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Immersive Technologies in Indonesia Faces "New Normal" COVID-19

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Abstract. Indonesia is attempting to rebuild the entire country's condition to the "New Normal" era during the COVID-19 pandemic. One of the emerging technologies with significant potential for dealing with the crisis is Immersive Technology (ImTech). In Indonesia, there is a growing demand for immersive technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). The Indonesian government is actively prioritizing digitalization implementation in various sectors to stimulate a post-COVID-19 recovery. This study aims to map the current and potential future applications of ImTech in Indonesia about dealing with the "New Normal" following the COVID-19 pandemic. A systematic literature review (SLR) was used to analyze the publications for a thorough understanding of the existing ImTech applications in Indonesia. According to 50 papers, the ontology of current ImTech applications in Indonesia is produced, focusing on four sectors (medical, industry, tourism, and education). As indicated by the growth of "start-ups" relating to this technological application, Indonesia has enormous potential to adopt ImTech. The future application of this technology is discussed on the industrial sector.

Keywords: Immersive technology (ImTech); Indonesia; Systematic literature review; Sector

1. Introduction

The World Health Organization (WHO) has declared the Corona Virus Disease 2019 (COVID-19) a pandemic. COVID-19 cases are becoming more common in various regions of Indonesia, as evidenced by an increase in the number of cases and deaths caused by COVID-19. In March 2021, the daily new cases and new deaths remained high, with around 5,000 people and 200 people, respectively (WHO, 2021). The COVID-19 pandemic has had a broad impact on people's lives, including the medical, social, and economic sectors (Berawi, 2020a; Supriatna, 2020). Workers in industry and education were the hardest hit, nearly half reporting a decrease in income due to pay cuts or reduced hours of work available (Dekker, 2020).

Indonesia is struggling to deal with the pandemic as it faces the worst economic downturn in 20 years and an increasing rate of COVID-19 infection. The government relaxed some of the country's social distancing restrictions (PSBBs) in June 2020 and opened up some sectors of the economy. President Joko Widodo described these

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measures as preparing for the "New Normal" (Sparrow et al., 2020). "New Normal" is a necessary remedy in an unknown pandemic. It is a shift in norms, values, and people's interactions with others and their surroundings in the "New Normal". Even if they return to their everyday routines, each individual must do something new to change their previous behavior and habits. For one thing, gathering with colleagues has begun to be limited in the workplace, school, club, tourist, and so on (Fridayani & Iqbal, 2020).

Working-from-home and social distancing restrictions during the "New Normal" increased Indonesia's reliance on information and communication technology (ICT), such as mobile technology, resulting in double-digit growth in the ICT area yearly. Using ICT technology to tackle global challenges during the COVID-19 pandemic can enhance productivity, increase the quality of education, improve quality of life, and promote healthy lives for everyone (Berawi, 2020b). This usage had a positive impact on employment in the sectors. However, the industry has accounted for less than 5% of GDP, and contractions in other sectors dwarfed the increase in employment. Businesses adopted ImTech in response to the widespread need for social distancing and the shift to remote work. ImTech is one of the most effective strategies for increasing human involvement and connecting employees for remote collaboration, exhibitions, and events. Currently, it has a taxonomy that consists of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) (Ercan, 2020).

Compared to others, VR is a technology that is fully immersive, in which the user comes to a virtual environment generated by a computer. Therefore, it removes a genuine relationship with the real environment or low-level interaction. AR technology introduced a new way to solve VR technology problems (Ercan, 2020). This technology uses real-time interactivity and three-dimensional (3D) registration to mix computer-generated virtual things and the actual world. As a result, it is possible to increase the user interaction level, but at the same time, it will reduce the user immersion level. To overcome the immersive problem, MR combines the virtual and real worlds, supported by a high degree of connected devices to enhance a user's experience and allow for near-seamless interaction between both worlds (Rokhsaritalemi, et al., 2020; Santoso et al., 2021).

