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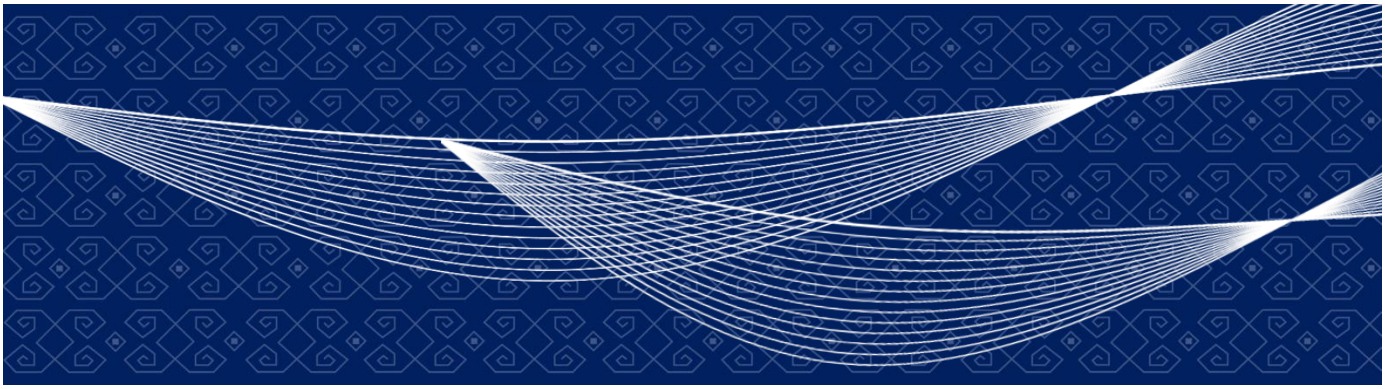

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WORKING PAPER

CONNECTING THE DOTS: THE SOURCE OF SUSTAINABLE ECONOMIC GROWTH THROUGH THE INTEGRATION OF SMES IN INDUSTRY'S SUPPLY CHAIN

Arnita Rishanty, M. Cahyaningtyas, Rudy Marhastari, Rizki Fitrama, Retno Puspita K. Wicaksono, Rivky Rasyid

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Abstract

This study is to identify the benefits of Micro, Small, and Medium Enterprises (MSME) participation in the industry supply chains and to analyze the commitments, enablers, and obstacles that shape MSME involvement in the supply chains of medium and large industries. The integration of MSME into the manufacturing industry supply chain is crucial for advancing economic development and fostering sustainable growth. Currently, the proportion of MSME that have entered supply chains remains low, indicating significant potential for increasing MSME contributions to the manufacturing sector. Building on the results of the mixed method approach comprising Propensity Score Matching (PSM) and Partial Least Squares-Structural Equation Modeling (PLS-SEM) analysis, and case study analysis of two high-value-added sectors (identified through input-output table analysis), rubber and automotive sectors, this study has identified the significance of MSME participation in supply chains, as well as the factors influencing MSME performance. This study suggests that supply chain financing (SCF) plays a critical role in ensuring the commitment of MSME to be part of the industrial supply chains, which in turn positively and significantly affects MSME performance. Supply chain commitment is also suggested to mediate the relationship between SCF and MSME performance. Further, the study identifies challenges faced by MSME and delivers policy recommendations for regulators in supporting MSME.

Keywords: Sustainable Growth, MSME, Supply Chain.

1. Introduction

The manufacturing industry is one of key drivers of Indonesia's economic growth, contributing 18,67 per cent of the total Growth Domestic Product (GDP) in 2023. Despite its significant contribution, the manufacturing industry has experienced a slowdown. This is shown by the declining trend in the share of the manufacturing sector to the total GDP over the past ten years (Figure. 1). In practice, manufacturing sector policies have been more focused on enhancing the competitiveness of large and medium industries, which is only 1 per cent of the total players in the manufacturing sector. Meanwhile, 99 per cent of the players in the manufacturing sector are Micro, Small, Medium, Enterprises (MSME). MSME significantly contribute to the Indonesian economy, accounting for 61 per cent of the total GDP and employing 97 per cent of the workforce. Hence, integrating MSME into the value chain is important and can support development and economic growth. Moreover, MSME play an essential role in poverty alleviation, improving income distribution in rural areas, developing the manufacturing industry, rural development, and export growth (Tambunan, 2019).

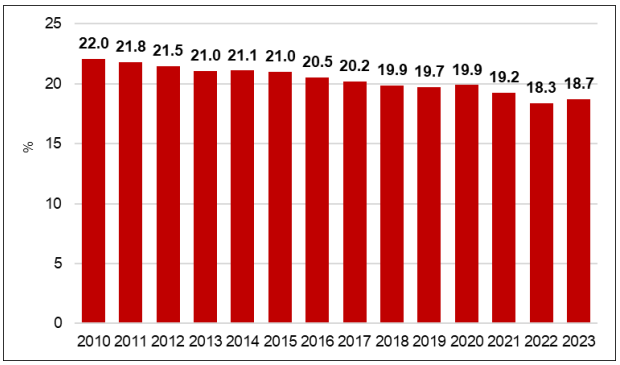

Figure 1. Manufacturing Contribution to Indonesia GDP

Nonetheless, MSME participation in the value chain also presents substantial challenges, such as economic dependency on larger firms, obstacles associated with financing, technological access, and regulatory frameworks. These factors collectively influence the discourse on MSME engagement in value chains, especially within developing regions, where the potential for inclusive growth frequently intersects with persistent systemic barriers. Although many MSME have been able to leverage digital technology to increase their productivity and competitiveness, they still face various fundamental challenges in joining the Global Value Chain (GVC). Only a small fraction of MSME has successfully integrated into the GVC, reflecting the relatively low integration of Indonesian MSME into the GVC. This is also emphasized by the WTO (2022), which states that manufacturing sector MSME in developing countries have a relatively lower level of participation.

Despite these challenges, the literature emphasizes the importance of MSME participation in value chains. Hill (2001) highlights that MSME contribute to driving economic growth, including advancing regional economies. Lunati, et. al (2008) found that MSME that successfully integrate into value chains can capitalize on opportunities for market expansion and innovation. Similarly, the findings of Jamieson et al. (2012) and Epede and Wang (2022) support this conclusion. A case study in India by Reddy and Sasidharan (2021) demonstrated that policies designed to improve access to finance and training can significantly empower MSME, strengthening their capabilities and enabling deeper engagement in value chains. Wicaksono et al. (2023) highlight that enhancing labour productivity in the manufacturing sector can strengthen domestic supply chains and drive integration

into the global supply chains. Mohanty and Gahan (2012) found that price structure, level of information exchange, technology exchange, business area, and products/processes are of the highest priority in establishing relationships between large industries and MSME. While MSME are seen as a major contributor to a nation's inclusive growth through enhanced productivity and employment creation, MSME have not well-utilized business and trade opportunities in the industries' supply chain. Nonetheless, within the existing literature, there is still limited research that analyzes the comprehensive interconnectedness between industries and MSME. How to create and support an enabling environment for MSME to increase their capability and have access to international markets through GVC, is not well documented (Abe et al., 2012; ADB, 2015; ESCAP, 2007, 2009). Research remains limited regarding the specific benefits of supply chain participation on MSME productivity and other critical performance metrics. Furthermore, there is a lack of comprehensive studies examining the enablers and barriers to MSME integration into the industry supply chain and strategies to reduce the import content of their products. Critics also argue that, although participation in the supply chains may offer growth opportunities, they can simultaneously reinforce inequalities and constrain the bargaining power of MSME, raising concerns regarding the long-term sustainability of MSME participation within these supply chains.

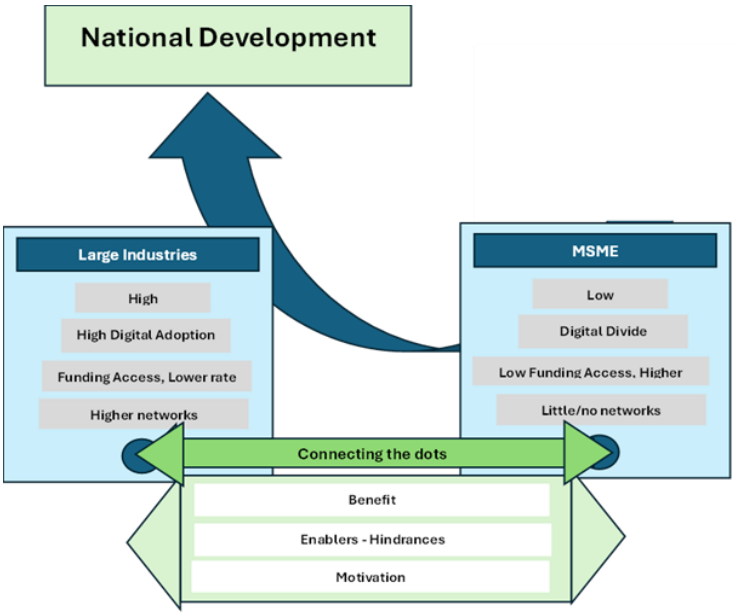

Figure 2. The "Connecting the Dot" Paradigm between MSME and Large Industries

Addressing gaps in the literature, this study examines the benefits, enablers, barriers, and commitment of MSME participating in the manufacturing industry supply chain, fostering new economic growth in Indonesia. As illustrated in Figure 2, the proposed "connecting the dots" paradigm provides a framework for this research. This analysis not only elaborates on connecting these dots but also explores strategies for establishing and strengthening these linkages. Guided by this framework, the research questions for this study are as follows: (1) What are the benefits of MSME participation and cooperation within industry supply chains? (2) What are the commitments, enablers, and hindrances influencing MSME involvement in these supply chains?

