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Digital Transformation and Its Impact on Inclusive Growth: A Four-Decade Experience in Indonesia

Abstract

The debate over whether digital transformation benefits or harms inclusive growth continues. Existing evidence in the literature, on the other hand, is frequently based on short study periods, subjective measurement issues, and endogeneity issues, resulting in less credible findings in previous studies. To address this gap, this study draws on four decades of Indonesian experience spanning 1980 to 2021, with a focus on two primary objectives. First, this study utilises Principal Component Analysis (PCA) to assess the key factors forming the progress of digital transformation and inclusive growth. Second, the Two-Stage Least Square (2SLS) estimation method is applied in this study to investigate the endogenous impact of digital transformation on inclusive growth. The PCA results show that medium and high-tech manufacturing play a dominant role in representing digital transformation, while GDP per capita growth and poverty alleviation are the primary contributors to measuring inclusive growth. The 2SLS estimation shows that digital transformation significantly promotes inclusive growth in Indonesia, with its impact closely related to the previous year's digital transformation status. When these findings are considered jointly, it is clear that the beneficial effects of digital transformation are mainly explained by how medium and high-tech manufacturing sectors can stimulate inclusive growth in the context of increasing GDP per capita and reducing poverty in Indonesia.

Introduction

Rapid advances in digital technology have resulted in transformative changes across various sectors and dimensions of society over the last few decades (World Bank, 2016). This phenomenon, colloquially known as "digital transformation" (Corejova & Chinoracky, 2021; Nambisan et al., 2019; Olczyk & Kuc-Czarnecka, 2022), has created new opportunities, challenges, and new debates about the global economy and societies. At the heart of these debates is the fundamental question of whether digital transformation truly promotes inclusive growth, driving economic progress while ensuring equitable benefit distribution.

The integration of digital technologies into various aspects of life is driving a comprehensive shift in how societies work. Changes in communication, production processes, services, governance, and other areas often result in increased efficiency, improved connectivity, and novel forms of economic interaction (Pyke, 2018). Digital transformation proponents argue that it has the potential to stimulate inclusive growth by opening up access to information, services, and markets, allowing marginalised groups to participate in economic activities (Burganov et al., 2022; Kamel, 2021; Leong et al., 2022). However, there is a counter-argument that highlights potential negative consequences such as job displacement (Acemoglu & Restrepo, 2019), increased inequality (Njangang et al., 2022), and exacerbation of existing digital disparities (Puspitasari & Ishii, 2016).

While some studies argue that digital transformation can be a catalyst for inclusive growth by creating up new economic opportunities and increasing productivity, others warn that its benefits may be unevenly distributed, potentially leaving certain segments of the population behind. Concerns have

been raised about less privileged groups' limited access to technology and a lack of digital skills, which may limit their participation in the digital economy (Jamil, 2022). Furthermore, changes in job qualification requirements as a result of digital transformation may widen skill gaps if not balanced with appropriate educational and training efforts (Acemoglu & Restrepo, 2020; Colombari & Neirotti, 2022; Goulart et al., 2022; Kuper, 2020). In this context, it is critical to implement strategies that ensure the benefits of digital transformation are felt uniformly across every social class, thereby reducing the risk of exclusion and inequality.

The purpose of this study is to contribute to the ongoing debate by providing a comprehensive analysis of how digital transformation has influenced patterns of inclusive growth in Indonesia. Indonesia is an interesting case study because digital transformation is a major force shaping the country's economic and social landscape (World Bank, 2021). Indonesia, with a population of over 270 million people and a diverse range of economic activities, provides a unique context for investigating the intricate relationship between digital transformation and inclusive growth. Over the last four decades, the country has seen rapid economic growth, political transitions, and technological advances, all of which have shaped the impact of digital transformation on inclusivity (World Bank, 2021). As a result of this research, a better understanding of how digital transformation affects inclusive growth patterns in Indonesia's diverse and dynamic context can be gained.

Earlier study on digital transformation and inclusive growth in Indonesia has often been limited to short time periods. For example, Jamil's study (2022) limited its analysis to the years 2008 to 2020, Noh & Yoo's (2008) study focused solely on the years 1995 to 2002, Asongu et al. (2021) considered only the years 2012 to 2016, and Alekhina & Ganelli's (2023) study considered only the years 1992 to 2017. Those limitations may result in a lack of understanding of long-term changes and trends that may only be revealed through observations conducted over a longer timeframe.

Furthermore, many studies apply indices with subjective weighting (e.g., Kartiasih et al., 2022, for measuring digitalization, and Rini & Tambunan, 2021, for measuring inclusive growth). These techniques have the potential to produce biased or inaccurate results when representing the intricate relationship between digital transformation and inclusive growth. In this context, it is also worth noting that prior research has tended to focus on a narrow set of indicators when measuring digital transformation. For instance, internet penetration rates (Jamil, 2022; Sujarwoto & Tampubolon, 2016), mobile phone technology usage rates (Ariansyah et al., 2023; Esquivias et al., 2020; Puspitasari & Ishii, 2016), fixed broadband subscriptions (Edquist, 2022), and ICT exports (Rath & Hermawan, 2019) are partially used to assess digital transformation. As a result, understanding of the complexity of the digital transformation and inclusive growth phenomena may be limited, ignoring critical aspects that may not be included in the analysis.

Hence, the aim of this research is to fill these gaps in a holistic and comprehensive manner. This study will span four decades (1980-2021) to provide an expanded view of the evolution of digital transformation and inclusive growth in Indonesia. Also, the Principal Component Analysis (PCA) method will be used to address subjective weighting and broaden the scope of measurement indicators. This method allows for more precise identification of key dimensions of digital transformation and inclusive growth. The methodology used in this study aligns with that used in the studies by Kouladoum (2023) and Dörffel & Schuhmann (2022).

Beyond addressing measurement constraints, this research will make a significant contribution to developing solutions for endogeneity issues that may impact the analysis of the effects of digital transformation on inclusive growth. To address this, the study will use the Two-Stage Least Squares (2SLS) method, which allows for the consideration of endogenous factors that affect both phenomena

concurrently. This research, using the 2SLS approach, is expected to provide a better understanding of the cause-and-effect relationship between Indonesia's ongoing digital transformation and inclusive growth. Thus, this research will make a significant contribution to elucidating the factors influencing the intricate interaction between digital transformation and inclusive growth, while also providing policymakers, stakeholders, and academics with a more precise understanding of how to foster inclusive growth in Indonesia by leveraging the potential of digital transformation.

The following is the rest of this paper. The **Method** section of this paper will go over how to use PCA methodology to measure digital transformation and inclusive growth, as well as how to use the 2SLS method to estimate the impact of digital transformation on inclusive growth. The **Results** section will delve into the most influential factors in determining the aggregate index of digital transformation and inclusive growth, as well as the statistical implications of digital transformation. The **Discussion** section will look at the empirical justifications why digital transformation drives inclusive growth, as well as why this effect is heavily contingent on digital transformation in previous years. The research findings, as well as the implications and future research agenda for a digital transformation model capable of fostering inclusive growth, will be outlined in the **Conclusions** section.

Research Method

Data Collection and Variable Measurement

The World Development Indicator, published by the World Bank (2022), and the V-Dem Dataset, published by the V-Dem Institute (2023), provided the data for this study. Three variables associated with institutional quality, namely the accountability index, civil liberties index, and rule of law, were sourced from the V-Dem dataset. The World Development Indicator was used to obtain all other variables. It is worth noting that gaps in data existed in Indonesia for several years due to limitations in the government's data collection capacity, and these gaps were only filled in the early 1980s. Given the available datasets, this study employs time series data from Indonesia spanning the years 1980 to 2021.

