Interactive Trainings

Different types of trainings are being provided to the existing and new employees in the hospitality sector. This is also an important role of the HR department. The most common type of training highlighted during interviews is the online training manuals. Employees are provided with different electronic training manuals for routine jobs, new projects, or products, and for the new employees. These types of trainings are not very interactive and participative. If something is unclear, employees need to clarify it themselves. However, the lack of interaction and clarity was found to have a positive effect on learning and innovative capability in a unique way. When employees are not clear of something, or something is not being told in a simple and straight forward way, in this situation they need to think for themselves and they might come up with a different approach to solve the problem. This phenomenon can lead to new knowledge and procedures. For example, one of the participants said that: "Due to lack of interaction and clarity in training manuals, sometimes she needs to think of alternative ways of doing things".

In this way, the lack of interaction and straight forward solutions to problems, sometimes leads to idea generation and implementation. This may lead to innovative capability. Therefore, it is not always recommended to provide unclear training manuals, but for some non-core activities, organizations can use this as a tool to enhance the innovative capability of employees.

Figure 6 explains how the non-interactive trainings for non-core activities can affect the innovative capability due to unclear solutions leading to increased tendency to think alternative solution, which results in knowledge creation and idea generation.

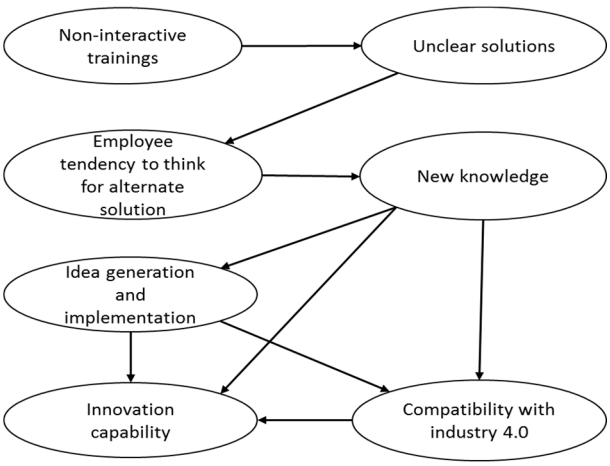

Figure 6. Non-interactive training for non-core activities as a tool for innovation capability and Industry 4.0 compatibility.

3.4.4. Job Design

Job design is also an important issue of HR management. There is extensive job rotation in the hospitality sector, which enables employees to multitask. According to the information provided by participants, this kind of multitasking enables them to learn different things, and expands their knowledge. However, for whatever job they perform, many employees reported that they are fully packed with the tasks at hand, and do not have time to look for information which is not directly relevant to the current tasks at hand. The main hub of information in the hospitality sector is its information system. Research revealed that analyzing different information and understanding the pattern of information leads to knowledge creation [51]. So the issue found in this research with job design is the lack of time for information analysis by using the information system because of a fully packed schedule. For example, on asking a question about the use of the information system to analyze multiple information sources, one of the respondents argued that "She wants to see and

analyze different information other than those needed for the current task in hand, but she does not have time for it in working hours".

Although they have flexible time shifts, they do not have sufficient free time for extra learning activities. Another important issue found in this study related to job design is the lack of autonomy. Employees reported that they are not empowered to take important decisions on the spot when it is needed. It hinders the tendency of providing innovative and customized services, which are the major concerns of Industry 4.0.

Figure 7 presents the summarized discussion on how the busy routine and lack of time for information analysis can reduce the innovative capability and knowledge creation. Fully packed routine of hospitality employee hinders the tendency to create new knowledge and negatively affects innovative capability.

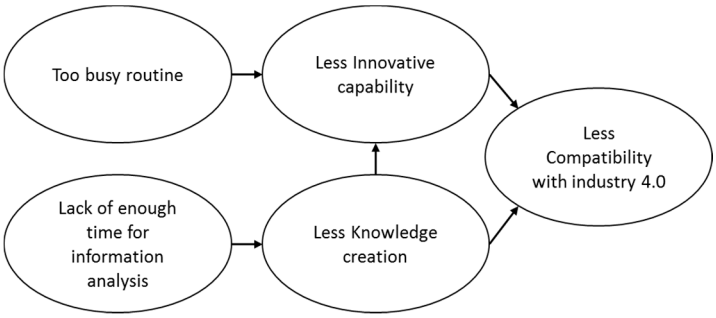

Figure 7. Too busy employee routine hindering the Industry 4.0 compatibility.