To address the first question, we examined the benefits of MSME participation in the industrial supply chain through Propensity Score Matching (PSM) analysis, utilizing data from the MSME Financial Report Survey (*Survei Laporan Keuangan*

UMKM/SLKU) issued by Bank Indonesia. In this analysis, we designated the participation variable as the treatment variable and applied various MSME characteristics as control variables. This approach enables the measurement of key metrics to assess the impact of MSME involvement in the manufacturing industry supply chain. To address the second question, we employ Partial Least Squares-Structural Equation Modeling (PLS-SEM) as the analytical approach. This analysis utilizes data collected from a bespoke MSME survey conducted specifically for this study.

Integrating MSME into the manufacturing industry supply chain is crucial because it is expected to increase MSME productivity and, at the same time, reduce the manufacturing industry's dependence on imported raw materials from other countries. This condition appears since Indonesia's manufacturing industry, including MSME that join the value chain, still relies heavily on imports from several countries for raw materials (WTO, 2022), leading to vulnerability to disruptions in the global supply chain and the depreciation of the exchange rates. As a means of supporting quantitative founding, we also investigate the use of case studies in the sector that have a high export value and provide high value added. The selection that meets these criteria is considered to have the potential to contribute to sustainable and new economic growth. Additionally, we select sectors with high import content and low import content to determine the root cause of the high import content. We justified the selection of the sector that meets the criteria by conducting an input-output (I-O) analysis. The rubber and automotive sectors both meet the criteria that we have already implemented, as they have a high export value and value added, as indicated by the I-O analysis. Additionally, the rubber industry sector and the automotive sector are distinguished by their respective import content levels. The former is characterised by a low level of imports, whereas the latter is the opposite.

Through these aims, this study intends to support MSME participation in the industrial supply chain. With the inclusion of MSME in the industrial supply chain, it is hoped that a technology transfer process will occur, thereby increasing MSME productivity and reducing the industry's dependence on imported raw materials, making the economy more resilient to global shocks. Additionally, this research is expected to define various strategies to enhance the role of MSME in the manufacturing industry supply chain, thereby increasing MSME productivity and promoting sustainable and more resilient economic growth.

This study has been organized in the following way. Section two explores the literature. Section three presents the methodology and data used for this study. Then, the fourth and fifth sections provides the empirical results; and a discussion and policy recommendations, respectively. Finally, the conclusion of this study are presented in Section Six.

2. Literature Review

The importance of MSME in driving the countries' economy has been recognized in many literature. Hill (2001) states that MSME contribute to driving economic growth, including advancing regional economies. On the other hand, the manufacturing sector plays a key role as one of the priority sectors with the highest forward linkages compared to other sectors (Subanti et al., 2017). Wicaksono et al. (2023) highlight that enhancing labour productivity in the manufacturing sector can strengthen domestic supply chains and drive integration into the global supply chains. Further, Kuswardhana et al. (2021) find that productivity spillovers in the manufacturing industry tend to be stronger intra-regionally than inter-regionally,

emphasizing the importance of increasing infrastructure investment to enhance industrial productivity. Hence, integrating MSME into the value chain is important and can support development and economic growth. Moreover, MSME play an essential role in poverty alleviation, improving income distribution in rural areas, developing the manufacturing industry, rural development, and export growth (Tambunan, 2019).

Several studies also highlight the importance of MSME position in the manufacturing industry supply chain. Mohanty and Gahan (2012) found that price structure, level of information exchange, technology exchange, business area, and products/processes are of the highest priority in establishing relationships between large industries and MSME. According to Jamieson et al. (2012), MSME benefit from entering larger industry supply chains, especially in terms of financial gains and network expansion. Collaborative ability and internalization are key factors for MSME to become more involved in GVC (Zahoor et al., 2023). Abe (2016) conducted a survey, assessing the participation of MSME in the GVC, which sought to capture a comprehensive picture of the present activities and environments of MSME in four selected countries: Kazakhstan, Papua New Guinea, the Philippines, and Sri Lanka. The survey also sought to identify constraints and success factors to facilitate MSME effective participation in GVC.

Although entering the larger industry supply chain brings benefits to MSME, they face a number of constraints and challenges. According to Harvie and Charoenrat (2021), East and South Asian MSME face capacity constraints, resulting in difficulties in accessing finance, technology, and skilled labour, which also results in inadequate innovation, entrepreneurial deficiencies, and limited connectivity to domestic and international markets. Utilised data from Indonesia, Premadasa (2021) argues that Indonesian MSME have low participation in GVC as they are more difficult to integrate into upstream and downstream value chains due to a lack of human capital, production capacity, research and development, and strong international networks. Hidayat et al. (2017) also found that the performance of Indonesian MSME are still relatively small, especially regarding productivity, contribution to exports, participation in global and regional production networks, as well as the contribution to value added. Human resources, marketing strategy, innovation, the improvement of ease of doing business, access to finance and capital, access to markets, infrastructure, and macroeconomic conditions can improve the productivity of Indonesian MSME (Hidayat et al., 2017). Adopting digital technology also can improve MSME productivity (Affandi et al., 2024). Furthermore, Lusiantoro et al. (2024) found that supply chain finance and business survivability affect circular economy practices indirectly to MSME and non-financial support is needed to motivate MSME to adopt circular economy practices.

3. Methodology and Data

Methodology

To address the research questions, this study adopts mixed methods research design as seen in Figure 3. Starting from the research problem identification, this study involves the use of qualitative and quantitative methods on which findings justify and triangulate each other. One method confirms and explains the relationships between variables emerging from the other. The quantitative study comprises PSM analysis and PLS-SEM, which then followed by qualitative study which is a case study. The case study analysis is performed as a means of supporting

quantitative founding. The decision to focus the case study to the rubber and automotive sectors is justified by Input-Output (I-O) analysis conducted. Both sectors in the case study analysis have a high export value. This is deduced that these two sectors are considered to have the potential to contribute to new and sustainable economic growth. The contrast between the rubber industry sector and the automotive sector, is that the previous has low import content while the latter is the opposite. The mixed method approach employed in this study directs the importance of the triangulation to be performed, to integrate and utilise all findings and the contextual background of the studies.

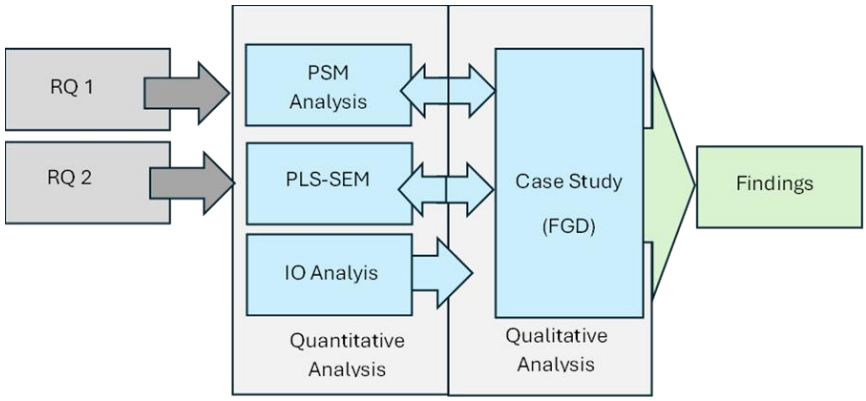

Figure 3. Research design

3.1. Propensity Score Matching (PSM)

To assess the impact and benefit of MSME participation in the industry supply chain, we used the PSM method. The PSM method can help us address the issue of causality, as from a statistical perspective, it is difficult to determine the direction of causality, especially because of the limitation inherent in the cross-sectional data (Giovannetti et al., 2014). The PSM method is utilized to eliminate selection bias and is considered capable of compensating for imbalances between MSME that participate in the manufacturing industry supply chain and those that do not use estimated propensity scores based on observed characteristics of the respondents (Rosenbaum & Rubin, 1983). It aims to select a subgroup of MSME from an external comparator group who have similar characteristics to those in the study population of interest, thus mimicking the randomization process in Randomized Control Trial (RCT). By matching MSME according to these criteria, confounding factors can be minimized. So that the outcomes can be more confidently attributed to the treatment rather than any other differences between the groups.

In this study, the treatment group consists of MSME that participate in the manufacturing industry supply chain, while the control group comprises MSME that do not participate in the manufacturing industry supply chain but share similar characteristics with the treatment group.

