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The Role of Banking Credit and Innovation Technology in Deindustrialization in Indonesia

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Abstract

Research Originality: This study contributes to the literature by being the first to investigate the cause of deindustrialization from the production side, considering banking credit and innovation technology by Kaldor's Second Law, specifically focusing on a regional level in Indonesia.

Research Objectives: To investigate the impact of banking credit and innovation technology on deindustrialization on a regional level in Indonesia.

Research Methods: This research uses using panel data model on 34 provinces from 2017-2022 and a Fixed Effect Model (FEM) with a Seemingly Unrelated Regression (SUR) method, incorporating other control variables was used. Share of bank credit to the manufacturing industry is used as a proxy for bank credit, while internet usage is used as a proxy for innovation technology.

Empirical Results: The results showed that deindustrialization occurs in Indonesia even at the regional level. Banking credit and innovation technology are key factors driving the increase in GVA's share of the manufacturing industry in Indonesia. Prioritizing the quality of workers and improving international trade could also effectively increase the GVA share of the manufacturing industry.

Implications: This study offered valuable insights into designing and implementing capital policy strategies and equalizing internet access as an accelerator of innovation in the context of technology improvement to increase the manufacturing industry's GVA share.

Keywords:

Deindustrialization; manufacturing industry; banking credit; innovation technology

How to Cite:

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INTRODUCTION

Economic development is an important issue that occurs in various countries in the world, including Indonesia. One of the economic development strategies of a country is to focus on rapid industrialization, which prioritizes the growth of the manufacturing sector (Todaro & Smith, 2015). This is followed by Kaldor's growth theory, which states that the manufacturing industry sector (secondary sector) is the engine of growth in the economic system of a country or region (Kaldor, 1996). The manufacturing industry sector is seen as important in economic development because it can create many jobs to absorb much labor (Kien, 2014) and has a high linkage effect to its sector or other sectors (Gabriel & Ribeiro, 2019). The manufacturing sector contributes to economic growth by increasing industrial output and encouraging innovation using resources for optimal production (Elfaki et al., 2021). The manufacturing sector also protects the economies of several countries in the world when a global crisis occurs because the adjustment response is swift (Lavopa & Donnelly, 2023). The manufacturing industry also plays an important role in the Indonesian economy. Over the past few years, manufacturing has become the most significant contributor to gross value added (GVA) in gross domestic product (GDP) and crucial in employment. In 2022, according to Badan Pusat Statistik, the GVA share of the manufacturing industry was 18.34 percent, and 14.17 percent of Indonesia's total workforce was absorbed. Therefore, developing the performance of the manufacturing industry sector is important for the sustainability of a country's development.

The development of the performance of the manufacturing industry sector is a topic that is widely discussed because it is an agenda that must be resolved together and is contained in the Sustainable Development Goals (SDGs) promoted in 2015, precisely the ninth goal related to infrastructure, industrialization, and innovation. However, Indonesia has experienced deindustrialization. Figure 1 shows that the GVA share of Indonesia's manufacturing industry at constant and current prices has decreased in recent years. Tregenna (2009) explains that the decline in the GDP share of the manufacturing industry at both constant and current prices indicates the failure of a country's industrialization process. Another problem is that the GVA growth rate of the manufacturing sector is consistently below economic growth from 2017 to 2022, while the service sector shows strength with a GVA growth rate above economic growth. Even in 2022, several service sectors show considerable GVA growth, such as the information and communication services sector, GVA grew by 7.74%; In the corporate services sector, GVA grew by 8.77%; and in other service sectors, GVA grew by 9.47%.

