Sustainable Leadership: A new era of Leadership for Organizational Sustainability and Challenges

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ABSTRACT

The Fourth Industrial Revolution, known as Industry 4.0 with the help of advanced technology, from *the Internet of Things* to *the Digital Twin* to *Artificial Intelligence* , all with the hope of reducing and eliminating waste and increasing organizational sustainability in order to maintain the sustainability of the planet earth. Thus, the industry has entered an era of change that requires a sustainability strategy. RI 4.0 encourages industry to adapt to environmental sustainability, economic preservation and social resources. Leaders are an influential factor in determining an organization's survival efforts in an increasingly competitive environment. *Sustainable Leadership* was born as a leadership paradigm for sustainable development by practicing creative management skills that produce creative and innovative ideas to support the implementation of appropriate strategies in the industrial era 4.0 in responding to sustainability challenges and opportunities. The role of *sustainable leadership* helps to practice core managerial competencies in creating business model innovation, reducing carbon emissions, increasing profitability, economic growth, energy and resource sustainability, developing environmental responsibility, developing human resources, increasing production efficiency and productivity through job creation, reducing costs. production and manufacturing agility and flexibility in responding to sustainability opportunities and challenges.

Keywords: sustainable leadership, industry 4.0, organizational sustainability

INTRODUCTION

Indonesia continues to adapt in the digital industrial era in preparing strategic sustainability. Changes in the current digital way of life, we realize that in the 21st century there has been an industrial revolution 4.0 and digital transformation in the business world. Digital transformation was known at the beginning of the industrial revolution 4.0 in 2011(Tetik, 2020), and global industry seized this moment as an industrial opportunity to survive by developing digital manufacturing and various innovations in the field of industrial technology which continues to develop. Industry 4.0 is not only developing in the manufacturing sector but all industrial sectors.

Germany is the first country to create a roadmap regarding the implementation of the digital economy(Studi et al., 2021). The Indonesian government is currently implementing strategic steps to prepare Indonesia to enter the top 10 countries with the strongest economies in the world by 2030 (Satya, 2018). The world is currently facing the 4th industrial change or what is known as Industry 4.0. Mckinsey Global Institute analyst, Industry 4.0 has a very large and broad impact, especially on the employment sector, where robots and machines will eliminate many jobs in the world. For this reason, industry players must respond to this era of industrial revolution wisely and carefully. On the one hand, this industrial era, through connectivity and digitalization, is able to increase manufacturing chain efficiency and product quality. However, on the other hand, this industrial revolution will also eliminate 800 million jobs worldwide by 2030 due to industrial digitalization (Satya, 2018).

The industrial revolution 4.0 has the implication that industrial digitalization has a positive impact on the

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industry of developed countries such as Germany and the large industries that are developing in China (Beier et al., 2017). This includes Indonesia having prepared a roadmap strategy for Industry 4.0 by the President of the Republic of Indonesia in April 2018. The study aims to study the concept of IR 4.0 for its implementation in Indonesia (Satya, 2018).

Indonesia has implemented 5 main *IR 4.0 technologies, namely artificial intelligence (AI), Internet of Things (IoT), Wearable Technology (WT), Advanced Robotic (AR) and 3D Printing (3DP)* (Hadi & Murti, 2019). Each technology component most importantly used in various industries and manufacturing. It is believed that the use of IR 4.0 will provide benefits in making performance more effective and more efficient.

The role of organizational leaders is strategic and an important factor that influences determining organizational sustainability efforts in a competitive environment, where leaders can implement appropriate strategies in industry 4.0 by innovating, implementing creative ideas as investment direction and producing appropriate strategies. Sustainability issues in both environmental, social and economic dimensions. With Industry 4.0, *sustainable leadership* has emerged as an important issue in technological innovation considering sustainability perspectives in the ecological and social resource fields.

This paper discusses the role of *sustainable leadership* in helping to practice core managerial competencies in responding to opportunities and challenges in supporting sustainability in the industrial era 4.0. The discussion begins with information on the concept of Industry 4.0, the importance of *sustainable leadership* and the final section identifies in detail the opportunities and challenges of Industry 4.0 in organizational sustainability.