The PSM method estimates the average treatment effect (ATE) of MSME participation in manufacturing industry supply chain. It begins with estimating of the propensity scores of treatment and control groups based on observed characteristics (X_i). The Propensity Score is estimated using logistic regression with the following model:

$$H_i = \beta_0 + \beta_1 X_i + \varepsilon_i \quad (1)$$

where H_i represents whether firm i participates in manufacturing industry supply chain (treatment group) or not (control group), X_i represents the control variable or

characteristics of both MSME groups. From the logit model, we can obtain the propensity score measuring the predicted probability (p_i)**:**

$$p_i = \frac{e^{\hat{\beta}x_i}}{1+e^{\hat{\beta}x_i}} \quad (2)$$

where $\hat{\beta}$ is from the estimated logit model. Then, the matching process between the treatment and control groups based on the propensity scores is performed. ATE is estimated as the mean difference of the outcome variable between matched pairs from the treatment (Y_i^1) and the control groups (Y_i^0) with following formula:

$$ATE = E(Y_i^1 - Y_i^0) \quad (3)$$

In this study, we also examined the effect of MSME participation in manufacturing industry's supply chain on the treated population. The average effect of the treatment on the treated population (ATT) is given by:

$$ATT = E(Y_i^1 - Y_i^0 | T = 1) \quad (4)$$

where $T = 1$ indicates the treatment. Then, the equation can be written as:

$$ATT = E(T = 1) - E(T = 1) \quad (5)$$

However, we cannot observe the $E(T = 1)$ which represents the average outcome in the treated group if they had not received the treatment. Instead, we observed $E(T = 0)$, which is the average outcome in the control group without of treatment. If we replace it to Equation (5), we get:

$$ATT = E(T = 1) - E(T = 0) \quad (6)$$

Following Wellalage & Fernandez (2019), we reported both ATE and ATT results. ATE showed the average effect of treatment (participation in the industry supply chain) on the MSME productivity of the whole population of firms (those who participate in the industry supply chain and those who do not), while ATT showed the average effect of the treatment on the treated, which identifies the benefit of the treatment for the treated group.

To check the robustness of the PSM result, we also examined the impact by another alternative estimator, that is nearest neighbor matching. In the nearest neighbor matching, the matching process is based on the distance by a weighted function of the covariates. It will find the nearest neighbors in terms of the covariate values using Mahalanobis distance to match the treated and control unit (SAGE Publications, Inc., 2017).

3.2. Partial Least Square- Structural Equation Modeling (PLS-SEM)

We used PLS-SEM to test the hypothesis. By using PLS-SEM, it allows us to estimate a complex model with many constructs and indicators, as well as works well with a relatively small sample size and is closer to reality as it does not make assumptions about the underlying distribution of the data.

The PLS-SEM model consists of a structural model (inner model) and measurement model (outer model). Structural models link together the constructs (circles or ovals) and display the relationship between the constructs. While the measurement model displays the relationship between the constructs and the indicator variables (rectangles). This model consists of exogenous latent variables (i.e., constructs that only explain their constructs in the model) and endogenous latent variables (i.e., constructs that are being explained in the model). The error

terms are connected to the endogenous constructs and represent the unexplained variance when path models are estimated.

3.3. Input – Output Analysis

We employed Input-Output 2016 data of 185 products to explore the significant contributor sectors to the export balance of Indonesia. We explored the economic sectors that have a high export value and value added. Due to study time and resource limitation, we limit the case study to 2 case studies. Hence, the next step is we direct the filtering of the input-output table data to the first case study, which is the sector with low import content, and the second case study, which is the sector with high import content.

We used product (commodity)-level data instead of sector-level data as it fits with the conduct of the case study analysis that requires in-depth qualitative analysis. Further, in determining which industrial products potentially contribute to the economy through their value-added and export value, first, we only focused on 92 industrial products out of 185 products. We also calculated the value added based on the primary input component of each product. We compared the export and import values of each industrial product from the supply and demand tables. The components include employee compensation, operating surplus, and gross operating surplus. We then sorted and mapped the products based on the following requirements to select two products which represent: (1) Sectors with high export value, high value-added and low import value; (2) Sectors with high export value, high value-added and high import value. Sectors with high export value, high value-added, and low import value are considered low-hanging fruit as a new source of growth for the Indonesian economy, provided that we optimize the development of these sectors. Sectors with high export value, high value-added, and high import value are seen as having significant potential for integrating MSMEs into the supply chain of large industries. This integration would facilitate knowledge transfer, which in turn could enhance MSME productivity and gradually reduce import content. The selected industry sectors are then chosen to become our case studies.

3.4. Data

For the quantitative approach, we employed both primary and secondary data. The primary data is collected for the case study analysis, while the secondary data is collected for the PSM, PLS-SEM and I-O analysis.

For the case study analysis, the primary data is collected through conducting both online and offline Focus Group Discussions (FGD) with several relevant stakeholders, including ministries/local government, associations, MSME, and Large Industries. The data is collected from the relevant stakeholders in the national level which are located in Jakarta, Indonesia, and in the regional level which are located in the region that have significant production of the focus commodities. For rubber industry sector, the regional level data is collected from the relevant stakeholders in Palembang, Indonesia. For automotive industry sector, the regional level data is collected from the relevant stakeholders in Central Java, Indonesia.

For the PSM analysis, we used the secondary data from the MSME Financial Report Survey (Survei Laporan Keuangan UMKM/SLKU) issued by Bank Indonesia to analyze the benefit and impact for MSME to join the manufacturing industry supply chain towards productivity and other key metrics by using PSM estimation. We employed the SLKU database from 2021 until 2023 since the question of whether the MSME participates in the medium and large industry was only available in those years. The SLKU database cannot be used for panel estimation due to a lack of

identifiers, as this becomes a limitation of this study. Thus, this study used SLKU cross-sectional estimation. We also used Input-Output 2016 data from 185 products for the IO analysis to select the potential industries for our study case. The data is publicly available from the Central Bureau of Statistics (Badan Pusat Statistik/BPS).

For the PSM analysis, it is important to select the similar observable characteristics of MSME which participate in the industry supply chain and those that do not to generate comparable propensity scores between the two groups. This study used firm size, training, certification, digital adoption (proxied by digital payment), collaborative ability, circular economy practice (CEP), owner's years of school, owner's age and gender. The definition of each variable is shown in Table 1. Variables which are in value form are transformed into log value.

This study aims to analyse the impact of MSME participating in the manufacturing industry supply chain on their productivity in order to achieve new economic growth in Indonesia, thus several productivity measures and performance of MSME were selected. The performance of MSME revenue, the internationalization ability (export and import), total cost, and profit.

In the SLKU database, the main business field of the MSME only consists of three types, namely services, processing, and trade units. Additional filters, such as business field selection, are important to be applied. For this study we only selected MSME that was included in the processing business unit as its participation in the manufacturing industry's supply chain is only possible if the MSME is running as a processing industry as well.

Table 1. Variable Definition

Variable	Definition
Treatment Variable	
Participation	Whether the particular MSME participated in the manufacturing industry supply chain
Control/Characteristics Variables	
Firm Size	Whether the particular MSME is categorized as Micro/Small or Medium Enterprises based on their revenue
Training	Whether the particular MSME obtained a training for their business
Certification	Whether the particular MSME has a formal business permit or certification for their business
Digital Payment	Whether the particular MSME use digital payment for their business
Collaborative ability	Whether the particular MSME has a contract/pre-order with other partner
CEP	Whether the particular MSME re-use/re-process their production waste
School Year	The total years of school completed by the owner of the MSME
Age	The owner's age (year)

Gender	Whether the owner is male (1) or female (0)
Outcome Variables	
Productivity	The share of MSME revenue in a year per number of labor
Revenue	The value of revenue of the MSME in a year (IDR)
Export	The percentage of exported product
Imported Input	The percentage of the imported input
Total Cost	The value total cost (input, labor, overhead, other costs) (IDR)
Profit	The difference between the business revenue and their total cost (IDR)

For the PLS-SEM analysis, we used a database of manufacturing MSME (i.e. MSME which produce something to sell) developed by Bank Indonesia as our sample frame. The survey was conducted in about one month (1st – 30th September 2024) and gained 627 responses. For the purpose of this research, however, we focus on MSME which supply medium or big companies, indicating their ability to integrate into the industrial supply chains. After filtering out the responses, we utilise 130 responses meeting the criterion or 20.73% of the collected responses. The responses come from different sectors, ranging from food, agriculture, craft, to fashion. We use SmartPLS4 to run the PLS-SEM model, which is suitable for a small sample size.

4. Result and Analysis

4.1. Descriptive statistic

4.1.1. Propensity score estimation

Before the matching process, we first used a logit model to predict the propensity scores (probability of treatment) based on the observable characteristics such as firm size, training, certification, digital payment, circular economy practice (CEP), owner's years of school, owner's age and gender. The logit estimation result is shown in Appendix Table A3. The propensity scores were then generated and used to match the treatment and control group to examine the impact of the MSME participation in the manufacturing industry supply chain.

As the matching was estimated using PSM, we need to check the technical requirement for PSM. The similar characteristics between treatment and control group was examined by matching the propensity scores estimated from the logit model. Table A4 in Appendix shows the sample average before and after matching, as well as the reduction bias of each covariate. The table reveals that the sample average after the matching is similar between the treatment and control and the bias is reduced significantly.

The balancing test for covariates also has to be satisfied, with treatment and control group compared statistically based on the observable characteristics (Shah et. al, 2018; Lee, 2013). Figure 4 shows the distribution of propensity scores before and after the matching process. The figure indicate that before the matching process, the overlap between treatment (treated) and control (untreated) group shows that there are comparable MSME in both groups with similar observable characteristics and the standardized bias of the covariates are large.