The symptoms of deindustrialization that occurred in Indonesia are considered premature and are not the result of successful economic development (Andriyani & Irawan, 2018). Rodrik (2016) explains that early deindustrialization occurs in developing countries because the country transforms into a service-based country without experiencing an established industrialization process. Established industrialization occurs when the GVA share of the manufacturing industry ranges from 30 to 40 percent. GDP per capita is above $7000-$10,000. However, conditions in Indonesia show that the decline in the GVA share of

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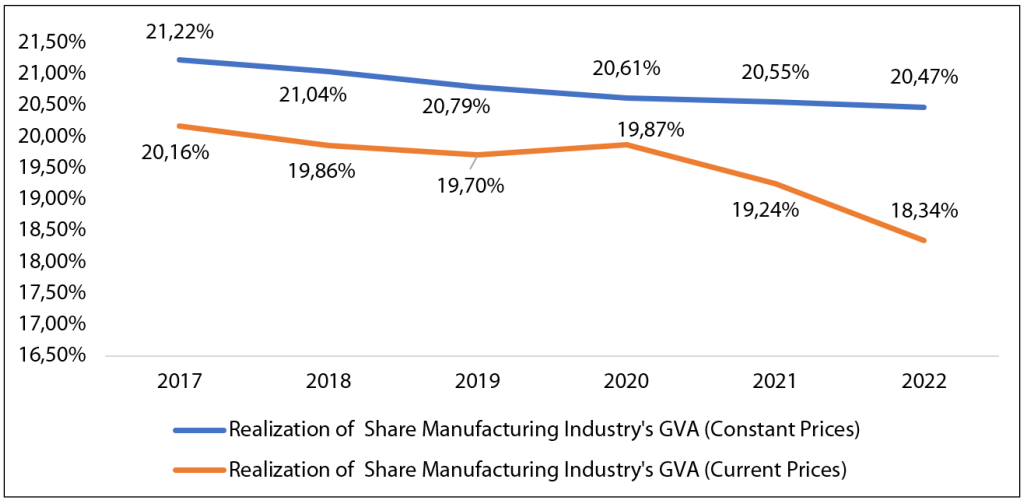
the manufacturing industry has occurred when the size is still at 20 percent, Indonesia's GDP per capita is also still at $4788. The United Nations Industrial Development Organization (UNIDO) also places Indonesia in the group of developing industrial economies (United Nations Industrial Development Organization, 2022), and the development of the GVA share of the manufacturing industry still needs to be a common focus.

Figure 1. Realization for Indonesian Share Manufacturing Industry's GVA 2017-2022



Source: Badan Pusat Statistik

Kaldor's Second Law of Growth states that the manufacturing industry sector is considered to accelerate output growth compared to input growth (Increasing Return to Scale) through capital accumulation and technological innovation. External demand is another factor that can accelerate the expansion of manufacturing industry output productivity (Deleidi et al., 2023). In this regard, Indonesian economist Faisal Basri explained that there are two causes of the decline in the performance of the manufacturing industry in Indonesia. The first is related to capital problems in the manufacturing industry due to the low absorption of bank credit in the manufacturing industry sector. The low absorption of bank credit in Indonesia's manufacturing industry sector is due to banks' reluctance to channel credit to the goods production sector. One of the growing service sectors in the Indonesian economy is the banking sector, but unfortunately, this sector re-channels its services to financial services. As a result, industrial capital does not develop. The low absorption of bank credit to the industrial sector is also due to low domestic demand, making banks fear the possibility of bad credit.

The second cause of Indonesia's manufacturing industry's declining performance is low innovation. The Indonesian government is seen as not encouraging the acceleration of industrialization but only focusing on completing infrastructure projects; this is what makes the low industrial facilities and capital in Indonesia; the investment that enters Indonesia is felt to be primarily muscle-based, such as physical development and not brain-based such as investment in information and technology. As much as 83% of investment in the country is related to construction and building, 4% is related to

transportation development, and only 3% is in the IT sector. The lack of investment related to research and development makes innovation capabilities low, so industrial competitiveness is also weak (Asian Productivity Organization, 2022).

Some previous studies have mainly discussed the causes of deindustrialization from the demand side, such as globalization, population per capita income, and also trade openness, which are factors driving the increase in manufacturing industry output (Škuflić & Družić, 2016; Van Neuss, 2018; Vu et al., 2021). There are still few studies that address the factors that cause deindustrialization from the production side, as stated in Kaldor's Second Law, which includes bank credit and innovation as catalysts that drive the productivity of the manufacturing sector.