LITERATURE REVIEW

Industry 4.0

Global Industrial Revolution in industry 4.0 is characterized by artificial intelligence, super computers, genetic engineering, nano technology, automatic cars and innovation. These changes occur at an exponential speed that will impact the economy, industry, government and politics. In this era, the world is becoming increasingly visible as a global village. Industry 4.0 is a term first that was coined in Germany in 2011 which is marked by the digital revolution. This industry is a digitally connected industrial process that includes various types of technology, from 3D printing to robotics which is believed to be able to increase productivity.

History records that there have been three industrial revolutions that occurred in the past, marked by the discovery of the steam engine and trains in 1750-1930; the discovery of electricity, communications, chemistry, and oil in 1870-1900; invention of computers, internet and mobile phones 1960 until now. In the third industrial revolution, the manufacturing industry has turned into a digital business. Digital technology has taken over the media and retail industries. The third industrial revolution changed the relationship and communication patterns of contemporary society. This revolution has shortened distance and time, this revolution prioritizes real time. A big leap occurred in the industrial sector in the era of the fourth industrial revolution, where information and communication technology was fully utilized. In this era, business models experience major changes, not only in the production process, but also throughout the industrial value chain. Industrial value chain research continues to be developed (Barata et al., 2018) ,(Ardito et al., 2019),(Ghobakhloo & Fathi, 2020)namely by developing *lean digitization manufacturing.*

Industrial Revolution 4.0 is known as a process of transformation of new, sophisticated technologies such as *the Internet of Things* to *Digital Twin , Artificial Intelligence* with the hope that in the industrial era 4.0 industry is expected to reduce and even eliminate waste thereby increasing the sustainability of

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organizations and the planet on this earth (Hizo, 2019) . The industrial revolution 4.0 has entered an era of change in supporting *sustainability development goals* , the presence of *Sustainable Leadership* as a leadership paradigm for sustainable development, which prioritizes the balance of *triple bottom line goals* where the need for companies to meet the demands of sustainability responsibilities is clearly visible in all sectors, such as production processes and environmentally friendly services, simultaneous engineering, triple bottom strategy, design and performance. In Industry 4.0, this technological innovation provides a platform for company transformation.

Industry 4.0 on the development of digital manufacturing

Industrial revolution 4.0 can develop digital manufacturing, global industry seizes this moment as an industrial opportunity to survive by developing *lean digitalization manufacturing* (Ghobakhloo & Fathi, 2020).

Technological innovation efforts start from developing *innovation, marketing, internet of things, patent analysis, cloud computing, supply chain management, big data analytics, cyber security, supply chain management-marketing integration, customer profiling in* many researches to develop digital technology to manage interfaces between supply chain management and marketing processes and their role in maintaining supply chain management-marketing (SCM-M) and integration from an information processing point of view (Ghobakhloo, 2020), (Barata et al., 2018) . The entire supply chain stages from raw material procurement to product delivery have been developed with digital technology.

The Impact of Industry 4.0 on Organizational Sustainability

The industrial revolution 4.0 has the implication that digitalization of industry has a good impact on the industry of developed countries such as Germany and large industries that are developing in China, where digital transformation in industry 4.0 has an impact on the transformation of the ecological dimension (resource efficiency, renewable energy) and technical transformation. will most likely be followed by social transformation (Beier et al., 2017). This social, ecological and technical transformation becomes policy direction and helps decision makers in the political field to anticipate and shape the path to the future a more sustainable future in the industrial sector. The current impact of the digital industrial revolution in China is that the use of coal and oil energy poses future risks to sustainability, so that ecological transformation in renewable energy (renewal energy) is expected to be carried out in digital production processes so that energy reduction can be a solution to industrial sustainability in China, which is developing. Most industries in China, as much as 54%, apply industrial ecology standards, while in Germany one step further, the implementation of Industry 4.0 shows the compatibility between *renewable energy* and the benefits obtained from its use, so that the digitalization of industrial processes in Germany provides opportunities for developing countries like China. China to supply renewable energy more widely in developed countries such as Germany (Beier et al., 2017).

