Driving Factors of Digital Transformation Correlation Analysis

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***Abstract*— Digital transformation is an inevitability that cannot be avoided in the lives of various countries. Various studies have been conducted to uncover the drivers of successful digital transformation. However, there are several failures in its implementation. Organizations need to implement the right strategy through the factors most correlated to the success of digital transformation. This research marks the beginning of studies on digital transformation, with an initial focus on revealing the ranking of the main correlating factors and supporting indicators for the success of digital transformation, accompanied by practical implementation. Correlation analysis was performed on the digital transformation index scores from 130 countries. The results indicate the strongest correlation with the factors supporting the success of digital transformation. Practical implementations for each factor are presented to facilitate the adoption of organizational strategy adjustments.**

Keywords*— *Digital Transformation, Driving Factor, Correlation, Digital Transformation Index

I. INTRODUCTION

The presence of Digital Transformation (DX) is a necessity that cannot be avoided. Industrial Revolution 4 was the beginning of DX's existence by combining technology and the Internet in the industrial sector. Although directly related to technology, the success of the industrial revolution was accompanied by various other factors. DX provides opportunities and challenges [1] that require companies and countries to respond appropriately [2]. Failure to address the driving factors of DX has left the country behind. The United Nations has recognized the power of technology and the 4th industrial revolution in achieving the Sustainable Development Goals adopted in 2015 by member states. Dynamic environmental changes require organizations and countries to identify future trends so that they can compete in the era of digital transformation. Various research topics related to DX were investigated, as presented in Figure 1. Although DX has been recognized in almost all aspects of life [1], [3], in reality, not all organizations and even countries can carry out the transformation successfully. Forbes released at least 84% of failed DX projects [4[4]–[6] and BCG released DX successes of less than 30% [7].

Despite Digital Transformation (DT) having significant disruptive impacts on businesses and society, organizations are aware of its potential effects. However, many lack a clear roadmap for redesigning existing processes with emerging technologies [8]. Other research suggests that many organizations are still striving to set and implement digital agendas [1], [9], [10]. Most research results focus on specific aspects of digital transformation or case studies [11]. The lack of an integrated approach to developing digital transformation strategies across the entire company is also identified by Hess et al. [12]; Hyvönen [13] and Ismail [14]. Meanwhile, some academic literature discusses aspects of Digital Transformation partially [15][16]–[18] and is dominated by DT in developed countries. DX is not just about shifting from manual to automated processes with technology. Comprehensive involvement of various factors is required to achieve DX success. Therefore, special attention to the factors driving the success of DX is needed, so that organizations and even countries can formulate strategies appropriately. As part of a larger research effort related to the success of DX, an initial identification of various key factors with a strong correlation to DX is conducted. This research represents an initial study within the larger research on DX, with the primary focus being to provide an overview of the strongest correlations among the drivers of DX in achieving its success.

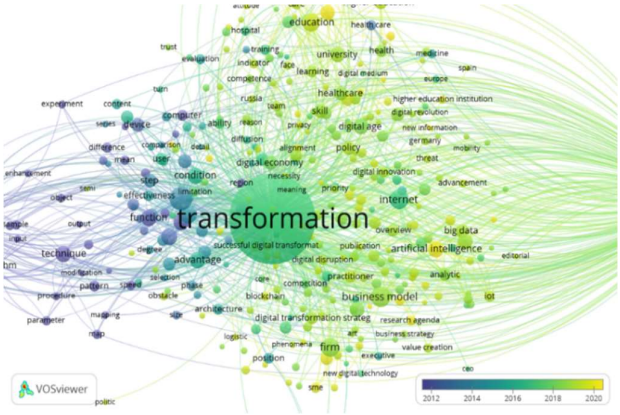

Fig. 1. Digital Transformation Research Mapping

The correlation between several DX supporting factors and detailed indicators was analysed to obtain the essential elements of increasing the DX score. Finding the most correlated factors for DX success makes it easier for management to formulate a DX success strategy appropriately. The results of this study provide a theoretical contribution in completing the DX reference, which continues to develop to date, in line with the lack of success of DX as a whole in every country. As the initial stage of research on DX, the findings of this study, which include the identification of key factors correlated with the success of DX, will serve as input for further research that can be considered in