Ogunmuyiwa et al. (2017) discussed Kaldor's Second Law but only looked at the relationship between bank credit and the performance of the manufacturing industry sector in Nigeria using Autoregressive Distributed Lag (ARDL) and did not add technological innovation factors. On the other hand, Zhang & Liu (2023) discuss the effect of technological innovation, in this case, access to the internet that can accelerate the export performance of the manufacturing industry in China using the Propensity Score Matching Method (PSM) but do not consider business access to capital activities.

The main novelty and scientific value added to our paper lie in its application of Kaldor's Second Law of Growth to the phenomenon of deindustrialization, taking into account the effects of bank credit and innovation technology, which has never been done in Indonesia. In addition, this research also discusses the problem of deindustrialization from the regional scope by utilizing panel data of provinces in Indonesia to obtain more complex results, identify regions with good prospective performance or underperformance of the manufacturing industry, and produce bottom-up policies to answer problems at the national level, unlike previous studies that only use time series data to analyze deindustrialization (Hena et al., 2019; Neoh & Lai, 2021; Nwabuisi et al., 2020).

Seeing the important role of the manufacturing industry sector in economic development and the impact of its decline, which can also significantly affect the socio-economic community, researchers are interested in examining this for the scope of Indonesia. This study had two main objectives. The first was to investigate the phenomenon of deindustrialization that occurs at both national and regional levels in Indonesia. Second, it aimed to fill a gap in the existing literature by providing empirical evidence of the effect of bank credit and technological innovation on the phenomenon of deindustrialization in Indonesia, according to Kaldor's Second Law.

METHODS

This empirical study was based on Kaldor's Second Law of Growth. It used a panel data approach and focused on provinces in Indonesia from 2017-2022. The limitation of this study is that the provinces analyzed are provinces before the latest expansion because some of the latest data from the provinces of the latest expansion are difficult to obtain. The data are obtained from the Badan Pusat Statistik (BPS) and Bank Indonesia (BI).

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The variables used are the GVA share of the manufacturing industry as the dependent variable, the bank credit share of the manufacturing industry, and the percentage of the population accessing the internet in the manufacturing industry sector as a proxy for innovation, as explained at Prescott & Van Slyke (1997) who states that the internet can be used as a proxy for technological innovation because it describes the process of exploring markets and acquiring new ideas, human development index as a proxy for human capital, and trade openness are variables that are thought to influence deindustrialization. The specifications of the empirical model are as follows:

$$ManShare_{it} = \beta_0 + \beta_1 BankCred_{it} + \beta_2 Inov_{it} + \beta_3 TOI_{it} + \beta_4 HC_{it} + u_{it} \quad (1)$$

Where $ManShare_{it}$ is GVA share of manufacturing industry of i[th] province in year-t, $BankCred_{it}$ is bank credit share of i[th] province's manufacturing industry in year-t, $Inov_{it}$ is the percentages of the population accessing the internet of i[th] province's manufacturing industry sector in year-t, TOI_{it} is trade openness of i[th] province in year-t, HC_{it} is human development index of i[th] province in year-t and u_{it} composite error of i[th] province in year-t.