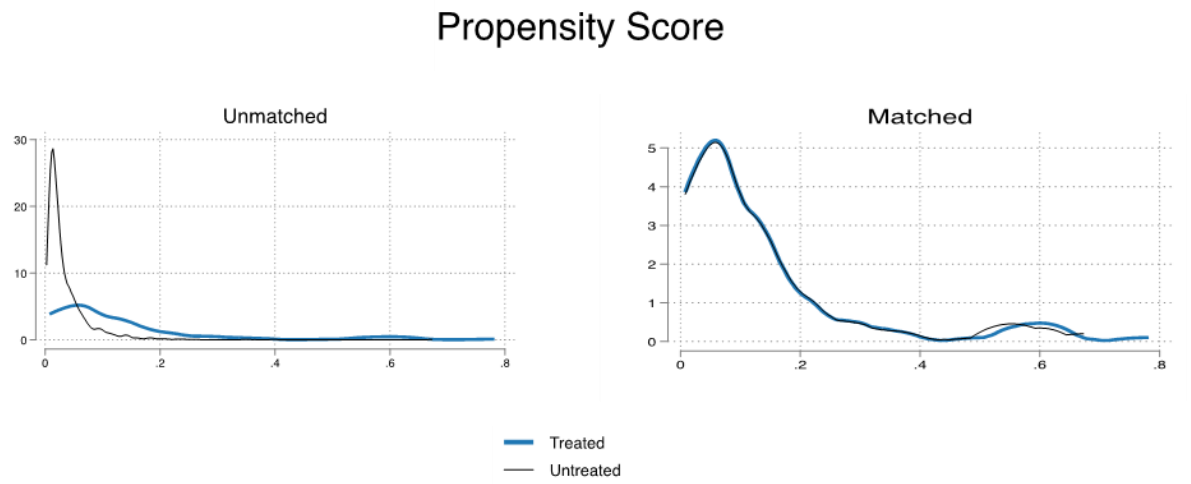

Figure 4. Distributions of the propensity scores before and after matching

4.1.2. PLS-SEM

Based on a survey conducted specifically for this study, most MSMEs that are part of a supply chain are focused on achieving gradual business growth and have developed long-term strategies to reach their goals. Approximately 79% of these MSMEs reported an average annual growth rate exceeding 10%, highlighting the significant benefits of participating in supply chains. Additionally, the majority recognize the importance of technology, with over 80% of respondents having invested in technological development. However, the limited quantity and capability of human resources remain the primary challenges faced by these MSMEs.

To strengthen our analysis, we develop five hypotheses which could extend the generalisability of our findings. We focus on our key findings that the commitment of MSME to be part of industrial supply chains is essential and that the commitment could be driven by financial and non-financial support from their supply chain members and other relevant stakeholders. Measures of supply chain finance (SCF) were adapted from Huang et al. (2022). We also adapt Huang et al. (2022) for measures of MSME performance in relation to SCF. Our measures of Supply chain non-financial support (SCNF) are in line with Huang et al. (2022), Wuttke et al. (2013), and Jia et al. (2020), whilst measures for commitment of MSME were adapted from Patrucco et al. (2020). Table A1 in the Appendix shows a list of items we use in this research. We argue that an increase in the commitment could lead to an increase in the MSME performance. We hypothesise that:

H1: SCF positively affects the commitment of MSME to be part of industrial supply chains.

H2: SCNF positively affects the commitment of MSME to be part of industrial supply chains.

H3: The commitment of MSME to be part of industrial supply chains positively affects MSME performance.

H4: The commitment of MSME to be part of industrial supply chains mediates the relationship between SCF and MSME performance.

H5: The commitment of MSME to be part of industrial supply chains mediates the relationship between SCNF and MSME performance.

Our factor analysis indicates that trade credit is not part of SCF considered by our respondents as all of its factor loadings (TRK1, TRK2, TRK3) are < 0.5 (Table A6 in Appendix). This further indicates that bank facilitated SCF schemes are still dominant. Delaying the payment, paying in credit, or payment with discount for a certain time period might not be relevant and helpful for MSME requiring certainty in their business operations. We also find that two items of MSME' financial performance (SMEFP4 and SMEFP5) have factor loadings of < 0.5, indicating that low price from suppliers and low inventory costs are not valid measures of MSME' performance. This further indicates that the two measures might not be their priorities. We took out the invalid measures and rerun the model. The updated results are presented in Table A7 in Appendix, showing that all items have factor loadings of >0.5 which is considered acceptable (Hair et al., 2014; Mishra et al., 2022).

The Cronbach's alpha and composite reliability (ρ_A, ρ_C) for all constructs are above 0.7 and therefore our model has good internal consistency, reliability and content validity. The average variance extracted (AVE) have all met the recommended threshold of > 0.5, indicating the overall convergent validity of our measures. The heterotrait-monotrait ratio (HTMT) scores show discriminant validity of measures for all constructs as they are all < 0.85 (Hair et al., 2019).

4.1.3. Input-Output Result for Study Case Selection

After the sorting and mapping procedures using the Input-Output 2016 data of 185 products, we selected products from two sectors: (1) the Automotive sector which represents the product with high export value, high import value, and high value-added; (2) Rubber sector which represents the product with high export value, low import value, and high value-added. Despite these differences in input sourcing, both sectors maintain a strong presence in export markets. This indicates that the automotive sectors still obtained their inputs from foreign countries although they have relatively high exports.

4.2. Estimation Result: Propensity Score Matching (PSM)

4.2.1. Impact of MSME participation

The PSM result to examine the impact of the MSME participation in the manufacturing industry supply chain is shown in Table 2. The estimation result shows the impact of MSME participation in two outcomes, those are the ATT and the ATE. ATT represents the impact of MSME participation on the treated population, while ATE shows the impact of MSME participation on the overall population.

The ATT result shows that MSME who participate in the manufacturing industry has a positive impact on MSME performances, especially a significant impact on productivity, revenue, total cost, and profit. The result also shows that the participation did not significantly affect the MSME export and import activities.

In general, the ATE shows similar results. On average, participation has a positive impact across the entire population, suggesting that MSME who participate in the manufacturing industry supply chain have better performances than those who were not participating. Similar to the ATT result, participation significantly increases MSME revenue, total cost, and profit.

The productivity estimation results reveal a discrepancy: the ATT demonstrates statistically significant results, whereas the ATE does not show significance. The ATT specifically measures the effect of supply chain participation on the productivity of MSME that actually participated in the supply chain. The ATE,

on the other hand, estimates the effect of supply chain participation on productivity for the entire MSME population, including both those who participated in the supply chain and those who did not. The ATE analysis, using the existing MSME as a proxy for those integrated into the industrial supply chain, suggests that the non-significant results for productivity in the ATE may indicate that many MSMEs not currently participating in supply chains lack the essential resources, technology, or capacity to fully leverage the benefits of such integration. The observed variation in readiness levels and resource availability across MSME significantly contributes to this disparity. The non-significant ATE suggests that, on average, supply chain participation may not yield uniform productivity gains across all MSME within the broader population, likely due to differences in capacity and readiness levels. This result highlights the critical need for targeted support aimed at enhancing MSME preparedness and capability to fully leverage the benefits of supply chain participation. This results is similar to what we found in our study case that MSME who participate in the industry supply chain as a tier 3 do not have the same or have lower productivity than MSME who participate as a tier 2, which supplies the products to the tier 1 industry or larger industry. This condition indicates a variation in capacity and readiness among MSME, even among those already participating in the industrial supply chain.

Table 2. The Propensity Score Matching Estimation Result

	PSM	
	ATT	**ATE**
Productivity Participation	**0.351****	0.139
	(0.16)	(0.23)
Revenue Participation	**0.681****	**0.605****
	(0.19)	(0.15)
Export Participation	3.034	1.464
	(2.74)	(1.76)
Imported Input Participation	-0.449	0.516
	(1.12)	(0.55)
Total Cost Participation	**0.797****	**0.734****
	(0.20)	(0.19)
Profit Participation	**0.706****	**0.675****
	(0.26)	(0.26)

* and *** indicate significant at 10 percent and 5 percent levels, respectively; standard error in parenthesis.

As the confirmation of the PSM results, we applied the robustness check using nearest neighbors matching. Using the nearest neighbor estimator (see Table A5 in Appendix), the result is consistently compared to the PSM estimation. The findings indicate that participation in the industrial supply chain leads to increases in MSME performances.

4.3. Estimation Result: PLS-SEM

We focus on our key findings that the commitment of MSME to be part of industrial supply chains is essential and that the commitment could be driven by financial and non-financial support from their supply chain members and other relevant stakeholders. Our model is free from collinearity as all relationships have variance inflation factor (VIF) value of < 3 (Hair et al., 2019), as shown in Table A10 in Appendix. We run 10,000 samples bootstrapping and find that the majority of the relationships are significant at 1% significance level; three out of five hypotheses are supported by the model (Table 3).

Table 3. Hypothesis testing

	Hypothesis		*p*-value	Decision
H1	SCF -> SC Commitment	0.382	0.000	Supported
H2	SCNF -> SC Commitment	0.139	0.194	Not supported
H3	SC Commitment -> MSME Performance	0.653	0.000	Supported
H4	SCF -> SC Commitment -> MSME Performance	0.250	0.000	Supported
H5	SCNF -> SC Commitment -> MSME Performance	0.091	0.233	Not supported

We further find that the R-squares values of the endogenous constructs are all above zero and are acceptable considering low R-squares found in previous supply chain management research (e.g. Zhou and Benton, 2007). As such, the R-squares values show an acceptable in-sample model fit. We then run a PLS predict algorithm with 10 folds (k = 10) and 10 repetitions (r = 10), resulting in satisfying Q-square predict values of more than zero, indicating a good out-of-sample predictive power for all endogenous constructs. In other words, our model outperforms the most naïve benchmark, i.e. the means of indicators from the training sample (Hair et al., 2019; Shmueli et al., 2019).