accelerating the achievement of digital transformation success. The practical implication of this study results is an essential consideration for management in implementing DX successfully through strategic focus on the vital factors most correlated with increasing DX scores. This research serves as an initial step, and its results can provide an initial input for practical contributions to shaping future research endeavors. For example, it can lead to the development of artifacts (such as applications) aimed at facilitating management in measuring the success of their digital transformation. These artifacts would take into account factors strongly correlated with DX success, which have been identified in this research.

II. Research Methodology Ease of Use

A. Research Stage

This study uses a correlation analysis approach in testing the correlation between the driving factors of DX. DX mapping in several countries was carried out by reviewing the main factors supporting the success of DX (Table 1). The stages of this research are presented in Figure 2

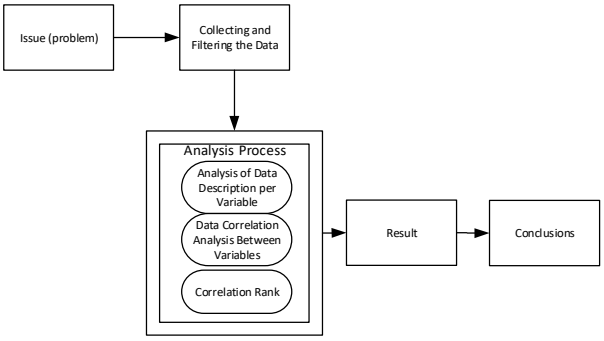

Fig. 2. Research Step

B. Data Collection and Processing

The main factors supporting DX include Technology, People, Governance and Impact[19], as shown in Figure 3. Technology is the main digital transformation, namely, the manual to digital transition. In addition, technology has a significant impact on the economy. In general, technology is measured on access [20], content [21][22], [23] and future technology[24]. The implementation of technology and its quality reflects the skills and ability to utilize technology [19][1]. Therefore the main factor supporting the next DX is people. This factor measures how people use ICT at the individual [25], business [26] and government[20] levels. Governance discusses the integration of operating systems in organizations or countries [19]. This governance addresses trust activity[27], regulation [28] and engagement[25]. Meanwhile, Impact is defined as assessing the impact of DX on the economy[29], society, and human[30][31].

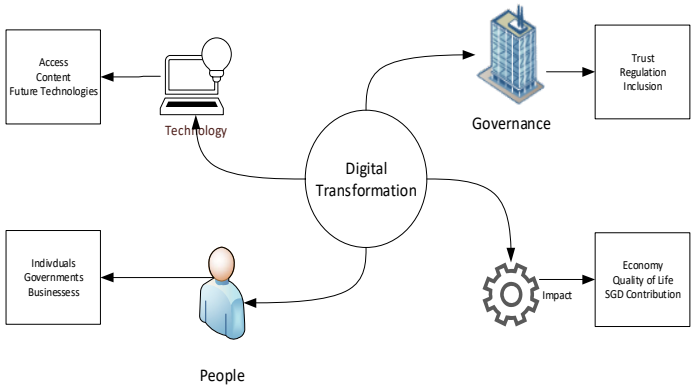

Fig. 3. Digital Transformation Factor (Own Illustrations)

In summary, DX supporting factors include Access, Content, Future Technologies, Individuals, Business, Governments, Trust, Regulation, Inclusion. Digital Transformation data in this study uses DX score data from 130 countries. Data collection with the latest period criteria is carried out through secondary data released from several DX reports internationally (Table 1)

TABLE I. Criteria Data

Data	Periode	References
Digital Transfomation	2021	[19][24]
Score	2020	[32]
Digital	2021	[33]
Competitiveness Ranking	2021	[34]
Digital Economy		
World Countries Rank		