Then the panel data regression model is formed using the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). The best model selection uses the Chow test (choosing between CEM or FEM), Hausman test (choosing between FEM or REM), and BP-LM test (choosing between REM or CEM). If the selected model is FEM, it is necessary to check the residual variance-covariance structure using the LM and λ_{LM} tests. The LM test is used to determine the presence or absence of heteroscedasticity while the λ_{LM} test is used to determine the presence or absence of cross-sectional correlation in the variance-covariance matrix structure. After obtaining the best model, non-multicollinearity detection and classical assumption testing are carried out. If the estimation method used is Ordinary Least Square (OLS), then the assumptions that need to be met are normality, homoscedasticity, non-autocorrelation, and non-multicollinearity. If the estimation method used is Generalized Least Square (GLS), Weight Least Square (WLS), or Feasible Generalized Least Square (FGLS) with Seemingly Unrelated Regression (SUR), then the assumptions that need to be met are normality and non-multicollinearity. Followed by a model significance test, namely simultaneous testing (F-test), partial testing (t-test), and the coefficient of determination (R^2). F-test to determine that there is at least one independent variable in the study on the dependent variable, t-test to determine the effect of each independent variable in the study on the dependent variable, and the coefficient of determination to determine how much the diversity of the dependent variable can be explained by the independent variables in the study.

RESULTS AND DISCUSSION

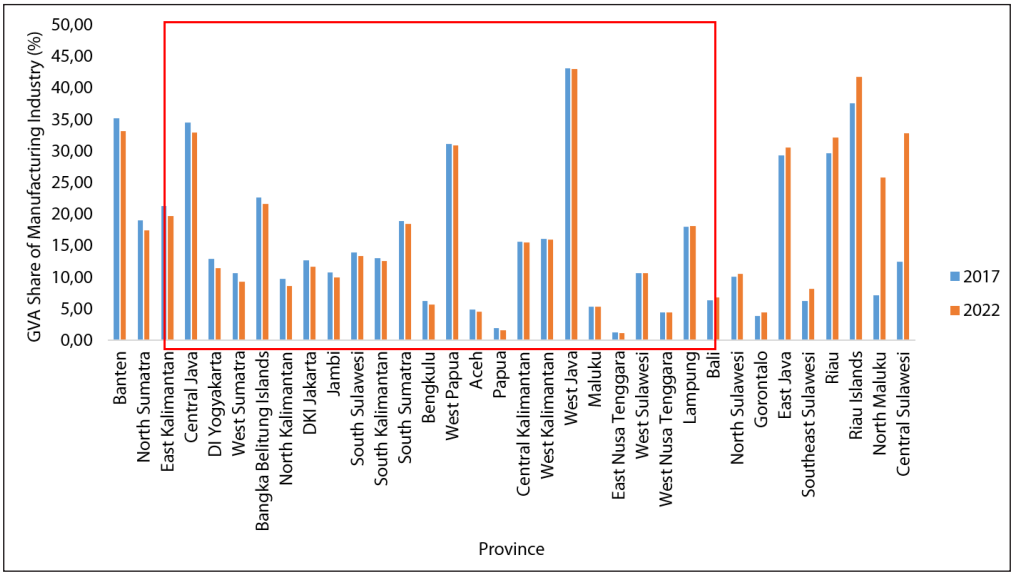
Figure 2 explains that the phenomenon of deindustrialization occurs not only at the national level but also at the regional (provincial) level in Indonesia. There are 24 (more than 70 percent) provinces that experienced a decrease in GVA share of the manufacturing industry from 2017 to 2022, including Banten, North Sumatra, East Kalimantan, Central Java, DI Yogyakarta, West Sumatra, Bangka Belitung Islands, North

Kalimantan, DKI Jakarta, Jambi, South Sulawesi, South Kalimantan, South Sumatra, Bengkulu, West Papua, Aceh, Papua, Central Kalimantan, West Kalimantan, West Java, Maluku, East Nusa Tenggara, West Sulawesi, and West Nusa Tenggara. The three provinces with the most significant decrease in the share of gross value added of the manufacturing industry are Banten at 1.99%, North Sumatra at 1.62%, and East Kalimantan at 1.62%. The three provinces that experienced the most significant increase in the share of gross value added of the manufacturing industry included Central Sulawesi at 20.28%, North Maluku at 18.59%, and Riau Islands at 4.15%.

