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# A Comparative Analysis Review of Digital Transformation Stage in Developing Countries

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***Abstract:***

***Purpose:*** Digital Transformation (DX) is a phenomenon that must be addressed properly so that its benefits can be optimized. Slow adaptation to DT leads to the destruction of the industry and threatens its sustainability. This article reveals significant insights in describing the trend of DX stages, especially in developing countries.

***Design/methodology/approach:*** Based on a comparative analysis of research related to DX in developing countries in reputable journals, more than 900 articles that reviewed DX. By conducting a strict and thorough screening of DX stages in developing countries, especially on the topic of Information Systems, 60 relevant articles were obtained.

***Findings:*** DX barriers in phase 1 comprise the fact that access and infrastructure are starting to be bridged, but not completely. DX barriers in developed countries have shifted predominantly from stage 1 to stage 2. More than 80 of the revealed indicators contribute to the success of DX in developing countries. In addition, this article also discusses various future research opportunities and essential indicators that intersect in stages 1, 2, and 3.

***Originality/value:*** DX barriers in developed countries have shifted predominantly from stage 1 to stage 2. More than 80 of the revealed indicators contribute to the success of DX in developing countries.

***Keywords:*** digital transformation, stage, developing countries, digital barrier, digital indicator

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## 1. Introduction

Although Digital Transformation has been introduced for quite a long time since the dawn of the 3rd industrial revolution, it is evident that digital transformation cannot be carried out concurrently throughout the world (van Dijk, 2020) There are differences in DX stages that occur in various countries. Those differences can be observed in developed and developing countries. Current discussions on DX in developing countries focus on digital skills

(Dobrolyubova, Alexandrov & Yefremov, 2017; van Deursen & van Dijk, 2019). Although access and infrastructure constraints have not been completely addressed, revolutions taking place in many countries in the wake of the industrial revolution 4.0 are suspected of contributing to bridging access problems (van Dijk, 2005). Digital Transformation continues to evolve, various academic literature and practitioners discuss aspects of DT with the dominance of DT discussions in developed countries. Meanwhile, digital transformation in developing countries faces complex problems that cannot be generalized with developed countries. To fill the research gap, this study proposes an in-depth discussion of DT trends, especially in developing countries. This research adds to the contribution of the literature on DX in general, and specifically for developing countries. In practical terms, this research adds a reference for management in determining the right strategy based on the development trends of DT specifically faced by developing countries. To respond optimally to the development of DX, identification of factors at each stage of DX is needed. Data collection in this study was carried out based on the classification of DX topics in developing countries. To maintain the quality of research results, the data sources selected were reputable journals indexed by Scopus. There were over 900 selected articles. The next step of data selection was selecting sources in the form of journals, eliminating sources in the form of book and conference, narrowing down the data to 186 articles. The data sources should focus on the topic of Information Systems. The next step was screening the title and abstract of the articles, further bringing down the number to 98 articles. Finally, after selecting and screening the full text of the articles, 60 relevant articles were obtained. This paper aims to identify the stages and key factors of DX in developing countries. In addition, it intends to contribute to overcoming or bridging DX problems through the implementation of appropriate strategies for the success of DX. This paper seeks to answer two main research questions, namely: finding out how is the trend of DX stages in developing countries and identifying the main factors at each stage of DX in developing countries. The paper is divided into three main parts. The initial chapter discusses the stages of DX. The next chapter discusses a comparative analysis of DX trends in developing countries through reputable journals until 2021. Furthermore, it reveals the DX factor identified through comparative studies. Finally, the brief conclusion section closes the article and presents various future research prospects.

## 2. Theoretical Context

Based on the stages, there are several terms about digital transformation, namely: Digitization, Digitalization, Digital transformation (Bumann & Peter, 2019; Reis, Amorim, Melão, Cohen & Rodrigues, 2020; Verhoef et al., 2021). Digitization is the conversion from analog to digital (Bumann & Peter, 2019), or the encoding of analog information into a digital format (that is, into zeros and ones) so that computers can store, process, and transmit that information. Digitalization describes how the use of digital technology and its impact in transforming existing business processes (Li, Nucciarelli, Roden & Graham, 2016; Verhoef et al., 2021). An example of digitalization is the creation of artefact as a means of online communication that allows customers to easily connect with companies, or to transform customer interactions that were previously carried out traditionally transformed into customer interactions using technology (Ramaswamy & Ozcan, 2016; Verhoef et al., 2021). Meanwhile, digital transformation illustrates company-wide changes leading to the development of new business models (Pagani & Pardo, 2017). This change involves the use of computer technology and the internet for a more efficient and effective process of economic value creation (Reddy & Reinartz, 2017). Digital Transformation is the main focus of this research. The success of digital transformation is related to the bridged digital barriers that exist. The digital divide is becoming a phenomenon that covers various aspects. The ever-changing digital problems have resulted in a dynamic digital divide. For a large number of people, lack of access becomes the main problem for connecting to technology, especially the Internet. Nevertheless, access to digital media or computer ownership starts from motivation and a positive attitude towards using it. Internet penetration is increasing rapidly and significantly reducing the gap between those who access it and those who fall behind in the digital world (Calderón-Gómez, 2021; Ragnedda & Kreitem, 2018). Although they have been reduced, access gaps persist, and inequalities in accessing the Internet can be observed both between countries (the global digital divide) and within countries (social digital divides between regions in those countries). Internet penetration is a part of broader digital inequality. Thus, it cannot reduce the multidimensionality of the digital divide (Ragnedda, 2018; Ragnedda & Muschert, 2017). For example, Indonesia has the highest internet penetration among developing countries in Southeast Asia (Das, Gryseels, Sudhir & Tan, 2016; Nikkei Asian Review, 2018; Tjiptono, Arli & Viviea, 2016). Nevertheless, Indonesia