In addition, Table 4 provides the summary of the R-square and Q-square predict values for all endogenous constructs, whereas Table 5 presents the PLS predict assessment for all items of the endogenous constructs. Overall, as Q-square predict values for all items are above zero, our model provides relevant and meaningful predictive power. We also find that our PLS-SEM model produces lower prediction errors (root mean squared error – RMSE and mean absolute error – MAE) for the majority of endogenous constructs' items compared to those of naïve linear regression model (LM). This indicates that our model has medium predictive power (Hair et al., 2019; Shmueli et al., 2019).

Table 4. Summary of in-sample model fit and out-of-sample predictive power of the endogenous constructs

	R-square	R-square adj	Q^2predict	RMSE	MAE
SC Commitment	0.239	0.227	0.196	0.950	0.682
SME Performance	0.427	0.422	0.152	1.034	0.613

Table 5. PLSpredict

	Q^2predict	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
(BC1)	0.209	1.482	1.163	1.594	1.193
(BC2)	0.180	1.408	1.098	1.527	1.168
(BC3)	0.201	1.325	0.997	1.425	1.056
(BC4)	0.070	1.003	0.703	1.093	0.790
(BC5)	0.052	0.951	0.651	1.029	0.741
(BC6)	0.045	0.980	0.685	0.989	0.722
(BC7)	0.049	1.180	0.826	1.294	0.960
(SMEFP1)	0.032	1.085	0.738	1.139	0.838
(SMEFP2)	0.104	1.207	0.838	1.223	0.934
(SMEFP3)	0.095	0.936	0.635	1.023	0.760
(SMEFP6)	0.092	0.833	0.528	0.872	0.606
(SMEOP1)	0.065	0.983	0.658	1.073	0.765
(SMEOP10)	0.051	0.795	0.580	0.764	0.554
(SMEOP11)	0.108	0.811	0.574	0.834	0.630
(SMEOP2)	0.074	1.040	0.708	1.139	0.829
(SMEOP3)	0.089	0.970	0.652	1.022	0.735
(SMEOP4)	0.005	0.965	0.634	1.055	0.691
(SMEOP5)	0.103	0.815	0.540	0.831	0.612
(SMEOP6)	0.106	0.788	0.563	0.778	0.554
(SMEOP7)	0.143	0.918	0.613	0.992	0.716
(SMEOP8)	0.127	0.770	0.533	0.768	0.585
(SMEOP9)	0.143	0.810	0.555	0.800	0.598

To ensure robustness, we test our model for nonlinear effects and endogeneity (Hair et al., 2019). To check for nonlinear effects, we run 10,000 samples bootstrapping with Quadratic Effects (QE) for all direct relationships within the model. The results (Table 6) suggest that none of the relationships shows significant QE ($p > 0.1$), indicating no nonlinear effects in the model. With the same bootstrapping, we tested all direct relationships for endogeneity with Gaussian Copula (GC). The results (Table 7) also suggest that none of the relationships shows significant GC ($p > 0.1$), indicating that our model is free from endogeneity.

Table 6. Quadratic effect

	***p*-value**
QE (SCF) > SC Commitment	0.648
QE (SCNF) -> SC Commitment	0.240
QE (SC Commitment) -> MSME Performance	0.348

Table 7. Gaussian copula

	***p*-value**
GC (SCF) -> SC Commitment	0.771
GC (SC Commitment) -> MSME Performance	0.475
GC (SCNF) -> SC Commitment	0.074

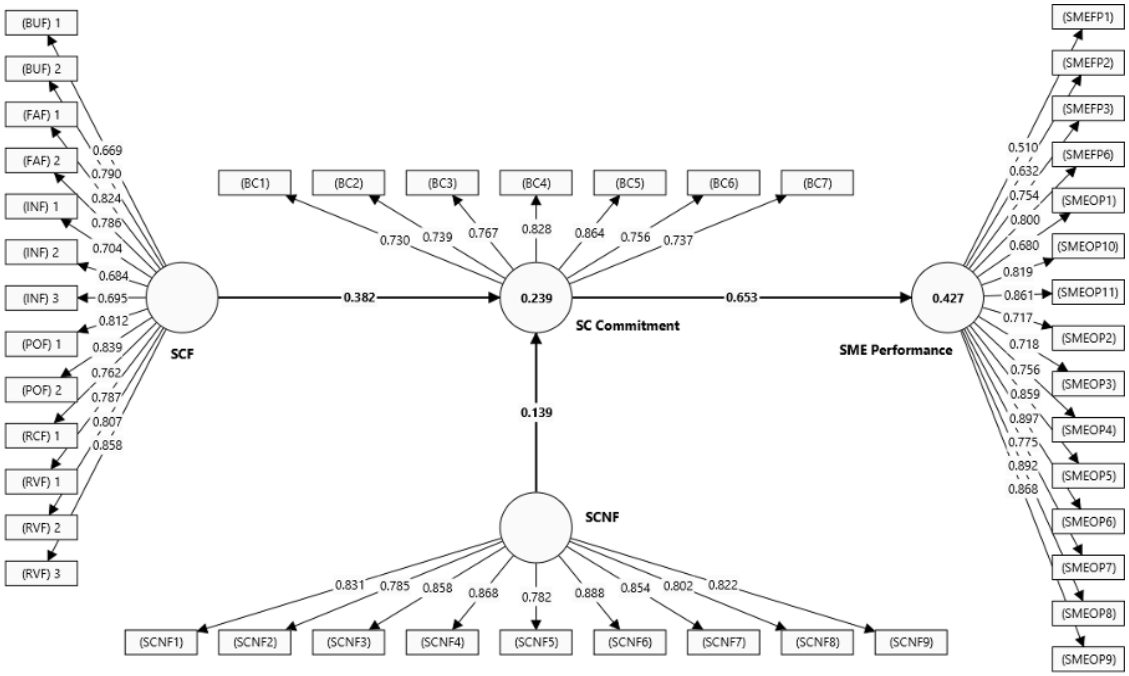

Figure 5. Tested structural model

Figure 5 shows the results of the tested structural model. Our model with a bigger sample confirms that SCF plays a critical role in ensuring the commitment of MSME to be part of the industrial supply chains, which in turn positively and significantly affects MSME performance. It should be noted that SCF in this research involves banks, suppliers, and buyers to help MSME temporarily fund their business operations while waiting for the real transactions to happen due to delays in their sales or their ability to immediately pay for their sourcing.

The results of our data analysis also suggest that SC commitment mediates the relationship between SCF and MSME performance. MSME needs to be committed to invest in people, facilities, and systems to accommodate the needs of medium and big companies as their buyers. MSME also needs to be committed to meet quality standards, administrations, big volume of orders, and regulations set by their buyers. Interestingly, SCNF support including mentorship and training, shared facilities, and networking supported by the government, banks, and big companies do not affect MSME' commitment to be part of industrial supply chains and therefore MSME performance. Whilst such support could motivate MSME to think about advancing their business, they might not be enough to solve the classical problem of MSME, i.e. the lack of capital to actually run their business and therefore be part of industrial supply chains, which are generally more demanding compared to sole operations.

4.4. Study Case: Indonesian Rubber and Automotive Industry

We adopted a multiple case study on automotive and rubber supply chains in Indonesia. These sectors were chosen since they can illustrate a supply chain integration involving both the MSME and larger companies. We visited and conducted focus group discussions (FGD) with companies and a rubber farmers' association in Palembang. FGD were also conducted with government officials related to the industries in Palembang. We then visited and conducted FGD in an industrial centre in Tegal and an automotive company in Semarang. From this study we learnt how MSME can connect with larger companies, which further process MSME' products to create higher value-added. Through this case study we seek to uncover why relatively few MSME are involved in the supply chain.

This case study identified many significant challenges that hinder MSME participation in the industrial supply chain. Commitment has been highlighted as one of root causes that prevents MSME from entering the industrial supply chains. Meeting the industry's numerous requirements is challenging, particularly in terms of quality standards. Their relatively simple work process, limited business capacity and access to capital contribute to their slow response to industry demand. Furthermore, the challenges encountered by MSME encompass inadequate capital, limited financial literacy, digital divide issues impeding digitalization initiatives, low productivity stemming from outdated equipment technology and insufficient employee skills, as well as difficulties in achieving product quality standardization and scalability. This case study also identified several enablers that facilitate MSME participation in the industrial supply chain, including technology transfer, opportunities for business expansion through partnerships with large industries, and government support, such as technology services and innovation centers. The subsequent examination will explain the condition in the rubber and automotive industries.

Rubber Industry

South Sumatra Province is the largest rubber-producing region in Indonesia. However, its production has gradually declined over time. The prolonged low price of natural rubber has made it difficult for farmers to maintain their crops optimally, such as through fertilizing and other necessary practices. Additionally, replanting old rubber trees that are no longer productive cannot be carried out due to financial constraints. Another issue contributing to the decline in production is the relatively basic farm management practices employed by most farmers. The production drop is further worsened by the shift from rubber to oil palm cultivation, which is seen more economically promising.

