An analysis of Leadership and proactivity to face the challenges of industry 5.0

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Abstract. Industry 5.0 is a new technological revolution accompanied by a process of changes as it aims to enhance the transformation of the industrial sector into intelligent spaces based on the Internet of Things, artificial intelligence, and robotics, among others. For this reason, industry 5.0 involves challenges, one of them is the knowledge of people in the fields of robotics and artificial intelligence to achieve adequate interaction between machines and operators. Therefore, the organization's responsibility is based on training employees in virtual education, in addition to safe training that can prevent employees from going through unnecessary problems during training sessions, in addition to enhancing communication and motivation of employees to obtain interactive knowledge environments [1] and thus can better adapt to these changes; which is why the need arises to find an appropriate leadership style that develops self-initiated behaviors in employees to carry out processes, autonomy to make decisions and confidence to face challenges. This article is important because it analyzes a perspective that has not been analyzed before and is an appropriate leadership style that develops proactive behavior of employees to overcome the challenges of Industry 5.0.

1 Introduction

The advances, developments and economic and social transformations experienced in the world have given rise to the so-called "Industrial Revolutions" that marked key and significant stages towards the path of what is today called the Fourth Industrial Revolution, which is manifested mainly by the development of technology and digitalization, leading to its most advanced and revolutionary expression, which is Industry 4.0 [2]. Industry 4.0 is mainly concerned with technology-driven productivity [3].

Derived from the above, the European Union in January 2021 presented its proposal on how technology can be implemented to support and strengthen the interaction between industry and society, so that companies are better prepared for the future. In this way, the fifth industrial revolution, called "Industry 5.0", began. Industry 5.0, as described [4] focuses on the interaction between humans and robots within an "intelligent business ecosystem" that prioritizes ecological economy and efficiency in the use of limited resources [5]. Since it focuses on manufacturing where the center is the human being, in addition to

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generating technological developments in smart social factories that aim to improve people's quality of life [6]. This means that Industry 5.0 brings a paradigm shift in sustainable production, focusing strongly on sustainability, human-machine collaboration, customization, and flexibility [7].

Therefore, one of the challenges that Industry 5.0 brings to the human factor is having qualified employees who can work together with advanced robotics. Therefore, it is essential to face these challenges that employees develop a willingness to take personal initiative to participate in a series of activities and influence the environment [8, 9] through of an appropriate leadership style that encourages the development of these positive behaviors in employees to be able to face best this process of changes and challenges that industry 5.0 faces, for this reason the following article aims to analyze a leadership style appropriate that encourages proactive employee behavior to meet these challenges. There is research on leadership styles, but this article is important because it demonstrates a perspective that has not been done before, which is to analyze an appropriate leadership style that allows the development of positive behaviors in employees to face the challenges of change, which leads to the implementation of industry 5.0.

The article is organized as follows: Section 1 the introduction, section 2 shows the literature review, mentioning the background of industry 4.0, Industry 5.0 and explains the conceptual definition and the relationship of the Empowering Leadership variable with the Proactive Behavior variable. Section 3 explains the methodology of this research; this article used a convenience sample as it is a non-probability and non-random sampling technique because the sample was composed of people who work in the telecommunications and computer systems sector. This sector was chosen because its activity is based on applying technological and scientific advances to generate innovations and improve existing services. Surveys were carried out on a total of 361 people. Section 4 shows the data analysis, to measure the constructs, we used scales previously developed in the literature, as these scales had been used and contrasted for reliability, factor structure, internal consistency, convergent validity, and discriminant validity. To perform the data analysis, we used Statistical Package for the Social Sciences (SPSS) software, version 24, which facilitates data collection and organization; and the statistical software package EQS 6.1 to confirm the reliability and validity of the measurement instruments. To test the relationship proposed, we used regression analysis with the Process macro for SPSS. Section 5 contains the discussion, theoretical, and practical implications; finally, section 6 contains the conclusions.

2 Background

2.1 Industry 4.0

Industry 4.0 is defined as the use of new technologies: cyber-physical systems, Internet of things and Internet of services, etc., in the design, manufacturing and marketing of products, through new business models that Consider the new dynamics between these technologies and employees, as well as between companies, suppliers and customers [10] Industry 4.0 represents a radical change in the way businesses operate, both internally and in the relationship with suppliers and customers. Whoever is prepared will have a clear competitive advantage in the market.