still has a low rating on the DX readiness index (Dutta & Lanvin, 2021). From time to time, the use of internet access has increased. The internet access of developed countries reaches around 70% to 98%, while the average internet access in developing countries is 40% (van Dijk, 2020). This access problem is generally categorized as the first stage of DX problem. Previous research has revealed that digital literacy or skills and usage are more important in the digital divide (Correa, 2016; Ragnedda, 2017). This divide is known as the second stage digital divide. The issue of DX divide further develops to the benefits of the Internet usage. In this case, not only the positive impacts are observed, but also the negative impacts such as cybercrime, illegal hacking, hate speech, disinformation on social media, smartphones, or the internet, and addiction to games (Calderón-Gómez, 2021; Ragnedda & Kreitem, 2018). The benefits of DX is known as the third stage digital divide. In summary, the definition of the stages of the DX issue is presented in Table 1.

| DX Stages | Definition | References |
|---|---|---|
| First Stage | The use of internet access and infrastructure distribution | (van Dijk, 2005, 2020; Newhagen & Bucy, 2003; Ragnedda & Kreitem, 2018; Ragnedda & Muschert, 2017) |
| Second Stage | Technological proficiency | (Dobrolyubova et al., 2017; van Deursen & van Dijk, 2019) |
| Third Stage | The use of technology to improve the quality of life | (Ragnedda & Kreitem, 2018; van Dijk, 2005) |

Table 1. Digital Transformation Stages

## 3. Methods

### 3.1. Data Sources and Search Strategy

The stages of this study are presented in Figure 1.

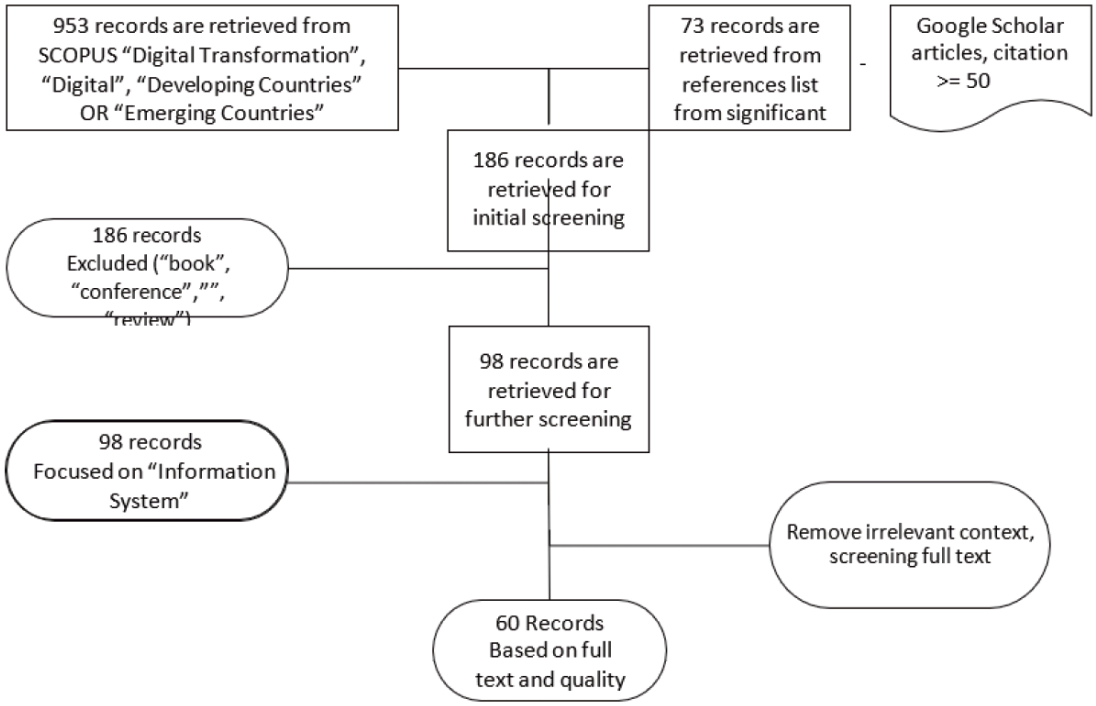


Figure 1. Stages of Research

The first stage of this study is to search for massive and thorough references about Digital Transformation. Second, focus the search results on the Information Systems field. Third, this study applies a strategy of presenting materials that represent most of the work on Digital Transformation. In this study, the source data

were taken from a reputable journal of Scopus. The selection of the scopus database is because for citation analysis, Scopus offers about 20% coverage (Falagas, Pitsouni, Malietzis & Pappas, 2008) more than other databases such as Web of Science and Google Scholar. In addition, Scopus covers a wider range of journals, which helps both in keyword search and citation analysis (Falagas et al., 2008; Harzing & Alakangas, 2016). The keywords of Digital Transformation, Digital, Developing Countries, or Emerging Countries are applied as an initial screening for data search. As a result, 953 articles were obtained from Scopus and 73 articles with more than 50 citations of the predetermined keywords are obtained from Google Scholar. The specificity of the data on the type of journal articles without other sources such as conferences were carried out to obtain a comprehensive DX discussion. Therefore, a total of 186 articles were obtained. Furthermore, data selection based on the topic of Information Systems and screening titles and abstracts related to DX were conducted, resulting in 98 articles. To find in-depth discussions related to DX in developing countries, the next data selection was carried out by screening full-text articles so that 60 relevant articles were obtained. Furthermore, the selected article is used as a source for the analysis of this paper.

