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LEADERSHIP QUALITIES AND SKILLS IN THE CONTEXT OF INDUSTRY 4.0

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Abstract
To successfully support a mindset of innovation in an organization, there must be strong leadership. As a result, leaders play a very important part in the shift to Industry 4.0. In the setting of Industry 4.0, this paper will talk about the most important traits and skills of a boss. Most of it was based on a study of the literature on leadership and Industry 4.0. As a result of this work, 10 leadership traits for industry 4.0 have been identified, along with how they relate to 4 groups of leadership skills: thinking skills, interpersonal skills, business skills, and strategy skills. These skills might be needed for leaders in the shift to Industry 4.0, which the organizations might think about.

Keywords:leadershipskills;leadership;Industry4.0,theoreticalapproach

1. Introduction

Industry 4.0 (I4.0) is the term for the current trend towards a manufacturing system that is highly linked and computerized, also called a "Smart Factory" [1]. In a smart factory, people, tools, and other resources that are used to make things talk to each other as easily as people do on a social network. The smart-manufacturing application rests on sensors that collect data in real time and separate industrial components that can connect to each other [3]. Investing in digital technologies like sensors, connectivity devices, software, and apps like the factory execution system (MES) [4] is also a very important part of I4.0 implementation.

I4.0 is a step towards a digital change in industry [1]. In this case, the digital environment includes the merging of the real and virtual worlds and the digitization of processes [5]. The digital industrial revolution promises to make manufacturing systems more flexible, allow for mass customization, speed up production, and improve quality and efficiency. In the meantime, companies will need to spend in tools, information and communication technologies, data analysis, and the integration of all data along the value chain in order to get these benefits [6]. Not only can these investments be expensive, but the changes and actions in processes at all levels of value creation carry the risk of throwing stable process chains out of balance or greatly disrupting them.

Leadership is an important part of I4.0 for organizations, because the change mode of production requires strategic choices at all levels of the organization that have a big impact. [1]. In this situation, the leaders of the future will need to be more sensitive to the trends and signs that network data shows [7]. They should try to figure out a direction that is set by a group of people working together in a field where growth, change, and opportunities are always happening [7]. To learn about the science of connectedness and organizational network learning [7], these leaders will need to build connected organizations and networks.

R. Kelly's [7] list of leadership stages for each Industrial Revolution (IR) shows how they change over time. For the first IR, charismatic leadership [7] has to do with how a leader acts and gets people to work together [8] through actions and personal traits. Scientific management had a big impact on the second IR. In scientific management, leaders have a top-down style, but they could also be called commanding leaders [7]. For the third IR, leadership is defined by relationship leadership, which is based on the theories of transformational leadership [7, 9] and aims to give people more freedom to come up with new ideas and work together. The third IR is also marked by transactional leadership, which is more about achieving the goals of followers and getting credit for it [10]. This study will look at both the leadership traits that are already needed and the new traits that are needed for the fourth IR.

Also, I4.0 needs more than just a boss who can change things. It also needs to put more emphasis on learning and new ideas [11]. A. Haddud and D. McAllen [12] say that it's important to know and understand more about the traits and skills of leaders in order to manage digital environments well. They also say that it's important to make sure that leadership styles match the needs of digital environments. [12]. Since a person's characteristic is a "prominent trait or aspect of something" [13], figuring out what those traits are in the context of I4.0 becomes a very important problem. It can help leaders deal with the difficult changes that come up when smart production systems are used. It can also help with the shift to I4.0 by helping them understand how to act in such a setting.

Skill is the ability to do something well. It includes both physical and mental skills that have to do with understanding or knowing something [14]. To have a skill, you need to have learned it through study, practice, and experience. In a digital environment, leaders need to change or improve their skills to act, predict markets and trends, make an informed business decision, and change the plan if technology and the market environment change in unexpected ways [18]. But leaders need to get ready by keeping their knowledge and skills up to date and learning more about which traits could help them do their jobs in a digital and flexible world, as I4.0 expects.