Based on the case study, we found that cultural aspects affect the supply chain development particularly in the rubber supply chain case. For example, many farmers in Palembang are motivated to sell their products to get immediate cash, which often cannot be fulfilled by the farmers' association. As a result about 30% of rubber farmers in Palembang are not registered in the association. They would rather sell their rubber (bokar) to the middlemen, who despite their low-price offer, can pay the farmers in cash right after the farmers hand in their rubber. However, farmers realize that they will receive higher prices if they were members of the farmers association. This is because the association generally sells directly to crumb rubber factories, eliminating the need for middlemen, and they also produce a high quality bokar. This immediate cash behaviour to some extent relates to their socio-cultural perspective as well as their bad experience.

Rubber has been the main income for farmers so that uncertainty in the payment process could affect their daily lives. They put low trust on the online payment because it delays them from getting the money as many of them do not have bank accounts and there were some fraud cases in which the middlemen did not pay them; they took the rubber and ran away. Therefore, even a one-day delay cannot be tolerated by the farmers.

There have been some challenges as well to ensure the quality of natural rubber. For example, farmers' behaviour of putting unnecessary things such as stones and sandals on the harvested rubber to increase the weight of the rubber, which affects the rubber quality and in fact decreases the price. Consequently, companies need to invest in machinery to clean up the rubber before moving it to production. Whilst farmers' associations are formed to ensure the quality of the rubber, many farmers are reluctant to join the associations. The local government suggests that companies also take advantage of the dirty rubber because they can get a lower price of the harvested rubber.

The rubber production has significantly decreased due to lack of raw material supply from the farmers. Some factors affecting low supply of natural rubber are:

1. Less productive plantation due to old rubber trees.
2. *Pestalotiopsis* disease (*Penyakit Gugur Daun Pestalotiopsis*/PGDP)
3. Shifting of land use to crude palm oil
4. Low and uncertain price
5. Lack of incentives from the government

Automotive Industry

Unlike the rubber industry, the involvement of MSME in the supply chain for the well-established automotive industry can be seen at the Small Industrial Estate (Lingkungan Industri Kecil/LIK) in Tegal Regency, Central Java. At the LIK the local government built a center for technology services and innovation, equipped with computer numerical control (CNC)-based production facilities. This facility is intended to support automation in various product manufacturing, material quality testing tools, and a design centre, which are being developed in stages.

The position of MSME in the automotive industry supply chain is as tier 2 and tier 3 suppliers. By partnership with large industries (tier 1) MSME have the opportunity to gain market certainty, enhance their competitiveness to move up their value chain, and benefit from technology transfer. Joining an integrated industrial ecosystem provides MSME with greater opportunities to expand their business. However, it also poses challenges in adapting human resource, technology, and product development. Furthermore, standardization of product quality required by big focal companies and tier 1 suppliers means that MSME must comply with standardized specifications and documentations including transparency and traceability of their operations. The integration process often takes time and makes the MSME impatient due to their short-term and result-based perspectives. As such, many MSME working in automotive industries fail to be part of the established supply chains.

One of the big car manufacturing companies suggests that they do not have issues with the volume of supply from the MSME. They are ready to support MSME with the right capabilities to invest in required technologies to ensure volume and stability of the supply. However, many respondents in our FGD suggest that scalability becomes one of key challenges for MSME wishing to be part of the industrial supply chains. On the other hand, MSME in the automotive part industry

are concerned about the sustainability of their operations as the industry is now moving to EV, which could reduce the need for parts by about 40%.

5. Discussion

The integration of MSME into the manufacturing industry supply chain is crucial for advancing economic development and fostering sustainable growth. However, MSME face several challenges and limited access to integration into the value chains of medium and large industries. Currently, the proportion of MSME that have entered supply chains remains low, indicating significant potential for increasing MSME contributions to the manufacturing sector. Therefore, this study investigates the benefits, enabling factors, barriers, and motivations associated with MSME participation in industry supply chains. The research addresses two key objectives: first, to identify the benefits of MSME participation in the industry supply chains; second, to analyze the commitments, enablers, and obstacles that shape MSME involvement in these supply chains.

To determine whether MSME participation in supply chains significantly impacts their performance, an analysis was conducted using the PSM method. The data used is derived from the MSME Financial Report Survey (Survei Laporan Keuangan UMKM/SLKU), which covers all sectors and regions in Indonesia. This approach revealed that MSME participation in the supply chain yields benefits across key performance metrics. Specifically, integration into the supply chain demonstrates a positive and statistically significant impact on MSME productivity, revenue, total cost, and profit. The integration of supply chain practices, collaborative planning, and the adoption of new technology could be contributing factors in driving the observed increase in productivity, as evidenced in the case study. This aligns with the findings of Pooe and Mahlangu (2017); and Benzidia and Makaoui (2020). MSME engaged in supply chain often achieve higher profitability due to access to expanded markets and diversified revenue streams, thus contributing to overall income growth (Gereffi and Luo, 2015). However, total costs also tend to increase with supply chain participation. An increase in total costs could be attributed to factors such as transportation expenses, coordination efforts, and adherence to international compliance standards (Ji et al., 2022). Nonetheless, the increase in total costs appears to be offset by a proportionally greater rise in revenue, leading to an overall increase in profit.

To address the second research question, we employed PLS-SEM as the analytical method. The data comprises primary data collected from survey on MSME across various sectors in Indonesia. The PLS-SEM analysis indicate that SCF significantly influence MSME' commitment. In contrast, SCNF support such as licensing and mentoring/training do not significantly impact MSME commitment. Whilst such support may encourage MSME to consider business advancement, they may be insufficient to address the fundamental issue faced by MSME, the adequate capital necessary to operate effectively and participate in industrial supply chains, which are typically more demanding than non-financial support. This condition aligns with the findings from our case study, indicating that capital is a crucial aspect for MSME in operating their businesses.

From these results, capital is one of a key factor for MSME to join the industrial supply chain, as many struggle with limited financial resources to scale production or meet the requirements of larger companies. Without adequate capital, MSME often face challenges in upgrading technology, ensuring consistent quality, or fulfilling large orders on time. However, joining the supply chain can provide access to

financing options, partnerships, and economies of scale that help alleviate these financial constraints. With the right support, MSME can overcome capital barriers and benefit from increased market opportunities and long-term growth.

Building on the results of the PSM and PLS-SEM analyses, this study has identified the significance of MSME participation in supply chains, as well as the factors influencing MSME performance. Further, an in-depth examination of two high-value-added sectors (identified through input-output table analysis), rubber and automotive sectors was conducted. Based on the interviews with the owner, management or employee revealed several major challenges for MSME. The main obstacles faced by MSME include: (i) low commitment, (ii) inadequate capital, (iii) limited financial and digital literacy, and (iv) low productivity due to limited equipment technology and low employee skills. MSME also encountered the challenges related to the product quality standardization, particularly within the automotive industry, which pose significant barriers to MSME participation in supply chains. The challenges in meeting product quality standards may stem from barriers to new technology adoption. This aligns with findings by Cunningham et al. (2023), who identified a lack of awareness regarding the benefits of technology adoption and a limited entrepreneurial mindset focused on value creation among MSME. These factors may also help explain the persistently high reliance on imported materials in the automotive sector. In the rubber sector, the requirements for high-quality standards and advanced technology adoption are generally less stringent compared to those in the automotive sector. Furthermore, these industries generally require larger quantities, requiring MSME to ensure stable and scalable production capabilities.

6. Policy Recommendation

Based on the findings presented above, we offer the following recommendations. The PSM results indicate that participation in the industrial supply chain provides positive benefits for MSMEs. Therefore, it is crucial to support MSMEs in joining these supply chains. However, it is equally important to consider the readiness level of MSMEs to ensure they are adequately prepared to benefit from such participation. We recommend providing comprehensive support to MSMEs seeking to enter supply chains, ensuring they are equipped with the necessary resources and guidance for successful integration, including coaching to help them meet the standards required by medium and large industries. This training can be conducted in collaboration with local governments and private companies. To further strengthen the MSME readiness, it is recommended to encourage outreach initiatives by the government and relevant agencies that focus on: (i) improving knowledge of licensing procedures, (ii) enhancing financial and digital literacy, and (iii) offering simplified and accessible financial reporting guidance. Moreover, expanding vocational training programs targeted at skills development is essential to improve MSME productivity.

Based on the PLS-SEM results for both SCF and SCNF, it is evident that SCF support is the most significant factor in improving MSME performance. Therefore, the primary policy recommendation is to assist MSME in becoming bankable. Additionally, increasing bank credit distribution to MSME can be achieved by optimizing existing financial regulatory policies, such as the Macroprudential Inclusive Financing Ratio (Rasio Pembiayaan Inklusif Makroprudensial, or RPIM).

For the rubber sector, to enhance the rubber sector's performance, it is recommended to focus on improving financial access, skill development, and productivity management. Providing easier access to capital can help MSME invest

in better equipment and safeguard against uncertainties. Regular technical training on sustainable cultivation practices and harvesting, along with business management and financial literacy workshops, will equip MSME with the necessary skills. Additionally, promoting innovation in production techniques, establishing quality control systems, and fostering collaboration with research institutions for high-yield, disease-resistant rubber varieties can significantly boost productivity and market competitiveness.