### 3.2. Extracting Data

The data extraction process in this study is based on to the research question, including how the trend of the DX stages is and what the main factors at each DX stage in developing countries are. The various DX factors identified from the article in the previous stage (chapter 3.1) are recorded and presented in Table 2.

| Digital transformation trend in developing countries | |
|---|---|
| **Identified factor** | **References** |
| Infrastructure, geographical location | (Raj, Dwivedi, Sharma, Lopes de Sousa-Jabbour & Rajak, 2020; Bakon, Elias & Abusamhadana, 2020; Aguilar-Rodriguez, Bernal-Torres, Aldana-Bernal, Acosta-Aguinaga, Artieda-Cajilema & Chalá, 2021; Anshari & Almunawar, 202l; Robards, Kang, Usherwood & Sanci, 2018; Hong, Zhou, Z., Fang, Y., & Shi, 2017; Idiegbeyan-Ose, Nkiko, Idahosa & Nwokocha, 2016; Igun, 201l; Minghetti & Buhalis, 2010; Chang, Kim, Wong & Park, 2015) |
| Investment on technology | (Raj et al., 2020; Chang et al., 2015; Aghimien, Aigbavboa, Oke, Thwala & Moripe, 2020; Breunig, Kelly, Mathis & Wee, 2016; Dalenogare, Benitez, Ayala & Frank, 2018) |
| Challenges in Value-chain Integration | (Raj et al., 2020; Narwane, Raut, Yadav, Cheikhrouhou, Narkhede & Priyadarshinee, 202l; Dalenogare et al., 2018; Majeed & Rupasinghe, 2017) |
| Access broadband (Internet) | (Bakon et al., 2020; Wang, Guo & Wu, 2021; Hong et al., 2017; Igun, 2011; James, 2005; Acilar, 2020; Ohemeng & Ofosu-Adarkwa, 2014) |
| Low Maturity Level of Preferred Technology | (Raj et al., 2020; Hong et al., 2017; Petrillo et al., 2018) |
| Awareness (motivation) | (Alenizi, 2020; James, 2003; Chang et al., 2015) |
| Language and Content focus | (James, 2005; James, 2004; Arunachalam, 1999) |
| Socio-economic(income, education, social class) | (van Dijk, 2005; Ragnedda, Ruiu & Addeo, 2020) |
| Cultural Barriers | (Ohemeng & Ofosu-Adarkwa, 2014; Dimaggio, Hargittai, Celeste & Shafer, 2004) |
| Capability/ Skill | (Gravili, Benvenuto, Avram & Viola, 2018; Raj et al., 2020; Andreev, Kazanin & Zayed, 2021; Inshakova, Frolova, Rusakova & Kovalev, 2020; Aghimien et al., 2020; Hai, Van & Tuyet, 2021; Narwane et al., 2021; Joshi & Sharma, 2021; Alekseev, Lobova & Bogoviz, 202l; Vagin, Lascencov, Konovalova & Frank, 2021; Kozuh, Maksimović & Zajić et al., 202l; Robards et al., 2018; James, 2007; Kozma, McGhee, Quellmalz & Zalles et al., 2004; Muhamad, Mohamad & Nor, 2021) |
| Motivation | (Pee, Kankanhalli & On Show, 2010; van Klyton, Tavera-Mesías & Castaño-Muñoz, 2020; Acilar, 2020; Chang et al., 2015; Vagin et al., 2021) |