Industry 4.0 will move more towards digitalization every day, which is why business processes will be much more autonomous over time, generating a competitive advantage between industries, since by streamlining processes, they can reach more quickly to the end customer. This process will positively impact society, considering the "supply-demand"

factor since services will be provided more efficiently and new goods, mainly technological, can be transferred more directly to the consumer. Within the supply chain, the process line will be more direct, allowing companies to save money since they can eliminate indirect processes from their systems that generate delays in response times to customer needs; since one of the objectives of Industry 4.0 implies the promise of a new revolution that combines advanced production and operations techniques with intelligent technologies that will be integrated into organizations, people and assets [2]

2.2 Industry 5.0

Derived from the above, the European Union in January 2021 presented its proposal on how technology can be implemented to support and strengthen the interaction between industry and society, so that companies are better prepared for the future, more resilient, sustainable, and more human-centered. In this way, the fifth industrial revolution, called "Industry 5.0 [11], began. In this new concept, digitalization offers great new opportunities, such as achieving radical innovations, optimizing the interaction between machines and humans and capitalizing on the added value that the human worker brings to the process and the product [11]; That is to say, this revolution is marked by the emergence of new technologies such as robotics, analytics, artificial intelligence and the Internet of Things.

There is still not a very clear vision about what Industry 5.0 represents and means [12] However, it has begun to be related to the exponential development of robotics and artificial intelligence (AI) through two approaches: the first is working together with humans [13] where active collaboration and synchronized work between the robot and human employees allows them to complement each other, combining the creative capacity of the human being, their experience and judgment with the robot's workforce [14] There is talk of a collaboration between humans and machines, where the creative touch on the human side will be more decisive than automated mass robotic production [14]; The second refers to the bioeconomy, as the intelligent use of biological resources for industrial purposes in the search for balance between ecology, industry and the economy, that is, prioritizing sustainability [11]. The importance of Industry 5.0 lies in its potential to transform the manufacturing industry and create new opportunities for growth and innovation. By taking advantage of advanced technologies, manufacturers can optimize their processes, reduce waste, and create new products and services that meet the demands of today's consumers [14]; In addition, Industry 5.0 favors the construction of a human-centered, sustainable and resilient economy [16, 17], since the increase in disruptive technologies is driving the evolution of focused industrial operations in humans, that is, leading to better working conditions, new forms of jobs and more productivity in the workplace [3, 18].

It is important to argue that Industry 5.0 is a new concept that aims to transform the manufacturing industry and usher in a new era of productivity, customization and sustainability. This new paradigm builds on previous industrial revolutions, including steam power, mass production, automation, and digitalization, to create a new manufacturing model that leverages the latest advances in robotics, artificial intelligence and the Internet of Things. [14]; Therefore, adopting the ideas of Industry 5.0 will allow us to use resources more efficiently and move towards a better future [14]

Industry 5.0 leads to new forms of jobs and more productivity in the workplace [3, 18] , so new flexible work agreements appear that refers to the assignment of work considering different sociotechnical factors in the workforce such as workers' experience and capabilities [19] This strengthens the Industry 5.0 approach to worker well-being, as by developing new forms of employment in which the finer individual attributes of workers can be tracked and incorporated more effectively into job planning; The diversity of the workforce is considered,

reflecting individual capabilities, physical capabilities, experience, and level of technology acceptance; to this, carry out the assignment of work and in this way improve the satisfaction and well-being of the workforce [19, 20] and achieve better performance by better combining the policy labor and practice decisions with the diversity among the individual qualities of workers.

Industry 5.0 involves challenges, one of them is the knowledge of people in the fields of robotics and artificial intelligence to achieve adequate interaction between machines and operators; Therefore, the organization's responsibility is based on training workers in virtual education, in addition to safe training that can prevent workers from going through unnecessary problems during training sessions, in addition to enhancing communication and motivation of workers to obtain interactive knowledge environments [1] and thus count as a highly qualified workforce capable of working with technologies. It is important to highlight that Industry5.0 emphasizes the essential role of the human factor; so it aims to use the power of the human brain to increase the efficiency of processes; Humans are excellent in areas such as interaction, intuition, and complex decision making. Although humans and machines can arrive at the same answer, their different thought processes result in different paths to concluding. Tasks require contextual understanding, situational awareness, and interpretations related to culture, experience, and social norms; In this sense, humans are superior to machines, this means that the interpretation of the responses generated by machines requires human judgment [21]

It is important to mention that Industry 5.0 recognizes the power of the industry to achieve social objectives beyond employment. and growth, to become a resilient provider of prosperity, making production respect the limits of our planet and putting the well-being of the industry worker at the center of the production process, while Industry 4.0 focuses less on principles originals of social justice and sustainability, but more in digitalization and AI-driven technologies to increase production efficiency and flexibility.[5]

