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ADOPTION OF MASS MEDIA TECHNOLOGY ON INDUSTRY 4.0 PERSPECTIVE

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A B S T R A C T

Industry 4.0 has influenced the process of human communication from face-to-face to virtual. The communication process aligns with the Cyber-Physical System (CPS) concept. The CPS concept shows what is physically represented in cyberspace and vice versa. This has resulted in content production and distribution in the mass media adopting technological developments summarized in the Cyber-Physical and Smart Factory systems. The adoption of technology that the mass media should carry out is a challenge for the sustainability of the media industry to carry out the function of the press. Thus, this article offers forms of technology adoption in the mass media using the literature review method in previous studies. The literature review results in this article offer technology adoption in the mass media from the perspective of industry 4.0. The form of technology adoption is the process of computational journalism as a production action based on Smart Factory. Furthermore, news automation is a production act and a CPS-based news distribution. This production and distribution process should involve the mass media workforce, which requires an approach to technology adoption by humans in the future mass media.

INTRODUCTION

Historically, industry 4.0 originated from a report published by the German government as a form of technological strategy in 2020 (Zhou et al., 2015). It is based on the European monetary crisis that led the German government to present an industry 4.0 strategy to promote the influence of German manufacturing globally. The fourth stage of the industrial revolution is also referred to as industry 4.0. The naming process was carried out by experts and strengthened again in April 2013 with the emergence of the German Hannover industrial exhibition (Lasi & Frettke, 2014; Roblek et al., 2016; Zhou et al., 2015). This is the beginning of the global discussion on industry 4.0 that is at the core of the current information and communication industry strategy.

Zhou (2015) mentioned that industry 4.0 is based on integrating information technology, communications, and industries that rely on Cyber-Physical Systems (CPS) to realize smart digital factories and promote manufacturing to be more digital (Zhou et al., 2015). In addition to CPS, the fundamental concept of industry 4.0, namely Smart Factory, means having innovative technology related to digitized product models and their application of various independently controlled computing technologies; Self-

Organized, indicating how the system is organized works in a decentralized manner where each individual can do the system; A new system of distribution and procurement that is individual using a variety of existing channels; the new system of increasingly individualized product and service development with an open innovation approach that provides growth opportunities for product intelligence; the system is designed following human needs now and in the future; and a focus on Corporate Social Responsibility programs where there is social responsibility and resource efficiency (Lasi & Frettke, 2014; Roblek et al., 2016).

This fundamental concept of industry 4.0 is in line with the presentation of Germany's strategic plan in the application of the industry. At its core, the main concept to see the hallmarks of industry 4.0 is the existence of intelligent manufacturing with CPS technology towards decentralized production to shift popular products to personalized products as well as increase user participation, so that every user can feel pleasure in creating products (Zhou et al., 2015).

In addition to CPS technology, industry 4.0 uses the Internet of Things (IoT), Internet of Service (IoS), and Smart Factory technologies (Roblek et al., 2016). However, on the other hand, the Internet of Things is a development of the CPS system because it is a network of all CPS system objects in use of innovative machines, storage systems, and production facilities that can exchange information independently and control each other actions. Seeing the considerable influence of the mass media on the communication process, the question arises of how to adopt mass media technology from the perspective of industry 4.0. The rapid development of technology also emphasizes the long adoption process to meet human needs, especially in the communication process. Communication process and technology adoption is needed for communication to become effective and efficient because it relates to individual behavior when receiving new technology to achieve communication goals.

Technology adoption talks about the diffusion of an individual or organizational decision to use innovative products or technologies (Barron & Schneckenberg, 2012). Humans also accept technology of their own volition from intrinsic and extrinsic factors that motivate technology adoption. This motivation requires them to get technology. For example, the atheist public inevitably accepts the adoption of technology in digital payments for shopping, transportation, and purchasing tickets, etc. are forced to take technology to meet their needs. Houston (2020) states that technology in digital payments makes it easy to make transactions effectively and efficiently. The advantages of effectiveness and efficiency also make all industrial lines adopt technology for production and distribution activities. This is also done by the mass media combining new communication technology with conventional communication technology. Conventional media are forced to adopt current media technology; for example, radio, which used to be frequency-based, is forced to adopt internet-based media technology, which no longer requires frequency. This is related to the increasing trend of streaming radio through their respective gadgets by the current generation (Dhamayanti, 2019).

The trend in the media industry has shifted to the use of artificial intelligence in news dissemination, such as news anchors being replaced by artificial intelligence. This shift in the trend of the communications industry is relevant to the industrial revolution 4.0 where the phenomenon of digitization and automation of the combination of the internet and manufacturing (Sirait, 2022).

