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CAN DIGITAL TRANSFORMATION PROMOTE GREEN TECHNOLOGY TRANSITION INNOVATION CAPABILITY?

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ABSTRACT

This study aims to explore how much digital transformation is promoted green technology transition innovation. This research presents a study of digital transformation and sustainable development based on empirical evidences. Systematic literature analysis was carried out based on text analysis. This research using energy sector companies listed on the Indonesia Stock Exchange for the 2019 to 2022, the mechanism of the impact of digital transformation on the company's environmentally friendly technological innovation capabilities (green technology). The collected data was analyzed using statistical methods, including correlation and regression analysis. The results of digital transformation research have a positive and significant influence on environmentally friendly technology transition innovation. This research shows that digital transformation mechanisms can encourage environmentally friendly technological innovation in companies. Digital transformation allows companies to reorganize innovative elements such as design and development, aswell as technological processes with representative digital technologies, innovate in environmentally friendly energy-saving technologies, increase product added value and markets competitiveness, and encourage companies to innovate in green technologies. This research can help companies in the process of creating technology to support environmental friendliness, create value, and understand the challenges they have to face.

Key Words: Green technology innovation; digital transformation

1. INTRODUCTION

Indonesia is actively engaged in combating climate change through various regulations and actions, such as Law No. 6 of 1994, Law No. 17 of 2004, and Law No. 16 of 2016. Another approach to promoting sustainable development is the adoption of green technology, which merges technology with environmental science to ensure the sustainability of natural resources. Both the government and the business sector are continuously working to advance green technology.

Digital transformation can drive corporate technological innovation, particularly in the field of green technology, thereby enhancing corporate contributions to environmental protection and sustainable development. It also increases information transparency, helping companies improve governance and fulfill their social responsibilities more effectively.

Several studies have analyzed the factors influencing green technology innovation, including digital transformation, executive background in IT, the role of the chief information officer, and green dynamic capabilities. However, most research has focused on the impact of digital technology on innovation capabilities or the concept of innovation capability itself. Few studies have examined how the process of digital transformation affects green technology innovation within companies. For example, a study by Zhang, G., et al. found that the application of digital transformation in companies, moderated by the green dynamic capability variable, can reduce costs associated with the digital transformation process, enabling environmentally friendly development and cost reduction through green technology innovation.

This study aims to investigate the extent to which digital transformation promotes green technology innovation. It presents an analysis of digital transformation and sustainable development, grounded in empirical evidence. A systematic literature review was conducted using text analysis. The research focuses on energy sector companies listed on the Indonesia Stock Exchange from 2019 to 2022, examining the mechanisms by which digital transformation impacts their environmentally friendly technological innovation capabilities (green technology). This study offers valuable insights into how digital transformation can drive green technology innovation and contribute to sustainable development.

2. LITERATURE REVIEW

2.2. Schumpeter's innovation theory

Joseph A. Schumpeter (1883–1950) argued that innovation can cause economic fluctuations. He defined innovation as "a new combination of means of production, resources, labor, and other factors." Schumpeter's innovation theory is categorized into five types: product innovation, technological innovation, market innovation, resource allocation innovation, and organizational system innovation. When applied to environmentally friendly innovation, Schumpeter's theory can encompass eco-friendly product innovation and green technological innovation. Environmentally friendly technological innovation refers to any technological changes or adjustments in a work process that help reduce environmental pollution generated during production. This includes the application of new technologies, innovative eco-friendly patents, and similar advancements. Such technological innovation is also believed to enhance organizational productivity and flexibility for companies.

2.2. Influence Transformation Digital to Green Technology Transitions Innovation

The concept green technology innovation first time stated by Fussler and James on year 1996. Innovation technology friendly environment is strength pusher main for lead development company which friendly environment and give support important for development economy overall high quality as well as leading a new technological revolution in new situations are important ideas. Environmentally friendly technological innovation can effectively help companies realize the symbiotic value of ecological performance and economic performance, and ultimately make resource allocation achieve conditions which optimal. Therefore, the study about factors which influence the company's environmentally friendly technological innovation has become a hot topic nowadays (Xue, L., *et al* , 2022). Most academic research uses this approach qualitative (text analysis, interviews).

The digitalization of companies enables environmentally friendly collaborative innovation. In the IT era, the introduction of artificial intelligence and other technologies can help deeply explore and analyze business data, transform green innovation models, and inform decision-making. Additionally, digital platforms facilitate the exchange of

information between organizations, reducing information asymmetry and increasing transparency. This enhances investor and company collaboration, improving eco-friendly innovation capabilities (Shang, Y., et al., 2023).

Digital transformation promotes technological innovation, particularly in environmentally friendly technology, thus increasing a company's contribution to the environment and sustainable development. It also helps reduce information asymmetry, improving governance and enabling companies to better fulfill their social responsibilities (Zhu, Y., and Jin, S., 2023).