2.3 Empowering Leadership

To face the challenges of Industry 5.0, companies must adapt in the best way possible to this change process. In organizations, some change processes occur due to opportunities that arise, while others are designed to meet the demands of society. Industry 5.0 represents a significant change in the industry, driven by the integration of advanced technologies and human intelligence [22]. For a process to be carried out successfully, it is required, among other aspects, that teams take the initiative to improve current work processes in accordance with the spirit and objectives that underlie the change [23] ; That is why employees must develop initiative in these processes, through an appropriate leadership style, which allows employees to develop the key characteristics of Industry 5.0, which includes greater flexibility, agility, efficiency and productivity [22]

Research highlights the importance of leadership styles in team performance and meeting organizational goals [24]. Since organizations face situations in which the employee's role becomes broader and less formalized [25], it is important to maintain good guidance in the role through leadership. [26] indicates that "leadership is about two things: processes and behaviors", which are carried out by the leader to influence the employee, who has various skills and abilities, which through a coordinated effort give rise to compliance of objectives and goals in the organization [26]. Leadership is an important factor for employee performance because it encourages proactivity [27]. Among the different leadership styles, one of the most prominent is empowering leadership, which consists of "the tendency to provide greater autonomy to employees" [27]; That is, the leader shares power and authority with the employee in making decisions on issues related to work and resources [25]. In this

type of leadership, the leader provides the employee with the necessary support to effectively handle additional responsibilities [26].

2.4 Proactive Behavior

Industry 5.0 emphasizes harmonious collaboration between humans and machines, that is, having qualified employees who can work together with advanced robotics. This means that Industry 5.0 brings a paradigm shift in sustainable production, focusing strongly on sustainability, human-machine collaboration, customization, flexibility [7] and proactivity. Therefore, it is essential to face these challenges that employees develop a willingness to take personal initiative to participate in a series of activities and influence the environment [8] [28] This means incorporating beliefs, capabilities and skills to improve the environment [8] which is known as the development of proactive behavior. Proactive behavior is important because it allows the employee to identify opportunities and act on them, taking on challenges and actively working to transform the work environment and obtain the expected results [28], motivating him to learn new things and improve his talents [28]. This is vital for Industry 5.0 since it is characterized by a focus on human-centered design. This approach recognizes the importance of human intelligence in the manufacturing process. It seeks to integrate the knowledge and experience of human workers with the capabilities of advanced technologies, involving human workers in the design [22].

2.5 Empowering leadership is positively related to proactive behavior.

In empowering leadership, the leader provides the employee with the necessary support to handle additional responsibilities effectively and take the initiative to make changes [26]. That is to say, this leadership style encourages self-initiated behaviors in the employee. On the other hand, [28] highlights the employee's proactive behavior as "a stable disposition to take personal initiative in a variety of activities and situations,"; which generates greater confidence in the employee to take the initiative in unexpected events, taking on new challenges [8]; which will allow us to face better the human challenges imposed by Industry 5.0, such as the requirement for a highly qualified workforce capable of working with advanced technologies [22]

The following hypothesis is defined for all of the above: Empowering leadership is positively related to proactive behavior.

H1: Empowering leadership is positively related to proactive behavior.

3 Methodology

3.1 Sample and Procedures

This article used a convenience sample, which is a non-probability and non-random sampling technique. The sample was composed of people who work in the telecommunications and computer systems sector in Ecuador. This sector was chosen because its activity is based on the application of technological and scientific advances to generate innovations and improve existing services.

People were asked to answer the questionnaires anonymously, and the confidentiality of the information provided was explained to them; it was also indicated that the questionnaire has no right or wrong answers, and all answers are accepted; this was mentioned so that

people feel confident in answering. The information obtained through questionnaires or surveys is well understood and applied by academics in research because it has precise procedures that generate valid and easily interpretable data [29].

A cover letter explaining the study's objective and the confidentiality of the information provided was placed on each questionnaire. 424 people participated in the study. Of the 424 questionnaires completed, 63 were discarded, resulting in 361 usable questionnaires.

The questionnaires obtained are quite representative. Regarding gender, 40% were women, of whom 33% had university studies; on the other hand, 60% were men, of whom 20% had university studies, and 24% were managers and middle managers. Regarding the average age of the respondents, it is 35 years, the average seniority of the respondents in the company was 5 years, and the majority of employees (94%, n = 361) had an indefinite-term contract.