For the automotive sector specifically, tier 1 suppliers require a high level of standardization from MSME products. However, for most MSME, time is critical to sustaining their business operations, leading them to prioritize short-term sales (lower prices and less quantities). To address these challenges, MSME requires guidance from regulators or authorities to enhance their bankability, improve product quality, and scale up their productions. Additionally, tier 1 suppliers are willing to assist MSME in adopting new technologies and developing employee skills. To further encourage support from larger companies, the government or local authorities should provide incentives. These incentives may include corporate tax reductions, give incentives to lower operational fees, or collaborative efforts in hosting seminars focused on MSME development.

References

Affandi, Y., Ridhwan, M.M., Trinugroho, I., Hermawan, D. (2024) Digital adoption, business performance, and financial literacy in ultra-micro, micro, and small enterprises in Indonesia. *SRRN*. http://dx.doi.org/10.2139/ssrn.4719935

Benzidia, S. and Makaoui, N., 2020, July. Improving SMEs performance through supply chain flexibility and market agility: IT orchestration perspective. In *Supply chain forum: An international journal* (Vol. 21, No. 3, pp. 173-184). Taylor & Francis.

Cheah, J.H., Kersten, W., Ringle, C.M., & Wallenburg, C. (2023). Guest editorial: predictive modeling in logistics and supply chain management research using partial least squares structural equation modeling. *International Journal of Physical Distribution & Logistics Management*, 53(7/8): p. 709-717

Cunningham, J.A., Damij, N., Modic, D. and Olan, F., 2023. MSME technology adoption, entrepreneurial mindset and value creation: a configurational approach. *The Journal of Technology Transfer*, *48*(5), pp.1574-1598.

Epede, M.B. and Wang, D., 2022. Global value chain linkages: An integrative review of the opportunities and challenges for SMEs in developing countries. *International Business Review*, *31*(5), p.101993.

Gereffi, G. and Luo, X., 2015. Risks and opportunities of participation in global value chains. *Journal of Banking and Financial Economics*, (2 (4)), pp.51-63.

Hair, J. F. (2014). Multivariate data analysis. Pearson.

Hair, J.F., Risher, J.J., Sarstedt, M., & Ringle, C.M. (2019). When to use and how to report the resuts of PLS-SEM. *European Business Review*, 31(1): p. 2-24

Harvie, C., Charoenrat, T. (2021). SMEs and the rise of global value chains. In *Integrating SMEs into Global Value Chains: Challenges and Policy Action sin Asia.*

Hidayat, A., Hidayat, M., & Hendrix, T. (2017). The effect of Indonesia SMEs participation in global value chain to enhance competitiveness. *The Proceeding of The International Conference and Call for Paper on Trade 5th – 6thSeptember 2017*, p. 207-237

Hill, H. (2001). Small and medium enterprises in Indonesia: Old policy challenges for a new administration. *Asian Survey*, 41(2): p. 248-270

Huang, C., Chan, F. T., & Chung, S. H. (2022). Recent contributions to supply chain finance: Towards a theoretical and practical research agenda. *International Journal of Production Research*, 60, 493-516.

Jamieson, D., Fettiplace, S., York, C., & Lambourne, E. (2012) Large Business and SMEs: Exploring how SMEs interact with large business. *ORC International*

Ji, X., Liu, Y., Wu, G., Su, P., Ye, Z. and Feng, K., 2022. Global value chain participation and trade-induced energy inequality. *Energy Economics*, *112*, p.106175.

Jia, F., Zhang, T., & Chen, L. (2020). Sustainable supply chain finance: Towards a research agenda. *Journal of Cleaner Producti*on, 243, 118680.

Kuswardana, I., Nachrowi, N.D., Falianty, T.A., & Damayanti, A. (2021). The effect of knowledge spillover on productivity: Evidence from manufacturing industry in Indonesia. *Cogent Economics & Finance*, 9:1 p. 1-31

Lee, W.S. (2013). Propensity score matching and variations on the balancing test. *Empirical Economics* 44(1), p.47-80. doi:10.1007/s00181-011-0481-0.

Lusiantoro, L., Caselli, G., Rishanty, A. (2024). Predicting circular economy practices of SMEs in an emerging country: Do supply chain finance and business survaivability matter?

Mani, V., Jabbour, C.J.C., & Mani, K.T.N. (2020). Supply chain social sustainability in small and medium manufacturing enterprises and firms' performance: Empirical evidence form an emerging Asian economy. *International Journal of Production Economics*, 227

Mishra, R., Singh, R. K., & Govindan, K. (2022). Barriers to the adoption of circular economy practices in micro, small and medium enterprises: Instrument development, measurement and validation. *Journal of Cleaner Production*, 351, 131389.

Mohanty, M. K., Gahan, P. (2012). Buyer supplier relationship in manufacturing industry – Findings from Indian manufacturing sector. *Business Intelligence Journal*, p. 319-333

Patrucco, A.S., Moretto, A., Luzzini, D. and Glas, A.H., 2020. Obtaining supplier commitment: antecedents and performance outcomes. *International Journal of Production Economics*, 220, p.107449.

Pooe, R.I.D. and Mahlangu, D., 2017. Enhancing SME performance through supply chain integration, collaborative planning, and supply chain capabilities. *Journal of Contemporary Management*, *14*(1), pp.238-269.

Premadasa, M. (2021). Impact of Global Value Chain on the Performance on SMEs. *SRRN*.http://dx.doi.org/10.2139/ssrn.3953606

Reddy, K., Sasidharan, S. (2020). Driving small and medium-sized enterprise participation in global value chains: Evidence from India. *ADBI Working Paper Series No.1118*

Rosenbaum, P.R., and Rubin, D.B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), p. 41-55. doi:10.1093/biomet/70.1.41.

Subanti, S., Mulyanto, Hakim, A.R., Mafruhah, I., & Hakim, I.M. (2017). Priority economic sector and household income in Indonesia (an analysis of input output). *International Conference on Mathematics Science and Education 2017,* p. 1-5

Tambunan, T. (2019). Recent evidence of the development of micro, small and medium enterprises in Indonesia. *Journal of Global Enterpreneurship Research*, p.9-18

Tambunan, T. (2021). Micro, small and medium enterprises in times of crisis: Evidence from Indonesia. *Journal of the International Council for Small Business*, 2(4): p. 1-25

Shah, G.M., Nepal, A.K., Rasul, G., & Ahmad, F. (2018) Value chain development of bay leaf in Nepal: an impact assessment. *Journal of Development Effectiveness*, 10(2): p. 179-196

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing*, 53, 2322-2347.

Wang, S., Cheah, J.H., Wong, C.Y., & Ramayah, T. (2023). Progress in partial least squares structural equation modeling use in logistics and supply chain management in the last decade: a structured literature review. *International Journal of Physical Distribution & Logistics Management*.

Wicaksono, P., Hikmah, Y., & Ilmiawani, N. (2023). Productivity and global value chains: A tale from the Indonesian Automobile Sector. *Economies,* 11:62 p. 1-12

WTO. (2022). Small and Medium Manufacturing Enterprise Trade Participation in Developing Economies: MSME Research Note #2.

Wuttke, D. A., Blome, C., Foerstl, K., & Henke, M. (2013). Managing the innovation adoption of supply chain finance – Empirical evidence from six European case studies. *Journal of Business Logistics*, 34, 148-166.

Zahoor, N., Al-Tabbaa, O., Khan, Z. and Wood, G. (2020). Collaboration and internationalization of SMEs: Insights and recommendations from a systematic review. *International Journal of Management Reviews*, Vol. 12, pp. 427-456.

Appendix

Table A1. PLS-SEM instruments

Supply Chain Finance (SCF)
7-point Linkert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 Strongly agree
Trade Credit (TRK)
The supplier provides my company with flexible payment options, allowing payments to be made in installments without any additional fees or interest for a certain period.
The supplier provides my company with flexible payment options, allowing payments to be deferred without any additional fees or interest for a certain period.
The supplier provides my company with flexible payment options, offering a discount on payments for a certain period.
Reverse Factoring (RVF)
My company collaborates with a bank or other financial institutions, which help advance the payment for products my company purchases from the supplier.
My company receives financial assistance from a bank or other financial institutions to purchase products from the supplier.
My company receives a discount on fees or interest for paying the supplier's products through a bank or other financial institutions because they trust that my company can repay the advance payment they made to the supplier.
Receivable Financing (INF)
My company uses inventory as collateral to obtain financing from a bank or other financial institutions, allowing us to purchase products from the supplier.
The inventory at the company is partially managed by the supplier, so the company does not bear part of the inventory costs.
The inventory at the company is fully managed by the supplier, so the company does not bear any inventory costs.
Fixed Assets Financing (FAF)
The bank or other financial institutions assist in financing the company to purchase, build, renovate, or lease fixed assets such as factories and/or warehouses.
The supplier assists in financing the company to purchase, build, renovate, or lease fixed assets such as factories and/or warehouses.
Buyer Financing (BUF)
My buyers pay for the products to my company earlier than the agreed-upon time.
My buyers provide my company with capital funding assistance at a low cost or interest rate.
Purchase Order Financing (POF)
The supplier obtains capital funding from a bank or other financial institutions by presenting the purchase orders issued by my company, which are trusted by the bank or financial institutions.
The supplier repays the capital funding from the bank or other financial institutions once the products have been properly received by my company.
Types of Entrepreneurial Ventures (TEV)
Select one of the options
General Profile: Select one that best describes your business (TEV1)

(1) The income from the business is sufficient for personal and family daily needs. It is not yet formally registered. Usually, there is no permanent location and very few assets. There are no relationships with banks, and transactions are conducted in cash. There is no capacity or ability to invest in growing the business. The business was started out of necessity. It operates in a price-competitive market with many competitors.
(2) Income is relatively stable with a reliable business model and professional management. Can invest moderately to remain competitive in the market. Usually has a permanent location and employees, but does not expand or grow larger due to limited capacity. The number of employees remains the same.
(3) Has a reliable business model with steady growth over time. Occasionally launches new products and periodically enters new markets. Business expansion is carried out steadily and regularly, including the number of buildings, locations, and employees. Develops a strong local and regional brand. Reinvests for moderate business growth and development.
(4) Has strong innovation capabilities, driving rapid company growth through equity financing. Usually technology-based, with development driven by new market opportunities at the national and international levels. May be a candidate for initial public offerings (IPO) or acquisition.