III. Data Analysis

This study used two stages of data analysis. The first stage uses univariate analysis to identify the characteristics of these variables (figure 4). This analysis also ensured that there were no anomalous data in the data distribution. Each variable was tested for the first stage of analysis before continuing with the second stage. The second stage of analysis in this study was correlation analysis. This analysis was used to measure the strength of the relationship between variables and the direction of the relationship. Correlation was measured using Pearson's correlation. The dependent variable in this study is Digital Transformation, while the independent variables are the factors that influence it (Table II). The results of the next study were ranked to determine the factor with the highest correlation to the DX score (Table III)

TABLE II. VARIABLE OF DIGITAL TRANSFORMATION

Variable	Description	References
DX Score	Dependent Variable	[19][24]
Technology	Independent Variable	[19][24]
a. Access	Independent Variable	[20]
b. Content	Independent Variable	[21]
c. Future Technologies	Independent Variable	[24]
People	Independent Variable	[19][24][1]
a. Individuals	Independent Variable	[25]
b. Businesses	Independent Variable	[26]
c. Governments	Independent Variable	[20]
Governance	Independent Variable	[19][32][33][34]
a. Trust	Independent Variable	[27]
b. Regulation	Independent Variable	[28]
c. Inclusion	Independent Variable	[25]
Impact	Independent Variable	[19][24]
a. Economy	Independent Variable	[29]
b. Quality of life	Independent Variable	[30]
c. SDG Contribution		[30][34]

IV. RESULT AND DISCUSSION

The test of the four main driving factor variables, namely Technology, People, Governance, and Impact, is presented in Figure 4. The results of the analysis show that the distribution of data on the main driving factors for DX is normal. However, the distribution of data on impact tends to be irregular, which shows that the impact does not have a completely normal data distribution. The results of data processing on the correlation are presented in Figure 4 and Table III. All the main factors of DX, namely Technology, People, Governance, and Impact, have a strong correlation to DX with a correlation value > 0.95.The strongest correlation is shown by Technology, Governance, People, and Impact. In general, these four main factors have nearly equal relationship strengths. Technology stands out as more dominant than the other factors. Although technology is not the sole driver of DX, it serves as the initial step in connecting users to the digital process itself. Without technology, the digitization process is challenging to accomplish [35][36], [37]. In the Technology sub-factor, the strongest correlation is shown by Content, Access, and the last is Future Technology. These sub-factors are foundational elements in an organization's digital transformation journey. Data processing and security [38][39] are integral parts of technology. Infrastructure in digital transformation is based on advanced IT technology, with a focus on the presence and use of computers and computer networks (both wired and wireless) and the availability and types of Internet connections, including the use of fixed and mobile broadband or other fixed connections[40]. A high level of digital maturity often requires a high level of digital competence among employees during the digital transformation process [41]. The technological requirements for each digital transformation project must be defined to ensure its potential for success. The data processing results show a strong correlation in the "people" factor. In the analysis results, trust and regulations show a strong correlation with DX, as presented in the governance factor. Meanwhile, in the Governance sub-factor, the correlation rankings are Trust, Inclusion, and Regulation.