4 Data Analysis

4.1 Measures

The scales indicated in the literature were considered to measure the items; these scales were already used and validated in terms of reliability, factor structure, external consistency, convergent validity, and discriminant validity. A Likert-type scale with a range from 1 to 7, where 1 means "totally disagree" and 7 means "totally agree," was considered.

Empowering leadership is the independent variable of the model. It was evaluated using five items adopted from the scale developed by [26]. This scale evaluates the leader's behavior and relationship with the employee. Two items were eliminated due to factor loadings less than 0.5 [30]. The range of the factor loadings is between 0.705 and 0.846, and the validation scale was confirmed with a Cronbach's alpha of 0.815. The scales indicated in Table 1 are used to measure the items.

Proactive behavior of the employee is the dependent variable in this model. A four-item scale adapted from the scale developed by [31] was used and applied in proactivity studies [8] in which the characteristics of employees are evaluated to a series of qualities typical of proactive behavior. Two items were eliminated from the factor with loadings less than 0.5 [30]. The range of the factor loadings is between 0.715 and 0.847, and the validation scale was confirmed with a Cronbach's alpha of 0.838. The scales indicated in Table 1 are used to measure the items.

To perform the data analysis, we used Statistical Package for the Social Sciences (SPSS) software, version 24, which facilitates data collection and organization; and the statistical software package EQS 6.1 to confirm the reliability and validity of the measurement instruments. To test the relationship proposed, we used regression analysis with the Process macro for SPSS.

Table 1. Scales used.

CONSTRUCT: EMPOWERING LEADERSHIP [27] AHEARNE ET AL. (2005)
EL1. My boss explains the general goals we are trying to achieve
EL2. My boss teaches his employees how to solve problems
EL3. My boss shares important responsibilities with employees
EL4. My boss gives employees freedom to work
EL5. My boss permits employees to make important decisions

CONSTRUCT: PROACTIVE PERSONALITY
[8] BATEMAN AND CRANT (1993)

PP1. I am always looking for ways to improve.

PP2. I have always been key to addressing changes

PP3. For me there is nothing more exciting than seeing my ideas come true.

PP4. If I see something I don't like, I fix it

PP5. When I set my mind to something, I achieve it

PP6. I am a defender of my ideas, even if I am opposed by others.

PP7. I stand out from others when it comes to identifying opportunities

PP8. I am always looking for the best way to do things

PP9. If I believe in an idea, nothing will stop me from making it a reality

PP10. I am able to detect a good opportunity much earlier than others

4.2 Measurement model evaluation

### 4.2.1 Reliability and Validity

To examine construct validity, confirmatory factor analysis was performed. All factor loadings were significant ($t > 1.96$; $p < 0.05$) - greater than 0.5 - and individual reliability was greater than 50% for all but two items (two assessing leadership), these were eliminated. Table 2 shows mean values, standard deviation, average variance extracted (AVE), composite reliability (CR), and square root of AVE of the variables and the pairwise correlations between the variables.

The Convergent validity was verified through the estimation of the average of the variance extracted from the constructs (AVE), whose determined value must be greater than 0.50 [30]. The AVE of the variables was greater than 0.5 (AVE EL = 0.6861, AVE CP = 0.673 see Table 2). Furthermore, the CR composite reliability of all variables was greater than 0.7 (see Table 2). Therefore, convergent validity was confirmed. As the square root of the AVE for each construct was greater than any correlation (Table 2), discriminant validity was also confirmed. The results of the confirmatory factor analysis indicate that the values of normed $\chi2 = 2.07$, RMSEA = 0.054, NFI = 0.84, NNFI = 0.9 and CFI = 0.91 demonstrated that the model fits the data well.

Table 2. Mean value, Standard Deviation (SD), Convergent Validity(AVE variance extracted) and Discriminant Validity (CR composite reliability) and correlation of all variables.