Based on previous research by Xue, L., et al. (2022) and Tang, L., et al. (2023), digital transformation significantly positively impacts green technology innovation. This means that digital transformation encourages environmentally friendly technological innovation capabilities and enhances environmentally friendly and low-carbon economic development.

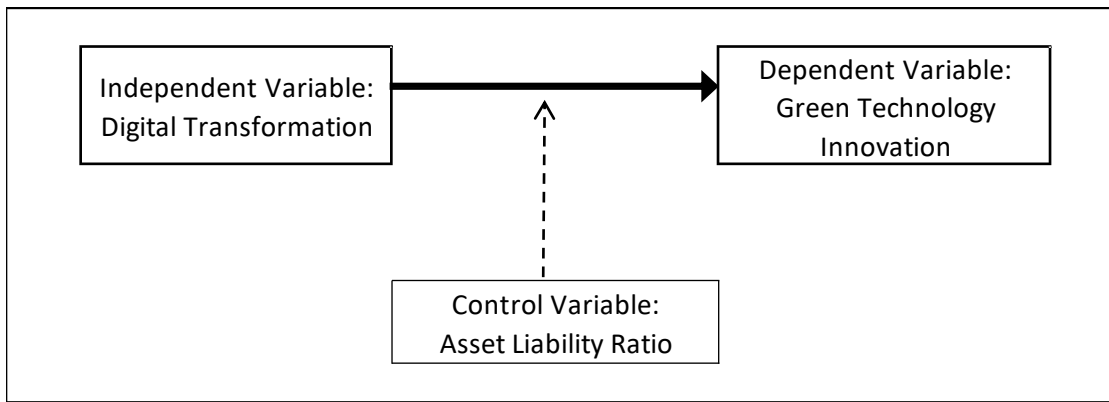
The concept of green technology innovation was first introduced by Fussler and James in 1996. Environmentally friendly technological innovation is a key driver for developing eco-friendly companies and supporting high-quality economic development, leading to a new technological revolution. Such innovation helps companies achieve the symbiotic value of ecological and economic performance, ultimately optimizing resource allocation. Consequently, the study of factors influencing environmentally friendly technological innovation in companies has become a popular research topic (Xue, L., et al., 2022). Most academic research on this topic uses qualitative approaches such as text analysis and interviews.

H1: Digital transformation positively influences the innovation of green technology transitions.

2.3. Framework Study

This research will examine the factors that influence green technology transition innovation on company sector energy which registered in Indonesian Stock Exchange through one independent variable, namely digital transformation which is controlled by asset liability ratio variable. Based on the explanation above, depicted with conceptual framework on study this as following:

Picture 2.3. Framework Study



3. RESEARCH METHOD

3.1. Election data and sample

The type of data used in research is secondary data sources, in the form of financial reports of energy sector companies listed on the IDX for the 2019 - 2022 period. Secondary data was obtained through the official website, namely the website of each company, IDX website (www.idx.co.id). The form of data used is periodic data (time series) namely data arranged based on time sequence, as for time used in this study is annual data. Data analysis method in this research use method Statistical Package for the Social Sciences (SPSS).

3.2. Definition Variable

Table 3.2 Definition Variable

Variable	Definition Operational
Green technology innovation (Innovation technology friendly environment)	Referring on study Li, W.J., and Zheng, M N (2016) and Xue, L. et al (2022) Innovation technology friendly environment be measured with use content analysis which there is in report annual with count amount technology which created for environmentally friendly contribution in the year the which then in logarithm natural and plus 1.
Digital Transformation	This study compile dictionary terminology related transformation digital company recorded based on the method development dictionary. Six key word such as digital economy, transformation digital, artificial intelligence, blockchain, computing cloud, and big data in financial reports then added up 1 or take natural logarithm (Zhang, Ge., et al, 2023).
Asset Liability Ratio	Total Liabilities/Total assets (Xue, L., Zhang, et al., 2022))

3.3. Design Model Empirical

To effectively identify the relationship between digital transformation green companies and technology innovation, this research sets the benchmark measuring the following regression showed on models:

$$LN\text{GTI}_{it} = \alpha + \alpha_1 LN\text{DNC}_{it} + \varepsilon$$

LN GTI is innovation technology friendly environment, LNDC is level transformation digital.

4. RESULT AND DISCUSSION

4.1. Statistics descriptive

In Table 4.1, the average value of digital transformation degree (LNDC) is 22.90, show that company sector energy own level awareness towards digital transformation is quite high, the minimum and maximum value of technology green innovation (LNGTI) of 1.00 and 7.00 respectively with standard deviation 1,941, show that level innovation technology very varies between company.