Figure 2 also explains the diversity of GVA share of the manufacturing industry between provinces in Indonesia. This is evidenced by the difference between the maximum and minimum values of the share of gross value added of the manufacturing industry between provinces in Indonesia in 2022 of 41.78%. The three provinces with the highest share of manufacturing industry gross value added in 2022 include West Java, with a value of 42.98%, followed by Riau Islands, with a value of 41.74%, and Banten, with a value of 33.18%. The explanation of this is in line with the findings conducted by Bogachev et al. (2019) and Sertyesilisik and Sertyesilisik (2021), which state that regions with a strong manufacturing sector that is the basis of the region's economy will make it easy to industrialize.

On the other hand, the three provinces with the lowest GVA share of manufacturing industry in 2022 are East Nusa Tenggara, with a value of 1.21%, followed by Papua, with a value of 1.65%, and Gorontalo, with a value of 4.40%. The explanation of this is in line with the findings conducted by Grabowski and Self (2019) and Sadik-Zada et al., 2019), which show that the economy in areas that are still based on the agriculture, forestry, and fisheries sectors makes it difficult for these areas to industrialize, however, it does not rule out the possibility of developing the industrial sector in these areas, because the manufacturing sector is entirely prospective.

Figure 2. GVA share of manufacturing industry at province in Indonesia, 2017-2022



Source: Badan Pusat Statistik

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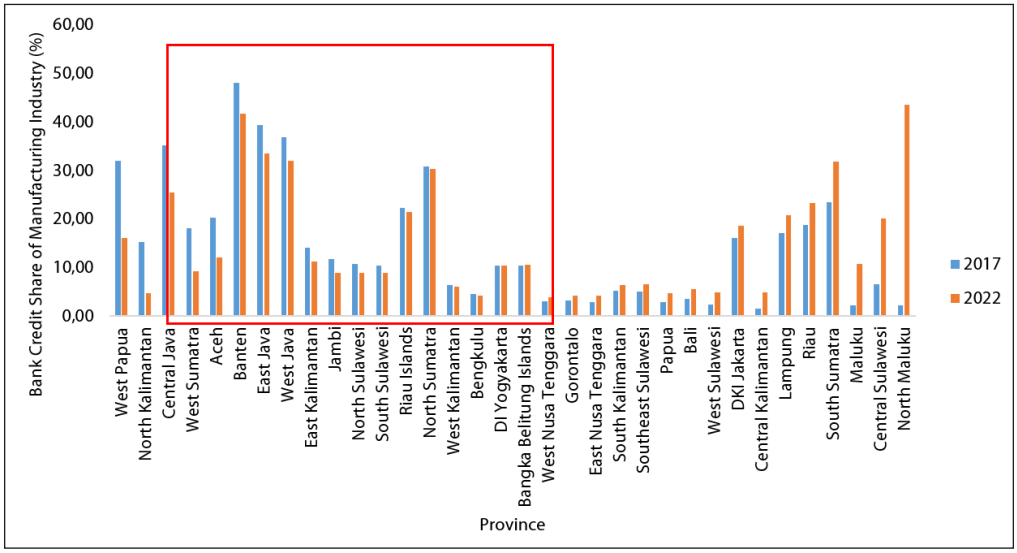
If it is associated with Kaldor's second law, this study found that banking credit and technological innovation at the Indonesian regional level have also declined. Figure 3 shows that 16 out of 34 provinces in Indonesia experienced a decline in bank credit share of the manufacturing industry from 2017 to 2022. The three provinces with the most significant decrease are West Papua at 15,80%, North Kalimantan at 10,6%, and Central Java at 9,63%. North Maluku, Banten, and East Java are the provinces with the highest bank credit share of the manufacturing industry in 2022. For Banten province, this is indeed per the motto of the province, namely investment in one gate of a million opportunities with prospective manufacturing sector lending and a low ratio of non-performing loans, so that the performance of banks in channeling credit in Banten province is maintained in quality.