| Digital transformation trend in developing countries | |
|---|---|
| **Identified factor** | **References** |
| Socio-Economic | (Ramazanov, Panasenko, Cheglov, Krasil'nikova & Nikishin, 2021; Wang et al., 2021; Joshi & Sharma, 2021; Gravili et al., 2018; Allen, Natarajan & Price, 2012; Minghetti & Buhalis, 2010; Calderón-Gomez, 2019; Ogbo, Brown, Gant & Sicker, 2020; Alenizi, 2020; Wilson & Wilson 2009; Alekseev et al., 2021; Finkelstein, Shapiro & Mandelman, 2021; Idiegbeyan-Ose et al., 2016) |
| Age | (Ogbo et a,l. 2020; Hong et al., 2017; Mubarak & Nycyk, 2017; Robards et al., 2018) |
| Gender | (Acilar, 2020; Ogbo et al., 2020; Singh, 2017; Tjiptono et al., 2016; James, 2007; Idiegbeyan-Ose et al., 2016; Allen et al., 2012; Alenizi, 2020) |
| Culture | (Raj et al., 2020; Hai et al., 2021; Aghimien et al., 2020; Bakon et al., 2020; Ramazanov et al., 2021; Aguilar-Rodriguez et al., 202l; Vagin et al., 2021; Gallab, Bouloiz, Kebe & Tkiouat, 2021; Singh, 2017; Mubarak & Nycyk, 2017; Idiegbeyan-Ose et al., 2016; Ohemeng & Ofosu-Adarkwa, 2014; Allen et al., 2012; James, 2007; Calderón-Gomez, 2021; Pianta, 2018; Hong et al., 2017; Minghetti & Buhalis, 2010; Lopes de Sousa-Jabbour, Jabbour, Godinho Filho & Roubaud, 2018) |
| Resource | (Raj et al., 2020; Andreev et al., 202l; Alenizi, 2020; Hai et al., 202l; Bag, Yadav, Dhamija & Kataria, 2021; Anshari & Almunawar, 2021; Muhamad et al., 2021; Joshi & Shanna, 2021) |
| Organization | (Raj et al., 2020; Aguilar-Rodriguez et al., 2021; Bag et al., 2021; Dalenogare et al., 2018; Aghimien et al., 2020; Vagin et al., 2021; Calderón-Gomez, 2021; Hai et al., 2021) |
| Regulation (government) | (Vagin et al., 2021; Raj et al., 2020; Mistry, 2005; Topornin, Pyatkina & Bokov, 202l; Effah & Nuhu, 2017; Ohemeng & Ofosu-Adarkwa, 2014; Vidyasagar, 2006; Anshari & Almunawar, 2021) |
| Intention to Use | (Calderón-Gomez, 2019; van Klyton et al., 2020; Dalenogare et al., 2018; Pee et al., 2010; Robards et al., 2018) |
| Partnership | (Aghimien et al., 2020; Allen et al., 2012; Bag et al., 2021; Narwane et al., 2021; Wilson & Wilson, 2009; Kozma et al., 2004) |
| Disruption Existing Job | (Raj et al., 2020; Finkelstein, Shapiro & Mandelman, 2021; Snowball, Delon-Tarentaal & Sapsed, 2021) |
| Communication | (Aghimien et al., 2020) |
| Navigation | (Robards et al., 2018) |
| Trust | (Aghimien et al., 2020; Joshi & Sharma, 2021; Alenizi, 2020) |
| Security | (Raj et al., 2020; Joshi & Sharma, 202l; Yudhiyati, Putritama & Rahmawati, 2021; Topornin et al., 2021; Aghimien et al., 2020) |
| Digital piracy | (Tjiptono et al., 2016; James, 2003) |
| Marginalizationof Workers | (Casilli, 2017) |
| Flexibility of operations | (Aghimien et al., 2020) |
| Job efficiency | (Aghimien et al., 2020; Pianta, 2018) |
| Educational level | (Ogbo et al., 2020; Idiegbeyan-Ose et al., 2016; Allen et al., 2012; Snowball et al., 2021) |
| Internet use pattern | (Ogbo et al., 2020) |
| Innovations | (Inshakova et al., 2020; Snowball et al., 2021; Alekseev et al., 2021; Mistry, 2005) |
| Culture | (Bakon et al., 2020) |

| Digital transformation trend in developing countries | |
|---|---|
| **Identified factor** | **References** |
| Public Services | (Kumar & Kaur, 2021; van Klyton et al., 2020; Wulansari & Parwanto, 2020; Kassim, Bhattarai, Zamzuri & Othman, 2017; Ahmed & Akhlaq, 2015; Wang et al, 2021; Robards et al., 2018; Hong et al., 2017; Bakon et al., 2020; Acilar, 2020; Garad & Oarnari, 2021; Odat, 2012) |

Table 2. DX Comparative Review of DX Stage based on the extraction of literature documents

## 4. Finding and Analyzing Data

There are nine factors identified in stage 1 of DX, including infrastructure, geographical location; Investment, Challenges in Value-chain Integration, Access, Low Maturity Level of Preferred, Technology, Awareness, Content focus, Cultural Barriers, and Motivation. The findings show that the dominance of the discussion of DX problems in stage 1, especially in developing countries, is infrastructure and geographical location that have a percentage of 29%, and access that has a percentage of 20%. However, other factors in general have a similar value. Cultural barriers in the findings explained how the cyber culture responds to the internet presence.

There are more than 15 factors related to DX problems in stage 2 problems that were identified in the literature review, namely Capability / Skill, Socio Economic, Age, gender, Culture, Resource, Organization, Regulation (government), Intention to Use, Partnership, Disruption Existing Job, Communication, Navigation, Trust, Security, Digital piracy, Marginalization of Workers. DX problem in stage 3 has not been widely discussed especially in developing countries. In this stage, seven factors identified, namely flexibility of operations, Job efficiency, Education level, Internet use pattern, Innovations, Culture, and Public Services.