Measuring digital transformation and inclusive growth is a critical component of this research. In this study, the examination of digital transformation and inclusive growth is carried out using Principal Component Analysis (PCA). This method has three major advantages (see Dörffel & Schuhmann, 2022; Kouladoum, 2023). Firstly, PCA allows for the objective identification of each indicator's relative contribution to the aggregate index, ensuring that the weighting is not susceptible to subjective biases. The aforementioned approach enables a focus on the most important factors in measuring digital transformation and inclusive growth. Second, PCA enables the efficient reduction of dimensionality of diverse indicators reflecting various aspects of digital transformation and inclusive growth into interpretable principal components, simplifying and streamlining the analysis. Finally, PCA helps to reduce multicollinearity among the indicators used, resulting in more stable and accurate analysis results. As a result, PCA is an effective tool for measuring complex concepts like digital transformation and inclusive growth in a more efficient and meaningful way.

There are eight comprehensive indicators that reflect digitalisation from both the demand and supply sides that can be used to measure digital transformation. On the demand side, mobile cellular subscriptions (DT_1), fixed telephone subscriptions (DT_2), fixed broadband subscriptions (DT_3), and internet users (DT_4) are included to measure the extent of technology adoption and connectivity among the population. Meanwhile, on the supply side, the indicators ICT goods exports (DT_5), ICT service exports (DT_6), medium and high-tech manufacturing value added (DT_7), and investment in telecoms with private participation (DT_8) are used to assess the production, export, and investment

aspects of the digital economy, providing a comprehensive view of a country's digital transformation progress. The first eigenvector (loading matrix) from PCA is used as the necessary weights to derive the aggregate digital transformation index (DT), resulting in the following linear combination:

$$DT = a_1 DT_1 + a_2 DT_2 + a_3 DT_3 + a_4 DT_4 + a_5 DT_5 + a_6 DT_6 + a_7 DT_7 + a_8 DT_8 \qquad (1)$$

On the other hand, four key indicators have been used, including GDP per capita growth (IG_1), the poverty rate index (IG_2), the Gini index (IG_3), and the unemployment rate (IG_4), as updates to the calculations previously performed by Kristyanto & Kaluge (2018) and Jamil (2017). Although per capita GDP growth (IG_1) reflects economic progress, the poverty rate index (IG_2), Gini index (IG_3), and unemployment rate (IG_4) provide insights into people's participation in economic activities as well as the distribution of economic benefits. Notably, the latter three indicators have an implicit inverse relationship with inclusive growth, implying that greater poverty, inequality, and unemployment are associated with lower inclusive growth performance. To make these last three indicators more understandable, a formula, $100 - IG_{2,3,4}$, is used to convert them. Following the conversion process, these three indicators can now be interpreted as efforts to reduce poverty, inequality, and unemployment rates. The aggregate index of inclusive growth (IG) generated by the first eigenvector (loading matrix) is expressed as follows:

$$IG = a_1 IG_1 + a_2(100 - IG_2) + a_3(100 - IG_3) + a_4(100 - IG_4) \qquad (2)$$

In equations (1) and (2), the values $a_1, \ldots, a_8$, correspond to the eigenvalue vector derived from the unrotated matrix in PCA. The unrotated matrix was chosen because it provides a more direct representation of the variance explained by each principal component, whereas the rotated matrix may introduce additional complexity and a less straightforward interpretation of the eigenvalues (Aït-Sahalia & Xiu, 2019).

In this study, the selection of control variables is rooted in a coherent rationale driven by existing literature in both the contexts of digital transformation and inclusive growth. Accountability, civil liberty, and the rule of law are identified as pivotal factors in digital transformation due to their established importance in shaping the digital landscape. By holding stakeholders accountable for their digital actions, accountability promotes transparency and trust (Crabtree et al., 2018). Individual rights in the digital space are protected by civil liberty, allowing for free engagement with technology (McDiarmid & Shears, 2016). The rule of law provides the necessary legal framework for digital activities, ensuring that established norms are followed (Kamau & Willems, 2019).

Similarly, in the context of inclusive growth, factors such as inflation, gross domestic saving, foreign direct investment (FDI), and oil rent are selected for examination based on a consistent logic. Because of the impact of inflation on people's purchasing power, it is relevant to inclusive growth (Easterly & Fischer, 2001), whereas gross domestic saving is required to fund inclusive initiatives (Corrado & Corrado, 2017). The potential contribution of FDI to economic growth and job creation is consistent with inclusive growth objectives (Fazaalloh, 2019), and effective oil rent management can support inclusive programmes in oil-dependent economies (Havranek et al., 2016).

Appendix 1 contains a detailed list of the indicators used to calculate the overall digital transformation and inclusive growth index. Appendix 2, on the other hand, contains the definitions of control variables used in both the initial and subsequent regression stages. These appendices serve to provide essential research reference materials.

Estimation Strategy

The Two-Stage Least Squares (2SLS) method was used in this study to address potential endogeneity issues in research on the impact of digital transformation on inclusive growth. Endogeneity occurs when there is reverse causality between variables within an analytical model, which may affect research outcomes (Mogstad et al., 2021; Pacini & Windmeijer, 2016). In this context, there is concern that researched variables such as digital transformation and inclusive growth may interact with one another, potentially introducing bias in regression analysis. It is critical to note that digital transformation is endogenous rather than exogenous (see, e.g., Doyar et al., 2023; Rath et al., 2023; Scheerder et al., 2017). To address this endogeneity, a careful analytical approach, such as the 2SLS method, is required to isolate and understand the true impact of digital transformation on inclusive growth.

The 2SLS method is a statistical method for dealing with endogeneity issues. A two-stage analysis is used in this method. In the first stage, the endogenous variable, digital transformation (DT), is regressed against external instrumental variables like accountability (AI), civil liberties (CLI), and the rule of law (RLI). The first-stage regression takes the following basic form:

$$DT_t = a_0 + a_1 DT_{t-1} + a_2 AI_{t-1} + a_3 CLI_{t-1} + a_4 RLI_{t-1} + \varepsilon_t \tag{3}$$

All external instruments with a one-year lag are used in equation (3) to help meet the exogeneity assumption (Bellemare et al., 2017). This assumption states that instruments should not be correlated with the model's error term. It is usually easier to assume that disturbances in previous periods are uncorrelated with the current instrumental variables when using data from previous periods. Because the data used are time series, lag dependent variables (DT_{t-1}) are also used as internal instruments because they exhibit better statistical properties, such as stationarity, than unprocessed data.

The predicted outcomes from the first stage ($\widehat{DT}$) are then used as independent variables in the regression examining the relationship between the endogenous variable, digital transformation, and the outcome variable, inclusive growth, in the second stage. The following is the equation form for the second stage:

$$IG_t = \beta_0 + \beta_1 \widehat{DT}_t + \beta_2 IG_{t-1} + \beta_3 I_t + \beta_4 GDS_t + \beta_5 FDI_t + \beta_6 OIL_t + e_t \tag{4}$$

where, inclusive growth (IG) is influenced not only by the endogenous variable, digital transformation ($\widehat{DT}$), but also by control variables such as inflation (I), gross domestic savings (GDS), foreign direct investment (FDI), and oil rents (OIL). Similar to equation (3), inclusive growth is also affected by lags of its dependent variable (IG_{t-1}), with the expectation that the stationarity properties of the time series data used can be obtained.