The phenomenon of digitization and automation in mass media has also led to the programming of algorithms on the editorial desk, especially for journalist workflow in producing news, thus giving rise to automation systems. Such automation systems reflect algorithmic processes that turn data into narratives without human intervention (Latar, 2018, p. 53)

In this study, the authors put forward a conceptual analysis of the adoption of mass media technology. The author limits the concept of industry 4.0 to the use of CPS systems and their development in the form of IoT, IoS, and intelligent factories which refer to the strategic plan for the application of industry 4.0. This concept of industry 4.0 affects the culture of

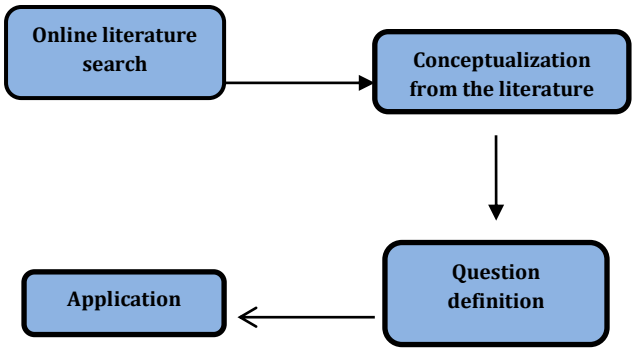
human communication that face-to-face previously turned virtual because the CPS system gives everything physically represented in cyberspace and vice versa everything that is described virtually exists in the real world. The use of technology by humans is also developing. Which was previously humans with machines, now and in the future, turned into machines with machines, just like the automation of content carried out by the news media (Roblek et al., 2016).

METHOD

In writing this article, the author uses a qualitative approach, that is literature study by referring to the results of a comprehensive review of books, scientific journals, conference articles, and other reference sources. The steps for writing are adapted from the framework of the scientific article *A Complex View of Industry 4.0* (Roblek et al., 2016), namely:

Picture 1

Research Flow: Eliminate Irrelevant literature



(Source: Roblek et al., 2016)

The author searched online literature by browsing academic papers based on the industry 4.0 concept and the applications offered in mass media technology. After that, the author eliminates irrelevant references by looking for common threads in the conceptualization of the discussion for the results and discussion framework. Based on this conceptualization, the author poses a limitation of this scientific article, namely, how is the adoption of mass media technology from the perspective of industry 4.0? Here, the author conducts a literature study on the concepts and purposes of writing used for analytical material in this scientific article.

RESULTS AND DISCUSSION

The industrial revolution 4.0 was marked by the emergence of intelligent factories and cyber-physical systems (CPS) in various lines of human life. A smart factory can be interpreted as an intelligent factory that has been digitized, and its application is controlled independently without human assistance. Simply put, this intelligent factory can be seen in the content production process in the mass media, which is done by a computerized system without direct human intervention. Then, the concept of CPS in industry 4.0 talks about integrating digital (virtual) spaces with physical ones representing one another. In this case, virtual and physical spaces become one, so there are no boundaries between the two areas. In addition, CPS obscures the role of humans in virtual and physical spaces in the content automation process by the news media. So, this article describes the forms of mass media technology adoption in response to the challenges of the 4.0 industrial revolution.

Computational Journalism as Smart Factory

Computational journalism is a contemporary term for journalistic work that carries out its work between two aspects, namely journalism and computing. This is not solely using computer media in reporting but using computers from the perspective of intelligent factories in industry 4.0. In Karlsen's research (2014), for example, he discusses computational journalism practiced in Norwegian newsrooms. Based on in-depth interviews with practitioners in the six largest newsrooms in Norway, it was found that computational journalism is a continuation of traditional investigative journalism. This is because the skills and tools required to do this kind of journalism differ from what they are used to. Although this technique of computational journalism is enjoyable to practice, little evidence has been found in computational journalism that it increases work efficiency so that the rate of eliminating journalists' work by humans is low. Agree with Clerwall's research (2014), showing that content produced by computational journalism is only descriptive and not engaging to read.

On the other hand, computational journalism provides benefits in recent research on journalists' reactions to robotic journalism, such

as those carried out by the Statsheet network (Van Dalen, 2012). Furthermore, Van Dalen (2012) stated that his research on the Statsheet web introduces machine-written news using an algorithmic system. The algorithm automatically generates news stories based on statistical information and a set of available phrases without interference from journalists. This is done on sports media websites and puts pressure or coercion on journalists to re-examine their skills. In that study, the journalists commented that the essence of their profession was that the ability to analyze, write, be creative, and have personality is more important than actual, objective, and fast. On the other hand, with journalism, these robots assist them in doing routine writing, so they have plenty of time for in-depth reporting.