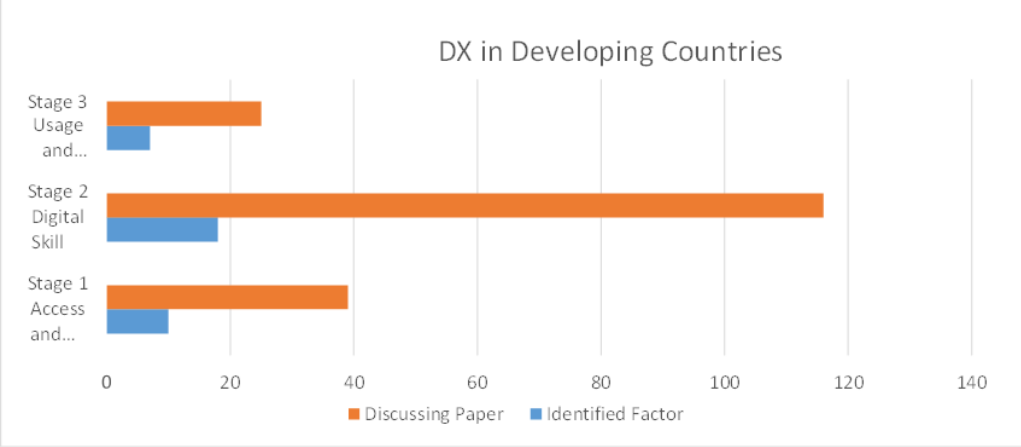


Figure 2. The comparison of DX Stages in developing countries

## 5. Discussions

Based on the analysis in the literature review, the discussion of the DX problem in stage 2 dominates. Physical problems make up 24% of the discussions. This shows that physical problems have not been completely resolved. In archipelagic and developing countries such as Indonesia, the fulfillment of infrastructure is an important problem due to limited physical access in reaching every corner (Indonesia.go.id, 2017). Furthermore, the economic-social complexities also contribute to digital divide. Income barriers have constrained the ability to invest in digital devices, resulting in the existence of digital divide (Raj et al., 2020). Moreover, broadband cost is not cheap (Bakon et al., 2020; Wang et al., 2021). This is further reinforced by the lack of motivation and awareness of the importance of technology (Alenizi, 2020). In general, low English proficiencies correlate with low technological skills among people in developing countries since most technologies use English as their main language (James, 2005). In cultural dimension, the order of social stratification classifies the acquisition of access to information, where the richer, the bigger the opportunity to obtain information (Ohemeng & Ofosu-Adarkwa, 2014; Dimaggio

et al., 2004). In its development, the emergence of new media has contributed to the exacerbation of knowledge gap between 'rich in information' and 'poor in information' (Hindman, 2000; Newhagen & Bucy, 2003; van Dijk & van Deursen, 2014). This phenomenon emphasizes the idea that socio-economic status affects the way of obtaining information and knowledge, resulting in a wider knowledge gap between high class and low class (Ragnedda & Muschert, 2017). Just as first phase of digital problems are influenced by socioeconomics, digital expertise problems are also influenced by the same factors. In the absence of material adequacy, especially adequate income, skill improvement will be affected, for example in paid training, digital piracy (Tjiptono et al., 2016; James, 2003). Some developing countries with strong cultures of separating between gender breadths are pushing for widening gaps in internet skills (Raj et al., 2020; Hai et al., 2021). Several researches showed the use of technology in developing countries has converged on several activities such as online banking (Ogbo et al., 2020) and other digital automation like email (Inshakova et al., 2020; Snowball et al., 2021). Digital Culture has emerged in developing countries, despite not all (Bakon et al., 2020) as an effort to avoid being left behind by allowing more access to information through education (Ogbo et al., 2020; Idiegbeyan-Ose et al., 2016; Allen et al., 2012; Snowball et al., 2021). In the end, the gap in the digital realm is influenced by socio-economic status - how the use and benefits of internet affect people's life opportunities, behaving, starting, and being tied to technology. This is a discussion of the DX problem in the third stage. Although it has not been widely discussed in developing countries, the results of literature review show that the benefits of internet have been addressed in several studies. At least 21% discussed the problem of using and optimizing the benefits of DX. The Extended Factor of the DX problem indicator is presented in this study, Figure 4. These findings are useful for supplementing information in formulating appropriate strategies to bridge the DX problem in developing countries.

### 5.1. Identified Extended Factors of Digital Transformation Stage in Developing Countries

This research also presents an extended factor of the Digital Transformation previously discussed, Table 3. In previous research, motivation on the use of digital technology was interpreted as an individual's effort to gain digital access. Motivation is categorized in Perceived Ease of Use, Perceived Usefulness, etc. Socio-economy has a comprehensive impact on the DX stage, especially in developing countries. Some other obstacles to DX adaptation in developing countries are digital resource processing. This includes data quality, digital sources and data sharing, digital leadership (Hai et al., 2021; Bag et al., 2021), and HR resources that are open to technological trends. Some of the organizational barriers that have arisen in several DX studies in developing countries include: Ineffective Change Management, organizational performance in using technology, project management that lacks support automation of activities, Absence of expected benefits on the use of technology, weak continuation of improvement, not yet established technological capital such as devices, digital equipment and organizational agility (Vagin et al., 2021). Overall government support for the successful adoption of Digital Transformation is necessary such as regulation of technology utilization and healthy competition procedures that support local businesses in the face of industry 4.0 and politics. Meanwhile, there are several factors that influence and hinder the achievement of digital partnerships in developing countries, including distrust among partners, collaborative relationships, and partnering goals, lack of defined partnering procedures, the difficulty in finding the right digital partners, sharing of resources, extension of product lines, as well as sharing of responsibilities and commitment in digital partner. In summary, the extended factors affecting DX in developing countries are presented in Table 3.