A weak instrument test was performed in accordance with the 2SLS procedure by comparing the Kleibergen-Paap F-statistic with a Stock-Yogo critical value of 16.38 in the first-stage regression (see Kleibergen & Paap, 2006 and Stock & Yogo, 2005, respectively). This step is critical to ensuring that the instruments used in the analysis are robust enough to deal with endogeneity issues. If the Kleibergen-Paap F-statistic exceeds the critical Stock-Yogo value, the instruments used are strong enough to support the analysis and reduce potential bias in regression results.

Furthermore, because this study uses time series data, regression diagnostics are required. The Durbin Test can be used to detect autocorrelation in regression residuals, indicating dependence among time series observations (Akter, 2014). Significant Durbin Test results indicate the presence of autocorrelation, which requires further investigation. The Breusch-Pagan/Cook-Weisberg test can also be used to test for heteroskedasticity in the data (Račkauskas & Zuokas, 2007). Significant results from

this test indicate imbalances in the variation of residuals over time, necessitating further consideration in the analysis of regression results. By performing these regression diagnostics, we can ensure that the fundamental assumptions of regression are met, thereby increasing the reliability of the regression analysis results.

Results

This section will first explain the indicators that are dominant in forming the aggregate index of digital transformation and inclusive growth before discussing the estimation results of the endogenous impact of digital transformation on inclusive growth. To enhance understanding within the context of this analysis, detailed explanations of each indicator's contributions will be provided. The goal is to identify key components that are critical to Indonesia's PCA of digital transformation and inclusive growth.

The PCA results suggest the possibility of two main components, as indicated by eigenvalues greater than one in the second component (see Figure 1a). However, only the first component has been chosen for further investigation for the purposes of this study. This choice is supported by an associated Rho value of 58.07%, indicating that the majority (almost two-thirds) of the indicators used in constructing the aggregate digital transformation index are encapsulated within the first component. Notably, the indicator measuring medium and high-tech manufacturing value added (DT_7) contributes significantly to the formation of the first component (see Figure 1b). This suggests that the variance in the digital transformation indices used in this study is primarily accounted for by value added in medium and high-tech manufacturing.

Note: $\rho = 0.5807$ in First Component
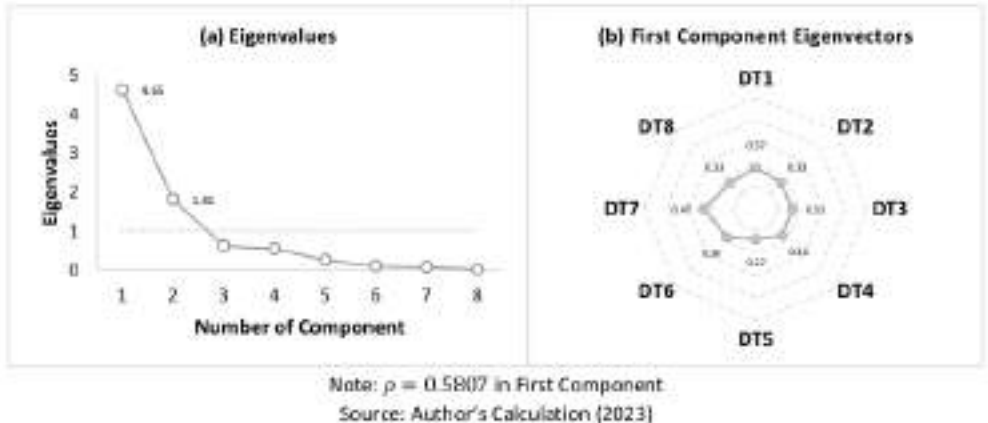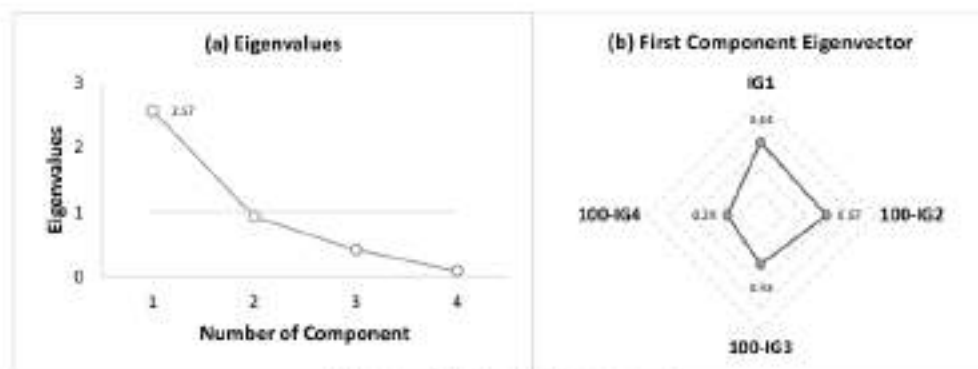
Source: Author's Calculation (2023)

Figure 1: Eigenvalues and First Component Eigenvectors in Digital Transformation Aggregate Indices

Furthermore, the PCA results show that only one significant main component is formed, with the first component having an eigenvalue greater than one (see Figure 2a). The indicators of per capita GDP growth (IG_1) and poverty alleviation $(100 - IG_2)$ have significant eigenvectors in the context of the first component (component 1), indicating that they contribute the most to the formation of this component. In contrast, the indicators of inequality $(100 - IG_3)$ and unemployment $(100 - IG_4)$ improvement contribute less to inclusive growth (see Figure 2b). In other words, in this context, inclusive growth is more dominantly defined as growth accompanied by poverty alleviation, whereas improvements in inequality and unemployment contribute less and play a smaller role in representing inclusive growth in Indonesia.

Note: $\rho = 0.6434$ in First Component

Source: Author's Calculation (2023)

Figure 2: Eigenvalues and First Component Eigenvectors in Inclusive Growth Aggregate Indices

To test for causality, the results of calculating the aggregate indices of digital transformation and inclusive growth are estimated using the 2SLS method. Before conducting the estimation, studies must examine classical assumptions, such as autocorrelation and heteroskedasticity, using the Durbin test and the Breusch-Pagan/Cook-Weisberg test on time series data. According to Table 1 and 2, there is no potential autocorrelation or heteroskedasticity in the first and second stage regressions. The results of the Durbin and Breusch-Pagan/Cook-Weisberg tests, which do not reject the null hypothesis, demonstrate this. As a result, this data shows no correlation of residuals across observation years and has constant variance. This enables accurate time series estimation.

Furthermore, the endogeneity test in the instrumental variable test is indicated by the Kleibergen-Paap F-statistic significantly exceeding the Stock-Yogo critical value. This shows that the instruments used are thought to be reliable for dealing with endogeneity issues. As a result, estimation using the 2SLS method can be performed with sufficient confidence and yield more accurate results when testing the cause-and-effect relationship between digital transformation and inclusive growth. This lays a solid foundation for further investigations into the impact of digital transformation on inclusive growth in Indonesia.