3.4.5. Staffing Issues

It is revealed that while hiring new employees, managers put most emphasis on employee retention. Managers make sure that the new hire stays in the organization for a longer period of time. This is basically linked with the fact that there is very high employee turnover in the hospitality sector [49]. One of the reasons for turn over found in this study is that hospitality is not a preferred career option for many employees, as mentioned above. It is good to consider employee retention during the recruitment and selection process. Hospitality managers also prefer to hire employees who they think are suitable for operational efficiency, but this study found some important things were missing. During the interviews, it is found that many employees in the hospitality sector explore information, seek new knowledge, and try to think of innovative solutions because of their personality. For example, one employee said that "I always seek new knowledge, because I want to be prepared of any uncertain and uninvited thing in advance. A customer can ask for anything and it is not good for you and organization to leave the customer dissatisfied".

This statement sheds lights on several important attributes, which should be given consideration during the hiring process, including a proactive personality, openness to new experiences, learning and performance goal orientation, and commitment. Seeking new knowledge reflects learning goal orientation, readiness for uncertainty reflects openness to experience, advanced preparation is a proactive approach, consciousness about customer services is relevant to performance orientation, and thinking what is good for the organization reflects organizational commitment and loyalty. The existing literature shows that all of these factors are a strong predictor of knowledge management, learning, and innovative capability. So it can be argued that hospitality recruiters should also put more emphasis on these factors, i.e., learning, knowledge, and innovations, which are the key factors for Industry 4.0. The current staffing approach of the hospitality sector is not very well aligned with the Industry 4.0 concept as it lacks the focus on learning, knowledge management, and innovative capability.

3.4.6. Performance Appraisal Issues

The current system and processes of performance appraisal in the hospitality sector are effective in general. They take care of important appraisal issues, i.e., MBO, objective and subjective evaluation, etc. However in the context of Industry 4.0, the direct explicit link is missing with learning, knowledge management, and innovative capability of individual employees. The subjective approach of performance appraisal is also common in hospitality firms, and in certain situations it is rational. Sometimes employee stats do not reflect actual performance and the contribution of employees, and due to some uncontrollable factors, the documented performance is not a true reflection of an employee's actual capabilities. For example, one of participants said that: "My previous manager who is now promoted had a high level of trust in my abilities, and he often assigned me the tasks beyond my job description. There are a few systems and procedural improvements due to my recommendations. My new manager rates me as an average employee in the performance appraisal on the basis of documented achievements against my documented objectives assigned to me in the beginning of year. On the intervention of my previous manager and addition of her subjective evaluation, I am promoted".

For Industry 4.0, emphases on learning, knowledge management, and innovative capability are important in the performance appraisal process. One way of evaluating and linking these variables with performance appraisal is subjective judgment, as done in the case mentioned above. However there is need to create an objective link as well. Knowledge and innovations should be systematically linked with the assigned objective, and additional objectives purely relevant to knowledge management, and innovation should be assigned. It is found that employees do the things that they think is important for their promotion. For example one of the participants argued that "I know that on what objectives I am going to be evaluated in performance appraisal, so I would not waste my efforts on unwanted and extra things which are not linked with my promotion".

Therefore, if the motivation to do something is based on promotion, managers should link the promotion with knowledge work and innovative performance. In this way, the performance appraisal system can facilitate the implementation of Industry 4.0.

3.4.7. Willingness to Share Information and Mutual Trust

Some employees reported that their bosses are often reluctant to share exact strategic information, and keep things confidential. This situation is detrimental to the environment, where there is a lack of mutual trust. For example, one participant said that: "Sometime my boss assigns me the tasks and I do not know why I am doing this. I think that he assumes that I might share the confidential information outside the firm or I might leave the organization".

Another employee shed light on the issue that there is certain information in the system that is without access. She said that: "I am a career oriented person and I want to learn, I want to analyze the corporate information but sometime it happens that I am in need of information for learning but there is no access to that information".

It is noted that there is certain information which is not shared with employees in a transparent way because senior management considers that it is important to be kept confidential. On the other hand, this confidentiality hinders the process of learning and knowledge management in several situations, which can slow down the pace which is required for the implementation of Industry 4.0. Organizations need to develop trust and loyalty among employees. A lack of trust can be linked with high employee turnover in the industry. Developing trust and loyalty can be done through appropriate leadership strategies and providing ownership of tasks, for example transformational leadership, knowledge oriented leadership, end result orientation, and capability orientation. Not sharing information reflects the culture of a high power distance preference, where managers keep a certain distance from the employees [52]. Once the organization successfully develops trust and loyalty, they can share the transparent information. Then, the availability of information can enhance learning and innovative capabilities, and this study also found that loyalty is important for knowledge sharing and

correcting the existing knowledge. In this way, the willingness to share information and mutual trust can facilitate Industry 4.0.