The mass media also feel the concept of computational journalism in the form of a robot journalist in Indonesia. For example, the online media, Beritagar.id, uses robot journalists to write sports news related to reporting the results of live sports matches. This robot journalist system is called Robotorial in Beritagar.id media launched on 24 February 2018 (Paramita, 2018). As reported by the beritagar.id website, the Robotorial utilizes the Application Programming Interface (API) provided by a third party to provide soccer match results data into a straightforward narrative. Likewise, statistical graphs are made automatically by a computer program so that no human touch is needed anymore as a graphic designer. Texts and pictures were published within minutes after the match was over.

This computational journalism will become an appropriate field for media companies and can reduce production costs so that the company's sustainability will run effectively. Here production activities are no longer carried out by human hands but are computer systems that provide artificial intelligence leading to the smart factory concept in industry 4.0. Smart Factory, which means having smart technology related to digitalized product models and their application of various computing technologies that are controlled independently; Self-Organized, meaning that the way the system is organized works in a decentralized manner where each individual can run the system; New system of individual distribution and procurement using various existing channels; a new method of product and service development that is increasingly individualized with an open innovation approach to provide growth opportunities for product intelligence; the system is designed to follow human needs now and in the future; as well as focusing on Corporate Social Responsibility programs where there is social responsibility and resource efficiency (Lasi & Frettke, 2014; Roblek et al., 2016).

News Automation System as Cyber-Physical System

News production in the digital era also changes the method of writing and disseminating news. In addition to journalists who carry out the news production process, from collecting data to making news narratives and spreading them to audiences, tools are offered to speed up the process of media work. These tools are advanced CAR systems that are part of the automation system. Shoshana Zuboff (in Linden, 2017) states that all human labor machines can replace will be automated without requiring direct human supervision. This has become a trend from an industrial perspective because it provides efficient production that competes with human resources. However, as the history of automation in the editorial office shows, not all of them have paid much attention to the system. This is the opposite when the automation process is acceptable to all relevant social groups and influences system policies. Relevant and influential social groups include media editors, internal publishers, media technology developers, business people in media companies, advertisers, media audiences, media providers, and users. In addition, governments and regulators such as data protection agencies or financial authorities also provide acceptance of automation in the industry (Linden, 2017).

Technological developments have always shaped journalistic work. Over the past few decades, information technology has entered newsrooms assisting journalists in various phases of the news production process. New technologies are always met with overly optimistic or pessimistic scenarios because new developments will change media content for better or worse, including

automated content creation and deployment. However, the idea of automation systems affecting the journalistic profession cannot be categorized as technological determinism because it is part of a more significant trend in journalism and society (Ornebring, 2010).

Automation permeates all aspects of news production and dissemination indirectly. This automated process uses artificial intelligence, which is tasked with finding new insights from big data. This system composes narratives without human involvement and automatically distributes news according to audience digital profiles. Media companies are expected to experience significant changes in the coming decades due to the introduction of artificial intelligence (AI) processes integrated into all news production and dissemination aspects. The editorial structure has also undergone changes led by new leaders such as data managers and software engineers.

The work of the automation system is to identify trends or patterns and publish articles in a specific format. It is carried out by a system that is often referred to as a robot journalist (Latar, 2015, 2018) by following orders given by human journalists. This robotic journalist is an active member of the news processing process and has his duties. Once the system or program is entered into the relevant software - then executed according to the procedure that has been designed - the robot carries out its mission without the intervention of journalists according to the algorithm compiled in the system (Kim & Kim, 2017).

The robot context here is not a robot that is physically visible but a system that has been programmed in the editing software and is ready to run. According to Latar (2015), the coverage of robotic journalists that form news automation is based on two pillars. First, the computer software will automatically generate new knowledge from data sets with the concept of social physics. Second, the algorithm transforms that knowledge into narratives that can be digested without human involvement.

From these two pillars, news automation is formed by the media for news production by optimizing data and resources in media organizations. So, the process of producing and distributing news is represented by robot journalists. The role of humans here is only to oversee the work of robot journalists. In contrast, robot journalists replace the part of humans (journalists) in terms of producing and spreading the news to audiences. This relates to the cyber-physical system (CPS), which obscures work that should occur in the physical space to be represented by machines in the virtual space. Simply put, what happens in the physical space will be described in the virtual space, including producing and distributing news to audiences. Tools or tools carry out this representation in automation technology.