Table 1 displays the results of the first-stage regression, illustrating the estimation of digital transformation determinants in Indonesia. With a significance level of 1%, the estimation results show that the previous year's digital transformation (DT_{t-1}) has a significant and positive influence on the current digital transformation (DT_t), both in the absence of control variables (as seen in column 1) and when control variables (as seen in column 2) are included. These coefficient values indicate that a one-standard-deviation increase in digital transformation from the previous year will result in a 0.97 to 1.00 standard deviation increase in digital transformation this year. According to these findings, a high level of digital transformation the previous year is followed by a significant increase in digital transformation the following year. However, as indicated by coefficient values that are not significantly different from zero, the factor one-year lag of accountability (AI_{t-1}), civil liberties (CLI_{t-1}), and rule of law (RLI_{t-1}) has no significant influence on this year's digital transformation (DT_t). In other words, the three external instruments used do not provide enough evidence to adequately explain current digital transformation.

Table 1: Digital Transformation Determinants in Indonesia

First Stage Regression	(1) Digital Transformation, DT_t	(2) Digital Transformation, DT_t
One-year lag of Digital Transformation, DT_{t-1}	1.0045***	0.9735***
	(0.0251)	(0.0629)
One-year lag of Accountability Index, AI_{t-1}	-	0.4982
		(2.1770)
One-year lag of Civil Liberty Index, CLI_{t-1}	-	-0.6440
		(3.8511)
One-year lag of Rule of Law Index, RLI_{t-1}	-	0.3761
		(3.5102)
N	41	41
R-squared	0.9763	0.9765
Regression Diagnostics for Time Series:		
Durbin's alternative test for autocorrelation	0.2318	0.2268
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	0.6333	0.5817
Weak Instrument Test:		
Kleibergen-Paap F-statistic	1603.66	374.06
Stock-Yogo critical value	16.38	16.38

The coefficient employs standardised beta, standard errors in parentheses, and *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Author's Calculation (2023)

Table 2: Estimated Impact of Digital Transformation and Others on Indonesian Inclusive Growth

Second Stage Regression	(1) Inclusive Growth, IG_t	(2) Inclusive Growth, IG_t
Digital Transformation, $\widehat{DT}_t$	0.1193*	0.1275*
	(0.0568)	(0.0641)
One-year lag of Inclusive Growth, IG_{t-1}	0.8100***	0.6950***
	(0.0936)	(0.1151)
Inflation, I_t	-	-0.0203***
		(0.0054)
Gross Domestic Saving, GDS_t	-	0.9589
		(1.4840)
FDI Net Inflow, FDI_t	-	5.0501
		(4.5706)
Oil Rents, OIL_t	-	-1.5745
		(2.1489)
N	41	41
R-squared	0.9600	0.9756
Regression Diagnostics for Time Series:		
Durbin's alternative test for autocorrelation	0.1035	0.2303
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	0.8000	0.8470

The coefficient employs standardised beta, standard errors in parentheses, and *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Author's Calculation (2023).

The impact of endogenously-driven digital transformation and other factors on inclusive growth in Indonesia is estimated in Table 2. The estimation results show that endogenously-driven digital transformation $(\overline{DT}_t)$ has a significant and positive impact on inclusive growth (IG_t), both when only the one-year lag of inclusive growth is considered (as shown in column 1) and when various control variables are included (as shown in column 2), with a significance level of 10%. The coefficient values indicate that each one-standard-deviation increase in digital transformation leads to an increase in inclusive growth of approximately 0.12 to 0.13 standard deviations. Furthermore, the lagged dependent variable (IG_{t-1}) has significant and positive effects on inclusive growth (IG_t), whether considered independently (column 1) or with the inclusion of control variables (column 2). This suggests that inclusive growth has persistent effects. In comparison, with a significance level of 1%, inflation (I_t) has a significant and negative impact on inclusive growth (IG_t). According to the coefficient values, each one-standard-deviation increase in inflation reduces inclusive growth by approximately 0.02 standard deviations. Control variables such as gross domestic saving (GDS_t), net inflow of foreign direct investment (FDI_t), and oil rents (OIL_t) have no significant effects on inclusive growth. In other words, the effect of these three control variables is statistically indistinguishable from zero.

Discussion

Key Contributor to the Progress of Digital Transformation and Inclusive Growth

Figure 3(a) depicts the evolution of the Digital Transformation Index calculated using Principal Component Analysis (PCA) for the period 1980-2021, reflecting a journey that began with low negative values at the start of the period, indicating early challenges in digital technology adoption. Following that, a positive transition occurred at the turn of the twenty-first century, indicating an improvement in digital technology adoption, and significant positive progress was made during the 2010s, reflecting an acceleration in digital transformation. The index peaked in 2020-2021, when it experienced a dramatic increase due to the COVID-19 pandemic and a significant increase in the use of digital technology. This exemplifies how global changes and technological trends can impact the rate and direction of digital transformation.

Medium and high-tech manufacturing is critical to Indonesia's digital transformation because it not only contributes to the production of high-tech technology, which serves as the foundation of digital infrastructure, but it also promotes the development of local capabilities, innovation, and economic value addition (Rahardja et al., 2012). While indicators such as the proportion of mobile subscribers, fixed-line subscriptions, and internet users reflect population technology adoption, the manufacturing sector's contribution in producing the necessary hardware and equipment is critical to digital transformation (Delera et al., 2022). Exports of ICT goods and services, as well as private sector participation in telecommunications, on the other hand, are critical, but they are more closely related to business and trade than to the fundamental development of digital infrastructure. Exports of ICT goods and services, as well as private sector participation in telecommunications, on the other hand, are critical, but they are more closely related to business and trade than to the fundamental development of digital infrastructure. As a result, medium and high-tech manufacturing becomes a key driver of Indonesia's broader digital economic growth.

Figure 3(b) portrays the Inclusive Growth Index calculated using Principal Component Analysis (PCA) for the period 1980-2021, reflecting Indonesia's evolutionary journey towards more inclusive economic growth. Negative values at the start of the period indicated uneven growth, but gradual improvement over time, particularly in the early twenty-first century, reflects efforts to improve the distribution of economic benefits. Significant progress was made in the 2010s, indicating success in

achieving more equitable economic growth, possibly through more inclusive social and economic initiatives. Although stability was observed in 2020-2021, sustained efforts are required to ensure that economic growth is evenly distributed across all segments of the Indonesian population, allowing all citizens to reap the benefits.

When compared to the reduction of inequality and unemployment, economic growth and poverty alleviation emerge as the primary contributors to inclusive growth in Indonesia. This is due to the fact that the Inclusive Growth Index favours overall population income and welfare improvement over income distribution or lower unemployment rates. Because of the structural changes required in the economy and the implementation of effective redistributive policies, reducing inequality often takes a longer time frame to manifest in the Inclusive Growth Index (Heshmati et al., 2019; Sen, 2014). Furthermore, while reducing unemployment has a more direct impact on the Inclusive Growth Index, when economic growth and poverty alleviation are pursued effectively, they naturally create new jobs and opportunities, which reduce unemployment. As a result, an initial focus on economic growth and poverty alleviation is frequently regarded as a critical first step in laying a solid foundation for inclusive digital transformation in Indonesia.
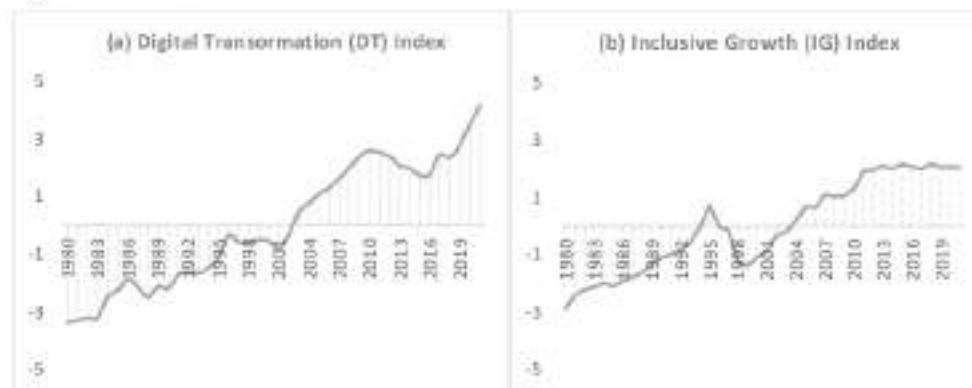
Source: Author's Calculation (2023)

Figure 3: The Evolution of Digital Transformation and Inclusive Growth in Indonesia

The key contributor to the evolution of digital transformation and inclusive growth is crucial in explaining the causal mechanism that enables digital transformation to have an impact on inclusive growth in Indonesia. In the subsequent section, we will take on the complex relationship between these two critical elements and explain how digital transformation can effectively drive inclusive growth in the Indonesian context.