SUSTAINABLE LEADERSHIP

In its development, the concept of *sustainable leadership* came from various initiators starting from the best practices of sustainable leadership in resilience and business performance (Avery & Bergsteiner, 2011)with a hierarchy of 14 basic practice elements, 6 high practice elements and 3 main performance driving elements that determine business performance results. .

Sustainable leadership is present as a leadership concept in addressing sustainability as a sustainability issue, that *sustainable leadership* is a new paradigm in business leadership which is the result of exploring shifts in economic and organizational theory caused by new insights from various fields of social sciences, sustainable mega-trends in the macro context. economics and business (Tideman et al., 2014). *Sustainable*

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leadership was developed from the leadership mindset that leaders need to develop to empower organizations for sustainable value creation into 6 pillars used in economic and business perspectives, namely *context , consciousness , continuity ,*

Sustainable Leadership has been studied in many fields, including psychology and education, military, administration, medical care, and nursing and especially in business. For a motivating and facilitating environment to influence employee creativity and other beneficial behaviors in work, leadership develops managerial competencies (Knight & Paterson, 2018), (Avery & Bergsteiner, 2011), (McCann & Holt, 2010).

Sustainable leadership has developed into a leadership approach paradigm in the era of sustainability where leaders are faced with the challenge of sustainability thinking that encourages innovation (McPhee, 2014), (Haroon et al., 2019).

Leadership has the capacity to increase innovation by implementing differentiation strategies which will have an impact on business performance (Semuel et al., 2017) . Sustainable leadership is able to encourage innovation and effectiveness through creative organizational behavior by adapting to technological innovation (Haroon et al., 2019)

DISCUSSION

The Relationship Between Industry 4.0 and Sustainable Leadership

The complex phenomena in global change greatly influence the culture and style of management and all social ecosystems along with the rapid growth of information, rapid development and rapid communication, the digital revolution has changed people's lives in the way they communicate with each other with technology (Tatik, 2020) . In an industry 4.0 perspective, a leadership role is needed in accelerating industry 4.0 change with organizational sustainability. Industry 4.0 provides big challenges for today's world with a new technological transformation process, so strategy becomes very important in today's changing and developing world. The leader's important role is in developing strategies to evaluate existing areas of opportunity and anticipate changes in the industry 4.0 process to bring the organization to sustainability. At this stage, SL issues from an industry 4.0 perspective need to be studied further.

Industry 4.0 is a conception that changes in organizations in managing the entire value chain in the product life cycle and production system, where this cycle focuses on increasingly individual customer demands and includes services throughout the chain, starting with the idea phase, product development and production orders to distribution and recycling a product to the end user. The role of sustainable leadership in industry 4.0 is important and strategic for executing decision making regarding conflicting steps in carrying out sustainable innovation efforts related to *smart manufacturing technology*, with environmental innovation using renewable energy, environmental management.

Sustainable leadership has a role in developing sustainable innovation, namely industry 4.0. *Sustainable leadership* has a role in maintaining competitiveness so it is necessary to adopt industry 4.0 and for all companies and increasing innovation and creativity in the digital era is considered one of the main ways to maintain competitiveness.

Opportunities and Challenges of Industry 4.0 on Sustainable leadership in organizational sustainability

In evidence, Industry 4.0 and leadership research proves that an ethical leadership style influences organizational learning that focuses on ecological innovation and can improve sustainable competitive performance in SMEs in Pakistan (Styles et al., 2023) . This research contributes to explaining the role of

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leadership style in the context of SMEs in Pakistan. In the Industry 4.0 era, where technological advances are changing industries, understanding the impact leadership towards sustainable competitive performance is critical.