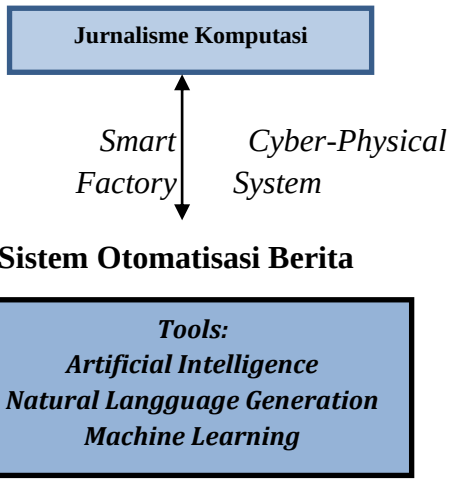
Tools or tools in this news automation technology include Artificial Intelligence, Natural Language Generation, and Machine Learning (Dorr & Hollnbuchner, 2017; Latar, 2015, 2018; Linden, 2017). These tools have, to some extent, shaped how news content is produced and disseminated. This tool is used in analyzing data sets to improve the quality of reports, but replacing human journalists in writing stories is still a polemic. Those tools bring changes to the practice of journalism. Most of the changes at this stage are collecting news materials, writing news texts, and disseminating news to audiences that no longer involve human roles. It starts with artificial intelligence machines (Artificial Intelligence) that run algorithms according to production goals. The branch of artificial intelligence is in the form of Natural Language Processing (NLP), Natural Language Generation (NLG), and Machine Learning algorithms that utilize the Application Programming Interface (API) to retrieve data that is freely available on the internet.

The emergence of authoring algorithms is a new expression of media transformation as they reshape the essential parts of the news business. In other words, the algorithm can eliminate the position of the human journalist's name in the news writing structure. Reiter and Dale (2000) inform that media has transformed more rapidly thanks to advances in the development of the NLG algorithm. The NLG algorithm that builds on language recognition developments has made its way into editors worldwide. They can

produce comprehensive news reports, such as sports updates, financial analysis, and breaking news, with little or no help from human journalists.

Picture 2

The Forms of Mass Media Technology Adoption in Industry 4.0



(Source: Dalen, dkk in Linden, 2017)

The two forms of technology adoption described previously show that there are challenges for mass media companies to innovate in the production, distribution, and consumption of content in particular. The production and distribution process involves mass media employees, so an approach is needed to implement the technology adoption process. Technology adoption is in line with innovative work put forward by Rogers (in Barron & Schneckenberg, 2012) regarding the diffusion of innovation as an individual or organizational decision to use innovative products or technologies. A large amount of work in this field has resulted in solid concepts and paradigms such as attributes of innovation, individual innovation, opinion leadership, and rate of diffusion.

Humans also accept technology of their own volition, influenced by intrinsic and extrinsic factors, including motivation for adopting technology, perceived benefits, subjective norms towards technology, and individual perceptions of organizational culture (Davis et al., 1989 Melitski et al., 2010). Then came the Technology Adoption Model (TAM) put forward by Taylor and Odd (Azam & Quaddus, 2013; Melitski et al., 2010; Straub, 2009), which argues that it influences a person to adopt new technology from the behavioral control variable, perceived, attitudes, and subjective norms about future goals.

Meanwhile, to deal with the concept of industry 4.0, mass media companies with fast technological developments. The idea of industry 4.0 will affect the culture of human communication, which previously turned face-to-face into virtual, because the CPS system, which is the basic concept of industry 4.0, provides that everything that exists physically is represented in cyberspace and vice versa. The use of technology by humans is also developing; previously, humans with machines, but now and in the future, have changed to machines with machines (Roblek et al., 2016).

Even in this digital era, mass media and communication have become unclear because of the nature of digital technology, which has no boundaries in the communication process. McQuail (in Deuze, 2011) suggests a shift towards a post-industrial view of media, in which the media are unimportantly involved in everyday life and mass communication because of their potential to reach the entire national or mass public with an unlimited variety of content. But what is more important is to see the impact of mass media, which is based on the voluntary involvement of the public in the media's rich and varied experiences that are mediated.

Likewise, Castells (2007) articulates the emergence of a new form of socialized communication, namely mass communication in large numbers. This new form of communication uses computer networks in a digital format, is distributed globally, and is interactive. Even revolutionary media like this do not determine the content and effects of the messages conveyed but allow unlimited diversity and global production, which is interpreted as mass media thinking today (Castells, 2007).

CONCLUSIONS

Industry 4.0 influenced the culture of human communication, which previously turned face-to-face into virtual, with the fundamental concepts of using CPS, IoT, and Smart Factory. This is a challenge for the sustainability of the

mass media to carry out its functions. This paper offers two forms of technology adoption: computational journalism as a Smart Factory-based production action and news automation as well as a CPS-based distribution action. The two forms of media technology adoption challenge mass media companies to innovate in the content production and distribution process in particular. Therefore, the production and distribution process involves mass media workers, so it requires an approach to carry out the process of adopting mass media technology.

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