The Determinant of Digital Transformation and Its Impact on Inclusive Growth

The findings of this study point out the critical roles of both internal and external factors in shaping digital transformation, particularly in the Medium and High-Tech Manufacturing sector. This discussion will go into detail about why internal factors, particularly the representation of digital transformation from the previous year, have a greater impact on this year's digital transformation. External factors such as accountability, civil liberties, and the rule of law, on the other hand, appear to have less influence than internal factors in the context of digital transformation.

Previous studies by Arrow (1962) and Bouché (2017) supports these findings, emphasising the importance of learning from the previous year's transformation in order to drive change the following

year. Organisations that are capable of evaluating the implementation of new technologies and restructuring past processes are more likely to identify innovation opportunities and efficiencies in the ongoing transformation. Internal factors, particularly through a continuous learning approach, lay the groundwork for better results in the coming year.

The findings of this study are supported by previous studies conducted by Van Looy (2020), which confirm that internal factors have a more immediate impact on the current year's digital transformation. Organisations that are adept at optimising internal processes, increasing productivity, and successfully implementing new technologies are better positioned to navigate market changes and innovation demands. The internal capacity of a firm to maximise its potential is frequently what drives success in digital transformation.

Nonetheless, prior research highlights the importance of external factors in driving digital transformation (as evidenced by Pearson & Wainwright, 2013, investigating accountability; Rao, 2013, investigating civil liberties; dan Myovella et al., 2021, investigating rule of law and regulations). While this study suggests that external factors such as accountability, civil liberties, and the rule of law may not have immediate effects on the ongoing year's digital transformation, previous studies take a different approach. These external factors may have a greater impact on the macroeconomic context and overall business environment, both of which drive digital transformation.

Previous research on the role of external factors has also suggested that accountability and civil liberties can shape a stable and transparent business environment (Alfonso-Gil et al., 2014; Barry & DiGiuseppe, 2019). Policy measures that promote the rule of law can help to create the safeguards needed for intellectual property rights and innovation (Mingaleva & Mirskikh, 2013). Although their effects may not be immediately visible and may take time to manifest, these factors contribute to an environment conducive to digital transformation.

By bringing together the findings of this study with those of previous studies, a more comprehensive and intricate picture of digital transformation emerges. At last, digital transformation in the Medium and High-Tech Manufacturing sector this year is influenced by the pivotal roles of internal factors, particularly learning and changes from the previous year. While the impact of external factors such as accountability, civil liberties, and the rule of law may not be readily apparent in this year's transformation, their role in shaping a business environment supportive of digital transformation remains important in the long run.

Furthermore, this study found that digital transformation plays a significant role in driving inclusive growth in Indonesia. In the context of digital transformation, the Medium and High-Tech Manufacturing sector has been the primary focus in understanding how the adoption of digital technology can bring positive changes to the Indonesian economy. Inclusive growth, which includes more equitable distribution of economic benefits and poverty reduction, has emerged as a central goal in Indonesia's efforts to implement digital transformation across various sectors. Two mechanisms are proposed in this study to explain the realisation of inclusive growth through digital transformation.

The first mechanism that explains how digital transformation in the Medium and High-Tech Manufacturing sector can accelerate inclusive growth in Indonesia is economic growth acceleration. This finding is consistent with previous research that found a positive relationship between digital technology adoption and economic growth. According to Ochoa-Jimenez et al. (2022), countries that effectively adopt digital technology have higher economic growth rates. As a result, digital

transformation in the medium and high-tech manufacturing sectors has the potential to positively contribute to Indonesia's inclusive growth by increasing production efficiency and productivity.

The second mechanism elucidating the role of digital transformation in poverty alleviation fits in with previous research findings. Burganov et al. (2022), Kaplinsky (2011), and Lee & Rodríguez-Pose (2016) found that access to and use of digital technology may reduce inequality and poverty. Wage increases in the Medium and High-Tech Manufacturing sector may be stimulated by the digital transformation represented by the sector's growth. With increased labour market competition, firms may compete to attract and retain skilled workers by offering higher wages and better working conditions. This can have a direct impact on low-income workers' living standards. The technical skills gained in this sector can also be transferred to the larger community, creating new opportunities for technology training and learning among disadvantaged households.

Comparisons with previous research, on the other hand, highlight some potential disagreements. According to the research of Acemoglu & Restrepo (2019) the adoption of digital technology may replace human labour, particularly in routine and repetitive tasks. This could lead to job insecurity for lower-skilled workers and contribute to structural unemployment (Acemoglu & Restrepo, 2020). To avoid societal disparities in this digital era, it is critical that the implementation of digital transformation be balanced with relevant skill training and development programmes.

Ultimately, the mechanisms of accelerating economic growth and poverty alleviation generated by digital transformation in the Medium and High-Tech Manufacturing sector are consistent with previous research findings that show the positive effects of digital technology on economic growth and poverty alleviation. However, the displacement of human labour by technology has the potential to cause conflict. As a result, the implementation of digital transformation should be guided by balance, taking into account skill training aspects and worker protection to ensure that its benefits are felt by all segments of society.

Other Factors Influencing Inclusive Growth Besides Digital Transformation

Apart from digital transformation, there are several other factors that have the potential to influence inclusive growth. The results of this study show that inflation has a negative impact on inclusive growth. When inflation rates reach a certain level, there is a risk of eroding individual purchasing power, particularly among those with lower incomes (Easterly & Fischer, 2001). Consumers are forced to spend a significant portion of their income just to maintain their current consumption patterns, resulting in lower quality of life and limited access to essential goods and services (Du & Kamakura, 2008). Other variables, such as Gross Domestic Savings (GDS), Foreign Direct Investment (FDI), and Oil Rents, on the other hand, have proven to make only minor contributions to enhancing inclusive growth.

When Gross Domestic Savings (GDS) are examined, it becomes clear that higher savings rates do not inherently translate into parallel improvements in inclusive growth. In other words, while higher savings indicate more frugal economic behaviour, this correlation does not always result in significant inclusive growth outcomes. In this context, the effective use of accumulated savings or strategic investments in productive endeavours emerges as a critical factor in achieving tangible benefits for society as a whole.

The same holds true for FDI inflows. Despite being widely regarded as a critical catalyst for economic growth, the relationship between FDI and inclusive growth is far from universal. The impact of FDI on inclusivity can vary significantly depending on how carefully critical factors like equitable income distribution and the provision of respectable employment opportunities are taken into account. As a

result, it is critical to take a nuanced approach that considers these critical factors when assessing the impact of FDI on inclusive growth.