Figure 3. Banking Credit of Manufacturing Industry at province in Indonesia, 2017-2022

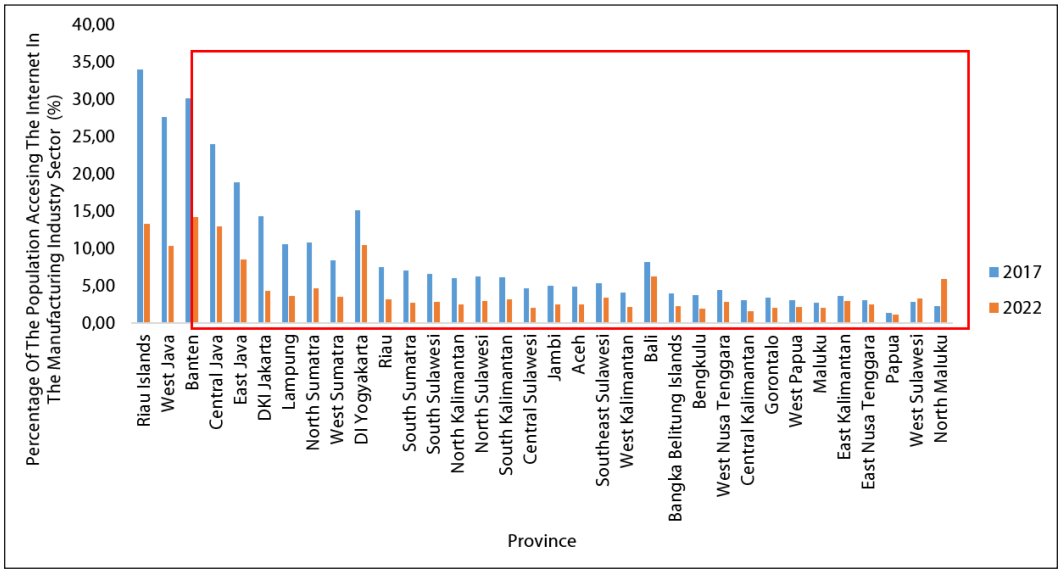


Source: Bank Indonesia

Figure 4 shows that 32 out of 34 provinces in Indonesia experienced a decline in the percentage of the population accessing the Internet in the manufacturing industry sector from 2017 to 2022. The three provinces with the most significant decrease are the Riau Islands at 20,81%, West Java at 17,26%, and Banten at 16,02%. The provinces with the highest level of innovation are Banten, Riau Islands, and Central Java. For Riau Islands, this is because Batam, as one of the cities in Riau Islands, is envisioned as an innovation hub or digital bridge through the development of Nogsa Digital Park.

Inferential analysis in this study shows that the best model chosen to explain the effect of banking credit and innovation technology on deindustrialization in Indonesia is the Fixed Effect Model (FEM), with the estimation method used is Seemingly Unrelated Regression (SUR). The results of the analysis stages are shown in Table 1.

Figure 4. Innovation Technology in Manufacturing Industry at Province in Indonesia, 2017-2022



Source: Badan Pusat Statistik

Based on Table 1, the test results with the Chow test and Hausman test show that the best model chosen is the Fixed Effect Model (FEM). Then, proceed with checking the variance-covariance structure. The results are heteroscedastic, and there is a cross-section correlation, so the estimation method used is Seemingly Unrelated Regression (SUR).

Table 1. Summary Of Best Model Tests

Value	Chow Test	Hausman	LM Test	λ_{LM} Test
(1)	(2)	(3)	(4)	(5)
Test Statistics	216,2906	41,8084	1024,21	1035,469
Table Statistics	1,5067	9,4877	47,3999	617,2098
Decision	Reject H_0	Reject H_0	Reject H_0	Reject H_0

Then non-multicollinearity detection and normality assumptions are carried out. Based on Table 2, the VIF value for each independent variable in the model is less than 10 so it can be said that there are no multicollinearity symptoms in the model. Testing the normality assumption obtained a Jarque Berra test statistic of 1.3704 < $\chi^2_{(0,1;2)}$ = 4,6052 so that the decision failed to reject H0 so that with a 90% confidence level it can be shown that the error follows a normal chance distribution.