| Main Factor | Sub Factor | Explanation |
|---|---|---|
| **Motivation** | **Motivation** | **Motivation to use technology drives individual efforts to gain access.** |
| | Perceived Ease of Use | The perception of the ease of use refers to the extent to which an individual believes that using a particular system will be free from effort/easy. |
| | Perceived Usability | Perceived usability refers to the extent to which an individual believes that using a particular system will improve performance. |
| | Subjective Norm | An individual's perception regarding the extent to which an essential social reference will require a certain behavioral performance. |

| Main Factor | Sub Factor | Explanation |
|---|---|---|
| | | Encourages one to use technology and he is willing to comply, he tends to behave accordingly. |
| | Perceived Behavioral Control | When a person senses that there are significant situational obstacles in using technology, his confidence in successfully carrying out behaviors weakens, and this reduces his intention to engage in behaviors to avoid disappointment. |
| | Adaptive attitudes | The behavior of willing to adapt to the technology. |
| **Socio-Economic** | **Education and income** | **Education and income affect technology adoption rates.** |
| **Age** | **(Age)** | **Age affects the patterns of internet usage** |
| **Gender** | **(Gender)** | **Gender affects the Internet.<br>Gender and age are the main determinants of the frequency of Internet use for new activities, such as playing online games.** |
| | Obstacles to access | Many women have difficulty in accessing and using ICT, especially in developing countries. |
| | (Lack of) education and skills and technological literacy | Digital literacy leads to a lack of convenience in using technology and accessing the Internet. |
| | Affordability | Affordability in the economy, education, and employment affects the main obstacles in accessing ICT. |
| | Gender biases and sociocultural norms | Socio-cultural norms can encourage gender stereotypes concerning the use of technology. Culture can cause gender bias in technology adoption. |
| | Domestic responsibilities | Domestic roles, such as raising children, making food, and taking care of the home, can prevent women from accessing and using new technologies. |
| | Language | Limitations of the language used in accessing technology. |
| | Time | Time constraints that certain genders have due to domestic obligations. |
| | Perceived benefits | lack of awareness of the potential benefits that the Internet can bring. |
| | Self-confidence | Lack of confidence in using |
| | | technology because of a stereotype |
| | | stating that a certain gender is more |
| | | dominant in using it. |
| | Illiteracy | Illiteracy is an essential barrier for |
| | | women and girls to access online |
| | | services |
| | Computer anxiety | fear of technology and distrust of its benefits. |
| **Culture** | **(Culture)** | |
| | Socio-cultural | More and more social practices are |
| | | mediated with internet technology |
| | | devices, such as smartphones. |
| | | Cyberculture is becoming |
| | | increasingly common among young |
| | | people |

| Main Factor | Sub Factor | Explanation |
|---|---|---|
| | (1) Culture and IS development; | Cultural patterns influence how information systems are developed. |
| | (2) Culture, IT Adoption, and Diffusion; | Cultural patterns affect the technology acceptance. |
| | (3) Culture, IT Use, and Outcomes; | Culture is associated with the use of IT and how to take advantage of it. |
| | (4) Culture, IT Management, and Strategy; | Culture plays a role in how to evolve technology and creating strategies. |
| | (5) IT Influence on Culture; and | Technology brings influence to culture. |
| | (6) IT Culture, or the value attributed to IT by group. | IT Culture is part of IT values |
| | Resistance to change | Companies that conventionally conduct operations for many years have a natural tendency to resist change. |
| **Resources** | **(Resources)** | **The resources in question are trust, data quality, education, awareness, digitization process, and participation of all stakeholders related to technology.** |
| | Data Quality | The large volume of data collection through various technologies used in Industry 4.0 causes difficulties in extracting useful data. |
| | Digital resources and data sharing | Digital resources are digital data or databases to present information. Limited data sharing hinders the adoption and development of digital technology. |
| | Digital Leadership | Leaders must be the pioneers in innovating digital transformation thinking, changing leadership methods, and managing work within the organization. |
| | Developing digital human resources | Establish Human Resources that can accept new production technology trends. |
| **Organization** | **(Organization)** | **Organization adaptation to technology** |
| | Ineffective Change Management | Ineffective management during the rocess of changing employees, executives, third-party channel partners, and value chain members. |
| | Organizational Performance | The use of technology has a fundamental purpose in improving organizational performance. |
| | Project management, | Project management is a process that targets particular attention or problems in connection with a specific business arrangement, in this case, technological support for the automation of object-oriented activities to obtain good productivity. |
| | Expected benefit | There is no expected benefit in the use of technology. Technology is used in a basic manner. |
| | Continues Improvement | The process of continuous improvement, also often called the sustainable improvement process, is an ongoing effort to improve a product, service, or process by utilizing technology. |
| | Capital | Technological capital, such as devices, digital equipment. |
| | Agility | The company's agility in accepting and adapting to technology. |
| | Digital Strategy Alongside Resource Scarcity | Industry 4.0 requires consistent availability and data flow both horizontally and vertically, within and across organizations. |
| **Regulation (government)** | **(Regulation)** | **Regulations governing digital adaptation** |
| | Regulatory Framework | There is a lack of standards and government regulation across the industries that embraces industry 4.0. |