Table 4.1 Results Test Statistics Descriptive

	Variables	N	Mean	Min	Std. Dev
Dependent Variable:	GTI	68	1,93	1,00	1,94181
Independent Variable:	DT	68	22,9	1,00	3,14885
Control Variable:	ALR	68	0,45	1,01	0,22863

Source: Outpus SPSS 20

4.2. Regression Analysis

Table 4.2 shows the regression results of the company's digital transformation level to innovation technology friendly environment. In model regression, researcher control assets liability ratio, the regression coefficient of digital transformation is respectively equal to 0.081, 1.000 and each significant on level 1%. This results confirm formation hypothesis and answer question, which show that transformation digital company has a significant promotional impact on friendly technology transition innovation environment. In particular, digital transformation possible company for reorganize innovative elements such as product, design and development, as well as technological processes with representative digital technology, deep innovation environmentally friendly energy saving technology, increasing the added value of products and market competitiveness, as well as encouraging companies to increase their level of green technological innovation.

Table 4.2 Results Test Analysis Regression

Multiple

Variables	Unstandardized Coefficients	Sig. t
(Constant)	-1,926	0,029
DT	0,176	0,081

ALR	0,162	1,000
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Source: Outpus SPSS 20

From results test regression linear simple on table 4.2 is known influence digital transformation variable, on the dependent variable the dependent variable, namely green technology innovation then you can arranged equality regression simple linear as following:

$$Y = -1.926 + 0.176LNDC + \varepsilon$$

From equality regression linear simple on can explained as follows:

$b_0 = -1.926$ meaning that if the digital transformation value is equal to zero (0), then green technology innovation value as big as -1,926.

$b_1 = 0.176$ means that digital transformation has increased by one unit so green technology innovation go on as big as 0.176 unit with assumption variable others are constant.

4.3. Test Coefficient Determination (R2)

Table 4.3 Results Test Coefficient of determination (R2)

Model	Adjusted R Square	Std. Error of the Estimate
1	0,688	0,85485

Source: Outpus SPSS 20

- a. *Predictors: (Constant) : Transformation Digital*
- b. *Dependent Variables : Green Technology Innovation*

The results of the regression analysis carried out, the adjusted R square value was obtained amounting to 0.688 or 68.8%, which means that the influence of the independent variable, namely transformation digital to green technology Innovation as big as 68.8% while the rest 31.2% were affected by other factors that are not included in model study. Standard error of estimate worth 0.85485 which in matter this means that the smaller the standard error of estimate, the more precise the model will be regression predict variable dependent. Influence transformation digital to green technology innovation can be identified from the results of the analysis that has been carried out that the digital transformation variable partially has a significant influence towards green technology innovation which is listed on the Indonesia Stock Exchange (BEI) 2019-2022 period.

Based on the results of the hypothesis test, it can be concluded that digital transformation influential positive and significant to green technology innovation. Base on study previously results study, there is no theoretical connection whatsoever in studying the impact of digital transformation on environmentally friendly technological innovation. The author adds by linking the results of the analysis to the "Schumpeterian" theory.

4.4. Test Hypothesis

Table 4.4 Results Test By Partial (t-test)

Variables	Unstandardized Coefficients	Sig. t
(Constant)	-1,926	0,029
DT	0,176	0,081
ALR	0,162	1,000

Source: Outpus SPSS 20

Table 4.4 reports the regression results of the company's level of digital transformation to green technology innovation. In model regression, researcher control with the asset liability ratio (ALR). Digital transformation has a beta value of 0.176. The significance value is 0.081, meaning there is a positive and significant influence between digital transformation variables and green technology innovation. This result confirm formation and answer hypothesis, which show that the company's digital transformation has a significant promotional impact on green technology innovation. Digital transformation allows companies to arrange repeat elements innovative like design and development, as well as process technology with technology digital which representative, innovate in environmentally friendly energy saving technology, increasing the added value of products and power competitive market, as well push company for innovate on green technology.

5. CONCLUSION AND FURTHER RESEARCH

Based on data from energy sector companies listed on the Stock Exchange between 2019 and 2022, this study empirically investigates the extent of digital transformation. The empirical findings highlight the significant role of digital transformation in promoting environmentally friendly technological innovation within companies.

The theoretical significance of this study offers a new perspective on exploring how digital transformation mechanisms influence eco-friendly technological innovation in companies. Practically, the study uncovers these mechanisms to drive eco-friendly technological innovation, providing insights for policy makers to enhance the promotion of enterprise digital transformation towards fostering eco-friendly innovation.

This study suggests that companies should prioritize increasing their awareness of digital transformation, enhancing data infrastructure, and promoting the deep integration of advanced technologies such as artificial intelligence, blockchain, cloud computing, big data, and others with their business operations. These steps are crucial for advancing the level of digitalization within companies and fostering environmentally friendly technology adoption.

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