ImTech is an emerging ICT-related technology that has significant potential for dealing with the crisis in the "New Normal". It brought up various opportunities to transform businesses, drive innovations, and enhance productivity and solutions. These technologies are becoming increasingly popular in Indonesia. Even before the pandemic, Indonesia recognized the benefits of ImTech applications. The Indonesian government is actively prioritizing digitalization implementation in various sectors to stimulate a post-COVID-19 recovery. According to a consumer survey, 63 percent of surveyed companies used immersive technologies to navigate the pandemic's challenges. The impact of AR and VR could be far-reaching, improving workplace safety and efficiency around the world. In Indonesia, VR and AR usage are not yet widespread. Respondents are enthusiastic about VR/AR possibilities, as evidenced by positive responses to questions about VR/AR applications in education, advertising, and professional work. However, because VR and AR technologies have yet to be widely adopted by Indonesian consumers, Indonesian VR/AR businesses face a long road ahead (DailySocial, 2017).

This research focuses on mapping the current and potential applications of immersive technology in Indonesia to deal with the "New Normal" following the COVID-19 pandemic. It contributes in identifying potential future applications of ImTech in Indonesia as the country prepares for a "New Normal" and gives the future research direction. Besides, it helps to accelerate the usage and implementation of immersive technology in Indonesia, which is not only for the current condition during the "New Normal" but also for long-term planning in crucial sectors. The remainder of this paper is organized as follows. Following

this introduction, the methods are described. We will discuss the potential mapping of ImTech in Indonesia in section 3 and conclude our study in the last section.

2. Methods

The research proposed a systematic literature review (SLR) to investigate the state-of-the-art ImTech applications in Indonesia. This approach aims to search, screen, synthesize and analyze the studies relevant to a specific research field following the five steps: planning, scoping, searching, assessing, and analyzing (Baroroh et al., 2021). This will develop the domain ontology of existing ImTech applications in Indonesia.

2.1. Planning step

In this step, Google Scholar (https://scholar.google.com/) was chosen as the primary academic database to be explored. Compared to Web of Science and Scopus, Google Scholar is the most comprehensive academic search engine with a multidisciplinary database. However, it lacks stability and dependability and delivers fewer results with simple searches that do not use other limiters (Gusenbauer, 2019).

2.2. Scoping step

We created a classification framework for SLR by considering the domain and goal of this research. The framework was developed through an iterative brainstorming process. In this framework, we attempted to focus on (a) publication year, (b) the type of immersive technologies (including VR, AR, and MR), (c) the device used in the application (including a head-mounted display (HMD), a hand-held device (HHD), a monitor, and a web-based), and (d) sector in which the technology is used.

2.3. Searching step

We searched the relevant paper in the Google Scholar database using two keywords: "ImTech" and "Indonesia" with the Boolean operator "AND".

2.4. Assessing step

The literature collected in the previous step was assessed in two phases. In the first phase, the search results were screened by various criteria such as the year publication (2015-2021), document type (journal and proceeding), and language (English). Because of duplicate and irrelevant literature, we manually analyzed the findings in the second phase. The relevant paper focuses on four sectors (medical, industry, tourism, and education) and has a connection to Indonesia. Three criteria represented Indonesia, including (1) the paper is a case study in Indonesia, (2) the author comes from Indonesia, and (3) the journal or conference publisher is located or from Indonesia.

2.5. Analyzing step

Data collection was analyzed, organized, and presented in descriptive statistics to derive valuable findings, as shown in Figures 1 and 2. Domain ontology of the resulting literature is based on the framework described in the scoping step (Figure 3).

3. Results and Discussion

Approximately 68 papers were collected using the keywords mentioned in the searching step. However, after the manual screening, we only received 50 documents relevant to the topic and scope of the research. To deal with the COVID-19 pandemic, the Indonesian government has implemented remote learning, work from home (WFH), and social distancing. Those strategies impact the high demand for information and communication technology, particularly ImTech. The number of publications related to

immersive technologies in Indonesia increased slowly from 2015 to 2017 but dramatically in 2018 and 2020 (Figure 1 (a)). Those periods are before and during pandemic COVID-19. However, the number of papers in 2021 is low compared to other years because the search period was done in early 2021, when there is not much publication yet. In this study, most article sources come from journals and conferences around (40:60), as displayed in Figure 1 (b).