Similarly, the complexities of the relationship between oil rents and inclusive growth emerge. While revenues from oil exports (commonly referred to as oil rents) may appear advantageous at first, their translation into consistent and significant advances in inclusive growth is not guaranteed. The reliance on oil revenues can cause adverse economic fluctuations within communities and may even stymie sincere efforts to alleviate poverty. To effectively harness the potential benefits of oil revenues while ensuring sustainable and inclusive growth, a thorough understanding of the context and prudent resource management are required.

In the end, this study not only emphasises the adverse impacts of inflation on inclusive growth, but it also confirms the limited effects of factors such as Gross Domestic Savings (GDS), Foreign Direct Investment (FDI) inflows, and Oil Rents on increasing inclusivity. These findings highlight the importance of a comprehensive policy framework that takes into account a wide range of factors in order to foster sustainable and equitable economic growth that benefits all segments of society.

Conclusions

The research findings conclude that medium and high-tech manufacturing play a critical role in realising digital transformation, while GDP per capita growth and poverty alleviation emerge as primary contributors to measuring inclusive growth in Indonesia. Most importantly, this study concludes that the beneficial impact of digital transformation is primarily elucidated by how the medium and high-tech manufacturing sectors can stimulate inclusive growth, particularly in terms of increasing GDP per capita and reducing poverty. Its impact is closely related to the previous year's digital transformation status.

Based on these findings, this study proposes two major points. Firstly, because digital transformation is inextricably linked to prior digitalization learning processes, it is imperative to foster the ability to understand and apply lessons learned from previous experiences as a solid foundation for a more effective digital transformation journey. Learning from previous endeavours provides valuable guidance on what works, what needs to be modified, and how to deal with challenges that may arise when embracing new technologies. Internal capacity development and organisational adaptation to technological advances become critical components in maximising the benefits of digital transformation. Leveraging past insights allows organisations to avoid making the same mistakes, implement smarter approaches, and become better prepared to address ongoing changes in the constantly evolving digital era.

Secondly, once the medium and high-tech manufacturing sectors have a solid foundation in digital transformation, it is of the utmost importance to increase the inclusiveness of economic growth in these sectors, particularly for impoverished poor households. The recommended policy measures to improve economic inclusivity in the medium and high-tech manufacturing sectors for disadvantaged populations include establishing affordable community-based training centres, offering training programmes that align with labour market needs, promoting partnerships between training centres and industries, and providing education subsidies focused on lifelong learning.

However, the limitations of this study must be acknowledged. The scope of this research is primarily focused on the Indonesian context, and it may not fully encompass the nuances of digital transformation and inclusive growth across various regions or countries. Furthermore, while the study emphasises the importance of internal factors and prior learning experiences, future research can

delve deeper into specific strategies and mechanisms that organisations can implement to stimulate hands-on learning practises and facilitate digital transformation.

Future research should aim to broaden the scope of study by incorporating comparative analyses of digital transformation and its impact on inclusive growth across various countries and sectors. Furthermore, investigating the roles of government policies, regulatory frameworks, and collaborations between the public and private sectors in promoting inclusive digital transformation can provide policymakers and practitioners with valuable insights. Following that, investigating the potential challenges and opportunities arising from the integration of emerging technologies such as artificial intelligence and blockchain within the context of inclusive growth will provide a more comprehensive understanding of the subject. Future research can pave the way for more effective strategies to harness the power of digital transformation for inclusive and sustainable economic development by addressing these issues.

References

Acemoglu, D., & Restrepo, P. (2019). Automation and New Tasks: How Technology Displaces and Reinstates Labor. *Journal of Economic Perspectives*, *33*(2), 3–30. https://doi.org/10.1257/jep.33.2.3

Acemoglu, D., & Restrepo, P. (2020). Unpacking Skill Bias: Automation and New Tasks. *AEA Papers and Proceedings*, *110*, 356–361. https://doi.org/10.1257/pandp.20201063

Aït-Sahalia, Y., & Xiu, D. (2019). Principal Component Analysis of High-Frequency Data. *Journal of the American Statistical Association*, *114*(525), 287–303. https://doi.org/10.1080/01621459.2017.1401542

Akter, J. (2014). Bootstrapped Durbin–Watson Test of Autocorrelation for Small Samples. *ABC Journal of Advanced Research*, *3*(2). https://doi.org/https://doi.org/10.18034/ABCJAR.V3I2.415

Alekhina, V., & Ganelli, G. (2023). Determinants of inclusive growth in ASEAN. *Journal of the Asia Pacific Economy*, *28*(3), 1196–1228. https://doi.org/10.1080/13547860.2021.1981044

Alfonso-Gil, J., Lacalle-Calderón, M., & Sánchez-Mangas, R. (2014). Civil liberty and economic growth in the world: A long-run perspective, 1850-2010. *Journal of Institutional Economics*, *10*(3), 427–449. https://doi.org/10.1017/S1744137414000095

Ariansyah, K., Barsei, A. N., Syahr, Z. H. A., Sipahutar, N. Y. P., Damanik, M. P., Perdananugraha, G. M., Dunan, A., Nupikso, D., Darmanto, Hidayat, D., Mudjiyanto, B., Hermawati, I., & Suryanegara, M. (2023). Unleashing the potential of mobile broadband: Evidence from Indonesia's underdeveloped regions on its role in reducing income inequality. *Telematics and Informatics*, *82*, 102012. https://doi.org/10.1016/j.tele.2023.102012

Arrow, K. J. (1962). The Economic Implications of Learning by Doing. *The Review of Economic Studies*, *29*(3), 155. https://doi.org/10.2307/2295952

Asongu, S., Amari, M., Jarboui, A., & Mouakhar, K. (2021). ICT dynamics for gender inclusive intermediary education: Minimum poverty and inequality thresholds in developing countries. *Telecommunications Policy*, *45*(5), 102125. https://doi.org/10.1016/j.telpol.2021.102125

Barry, C. M., & DiGiuseppe, M. (2019). Transparency, Risk, and FDI. *Political Research Quarterly*, *72*(1), 132–146. https://doi.org/10.1177/1065912918781037

Bellemare, M. F., Masaki, T., & Pepinsky, T. B. (2017). Lagged Explanatory Variables and the Estimation of Causal Effect. *The Journal of Politics*, *79*(3), 949–963. https://doi.org/10.1086/690946

Bouché, S. (2017). Learning by doing, endogenous discounting and economic development. *Journal of Mathematical Economics*, 73, 34–43. https://doi.org/10.1016/j.jmateco.2017.08.004

Burganov, R. T., Gafarov, M. R., & El'shin, L. A. (2022). A factor analysis of digitalization impact on the region's inclusive growth. *Regional Economics: Theory and Practice*, 20(5), 904–919. https://doi.org/10.24891/re.20.5.904

Colombari, R., & Neirotti, P. (2022). Closing the middle-skills gap widened by digitalization: how technical universities can contribute through Challenge-Based Learning. *Studies in Higher Education*, 47(8), 1585–1600. https://doi.org/10.1080/03075079.2021.1946029

Corejova, T., & Chinoracky, R. (2021). Assessing the Potential for Digital Transformation. *Sustainability*, 13(19), 11040. https://doi.org/10.3390/su131911040