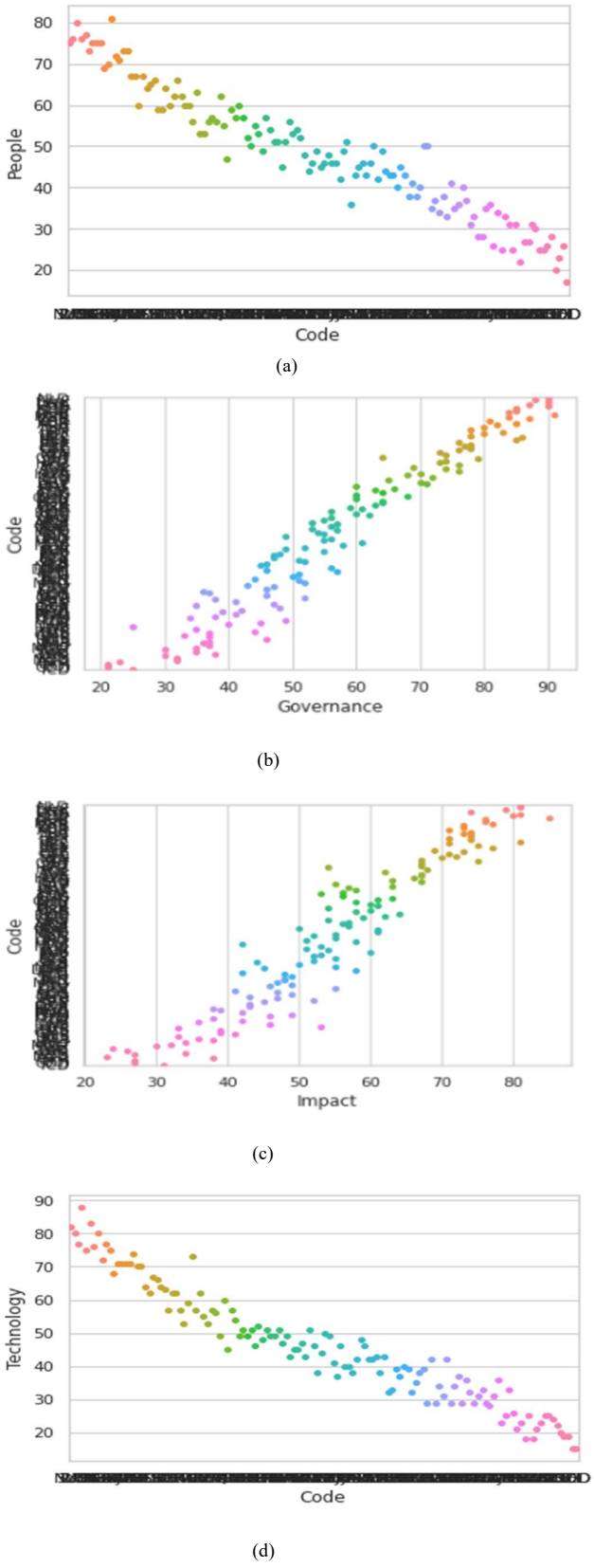

Fig. 4. Analysis step 1, univariat data test (a) variable People, (b) Governance, (c) Impact, (d) Technology

The success of DX has interrelated effects on the digital transformation process. Economic sufficiency, for example, enables the fulfilment of basic needs to connect with technology. This fulfilment is challenging to implement when the community still faces economic limitations. Furthermore, DX has the potential to have a significant effect on economic improvement, offering both significant opportunities and high risks for organizations [43]. The analysis results indicate a strong correlation between the impact factor and DX. Finally, on the Impact sub-factor, the correlation rankings were Contribution, Economy, and Quality of Life.

V. CONCLUSION

The results show that technology is the dominant factor in DX, with the main sub-factor being content. These findings support previous research that technology is at the heart of DX [1], [11]. To accelerate the success of DX, organizations need to expand the digital content that can be used locally. Examples of digital content include using GitHub commits as a medium to demonstrate programming skills, Wikipedia edits, registering internet domains, developing mobile applications, and publishing scientific articles related to AI.

Technology itself plays the role of the initial bridge connecting to the digital or technological aspect of digital transformation. Without technology, user connectivity in DX is challenging to implement. However, Digital Transformation is a complex process that is not solely dependent on technology. The implementation of technology in the business process is only a small part of the overall digital business transformation. Furthermore, digital technology must create added value for customers, the business itself, and other important stakeholders [44]. Owing to its social, technical, technological, and managerial implications within an organization, Digital Transformation must be managed from a holistic perspective [8], [45]–[49] [50]. Governance is the second most dominant factor after technology. Public trust was the main supporter of this factor. The governance in question concerns an integrated system for the safety and security of its users.

Public trust in Internet server security, cybersecurity, and online financial access. People in the context of society are the third main factor for increasing the DX score. This is slightly different from previous research, which puts the people factor as the main factor driving change[51]. It is suspected that this difference is due to the context of people's understanding of the government towards the government. In this case, the most important factor supporting the success of DX is how the government uses and invests in ICT to benefit the public. Examples of supporting factors in the people context include the availability of government online services, publication and disclosure of data, government investment in new technologies, and R&D spending by the government and higher education. In several previous studies, culture became one of the important factors in the context of society[52][53] which did not appear in the Digital Transformation score data in this study.