Research in Indonesia (Studi et al., 2021)analyzes how leadership style and innovation strategies can create competitive advantages in the application of Industry 4.0 in the manufacturing sector in medium and large industries operating in the automotive, electronics , food and beverage sectors in Bekasi, Kerawang and Puwakarta . This research provides theoretical and managerial implications regarding the strategic steps that industry needs to take in implementing Industry 4.0 through leadership strategies and innovation strategies to create competitive advantages.

(Dowson, 2022), (Zieger, 2009) analyze how Sustainable Leadership in RI 4.0 environment can be applied to achieve Corporate Social Responsibility in paper and pulp industry in Sweden. Sustainable leadership refers to leaders who have the ability to inspire the workforce and support action for a better future, by finding sustainable solutions. Research concludes that factories are becoming more digital, to improve sustainability. Having a more digital organization means a better environmental impact , increased worker safety, and more economically sustainable operations (Abdul et al., 2021). Changes towards digitalization in industry and production processes have brought changes to work tasks, where workers are now required to adapt by having appropriate competencies in the digital era.

How Industry 4.0 and Sustainable Leadership contribute to the SDGs

Climate change, desertification, water shortages, pollution and shortages of raw resources are some of the most important long-term challenges faced by the world, making it necessary to develop strategies that enhance sustainable development (Ghobakhloo et al. 2021), sustainable innovation and economic performance (Aghion , Hemous, and Veugelers 2009).

Sustainability is a strategic choice for companies, because sustainability is an important factor for company survival (Cillo et al. 2019). Industry and sustainable development require continuous innovation and a new mindset in leaders which is defined as sustainable leadership (Tideman et al., 2014)

Industry 4.0 offers tremendous support to facilitate a circular economy (CE) where production processes rely on sustainability principles such as green purchasing, reuse, recycling and remanufacturing so that sustainability aspects in the industrial era 4.0 prioritize green operation (Büchi et al., 2020; Kouhizadeh, Sarkis et al., 2019; Razzaq et al., 2021) . Industry 4.0 is a paradigm shift that changes the traditional business model of manufacturing companies by integrating circular economy practices (Rosa et al., 2020). This transformational technology lubricates production efficiency, production flexibility, and overall environmentally friendly factor productivity through several embryonic information, communication, and intelligence technologies (Büchi et al., 2020; Durach et al., 2021; Kou hizadeh et al., 2021) .

Under the guise of Industry 4.0, the circular economy is associated with various technological innovations that mainly include blockchain, big data analysis, artificial intelligence, cloud, industrial simulation, Internet of Things, and additive manufacturing (Dalenogare et al., 2018; Rüßmann et al., 2015) . These technologies improve the existing industrial structure through an innovation-driven process by ensuring financial and environmental management (Huynh et al., 2020; Razzaq, Sharif, Ahmad, & Jermsittiparsert, 2020.

The role of a leader in the RI 4.0 era is in a strategic position, namely a sustainable leader must be able to make decisions regarding implementation strategies by improving the circular economy through carrying out several strategic actions, namely business model renewal and innovation, reducing carbon emissions/hazardous gases, increasing company profitability, economic growth , sustainability of energy and sources, development of environmental responsibility, development of resources, increasing production

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efficiency and productivity, creation, reduction of production costs, agility and flexibility of manufacturing.

CONCLUSION

Industry 4.0 provides opportunities and challenges to organizational sustainability. The economic sustainability of functions such as production efficiency and business model innovation are likely to be more pressing outcomes of Industry 4.0, paving the way for development in more remote areas. The socio-environmental sustainability functions of Industry 4.0 such as energy sustainability, reducing harmful emissions, and increasing social welfare. This article can serve Industry 4.0 stakeholders as leaders in the public and private sectors, industrialists, and academics need to better understand the opportunities that the digital revolution may offer for sustainability. Stakeholders, academics, leaders in public and private sectors work together more closely to ensure that Industry 4.0 delivers the intended sustainability functions throughout the world effectively, equally and fairly. Sustainable leadership is needed in the RI 4.0 era, in the era of digitalization, organizational leaders must be dynamic in following the challenges in responding to business challenges in the digital era.

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