Corrado, G., & Corrado, L. (2017). Inclusive finance for inclusive growth and development. *Current Opinion in Environmental Sustainability*, 24, 19–23. https://doi.org/10.1016/j.cosust.2017.01.013

Crabtree, A., Lodge, T., Colley, J., Greenhalgh, C., Glover, K., Haddadi, H., Amar, Y., Mortier, R., Li, Q., Moore, J., Wang, L., Yadav, P., Zhao, J., Brown, A., Urquhart, L., & McAuley, D. (2018). Building accountability into the Internet of Things: the IoT Databox model. *Journal of Reliable Intelligent Environments*, 4(1), 39–55. https://doi.org/10.1007/s40860-018-0054-5

Delera, M., Pietrobelli, C., Calza, E., & Lavopa, A. (2022). Does value chain participation facilitate the adoption of Industry 4.0 technologies in developing countries? *World Development*, 152, 105788. https://doi.org/10.1016/j.worlddev.2021.105788

Dörffel, C., & Schuhmann, S. (2022). What is Inclusive Development? Introducing the Multidimensional Inclusiveness Index. *Social Indicators Research*, 162(3), 1117–1148. https://doi.org/10.1007/s11205-021-02860-y

Doyar, B. V., Rzali, S., & Dikkaya, M. (2023). Development of the ICT sector and the determinants of Internet use in the Southern Caucasus. *Telecommunications Policy*, 47(1), 102455. https://doi.org/10.1016/j.telpol.2022.102455

Du, R. Y., & Kamakura, W. A. (2008). Where did all that Money Go? Understanding how Consumers Allocate their Consumption Budget. *Journal of Marketing*, 72(6), 109–131. https://doi.org/10.1509/jmkg.72.6.109

Easterly, W., & Fischer, S. (2001). Inflation and the Poor. *Journal of Money, Credit and Banking*, 33(2), 160. https://doi.org/10.2307/2673879

Edquist, H. (2022). The economic impact of mobile broadband speed. *Telecommunications Policy*, 46(5), 102351. https://doi.org/10.1016/j.telpol.2022.102351

Esquivias, M. A., Sugiharti, L., Jayanti, A. D., Purwono, R., & Sethi, N. (2020). Mobile Technologies, Financial Inclusion, and Inclusive Growth in East Indonesia. *Journal of Telecommunications and the Digital Economy*, 8(2), 123–145. https://doi.org/10.18080/jtde.v8n2.253

Fazaalloh, A. M. (2019). Is foreign direct investment helpful to reduce income inequality in Indonesia? *Economics & Sociology*, 12(3), 25–36. https://doi.org/10.14254/2071-789X.2019/12-3/2

Goulart, V. G., Liboni, L. B., & Cezarino, L. O. (2022). Balancing skills in the digital transformation era: The future of jobs and the role of higher education. *Industry and Higher Education*, 36(2), 118–127. https://doi.org/10.1177/09504222211029796

Havranek, T., Horvath, R., & Zeynalov, A. (2016). Natural Resources and Economic Growth: A Meta-Analysis. *World Development*, 88, 134–151. https://doi.org/10.1016/j.worlddev.2016.07.016

Heshmati, A., Kim, J., & Wood, J. (2019). A Survey of Inclusive Growth Policy. *Economies*, 7(3), 65. https://doi.org/10.3390/economies7030065

Jamil, H. (2017). Implikasi Kebijakan Fiskal Era Orde Baru dan Era Reformasi dalam Mewujudkan Pertumbuhan Inklusif di Indonesia. *Jurnal Ilmiah Mahasiswa FEB*, 5(2). https://jimfeb.ub.ac.id/index.php/jimfeb/article/view/4079

Jamil, H. (2022). Less Inclusive Growth in Indonesia? The Unintended Consequences of Internet Penetration. *Jurnal Ekonomi Bisnis Dan Kewirausahaan*, 11(2), 197. https://doi.org/10.26418/jebik.v11i2.53871

Kamau, M., & Willems, A. (2019). Of Binding Provisions and Trust Marks; Roadmap to a Global Legal Framework for the Digital Economy. *Legal Issues of Economic Integration*, 46(Issue 3), 225–246. https://doi.org/10.54648/LEIE2019014

Kamel, S. (2021). The Role of Digital Transformation in Development in Egypt. *Journal of Internet and E-Business Studies*, 1–10. https://doi.org/10.5171/2021.911090

Kaplinsky, R. (2011). Schumacher meets Schumpeter: Appropriate technology below the radar. *Research Policy*, 40(2), 193–203. https://doi.org/10.1016/j.respol.2010.10.003

Kartiasih, F., Djalal Nachrowi, N., Wisana, I. D. G. K., & Handayani, D. (2022). Inequalities of Indonesia's regional digital development and its association with socioeconomic characteristics: a spatial and multivariate analysis. *Information Technology for Development*, 1–30. https://doi.org/10.1080/02681102.2022.2110556

Kleibergen, F., & Paap, R. (2006). Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics*, 133(1), 97–126. https://doi.org/10.1016/j.jeconom.2005.02.011

Kouladoum, J.-C. (2023). Digital infrastructural development and inclusive growth in Sub-Saharan Africa. *Journal of Social and Economic Development*. https://doi.org/10.1007/s40847-023-00240-5

Kristyanto, V. S., & Kaluge, D. (2018). Peningkatan Inklusivitas Ekonomi Melalui Pembiayaan Investasi Modal Manusia. *Jurnal Ekonomi Kuantitatif Terapan*, 11(2), 182–189. https://doi.org/10.24843/JEKT.2018.v11.i02.p04

Kuper, H. (2020). Industry 4.0: changes in work organization and qualification requirements—challenges for academic and vocational education. *Entrepreneurship Education*, 3(2), 119–131. https://doi.org/10.1007/s41959-020-00029-1

Lee, N., & Rodríguez-Pose, A. (2016). Is There Trickle-Down from Tech? Poverty, Employment, and the High-Technology Multiplier in U.S. Cities. *Annals of the American Association of Geographers*, 106(5), 1114–1134. https://doi.org/10.1080/24694452.2016.1184081

Leong, C., Tan, F. T. C., Tan, B., & Faisal, F. (2022). The emancipatory potential of digital entrepreneurship: A study of financial technology-driven inclusive growth. *Information & Management*, 59(3), 103384. https://doi.org/10.1016/j.im.2020.103384

McDiarmid, A., & Shears, M. (2016). The Importance of Internet Neutrality to Protecting Human Rights Online. In *Net Neutrality Compendium* (pp. 31–41). Springer International Publishing. https://doi.org/10.1007/978-3-319-26425-7_3

Mingaleva, Z., & Mirskikh, I. (2013). The Problems of Legal Regulation and Protection of Intellectual Property. *Procedia - Social and Behavioral Sciences*, 81, 329–333. https://doi.org/10.1016/j.sbspro.2013.06.437

Mogstad, M., Torgovitsky, A., & Walters, C. R. (2021). The Causal Interpretation of Two-Stage Least Squares with Multiple Instrumental Variables. *American Economic Review, 111*(11), 3663–3698. https://doi.org/10.1257/aer.20190221

Myovella, G., Karacuka, M., & Haucap, J. (2021). Determinants of digitalization and digital divide in Sub-Saharan African economies: A spatial Durbin analysis. *Telecommunications Policy, 45*(10), 102224. https://doi.org/10.1016/j.telpol.2021.102224

Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy, 48*(8), 103773. https://doi.org/10.1016/j.respol.2019.03.018