The readiness of human resources and awareness of technological change are essential to support the digital transformation process. Employee engagement, motivation, and participation in strategic changes within an organization are key to the success of Digital Transformation [41]. Continuous learning and change management [38] facilitate organizations in adapting to various forms of change [8]. Knowledge and skills are acquired through a willingness to learn continuously [10], [54]. Prospects of research on culture for increasing DX success are needed in the future, given the diverse characteristics of organizations and countries [55], [56]. This allows the application of different strategy patterns.

TABLE III. MAIN FACTOR AND SUB FACTOR CORRELATION TO DX

	MRIscore	*Technology*	*People*	*Governance*	*Impact*	*Access*	*Content*	*ureTechnolog*	*Individuals*	*Businesses*	*Governments*	*Trust*	*Regulation*	*Inclusion*	*Economy*	*Quality of Life*	*IGContributio*
MRIscore	1																
Technology	0,9763509	1															
People	0,9691705	0,939427	1														
Governance	0,9721546	0,9308687	0,9196305	1													
Impact	0,9557267	0,9073885	0,8989324	0,9066462	1												
Access	0,9283737	0,9397295	0,9013215	0,8866438	0,8657315	1											
Content	0,9470683	0,9484775	0,9115713	0,9182166	0,8865494	0,8534969	1										
Future Techn	0,8398553	0,8981443	0,7982121	0,7813531	0,7697286	0,7495406	0,7808691	1									
Individuals	0,802998	0,7540297	0,8518533	0,7522672	0,7612784	0,7956186	0,7347102	0,5519661	1								
Businesses	0,8764093	0,8560447	0,9129647	0,8222019	0,807711	0,7899584	0,8543011	0,7371619	0,6606149	1							
Governments	0,919534	0,905715	0,9214431	0,8891519	0,8438267	0,8371082	0,8548909	0,8348067	0,6618748	0,7881496	1						
Trust	0,9495588	0,9169433	0,8985139	0,9650918	0,8706711	0,8657718	0,9042162	0,7789522	0,6899803	0,8184155	0,8926521	1					
Regulation	0,8729913	0,8326437	0,8101384	0,9071387	0,8231112	0,7823466	0,8305925	0,7009102	0,6553959	0,7364456	0,7782239	0,813234	1				
Inclusion	0,9101381	0,8582286	0,8693824	0,9370179	0,8547538	0,8377069	0,8382821	0,706009	0,7783658	0,7456476	0,8130958	0,8699871	0,7886934	1			
Economy	0,8513457	0,826809	0,7938192	0,8046024	0,8797835	0,7798244	0,7714223	0,7539626	0,5683761	0,7494299	0,799166	0,8075184	0,7329558	0,7093052	1		
Quality of Life	0,8401309	0,7759676	0,7778713	0,7995944	0,9143447	0,7388171	0,7716528	0,6444896	0,7008953	0,6674094	0,7235578	0,7447756	0,7370507	0,7745889	0,6950876	1	
SDG Contribu	0,8921503	0,8506451	0,858733	0,8469867	0,9083518	0,8222172	0,8537989	0,6829114	0,7883137	0,7675987	0,758681	0,8017742	0,7547874	0,8264371	0,6843953	0,7722579	1

Further research is needed to reveal the characteristics of the organization/country through cultural factors. As for the impact factor, a contribution to the sustainable development goal that focuses on health, education, and the environment is needed. This is related to health insurance, life welfare, quality of education, gender equality in work, pollution, and public safety. Unfortunately, in some developing countries, the quality of education in DX faces challenges [57][58][59], this is allegedly one of the problems of infrastructure equity [60]. Further research is needed to reveal the characteristics of the organization/country through cultural factors. As for the impact factor, a contribution to the sustainable development goal that focuses on health, education, and the environment is needed. This is related to health insurance, life welfare, quality of education, gender equality in work, pollution, and public safety. Unfortunately, in some developing countries, the quality of education in DX faces challenges .

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