How pandemic and the industry 4.0 era constraint: the perspective of authentic leadership on innovation

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Abstrak. The COVID-19 crisis brought the importance of interdisciplinary knowledge to the forefront. Scholars carry out online communication and learning, instead of relying on face-to-face meetings at the conference, and are more proactive in disseminating their research online, which will achieve more success due to the higher number of readers citations. Remote work behaviour facilitated technology adoption in the era of industry 4.0 will affect company innovation. Then the authentic leaders who have the vision and views in industry 4.0 and are faced with pandemics will increase the level of innovation of these leaders. This research cannot be generalized to the industry in general but can be a reference for future researchers.

Keywords: innovation organization, authentic leadership, remote working, industry 4.0 and corporate culture

1. Introduction
Pandemics are exogenous shocks in companies with international commercial relations, including large multinational companies (MNEs), small and medium-sized companies, new businesses, and their supply chain partners [1]. The COVID-19 crisis brought the importance of interdisciplinary knowledge to the forefront. For example, understanding the pandemic's financial market implications requires understanding the human resource implications related to social distance and perspectives from economics, psychology, leadership, ethics, and corporate governance [2], [3]. Such an interdisciplinary approach is then essential to address issues related to the current 'big challenges,' emphasizing developing partnerships with key stakeholders (such as industry and government) to deliver impactful research [4].

On the other hand, COVID-19 has caused many conferences to occur online, which reduces barriers to access for many scholars who otherwise cannot attend due to travel and cost restrictions[3]. Scholars carry out online communication and learning, instead of relying on
face-to-face meetings at the conference, and are more proactive in disseminating their research online, which will achieve more success due to the higher number of readers' citations. In the aftermath of a great crisis, attention naturally turns to preparation for the next, along with a sincere universal hope that such development will never be needed. Although there is a guarantee that there will be no more pandemics in the future, the COVID-19 experience still deserves the attention of scholars and managers [2], [3].

No country in the world has avoided COVID-19. This COVID-19 has left its effects in all aspects of life; entire countries experienced shocks, borders closed, the global economy slowed, and schools were closed. Students study in their homes and employees work in their homes [5]. There are more than three billion Internet users globally, and more and more are using digital technology to work "remotely," which is defined as "detached from a permanent traditional workplace," such as the buildings where their employers employ[6]. During the pandemic, remote working becomes the choice to stay productive and maintain a healthy life.

Increasing competition in the market and rapid demand have driven companies to adopt advanced technology to enhance smart manufacturing. Industry 4.0 is the current automation and data exchange trend in production technology. Industry 4.0 extends advanced digital technology to broader content as the fourth industrial revolution, which mainly includes cyber-physical systems (CPS), the Internet of Things (IoT), and cloud computing. The Industry 4.0 concept originated from Hannover Messe, whose ideas initially focused on improving the German industry[7]. Led by IoT, Industry 4.0 acts as an integral part of the "High-Tech Strategy 2020 for Germany" to maintain German leadership in technological innovation competitions[8]. Meanwhile, other countries or regions have also proposed similar initiatives, such as the "Industrial Internet" in the US [9] and the "Made in China 2025" plan in China[10]. Sophisticated technology has led to a competitive advantage in the performance of each company. Human Resource Management (HRM) has evolved from personnel administration, employee relations, people management, human capital management, industrial relations, and work management. An organization is a collection of resources such as company management skills, namely: processes, routines, information, and knowledge that companies use in selecting and implementing strategies to achieve superior performance.

Companies must create an innovative organizational culture and value the relationship between knowledge and information, effectively gathering information and market applications. Companies must also understand customer needs, competing for actions, adjusting internal departments and cross-departmental collaboration to react flexibly to changing markets, achieve innovative values, and enhance creative behaviour.

Lack of understanding of how leaders such as ethics and behaviour can encourage social innovation for employees in companies, even though the social change has become essential in policy, academic, and practice debates, mainly because of the scarcity of empirical research on this matter [11].

2. Literature Review

2.1. Organizational Culture(OC) and Innovation

At the organizational level, the literature refers to the size, corporate design, strategy, leadership, human resource practices, financial support, and organizational culture. The most prominent is organizational design and organizational culture [12][13]; organizational culture is the organization's hidden values, beliefs, and assumptions [13]. Thus, culture can stimulate innovative action among an organization's members because it can encourage them to accept innovation as its fundamental value and grow its commitment[14].

Empirical research has also provided evidence of a significant relationship between culture and innovation [15]. What has not been clarified by the literature on the topic is what type of culture increases or inhibits innovation[13].