Table 4 displays the outcomes of the chosen model's estimations. An Adjusted R-squared value of 0.9986 indicates that 99.86% of the variation in the GVA share of Indonesia's manufacturing industry can be accounted for by the independent variables utilized in the model and the diversity of Indonesian provinces. The remaining variation is attributed to factors not encompassed in the model. The F-test result's p-value falls below the significance level (α = 0.05), suggesting the presence of at least one independent variable influencing the GVA share of Indonesia's manufacturing industry.

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Table 2. Variance Inflation Factor (VIF) of Independent Variable

Variable	Variance Inflation Factor
(1)	(2)
BankCred	1,9941
Inov	1,9166
TOI	2,5038
HC	2,4475

The estimation results answer the hypothesis of this study and support the theory presented in Kaldor's Second Law, which states that banking credit and technological innovation are factors that catalyze the performance of the manufacturing industry sector. It showed that banking credit significantly impacts Indonesian deindustrialization. Specifically, a 1 percent increase in bank credit allocated to Indonesia's manufacturing industry would boost the GVA share of the manufacturing sector by 0.0737 percent. It was also consistent with previous research by Ogunmuyiwa et al. (2017) and Yu and Zhao (2024). The estimation results also reveal that technological innovation, which is proxied by access to the internet, also significantly impacts Indonesian deindustrialization. Specifically, a 1 percent increase in innovation, represented by the proportion of the population accessing the internet within the manufacturing industry sector, would lead to an increase of 0.0348 percent in Indonesia's GVA share within the manufacturing industry. These findings are consistent with previous research by de Oliveira and da Fonseca Nicolay (2022) and Jianjiang et al. (2022).

Table 3. Summary Of the Best Model Output

Variable	Coefficient	Standard Error	t-statistic	p-value
(1)	(2)	(3)	(4)	(5)
Constant	4,0994	1,9803	2,0701*	0,0400*
BankCred	0,0737	0,0121	6,1121*	0,0000*
Inov	0,0348	0,0022	1,9417*	0,0539*
TOI	0,0305	0,0179	13,7996*	0,0000*
HC	0,1087	0,0269	4,0369*	0,0001*
Summary Statistics				
R-squared	0,9988	F-statistic	3788,890	
Adjusted R-squared	0,9986	Prob(F-statistic)	0,0000*	

Description: *significant at α = 10 percent

The effectiveness of banks in providing financing for working capital and investment makes the manufacturing industry more productive and efficient so that the performance of the manufacturing industry can increase. With bank credit channel to the manufacturing industry sector, it can increase the productivity of the manufacturing industry through technological development, investment, and business capital, which increase the value added of manufacturing industry products and ultimately increase GVA share of the manufacturing industry (Azolibe & Okonkwo, 2020). Research conducted

by Feijo et al. (2019) found similar results on deindustrialization that occurred in Brazil, how constraints on capital accumulation, in this case, the role of the banking sector, became an obstacle to economic progress, so no catalyst encouraged industrialization. The problem is that Indonesia's financial sector is not large enough to finance the industrialization process with a ratio of credit provided by the financial sector to GDP of just 51 percent according to the World Bank, Caldentey & Vernengo (2021) research found that the industrialization process in developed countries becomes more stable when financialization is mature. Banks can finance industrial capital activities.

Table 4. Individual Effect of Deindustrialization in Province in Indonesia

Province	Individual Effect	Province	Individual Effect
(1)	(2)	(3)	(4)
Aceh	-11,1002	Riau Islands	16,0885
Bali	-8,8243	Lampung	2,5254
Banten	13,5161	Maluku	-8,7268
Bengkulu	-9,4166	North Maluku	-8,3026
DI Yogyakarta	-4,5861	West Nusa Tenggara	-9,1458
DKI Jakarta	-6,1311	East Nusa Tenggara	-12,2908
Gorontalo	-9,6285	Papua	-10,8752
Jambi	-5,9672	West Papua	14,5236
West Java	25,5376	Riau	15,3658
Central Java	17,0278	West Sulawesi	-3,5149
East Java	12,1800	South Sulawesi	-0,1752
West Kalimantan	3,2146	Central Sulawesi	6,5650
South Kalimantan	-3,6663	Southeast Sulawesi	-7,9282
Central Kalimantan	0,7635	North Sulawesi	-4,4168
East Kalimantan	1,9005	West Sumatra	-6,6193