| Main Factor | Sub Factor | Explanation |
|---|---|---|
| | Procedure | Government protection is necessary to ensure healthy competition procedures in the market to support local businesses and SMEs to be prepared in facing industry 4.0. |
| | Politic | Political problems, such as corruption, delays in service delivery, lack of public sector accountability, and so on, are believed by many to be overcome by ICT utilization. |
| **Intention to Use** | **(Intention to Use)** | **Intention to use technology** |
| | Users in mobility | connectivity in mobility is now the most common way of using the Internet among young people. |
| | Basic User | Standard use of technology. Merely using/operating it without any clear expectation of benefit. |
| | Cyber consumer | Young internet users position themselves as consumers in using the Internet. |
| | Digital citizenship | Digital citizenship refers to user- developed voluntary behavior, such as recommending service, helping other users, and having system failure tolerance. |
| | ICT Use intention and behavior | How firm the intention of using technology is. |
| **Partnership** | **(Partnership)** | **Digital Partnerships are organizations that come together to share resources with the ultimate goal of achieving digital transformation.** |
| | Distrust among partners | When it comes to digital partnerships, trust issues can arise from fears of data loss and confidentiality, as it has been noted that some organizations have not reached the level of open data sharing for fear of their information being leaked to their competitors. |
| | Collaborative relationships | Getting a positive impact from the forms of digital collaboration, such as the ability to develop new products, expand into new markets, develop customer segments, develop new capabilities or add to the existing ones, support the existing customers, and have Access to new technologies and new data. |
| | Partnering goal, | It is necessary to have a common goal of partnership in digital cooperation. |
| | Lack of defined partnering procedure | The undefined partnership procedure in digital cooperation results in the failure of Digital Partnering. |
| | Getting the right digital partner | Challenge in choosing the right technology partner and forming a successful digital partnership. |
| | Sharing of resources | They are sharing digital resources in project implementation. |
| | Extension of product lines | Digital Partnerships allow for the expansion of product lines. |
| | Sharing of responsibilities | Digital Partnerships can reduce the risks of digital organizational transformation by dividing responsibilities. |
| | Commitment to digital partner | Commitment is a crucial issue in digital partnerships to achieve the goals of joint digital transformation. |

Table 3. Extended Factor

### 5.2. Identify Factors of Digital Transformation Stage in Developing Countries

In all stages of the DX problem, domain culture has a contribution, Figure 3. It cannot be ignored that the presence of culture at every stage gives rise to phenomena that are important for further research. In addition, the socio-economic domain is consistently present in its influence on DX, although in different embodiments.

The income (economic) factor arises in its influence in gaining access or physicality to technology. Since social and digital inequalities are so closely intertwined, the analysis of digital inequality must take the cultural and social systems in which technology is embedded into account. The results of the literature review reveal how the cultural dimension are consistently present. This opens the opportunities of how the DX problem can be properly analyzed from a sociological point of view. Culture is a dimension that affects every step of the Digital Transformation problem. At stage 1, cultural barriers appear as hindrance to technology and insecurity in using it. There is a gap in the cultural behavior between the upper and lower social class which connotes the breadth of access. The socio-economic dimension discusses income, education, and gender, which are considered as capitals in engagement with digital transformation. Motivational access is the early identification of technology gap. Without the presence of motivational access, the desire to own and use will not occur. The findings in this study confirm that the motivation and ownership of access have begun to shift, although it has not been fully resolved. The stages after access ownership are skills and arrangements.