Njangang, H., Beleck, A., Tadadjeu, S., & Kamguia, B. (2022). Do ICTs drive wealth inequality? Evidence from a dynamic panel analysis. *Telecommunications Policy, 46*(2), 102246. https://doi.org/10.1016/j.telpol.2021.102246

Noh, Y.-H., & Yoo, K. (2008). Internet, inequality and growth. *Journal of Policy Modeling, 30*(6), 1005–1016. https://doi.org/10.1016/j.jpolmod.2007.06.016

Ochoa-Jimenez, D., Toledo, E., & Jimenez-Pena, K. (2022). The role of high-tech manufacturing in Ecuador's economic growth. *2022 17th Iberian Conference on Information Systems and Technologies (CISTI)*, 1–5. https://doi.org/10.23919/CISTI54924.2022.9820220

Olczyk, M., & Kuc-Czarnecka, M. (2022). Digital Transformation and Economic Growth – DESI Improvement and Implementation. *Technological and Economic Development of Economy, 28*(3), 775–803. https://doi.org/10.3846/tede.2022.16766

Pacini, D., & Windmeijer, F. (2016). Robust inference for the Two-Sample 2SLS estimator. *Economics Letters, 146*, 50–54. https://doi.org/10.1016/j.econlet.2016.06.033

Pearson, S., & Wainwright, N. (2013). An interdisciplinary approach to accountability for future internet service provision. *International Journal of Trust Management in Computing and Communications, 1*(1), 52. https://doi.org/10.1504/IJTMCC.2013.052524

Puspitasari, L., & Ishii, K. (2016). Digital divides and mobile Internet in Indonesia: Impact of smartphones. *Telematics and Informatics, 33*(2), 472–483. https://doi.org/10.1016/j.tele.2015.11.001

Pyke, F. (2018). Managing technological change for inclusive growth. *Cambridge Journal of Economics, 42*(6), 1687–1695. https://doi.org/10.1093/cje/bey023

Račkauskas, A., & Zuokas, D. (2007). New tests of heteroskedasticity in linear regression model. *Lithuanian Mathematical Journal, 47*(3), 248–265. https://doi.org/10.1007/s10986-007-0018-6

Rahardja, S., Winkler, D., Varela, G., & Ing, L. Y. (2012). *Why the Manufacturing Sector Still Matters for Growth and Development in Indonesia.* World Bank. https://doi.org/10.1596/26721

Rao, A. (2013). Re-examining the Relationship Between Civil Society and the Internet. *Journal of Creative Communications, 8*(2–3), 157–175. https://doi.org/10.1177/0973258613512562

Rath, B. N., & Hermawan, D. (2019). Do Information and Communication Technologies Foster Economic Growth in Indonesia? *Buletin Ekonomi Moneter Dan Perbankan, 22*(1), 103–122. https://doi.org/10.21098/bemp.v22i1.1041

Rath, B. N., Panda, B., & Akram, V. (2023). Convergence and determinants of ICT development in case of emerging market economies. *Telecommunications Policy, 47*(2), 102464. https://doi.org/10.1016/j.telpol.2022.102464

Rini, D. L., & Tambunan, T. T. H. (2021). Inclusive Economic Growth of Indonesia and Its Determinants-Recent Evidence with Provincial Data. *Asian Journal of Interdisciplinary Research*, 85–100. https://doi.org/10.34256/ajir2118

Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of Internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, *34*(8), 1607–1624. https://doi.org/10.1016/j.tele.2017.07.007

Sen, K. (2014). Inclusive Growth: When May We Expect It? When May We Not? *Asian Development Review*, *31*(1), 136–162. https://doi.org/10.1162/ADEV_a_00022

Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear IV regression. In D. W. K. Andrews & J. H. Stock (Eds.), *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg* (pp. 80–108). Cambridge University Press.

Sujarwoto, S., & Tampubolon, G. (2016). Spatial inequality and the internet divide in Indonesia 2010–2012. *Telecommunications Policy*, *40*(7), 602–616. https://doi.org/10.1016/j.telpol.2015.08.008

V-Dem Institute. (2023). *V-Dem Institute Datasets*. V-Dem Institute. https://v-dem.net/data/

Van Looy, A. (2020). Innovating Organizational Processes With New Technologies: Problems and Solutions. *IT Professional*, *22*(5), 71–80. https://doi.org/10.1109/MITP.2020.2969614

World Bank. (2016). *World Development Report 2016 : Digital Dividends*. https://openknowledge.worldbank.org/handle/10986/23347

World Bank. (2021). *Beyond Unicorns: Harnessing Digital Technologies for Inclusion in Indonesia*. https://www.worldbank.org/en/country/indonesia/publication/beyond-unicorns-harnessing-digital-technologies-for-inclusion-in-indonesia

World Bank. (2022). *World Development Indicators*. https://data.worldbank.org/

Appendix 1: Digital Transformation and Inclusion Growth Index Indicators

Variables/Indicators	Unit	Definition
Digital Transformation (DT)		
Mobile cellular subscriptions (DT_1)	per 1000 people	Subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months)
Fixed telephone subscriptions (DT_2)	per 1000 people	The sum of active number of analogue fixed telephone lines, voice-over-IP (VoIP) subscriptions, fixed wireless local loop (WLL) subscriptions, ISDN voice-channel equivalents and fixed public payphones.
Fixed broadband subscriptions (DT_3)	per 1000 people	Fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s
Individuals using the Internet (DT_4)	per 1000 people	Individuals who have used the Internet (from any location) in the last 3 months. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.
ICT goods exports (DT_5)	% of total goods exports	Information and communication technology goods exports include computers and peripheral equipment, communication equipment, consumer electronic equipment, electronic components, and other information and technology goods (miscellaneous).
ICT service exports (DT_6)	% of service exports, BoP	Information and communication technology service exports include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions).
Medium and high-tech manufacturing value added (DT_7)	% manufacturing value added	The proportion of medium and high-tech industry value added in total value added of manufacturing
Investment in telecoms with private participation (DT_8)	current US$	Commitments to infrastructure projects in telecommunications that have reached financial closure and directly or indirectly serve the public.
Inclusive Growth (IG)		
GDP per capita growth (IG_1)	annual %	Annual percentage growth rate of GDP per capita based on constant local currency
Headcount Poverty Index (IG_2)		The percentage of the population living below the national poverty line(s)
Gini Index (IG_3)	Index	The distribution of consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution
Unemployment Rate (IG_4)	%	The share of the labor force that is without work but available for and seeking employment

Source: Author's Compilation (2023).

Appendix 2: Control Variables and Their Definitions

Control Variables	Unit	Definition
Control on First Stage		
Accountability Index (AI)	Index	Government accountability is understood as constraints on the government's use of political power through requirements for justification for its actions and potential sanctions.
Civil Liberty Index (CLI)	Index	The absence of physical violence committed by government agents and the absence of constraints of private liberties and political liberties by the government.
Rule of Law Index (RLI)	Index	The degree to which laws are executed transparently, independently, predictably, impartially, and uniformly, as well as the extent to which government officials' conduct aligns with legal standards.
Control on Second Stage		
Inflation (I)	% annual	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.
Gross Domestic Saving (GDS)	% of GDP	Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption).
Foreign Direct Investment, net inflow (FDI)	% of GDP	The net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.
Oil Rents (OIL)	% of GDP	Oil rents are the difference between the value of crude oil production at regional prices and total costs of production.

Source: Author's Compilation (2023).

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