So, the goal of this study is to show the main qualities of leadership in the I4.0 setting and the skills that could help develop these qualities, based on a subjective theoretical analysis. This study talks about experimental research as a reason for this. This is because the topic is still being discussed and the information in the area has not yet been gathered. We also think that a theory study of the area will help make the paper's goal a reality in future research projects. Different bibliographies sources from Web of

Science (WoS) and Scopus were used in the exploratory study. The format of this paper, then, is made up of five parts. This section's first part is an opening. In the second part, there is a study of the literature on I4.0, the qualities of leadership in I4.0, and the skills that leaders should have. Based on a theoretical contribution, the third section shows how this study was done, and the fourth section shows the data and talks about the analysis. Last, the fifth part talks about the conclusion and possible study that could be done in the future.

Industry 4.0

4.0 is sometimes called the fourth industrial revolution. Even though simple digitalization was already a part of the third industrial revolution, this simple digitalization is changing inexorably in the fourth industrial revolution. This is because many new pairings of technologies are giving innovation a boost [19]. The fourth industrial revolution is different from the others for three reasons: first, the speed, which is about how the world is connected in an exponential way and how new technologies lead to more innovations. The second reason is breadth and depth. Using the third industrial revolution as a point of reference and combining it with different technologies, this is a good way to explain this. And the third, the systemic effect, is the change to the whole system, whether it's a country, a company, a network for creating wealth, or society as a whole [19].

I4.0 is a term for all of the tools and ideas that are used by organizations in smart, linked value creation chains. In smart companies with a flexible structure, the Cyber-Physical System (CPS) watches the physical process to make a virtual copy of the real world and makes decisions without a central authority [20]. The Internet of Things (IoT) is thought to be the most important link between real-world and digital applications. It links real-world items (called "things") to their digital representations in an Internet-like structure. No longer just people take part, but also things [19]. So, IoT makes it possible for the CPS to talk to and work with people in real time.

Also, the Internet of Services (IoS) helps to improve the internal and cross-organizational services that players in the value chain can use [20].

Changes to the production process, design, product, operation, and systems linked to production are making the product's lifetime and value creation lines more complicated [21]. For example, at many spots along the value creation chain, sensors, transmitters, or radio frequency identification (RFID) systems are constantly sending information through the IoT that helps organizations to keep an eye on their processes. This can include keeping track of transports, materials, or tools, as well as process factors or key performance indicators (KPIs).
In the digital age and with cyber-physical systems, customer needs and expectations of ongoing innovation lead to shorter product life cycles, which is a problem for many companies [22].
Integration of technology, organizational change, data protection [22], encouraging people to try out new ideas at work, getting and using the right technologies, and sharing decision-making are all examples of challenges in an I4.0 setting [23]. To get people to work together, leaders must be confident and quick on their feet, focus on communication, and help people turn a goal into something real and exciting [24]. This leadership has to act in and support an environment that is flexible, which is the foundation for driving changes and making customers happier [25].
Innovative methods need to make use of technology, smart gadgets that are tied to the internet, and new ways to communicate and work together. These problems need wise choices and strong guidance.

The Leadership in Industry 4.0 context
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We picked and analysed key terms that could describe the "characteristics" of leadership 4.0 based on the theoretical approach to leadership in the I4.0 context that we found in databases like WoS and Scopus. Since a unified meaning of leadership 4.0 or leadership in the I4.0 setting is still being worked on, we looked at the relevance and possible definitions of the authors we used as references. So, the sum of these traits is: 1) responsive leadership, 2) swarm leadership, 3) learning and innovation leadership, 4) open leadership, 5) agile leadership, 6) participative leadership, 7) network leadership, 8) trust leadership, 9) digital leadership, and 10) collaborative leadership. In the research part, the leadership 4.0 traits that were found will be used. In the next part, we'll talk about how important leading skills are in groups.
Skillsofleadership

To figure out how to create leaders for I4.0, it's important to know which leadership skills are needed and how they connect to the main characteristics of leadership 4.0 that were discussed in the last section. Individual differences in cognitive abilities, personalities, temperaments, ability to control feelings, identities, and values, which come from both national context and personal experience [34], play a role in how people learn and improve their leadership skills.
The writers T. Mumford, M. Campion, and F. Morgeson [35] came up with a plan to put leadership skills in order. They put these skills into four groups, which are: 1) the cognitive skills, which are needed by executive leaders to understand the complex behaviour of patterns and include creative thinking, decision making, and strategic problem solving; 2) the interpersonal skills, which are "goal-directed behaviours used in face-to-face interactions to bring about a desired state of affairs"; and 3) the business skills, which include organization, negotiation, and management of personal, financial, and material resources. Table 1 shows that these four groups of leadership skills are made up of different skills [35].