	MEAN	**SD**	**AVE**	**CR**	**1**	**2**	**3**	**4**	**5**
1.Age	4.461	1.774	-	-	-				
2.Gender	1.500	0.500	-	-	0.103*	-			
3.Occupation	7.32	4.563	-	-	0.004	0.161***	-		
4. Empowering Leadership	5.8938	1.093	0.68	0.868	-0.086	-0.145***	-0.1*	0.828	
5. Proactivity Personality	5.4654	1.008	0.67	0.892	-0.052	-0.079	-0.011	0.361***	0.820

Notes. Explain coding. *p<0.1; **p<0.05; ***p<0.01
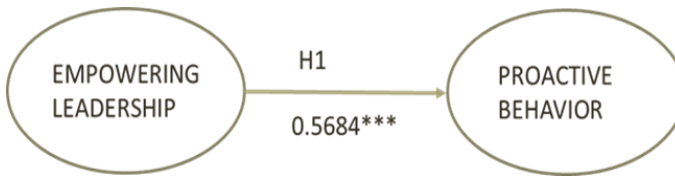
4.2.2. Correlation Analysis

The results show that empowering leadership was negative and significantly related to gender ($r=-0.145$, $p<0.01$) and occupation ($r=-0.1$, $p<0.01$), and positive and significantly related to proactive personality ($r= 0.361$, $p< 0.01$), therefore, it is shown that empowering leadership was positively related to proactive personality.

5 Discussion

It is argued that this article shares similarities with previous research that analyzes leadership styles in a general way, but this article is important because it demonstrates a perspective that has not been studied before, which consists of demonstrating why empowering leadership encourages proactive behavior of employees to face the challenges of industry 5.0, which is based on innovation and transformation to do things, so it is essential that managers choose an appropriate leadership style that develops proactive behavior in employees based in a positive attitude, focused on the future to anticipate changes and in this way be able to meet the demands in this environment, therefore this research has focused on analyzing the relationship of these variables to face these challenges.

The results obtained in this article respond to the need to find an appropriate leadership style that encourages the proactive behavior of employees to face the challenges of industry 5.0, therefore this article demonstrates its hypothesis that empowering leadership is positively related to proactive behavior; This occurs because the employee's proactive behavior is influenced by the effects of empowering leadership, which is based on trusting behavior between the leader and the employee [8], in which the employee develops autonomy to perform. work in a better way [32], oriented towards change and focused on the future [33], the application of an appropriate leadership style to develop proactive behavior in employees is of vital importance for industry 5.0 , because this industry wants to develop unions between the skills of a highly qualified and evaluated worker with the precise capabilities of a robot to develop activities with greater efficiency and effectiveness

For this reason, this research analyzed the importance of the relationship of empowering leadership with proactive behavior in this environment, because leaders can trust in the ability and willingness of their employees to take the initiative instead of spending their time assigning tasks and Monitoring their performance, this causes the employee to develop new skills, including problem solving and identification of opportunities considering a vision for the future [34].

Industry 5.0 is a new and changing process, so it is suggested that it would be interesting to conduct future research to analyze other leadership styles in other sectors to face the challenges of Industry 5.0; such as research that demonstrates the effects of managerial leadership on the proactive behavior of employees who work in the industrial sector to face the challenges of change.

5.1 Theoretical implications

This article considered the need for studies on how to develop proactive employee behavior to meet the challenges of Industry 5.0. This article contributes to the literature on an appropriate leadership style to face change processes and develop proactive behaviors in employees, especially for Industry 5.0, since it was taken into account that there is a shortage of theory on leadership styles that can encourage or inhibit employee performance in the face of these challenges.

5.2 Practical implications

A contribution of this article is that it is determined that among all leadership styles, empowering leadership is the most recommended style to encourage proactive employee behavior to face these challenges, since Industry 5.0 empowers the human workforce through promoting human-centered approaches to technological development; because this industry is based on certain technologies and functional principles, to expand the scope of corporate responsibility [3]; Therefore, the need arises to analyze an appropriate leadership style to encourage proactive behavior in employees, such as empowering leadership in which the leader shares authority with the employee, which allows the employee to develop capabilities and skills to perform challenging jobs [26] ; That is to say, empowering leadership develops autonomy in the employee in the search for solutions to problems and difficulties [35] , in other words, employees are empowered to make decisions related to work, leading them to share knowledge with each other before and during the decision process [5].

6. Conclusions

Industry 5.0 brings many challenges, one of them is having employees trained in technologies, robotics, and other fields to be able to adapt to these processes in the best way, which is why human resources have become a fundamental pillar, which is why managers feel committed to use an effective leadership style such as empowering leadership to influence the proactive behaviors of employees. This study shows that empowering leadership has positive effects on the proactive behavior of the employee because it allows the employee and the leader to carry out a knowledge exchange, where, ideas, information and relevant tasks are shared, which leads to participatory decision making, in which the contribution of team members to make decisions is valued; This gives the employee the opportunity to expand their knowledge, learn and acquire new skills, thus increasing their effectiveness and autonomy.

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