3.4.8. Platform for Knowledge Sharing

There are explicit platforms for employees to share their knowledge in hospitality firms. For example, in one hotel there is a practice that at the end of the shifts, employees fill a card on which they write what they observe during the working hours, e.g., problems faced, solutions offered, any unique experiences, etc. After filling this card they share the cards with each other. This is a good practice for knowledge and experience sharing which can increase the innovative capability of an organization and its employees by increasing their knowledge. However several interviewees reported that they have a lot in their minds but they do not know how to implement and transfer their ideas. This problem can also be found in the existing literature, as according to a survey, 45% of organizational knowledge exists in the minds of the employees [51]. On asking the question about storing the tacit knowledge in the information system of the organization, or converting their knowledge into procedures and policies, most of the employees had nothing to say. This clearly indicates the lack of cyber *Ba* in the organization. *Ba* is a Japanese term used for a knowledge sharing platform and is associated with the SECI model (the SECI model shows four ways of knowledge conversion, which are socialization; externalization; combination; and internalization (SECI)) of knowledge creation [20]. To enhance the process of learning and innovative capability, hospitality firms need to strengthen their platforms for knowledge sharing. They also need to convert the tacit knowledge of employees into organizational knowledge by transferring it into the organizational memory.

4. Discussion and Conclusions

In the first part of the study, the literature is integrated with logical beliefs to offer a view point on appropriate management practices for Industry 4.0. In the second part, management practices in the hospitality sector are examined to check the suitability of Industry 4.0. This study has highlighted a number of strengths and weaknesses of the hospitality sector in term of management practices in an Industry 4.0 environment. Management practices are important for stimulating learning and knowledge management, which enhances people's capabilities and technology acceptance. In turn, this capability is converted into innovation, which facilitates the compatibility with Industry 4.0 [3].

Industry 4.0 is a well-developed strategy to prepare for the fourth industrial revolution. Therefore, it is important to view it from all angles. Researchers have reported on technological aspects, but existing studies are restricted to manufacturing technologies. There are two major research lags that need to catch up: (1) None of the studies discuss how to develop the skills required for Industry 4.0, and what the appropriate management practices are; and (2) Existing research on Industry 4.0 does not covers the service sector. It is accepted that the primary focus of Industry 4.0 is the manufacturing sector, but the service sector is an indispensable part of supply and value chains and is also facing several similar challenges such as mass customization, smart working, digitalization, smart service, etc. This study has attempted to fill these gaps by investigating appropriate management practices in the hospitality sector, so as to enhance the compatibility with Industry 4.0 through learning, knowledge management, and innovative capability.

This study also provides practical implications for managers, especially in the hospitality sector. The study proposes a number of mechanisms to enhance the innovative capability, which is linked with the successful implementation of Industry 4.0, e.g., by facilitating technology acceptance including digital enhancements and the implementation of CPS. Managers can evaluate their tactics towards knowledge management and innovative capability on the basis of frameworks proposed in this study, and hence can act accordingly for improvements. Particularly, the HR management of hospitality firms has much to do with the findings of this study, in order to adjust job designs, staffing criteria, performance appraisal system, and the type of trainings to be provided. By doing these appropriately,

managers can enhance learning, knowledge management, innovative capability, and technology acceptance, and hence enable their organization to operate in the environment of Industry 4.0.

This study has offered a rich future research agenda for quantitative validation. All the models proposed in this study need to be validated by using quantitative research methods. Structural equation modelling can be a useful tool to examine these models. There is a need to develop the scale to measure the variables explored in this study. This is an initial attempt to explore the management factors important for the implementation of Industry 4.0, using the inductive approach. In future research, each factor can be discussed in more depth. Furthermore, this study is limited to the hospitality sector in the UK. To increase the generalizability of the findings, further research is necessary in other service sectors, and other geographical locations with a larger sample size. Industry 4.0 is initially a German concept, but is obtaining an expanding popularity as compared to other strategies for future industry. A number of other economies also plan for revolutionary up-gradation in their business environments. For example, in addition to the UK's "Manufacturing 2050", the USA is working on the "Smart Manufacturing Leadership Coalition" (SMLC), and China is implementing a strategic plan of "China Manufacturing 2025". In the future, these strategies should also be considered for academic research concerning their management approaches to implementation, and a comparison of Industry 4.0 with SMLC and China manufacturing 2025 could be a valuable contribution.

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