In addition, the internet, as an innovative approach and an important tool in telecommunications infrastructure, has a significant positive relationship in the industrial sector of an economy at making marketing activities better, efficient in making products, and also increasing the added value of the products being traded so that in the end it can increase the GVA share of the manufacturing industry (Zhang & Liu, 2023). However, the innovation problem in Indonesia is still an issue; based on World Bank data, the percentage of exported manufactured goods with high technology produced by Indonesia is only 8.3%, indicating that technological innovation has not been well promoted. According to research by Maslyukova et al. (2024), Indonesia is an intermediate innovation economy with low reindustrialization growth and needs to design sectoral innovation policies that target industries with competitive advantages. These policies should incentivize innovation in product development and supply chain optimization.

In addition to the two main variables examined in this study, two control variables also significantly affect the phenomenon of deindustrialization in Indonesia. First, human capital, a one-point increase in the human development index would result in a 0.1087

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percent increase in Indonesia's GVA share within the manufacturing industry. These findings are consistent with previous research by Samouel and Aram (2016), Araujo et al. (2021), Bao et al. (2021), and Wu and Liu (2021). Improving human quality, especially in terms of education, can increase the knowledge and skills possessed by the workforce. This increase will impact the output produced and ultimately increase the GVA share of the manufacturing industry (Hena et al., 2019). Second, a 1 percent increase in trade openness would lead to a 0.0305 percent rise in Indonesia's GVA share within the manufacturing industry. These findings are consistent with previous research by Umoh & Effiong (2013), which found that encouraging trade openness can attract fresh participants to the manufacturing sector, facilitating substantial technology exchange from external sources. The sector's existing technological and technical expertise can enhance export performance, contingent upon appropriate policy implementation (Neoh & Lai, 2021).

The FEM model in this study assumes that there are different intercepts in each province. The largest individual effect is West Java, with 25,5376. At the same time, the lowest is East Nusa Tenggara, with individual effect at -12,2908, meaning that if all independent variables in the model are assumed to be constant, then West Java has the highest GVA share of the manufacturing industry and East Nusa Tenggara has the lowest GVA share of manufacturing industry compared to other provinces. As a consideration, provinces with individual effect values below 0 indicate that their performance is below the national average and needs attention. This needs to be the government's focus since 18 provinces (more than 50%) have manufacturing industry performance below ideal. In this regard, research conducted by Capello and Cerisola (2023) in Europe suggests that industrial policy should strengthen the reindustrialization specifications of local industries where they already exist. The selection of specific manufacturing sectors is a matter of prioritization based on a clear vision of the region's future development. In this regard, a smart specialization strategy can help set priorities and choose a vision for the region.

CONCLUSION

This study showed that even at the regional level, deindustrialization occurs in Indonesia. Some provinces, such as West Java, Central Java, and Riau Islands, show promising prospects. However, more than 50% of provinces have suboptimal manufacturing sector performance. Banking credit and innovation technology are the key factors that drive the increase in the GVA share of the manufacturing industry in Indonesia, answering the hypothesis in Kaldor's Second Law of Growth. Prioritizing the quality of workers and improving international trade could also effectively increase the GVA share of the manufacturing industry.

This study provides valuable insights for Indonesian policymakers, firstly in designing and implementing capital policy strategies such as mandatory minimum capital requirements by commercial banks to be able to fund manufacturing industry activities, and secondly in distributing Fixed Broadband Internet access as an innovation accelerator in the context of technological upgrades to increase the GVA share of the manufacturing industry in overcoming the existing deindustrialization problem.

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