R. Ashkenas and B. Manville [17] interviewed great leaders of big corporations, startups, and non-profits to find out what they thought it took to become a leader. They came up with a list of six leadership skills based on what they said. Based on their research, these skills are: 1) creating a vision to focus and challenge the team; 2) turning the vision into a clear strategy for what to do and what not to do; 3) recruiting, developing, and rewarding a great team of people; 4) focusing on measurable results; 5) encouraging innovation and learning to keep the team or organization going; and 6) leading yourself. The writers say that the best way to get good at these leadership skills is to practise them all the time and get real-world experience, not just read books or go to classes or workshops [17].
M. J. Sousa et al. [40] found two skill set types of 4.0 leadership for the hotel industry. One was more about how people interact with each other, and the other was more about how to use technology. The most important leadership skills are being there for customers, being able to listen, working as a team, getting along with customers and coworkers, having a good appearance, using digital tools in their jobs, handling customer problems, and being able to deal with change [40]. When two 4.0 leadership skill profiles and the skills themselves are found, hospitality organizations will be more likely to come up with new leadership training that will help the business succeed [40].
In a survey about jobs in the digital age done by MIT Sloan and Deloitte, more than 90% of the people interviewed, including managers, analysts, and executives, said that skills need to be updated at least once a year to be able to work in the digital world [23]. In this situation, training and planning are important if you want to learn skills that are useful in the setting of the fourth industrial revolution. So, getting new skills at work can lead to a different organizational culture [40].

2. Methodology

As explained in the first part, the goal of this study is to find out what the most important leadership traits and skills are in I4.0. 1) a theoretical approach to leadership in the I4.0 context based on key terms to represent the leadership characteristics in I4.0, as described in section 2.2;
2) a search for leadership skills to support the leadership characteristics in I4.0, taking into account the use of leadership skills proposed by [35]; and 3) a subjective interpretation analysis to find a link between the groups of leadership skills and the characteristics of leaders 4.0. The next section explains how each step fits together and how it works.
Based on a review of the literature in the WoS and Scopus sources, this study made a list of the predicted traits for leadership 4.0. As motivations for getting these traits, the skills leaders need to have in I4.0 settings were also found. As [23] and [40] say, leadership skills are important to the job of a leader in the I4.0 context. The idea here is that leadership skills could drive the growth of the leadership 4.0 traits that have been found. So, it's important to figure out which skills should be worked on to improve each I4.0-related leadership trait. Using the model by T. Mumford, M. Campion, and F. Morgeson [35], the link between these leadership skills and the leadership traits was found. "Straplex" is what the authors called the process of building leadership skills at all levels of an organization. "Stratify" refers to the number of levels in an organized system, and "plex" comes from the word "complex," which means "divided into a certain number of parts" [35].

Table 1 already shows that the needed leadership skills for each group were written down [35]. For example, the interpersonal skills group's skill of discussion was coded as IS3, and then it was linked to the leadership 4.0 trait. For this study, we looked at Table 1's leadership skills from a subjective point of view based on how each skill's role was described by [35] and tied them to leadership 4.0 traits based on their context and descriptions. So, the skills picked for each trait help people understand the part of each skill when it's put to use. The skills that were chosen were based on how many times each skill was linked with a leader's trait in I4.0. For this link to make sense, the criteria were skills with better connection rates (those that were related to five or more of the ten leadership 4.0 characteristics). In the next part about the major results, the link between leadership 4.0 characteristics and leadership skills is shown.