Characteristics of pro-innovation organizational culture include: creating a climate
conducive to organizational change, expanding knowledge and increasing skills and sharing knowledge and information, developing a tolerance for risk, uncertainty, and exploration, strengthening respect for non-conformist attitudes, applying democratic principles decision making and conflict resolution, support group activities, building an atmosphere of recognition and respect for innovators, supporting creative thinking and problem solving, and developing awareness of change and promoting direct contact[16].

**H1:** There is a relationship between Organization Culture and Innovation Organization

### 2.2. Authentic Leadership (AL) and Innovation

In today's dynamic work environment, creativity and innovation are valuable resources for gaining a competitive advantage. More specifically, in the face of developing technology, domestic and global competition, an uncertain and turbulent economic environment, organizations need to go beyond innovative competitors and promote creativity to survive and prosper[17]. Besides, leadership is considered a contextual factor that influences employees' creative performance and innovation; it has become a significant concern for organizations to address leadership approaches based on their strategic plans [18].

Several research findings show the relationship between leader behaviour, leadership style, and creativity (regarding creative work, ideas, and performance)[19]. Several factors support that transformational leadership will increase employee creativity and innovation [20]. First, transformational leaders go beyond exchanging contractual agreements for desired performance by actively involving followers' value systems [21]. Second, intellectual stimulation provides transformational leaders to be able to encourage followers to think 'outside the box' and exploratory [20],[22]. Transformational leadership will increase organizational innovation[20],[19].

Behaviour associated with AL increases the moral perspective of followers [23]. Furthermore, the AL dimension (self-awareness, internalized moral perspective, balanced process, and relational transparency) promotes ethical follower behaviour [24],[25]. Considering its higher nature and additional capabilities, this shows the difference in AL from other leadership styles, such as transformational, ethical, charismatic, servant, and spiritual. For example, self-awareness shows knowing himself and being honest with oneself, as noted by[26], and self-awareness also impedes continuous self-assessment.

**H2:** There is a relationship between Authentic Leadership and Innovation Organization

### 2.3. Remote Working (RW)

The leading development and progress results can include greater flexibility and mobility, benefitting workers and organizations[27]. Employers can find flexible and operational workforce variations on how much human resources, how much work they can do, changes in time and workload, and locational flexibility[28].

The internet is a network that allows connections between people and information "]29[. When applied to the organizational level, HRM's implications are related to how employers and their workers are connected and the increased integration of 'digital' and 'non-digital' jobs[30].

**H3:** There is a relationship between Remote working and Innovation Organization

### 2.4. Industry 4.0

Industry 4.0's general assumptions include internet usage, production flexibility, and process virtualization. Many researchers and practitioners experience the impact of Industry 4.0; there
are three streams of Industry 4.0 based on literature [31]. First, The focus of implementation of Industry 4.0 requirements are according to system reconstruction [32], architectural configuration [33] and provision of information [34]. Second, the acceptance of social technology that connects technology with Industry 4.0 - for example, overcoming some of the limitations of augmented reality (AR) technology and applications in remote maintenance services [35]. Wireless network-related features and techniques and service quality, and data quality must be available [36]. Third, the impacts from a communication perspective focus on new requirements for humans, such as education[37].

3. Research Model
From the development of the above hypothesis, the following is a research model:

![Figure 1. Research Hypothesis Model](image)

4. Research Method
This study uses quantitative methods and by examining the relationship between the Innovation Organization (IO), Organization Culture (OC), Remote Work (RW), and Industry 4.0 variables as a mediating variable. The statistical test used Structural Equation Modeling (SEM) analysis with partial least square (PLS) approach to analyze variables and test models based on literature review, involved 139 respondents. First, the survey stages are to conduct a survey of 30 respondents to test the questionnaire material. Second, the survey focused on 139 respondents in financial or banking institutions in Jakarta. Of the 350 questionnaires were the manager and supervisor level employees, both junior and senior, but only 139 respondents answered that returned the questionnaire. We tested the research model (Fig. 1) and mediation relationships using partial least squares path modelling (PLS), modelling of variance-based structural equations[38],[39]. This research uses PLS analysis software with consideration; (1) sample size (n = 139) is relatively small; (2) complex models regarding the types of relationships (direct, indirect, and mediating) in the hypothesis; (3) this study uses a score of latent variables in subsequent analyzes for predictive purposes.

In total, there were 20 questions asked of respondents. Furthermore, each question item is measured using a five-point Likert scale where the number 1 shows "Strongly Disagree," while seven shows "Strongly agree."