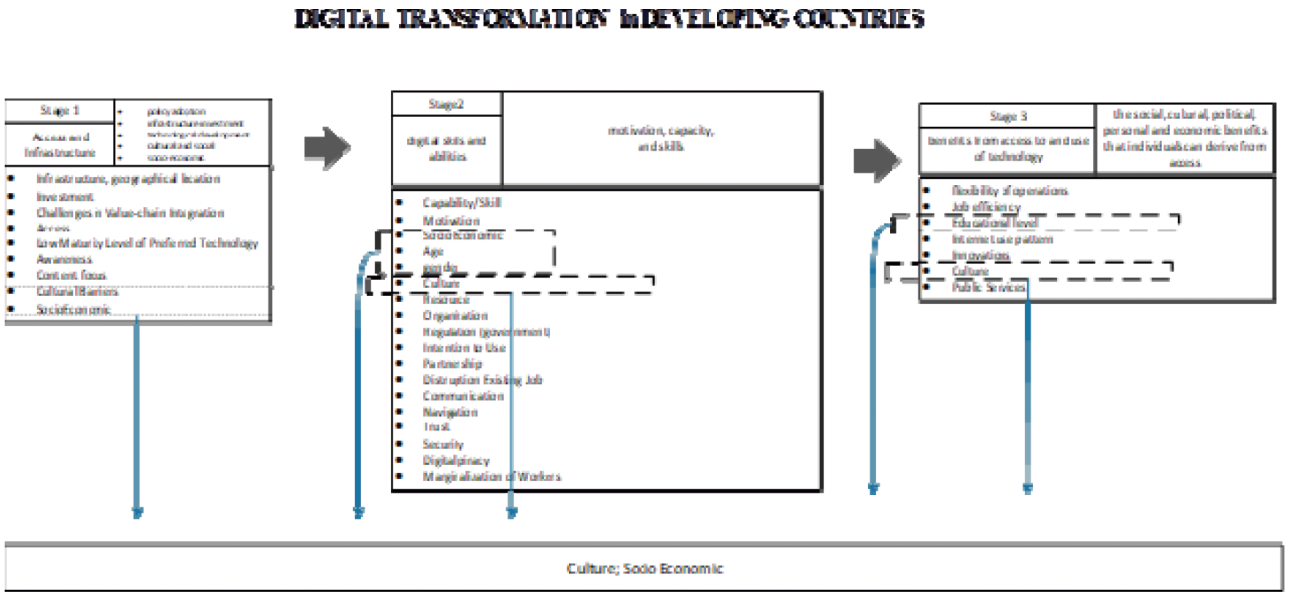


Figure 3. Framework DX in Developing Countries

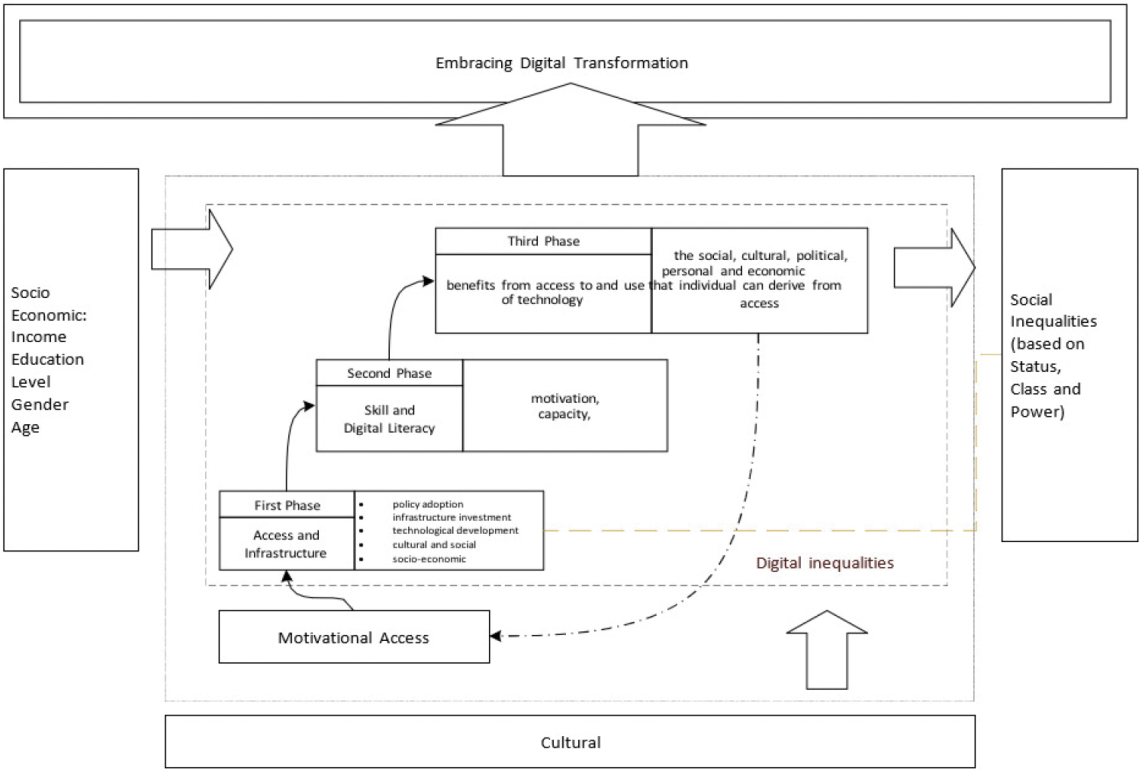


Figure 4. DX Gap Stage Analysis

## 6. Conclusions

Exploring the stages of DX is essential. Such a rapid development of DX requires proper brushing for it can bridge the existing problems. This paper identifies the DX stage in developing countries which has shifted from the first stage to the second stage. The first stage of DX discusses motivation and access. The dominant factors discussed in the DX phase 1 study of developing countries are access, infrastructure, and motivation. On the other hand, cultural barriers contribute to the digital problem of stage 1. Culture, as a long traditional process, affects people's motivation. This paper also provides future research prospects related to this cause. The dominance of the stage 2 discussion in developing countries exceeds the DX problem in stage 1 for about 50% while the rest are the problems in stage 1 and stage 3. Digital and Regulatory Skills and government participation are among the dominant factors discussed in phase 2 of the DX in developing countries. Future research prospects to explore solving skill problems are needed to produce the right policies to resolve issues in the second stage 2. Furthermore, in stage 3, income and innovations were identified in the literature review even though the percentage was around 20%. Meanwhile, in the advanced stages of DX on outcomes and innovations, it is possible to emerge new digital media. In the end, physical obstacles will be repeated. Although it is not yet a dominant problem in developing countries, the emergence of DX phase 3 discussions in developing countries needs to be explored further in order for the policymakers can respond to the situation in the third stage and for in the end the gap does not become wider. Several key factors that became controls at each stage of DX were identified, namely culture and socio-economics. The literature review results reveal how the cultural dimension consistently presents. This opens up the opportunities of how the DX problem can be properly analyzed from a sociological point of view.

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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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