3. ResultsandDiscussion

Figure 1 shows how the ten leadership traits (which are summarized in section 2.2 as the Leadership 4.0 or leader's traits in an I4.0 environment) relate to the required skills (Table 1), which are grouped into four categories: cognitive skills, interpersonal skills, business skills, and strategic skills [35].
The most important skills for the brain group (CS) are: Speaking (CS1): Leaders need to talk to each other and share information in a digital and flexible way so that everyone is better connected, learning and creativity are encouraged, a network environment is built, and more people get involved. Active hearing (CS2): pushing people to work together, building a feedback culture, and being open to people's ideas. Active learning (CS5): to prepare for and act in new digital situations and to encourage experimentation for learning and innovating with the use of different tools, driven by a digital attitude. And critical thought (CS6): Leaders need to be able to think critically about the digital world and the challenges they face when trying to use new, good tools in their businesses.
The skills that stand out most in the group of interpersonal leadership (IS) are: negotiation (IS3): It's important for leaders to make deals that everyone in their companies can benefit from. This makes the workplace more creative and encourages workers to try new things and come up with new ideas. Persuasion (IS4): It's important to create a learning and innovation setting that helps partners make decisions and, as a result, gets people to think in a more open and digital way.

And finally, the social perception (IS1): It is important for leaders to know how to prepare and train people to act in digital settings, as well as how to ensure participation, trust, and teamwork, which will lead to a more participatory culture.
The skills that stand out most for a group of strategic leaders (SS) are: visioning (SS1): This is important for a leader to know when coming up with a vision and plan for building a new, learning culture that is also more collaborative, shared, and decentralized. The discovery of key causes (SS5): checking the needs that could help encourage experimentation, spread a more collaborative, participatory, and networked culture, and make use of I4.0's major technologies. System evaluation (SS3) and solution appraisal (SS7) were also important skills for leaders.
These skills let them evaluate the technologies that companies have bought, as well as how they use internal and external network communication platforms. This lets them find gaps and problems that need to be fixed right away.
On the other hand, the projected link between the business leadership skills group (BS) and the leadership 4.0 characteristic was weaker. One reason could be that these skills, which help with the managing of personnel resources (BS2), cash resources (BS3), and material resources (BS4), are used less often. If the types of leadership for I4.0 are more collaborative, participatory, and decentralized, people will feel more motivated to make decisions and try new things to make a network culture that is agile and flexible. But the operations analysis skill (BS1) was more linked to leadership 4.0 because it helps evaluate the digital, responsive, and agile scenarios that I4.0 settings require. Technical skills were not addressed in the study because it was focused on the four groups of leadership skills [35]. This was done so that the leadership skills could be linked to the leadership 4.0 traits. But in future studies, technical skills could also be looked at, since I4.0 requires leaders to deal with and use technology.
Even though a lot of work has been done to link specific leadership skills to the characteristics of leadership 4.0, this paper's major addition may be the systematization of the ten leadership characteristics for I4.0 based on literature, as shown in Figure 1. Each of the leadership 4.0 traits can be better understood by looking at how they relate to the leadership skills listed in [35]. So, we think that leaders will be able to make a better shift to I4.0 if they build these traits and skills and use them in their work.

4. ConclusionandFutureResearch

With a theoretical method, the goal of this study was to show a link between the traits of leadership 4.0 and certain leadership skills. Based on this link, the key skills that could be most useful in an I4.0 setting are cognitive skills, interpersonal skills, and strategy skills. The results of this study can help develop leaders in a digital environment by helping us better understand and enable the development of these skills by putting them to use. This will help maintain and build the ten characteristics of leaders 4.0 that were listed in this study. This paper could also help people who are not experts because it has information that is easy to understand. Also, this paper makes an academic contribution to the literature that was looked at, since it talks about leadership and skills in the I4.0 context. Leadership and skills are important things to think about when putting new technologies into place, and they are also things that are still being developed, so there isn't a lot of solid knowledge about them yet. This work can be thought of as an addition to theory. Theoretical input takes into account the factors to be analyzed (what), how these factors relate to each other (how), and why these relationships are important (why) [41]. So, in the literature study, we talked about the leadership 4.0 traits and skills (i.e., the things that needed to be looked at). After that, we showed how and why these factors are related and important.
This paper has a weakness in that it doesn't look at other things, like the difficulties of I4.0 and leadership 4.0. The use of the leadership model suggested by [35] was also a weakness, since other leadership skills, such as the technical skill set, could have been taken into account. The last problem with this work was that only the writers did a subjective study, and there was no validation from experts in the field. For future research, we plan to expand the literature study and do field research with experts from industry and

academia. We will then compare the data to improve the leadership 4.0 traits and skills and show that they are relevant and useful.

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