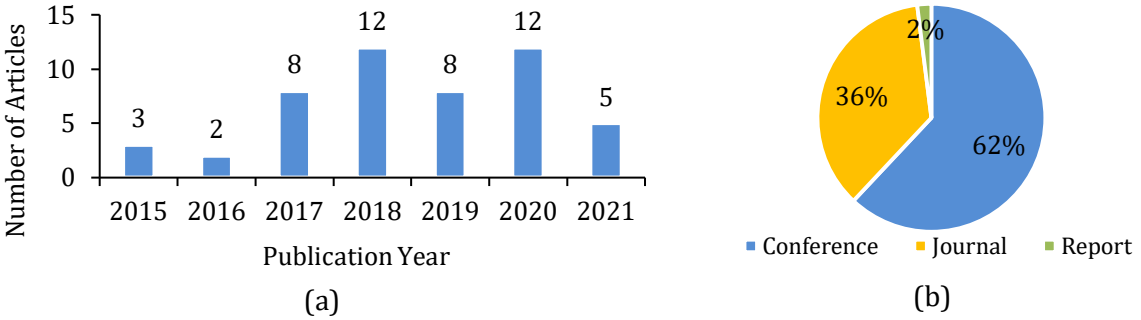

Figure 1 Article analysis based on: (a) Trend by year, and (b) Article type

Statistical analysis was performed by comparing the literature based on ImTech, device, and sector implementation, as presented in Figure 2. More than half of the paper collections revealed that virtual reality (VR) is more popular than augmented reality (AR) and mixed reality (MR) (as shown in Figure 2 (a)). In the context of the devices, as shown in Figure 2 (b), it only used visual modality to display the information or build a user interface. Figure 2 (b) indicates that HMD is the most popular device, with 38%, followed by multiple devices, with 28% preferring a combination of HMD and HHD. According to Figure 2 (c), most of them were implemented in the education sector (46%), followed by tourism (22%), medical (18%), and industry (14%). Based on depth analysis from Figure 2, in Indonesia, most VR applications used HMD (19 papers) and are still limited to use HHD (1 paper). Nevertheless, the implementation of VR using HMD is almost equal for all sectors. On the contrary, HHD dominated the AR applications (8 papers), and five were implemented in the education sector. On the other hand, MR application is still limited (2 papers), which are review papers or not case studies.

Remote learning is one of the reasons why the education sector is more popular than other sectors. During COVID-19, many researchers attempted to analyze new ways to make learning more fun and interesting. ImTech is one viable option for achieving the goal. Based on the 50 papers we gathered, we created an ontology representing the current device and implementing immersive technologies in each sector in Indonesia, as shown in Figure 3. Through implementation, it can help to enhance learning, and motivate students in the field of education. In addition, it can also improve user interaction by allowing them to see the object up close and interact with it even if the object no longer exists, such as interaction with endangered species (Fauzi et al., 2019).

A virtual tour is one of the most popular ImTech concepts, especially for the tourism industry (Putro, 2015). ImTech can provide users with the sensation of being in a physical location without time and space constraints. It can improve the experience of searching for heritage sites in the virtual world (Bafadhal, 2020; Setyowati et al., 2020; Syahputra et al., 2016; Wahyudi et al., 2018). This technology allows the user to learn about an ancient culture and visit places that no longer exist or are too dangerous or expensive to visit (Syahputra et al., 2016). As a result, users can also gain new experiences and knowledge. There are numerous existing tourism-related applications, such as landmark tours (Herumurti et al., 2017; Prasetya et al., 2018), university tours (Widiyaningtyas et al.,

2018), workshop tours, etc. A virtual tour will never be able to substitute traditional travel. Instead of functioning as an alternate form of tourism during COVID-19 and beyond, a virtual tour will be used as a critical destination marketing tool, assisting tourists in better designing their itinerary routes and learning about local attractions (Drianda et al., 2021).