The survey lasted for four months, around January 2020. The processing of survey data using the SEM (Structural Equation Modeling) method involves SmartPLS software Version 3.2.9. Model specifications in PLS-SEM include structural models and measurement models.
The structural model presents the structure of the path between constructs. In contrast, the measurement model shows each construct's relationship and its indicators. Hypothesis testing and the model's feasibility followed several stages following what was done by [38]. By testing the validity, the criteria are based on Cronbach's Alpha, Average Variance Extracted (AVE), and Composite Reliability (CR), and testing the model by looking at $f^2$. According to [38], testing of research models can use the CFA (Confirmatory Factor Analysis) and CCA (Confirmative Composite Analysis) methods. The stages carried out by [38] are as follows:

5. Validity and Reliability

It tested Loading Indicators on each research variable and its significance, guided by standardized loading of at least 0.708 and T-Statistic $\pm 1.96$, significant two-tailed tests at the 5% level executing the bootstrapping procedure. Analysis of AVE (Average Variance Explained) value as Convergent Validity, whose value must be greater than 0.5. In contrast, the Reliability test uses an internal consistency approach by analyzing CR values, where CR values must be greater than 0.7 [40].

The full research model is as follows:

**Table 1. Validity & Reliability**

| Variable | Cronbach's Alpha | Coef. | AVE T-Statistic | Coef. | CR T-Statistic | Finding |
|----------|------------------|-------|----------------|-------|----------------|---------|
| AL       | 0.868            | 0.655 | 17.036         | 0.904 | 57.657         | Supported|
| IE       | 0.829            | 0.745 | 21.333         | 0.898 | 52.172         | Supported|
| IO       | 0.863            | 0.709 | 20.687         | 0.907 | 63.110         | Supported|
| OC       | 0.684            | 0.511 | 9.291          | 0.786 | 12.388         | Supported|
| RWB      | 0.831            | 0.663 | 16.614         | 0.886 | 47.580         | Supported|

*Figure 2. Full Research Model*

The loading indicator for each variable > 0.7 opens the next analysis from the above models.
The overall measurement model also shows a coefficient of more than 0.5 or 5% and is significant. So the measurement model can be said to have good validity and reliability and can be carried out in the next stage of the assessment process.

6. Structural Model
The next test is to test the structural model or inner model by looking at the value of $f^2$ with the following criteria: 0.02 - 0.15 shows a small effect, 0.15 - 0.35 indicates a medium result, > 0.35 shows an enormous influence. From the structural model analysis, the $f^2$ value is obtained as follows:

| Relation       | Loading | $f^2$ | T-Statistic | Finding   |
|----------------|---------|-------|-------------|-----------|
| AL $\rightarrow$ IE | 0.248   | 0.063 | 2.730       | Supported |
| IE $\rightarrow$ IO  | 0.586   | 0.523 | 9.336       | Supported |
| OC $\rightarrow$ IE  | 0.016   | 0.000 | 0.172       | Not Supported |
| RWB $\rightarrow$ IE | 0.416   | 0.170 | 4.227       | Supported |

The table above shows that the relationship between OC $\rightarrow$ IE is not significant. Simultaneously, AL $\rightarrow$ IE refers to a remote connection and IE $\rightarrow$ IO, and RWB $\rightarrow$ IE shows the relationship with enormous influence.

Then from variable moderation, there is an indirect effect, as shown in the following table:

| Relations      | Loading | T-Statistic | Finding   |
|----------------|---------|-------------|-----------|
| AL $\rightarrow$ IE $\rightarrow$ IO | 0.145   | 2.608       | Supported |
| OC $\rightarrow$ IE $\rightarrow$ IO | 0.010   | 0.168       | Not Supported |
| RWB $\rightarrow$ IE $\rightarrow$ IO | 0.244   | 3.368       | Supported |

Table 3. shows that there are only two mediation relationship paths that are accepted, namely AL $\rightarrow$ IE $\rightarrow$ IO with the loading of 0.145 and RWB $\rightarrow$ IE $\rightarrow$ IO of 0.244. So it can be explained that the H2, H3, and H4 research hypotheses are accepted, and H1 is rejected, as shown in Table 2.

7. Conclusion and Limitations
In the industrial era 4.0, the leaders of organizations and companies faced the challenge of carrying out technology uptake in operating companies and management from the lower to the top. Prepare all parties to play a role and contribute to the absorption and implementation of the technology adopted. Companies that have a high level of innovation will be faster in the process of technology absorption. However, the covid-19 pandemic comes suddenly, forcing leaders to look for new strategies because, on the other hand, it must be intense at work, with the pandemic being contrary to plans and policies' previous policy. This study shows that remote work is a solution in dealing with solutions in dealing with the pandemic.

Moreover, remote work behaviour facilitated technology adoption in the era of industry 4.0, which will affect the level of company innovation. Then the authentic leaders who have the vision
and views in industry 4.0 and are faced with pandemics will increase the level of innovation of these leaders. This research cannot be generalized to the industry in general but can be a reference for future researchers.

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