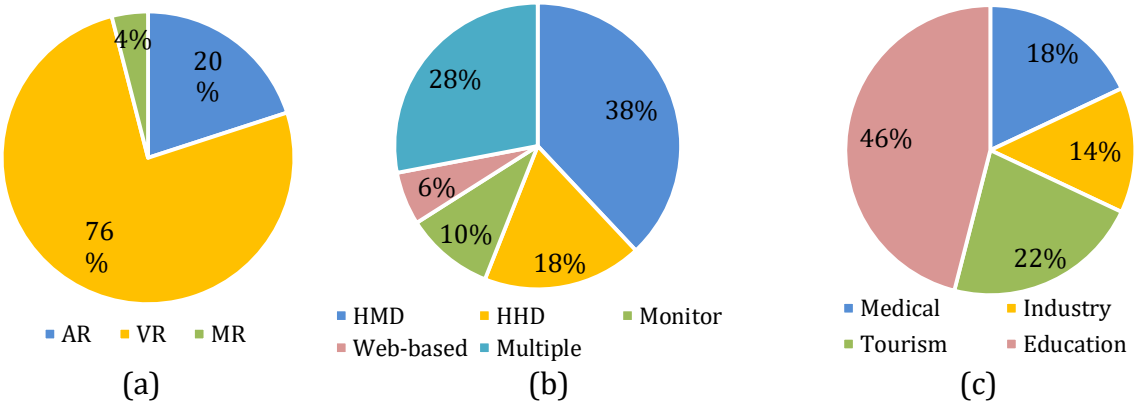

Figure 2 Descriptive statistical analysis of literature collections based on: (a) Immersive technology type, (b) Device type, and (c) Sector implementation

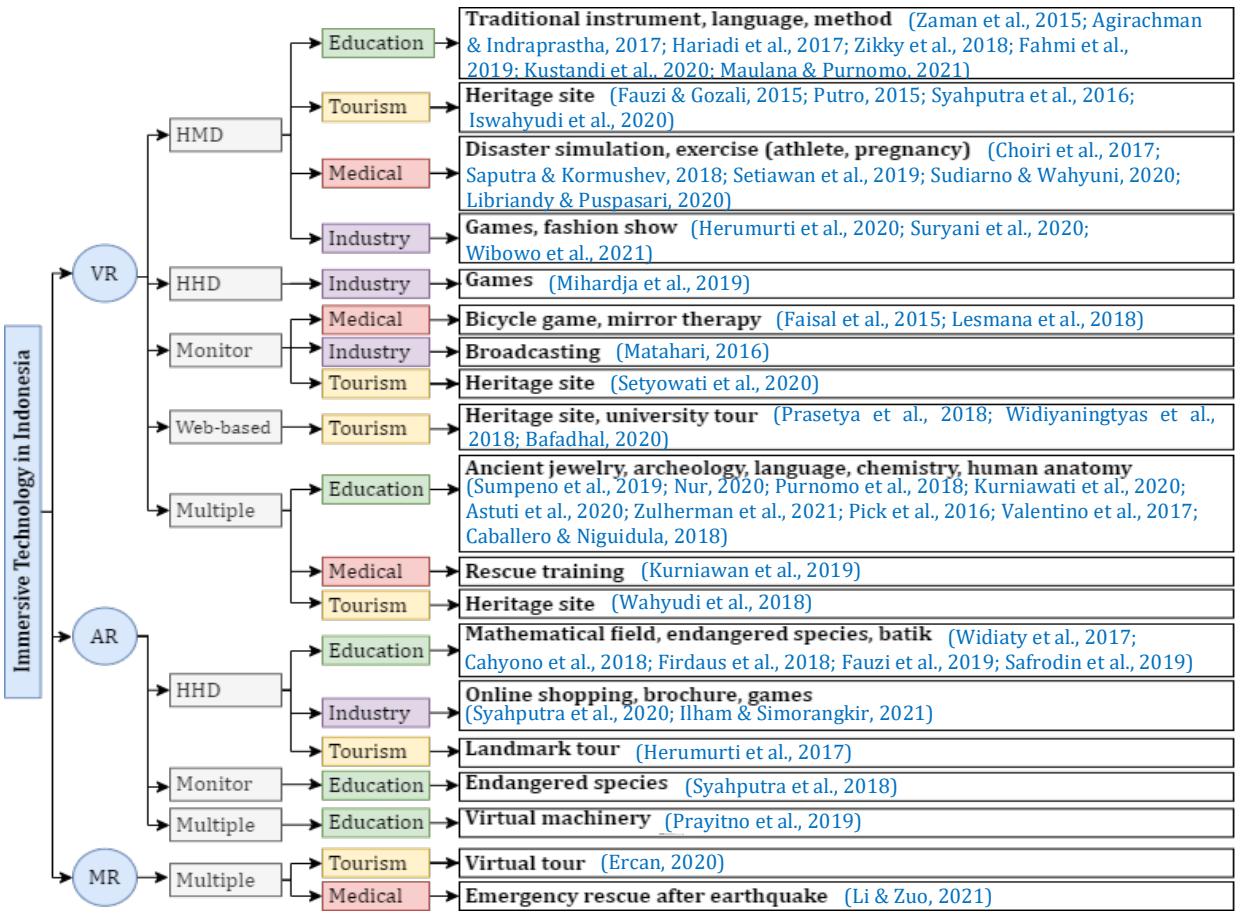

Figure 3 Ontology-based literature review

Immersive technologies have not yet been implemented in Indonesia to assist with operations such as hospitals. However, the use of ImTech for surgery has already been implemented, for example, in augmented reality-assisted surgery (ARAS). Currently, the implementation of those technologies in Indonesia is limited to healthcare (Faisal et al., 2015), explicitly improving therapy methods (Lesmana et al., 2018), and disaster rescue/training (Caballero & Niguidula, 2018) and continues to focus on other sectors. This

technology is already being used in the manufacturing industry in developed countries to increase output or make the system more effective and efficient by increasing human involvement. Though, it cannot be easily applied in Indonesia because most of the country's industry is still dominated by small and medium-sized businesses unfamiliar with or have barriers to implementing this type of technology.

The COVID-19 pandemic's consequences Indonesia has entered the era of the "New Normal." This era was also carried out to recover several sectors that almost died cause of the pandemic (Fridayani & Iqbal, 2020). The Indonesian government implements several strategies to reduce new cases in response to this condition. Those strategies have provided sufficient impetus for the widespread adoption of immersive technologies such as VR, AR, and MR. We discovered that ImTech exists in Indonesia and can increase due to the various possibilities. As internal factors, it can provide substituted reality experiences in multiple fields, including the ability to give a better reputation among consumers, high creativity, and diversity levels in application. All hot topics are supported for the real-time feature in current industrial fields. It is considered the fourth industrial revolution's key technology. However, this technology is a complicated design requiring high programming skills, imperfect devices, and still high implementation and operational costs (Ivanova, 2018), mainly when using a head-mounted display (HMD). Regardless of the shortcomings as external factors, the use of ImTech will aid in the development of new production methods and processes that will influence market trends. Because the development of this technology in Indonesia is lower than in developed countries, rising competitors are attempting to increase product popularity by utilizing multiple platforms, disrupting the production of new items.

ImTech not only helps people in ways that make a difference in their lives, such as virtual shopping, immersive learning education, entertainment, and healthcare, but it also protects businesses from pandemics. Remote working, immersive training for employees, and virtual events can be used to save a company by increasing efficiency and profitability (Prayitno et al., 2019). Businesses or industries should use digital platforms to improve their product or service offerings through virtual possibilities. Technology and automation will play an essential role in enhancing productivity (Berawi, 2020b). As evidenced by the existence of several start-ups in this field, Indonesia has enormous potential to implement ImTech (DailySocial, 2017). For instance, ARKids Studio and JENIUSVR are two companies in the education space. While in terms of e-commerce and marketing, there are DAV Global, SnapCard, SmartEye, and Octagon Studio. Although education and tourism are popular currently, it does not rule out further development in the industry or business sector. That sector is a significant impact on the country's burgeoning digital economy. ImTech has a lot of potential applications, especially for supporting intelligent systems, for example, as an interface between human and artificial intelligence to assist manual operations in manufacturing. A rising number of studies are focusing on using this emerging technology in the industry, particularly in the operation of maintenance and assembly, with training, monitoring, quality inspection, and other processes following (Baroroh et al., 2021).

4. Conclusions

Immersive technology is one of the technologies that can enhance user interaction by providing relevant information and making the system more appealing, informative, and interactive. It is divided into several types, including VR, AR, and MR, each with implementation differences. ImTech is becoming more popular than ever due to the increased demand for information and communication technology during the COVID-19 pandemic, notably to support remote learning and social distancing. The VR application is

more popular than the AR and MR applications. Although the available devices for supporting ImTech vary, only visual modality, particularly HMD, is Indonesia's most popular device (38%). Most applications are designed to benefit the education sector (with 46%). Although ImTech in industry or business is still limited, it has enormous potential, mainly when internal and external factors are considered. Indonesia has vast potential to implement ImTech, as evidenced by the emergence of "start-ups" related to this technology application.

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