What is your business's average annual growth rate? (TEV2)

(1) Almost none or zero
(2) Between zero and 5%
(3) 10% to 15%
(4) More than 20%

How far ahead does your business planning extend? (TEV3)

(1) Daily
(2) Weekly and monthly
(3) 1 to 2 years
(4) 2 to 5 years

What is the focus of your business management? (TEV4)

(1) Selling whatever can be sold
(2) Managing an established business model
(3) Gradually increasing business growth
(4) Increasing business growth on a certain scale

What is your business management style? (TEV5)

(1) Reacting only when problems arise
(2) There are short-term technical steps designed.
(3) There is a specific long-term strategy designed.
(4) There is a long-term strategy and a proactive approach to solving problems.

How high is your entrepreneurial orientation to seize opportunities? (TEV6)

(1) Very low
(2) Low
(3) Medium
(4) High

How much do you invest in technology? (TEV7)

(1) None

(2) Limited

(3) Moderate

(4) High

To what extent are your business's resource and operational constraints? (TEV8)

(1) Very significant

(2) Significant

(3) Somewhat significant

(4) Not significant

What is the source of your business financing? (TEV9)

(1) Personal

(2) Personal, family, friends, and bank

(3) Personal, family, friends, bank, and individual investors

(4) Bank, individual investors, venture capital, open financial markets (public)

What is your exit strategy if your business fails? (TEV10)

(1) Close it down

(2) Close it down or sell it

(3) Sell it or merge

(4) Sell it, merge, or go public

How advanced are your business's managerial skills? (TEV11)

(1) Producing and selling products

(2) Operational skills, including basic management knowledge

(3) Planning, strategy, delegation, and performance improvement

(4) Planning, innovation, cash flow management, and negotiation

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How complex is your business's organizational structure? (TEV12)

(1) Very minimal or nonexistent

(2) Simple

(3) Organizational structure based only on managerial functions and centralized

(4) Organizational structure based on managerial functions, products, and markets

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What is the economic motivation behind your business? (TEV13)

(1) The only source of income to meet basic needs and ensure personal and family survival

(2) To replace or serve as an alternative income

(3) To achieve moderate wealth

(4) To achieve high wealth

What type of reward do you get from your business? (TEV14)

(1) Weekly income

(2) Salary and bonuses

(3) Salary, performance incentives, and shares

(4) Shares and profit-sharing

Survivability in terms of Failure and Success (SVF)

7-point Linkert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 Strongly agree

My company has survived (remains operational) after going through adverse conditions such as economic crises, pandemics, or other situations that caused a decrease or even a complete lack of demand (SVF1)

I am optimistic that my company will survive (continue operating) for at least one more day (SVF2)

I am optimistic that my company will survive (continue operating) for at least one week to one month (SVF3)

I am optimistic that my company will survive (continue operating) for at least one to two years (SVF4)

I am optimistic that my company will survive (continue operating) for at least two to five years (SVF5)

I am optimistic that my company will survive (continue operating) for more than five years (SVF6)

Supply Chain Non-Financial Supports (SCNF)

7-point Linkert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 Strongly agree

My company receives assistance from the government to supply products to large companies (SCNF1)

My company receives assistance from the bank to supply products to large companies (SCNF2)

My company receives assistance from large companies to supply products to other large companies (SCNF3)

My company utilizes government facilities to supply products to large companies (SCNF4)

My company utilizes bank facilities to supply products to large companies (SCNF5)

My company utilizes facilities from large companies to supply products to other large companies (SCNF6)

My company is connected to large companies with the help of the government (SCNF7)

My company is connected to large companies with the help of the bank (SCNF8)

My company is connected to large companies with the help of other large companies (SCNF9)

SMEs Firm Performance (SMEP)

7-point Linkert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 Strongly agree

Financial performance (SMEFP)

The working capital needed by my company is well met (SMEFP1)

My company is able to pay the working capital funding costs provided by others effectively (SMEFP2)

My company is able to manage cash flow well (SMEFP3)

My company is able to obtain necessary products at low prices (SMEFP4)

My company is able to manage inventory at low costs (SMEFP5)

My company is able to obtain and manage profits effectively (SMEFP6)

Operational Performance (SMEOP)

My company quickly obtains the raw materials or products needed from suppliers (SMEOP1)

My company receives the necessary raw materials or products from suppliers accurately, reliably, and as needed (SMEOP2)

My company is able to sell inventory quickly (SMEOP3)

My company is able to produce or sell products at a capacity that meets demand (SMEOP4)

My company is able to store raw materials or products as needed (SMEOP5)

My company is able to increase product sales (SMEOP6)

My company is able to enhance collaboration with other supply chain actors (SMEOP7)

My company is able to build trust with other supply chain actors (SMEOP8)

My company is able to increase other supply chain actors' trust in my company (SMEOP9)

My company receives repeat orders or requests from buyers (SMEOP10)

My company is able to secure and ensure inventory in specific conditions when needed to meet demand (SMEOP11

Integration to the Industrial Supply Chain (IISC)

Answer with Yes/No

Integration with large company supply chains (ILISC)

My company has become a supplier to a national large company (ILISC1)

My company has become a supplier to a foreign large company (ILISC2)

My company sells products directly to buying companies without intermediaries (ILISC3)

7-point Linkert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree nor disagree, 5 = Somewhat agree, 6 = Agree, 7 Strongly agree

Buyer-Supplier Collaboration (BSC)

My company shares operational cost information with large buying companies (BSC1)

My company is required by large buying companies to improve operational costs (BSC2)

My company is required by large buying companies to improve product quality (BSC3)

Buyer Commitment (BC)

My company is committed to investing by providing dedicated employees for large buying companies (BC1)

My company is committed to investing by providing dedicated facilities for large buying companies (BC2)

My company is committed to investing by providing dedicated systems for large buying companies (BC3)

My company is committed to meeting quality standards to become a supplier for large companies (BC4)

My company is committed to fulfilling administrative requirements to become a supplier for large companies (BC5)

My company is committed to fulfilling large order quantities to become a supplier for large companies (BC6)

My company is committed to complying with all rules set by large buying companies (BC7)

Price (P)

The selling price of my company’s products to buyers is stable (P1)

he selling price of my company’s products to buyers tends to be low (P2)

Buying Behavior (BB)

My company’s products are purchased through a contract mechanism (BB1)

My company’s products are purchased even before they are ready for sale (BB2)

Table A2. Summary of the dataset across the year of observations

Variable	Treatment Group			Control Group		
	Obs	Mean	Std Dev	Obs	Mean	Std Dev
Control/Characteristics Variables						
Firm Size	94	0.13	0.34	2,247	0.01	0.10
Training	94	0.16	0.37	2,246	0.08	0.27
Certification	94	0.20	0.40	2,247	0.07	0.26
Digital Payment	94	0.61	0.49	2,247	0.36	0.48
Collaborative Ability	93	0.59	0.49	2,238	0.29	0.45
CEP	94	0.64	0.48	2,247	0.55	0.50
School Year	90	12.22	3.54	2,227	10	3.58
Age	93	46.17	13.40	2,242	47	11.16
Gender	94	0.70	0.46	2,247	1	0.49
Outcome Variables						
Productivity	94	2,053.72	3,821.46	2,247	960.45	1,687.04
Revenue	94	42,400,000	83,800,000	2,247	6,198,153	23,000,000
Export	94	6.17	22.97	2,247	0.61	6.78
Imported Input	94	2.02	9.11	2,247	0.25	4
Total Cost	94	34,600,000	69,500,000	2,247	4,750,554	17,900,000
Profit	94	71,075.01	161,723.90	2,247	13,116.12	65,133.63

Table A3. Logit model for predicting propensity scores

Variables	Partnership
Firm Size	**1.980****
	(0.43)
Training	0.294
	(0.33)
Certification	**0.847****
	(0.30)
Digital Payment	**0.573****
	(0.24)
Collaborative Ability	**0.930****
	(0.23)
CEP	0.32
	(0.24)
School Year	**0.129****
	(0.04)
Age	**0.0199***
	(0.01)
Gender	**0.613****
	(0.26)
Cons	**-7.137****
	(0.83)
N	2,305

* and *** indicate significant at 10 percent and 5 percent levels, respectively; standard error in parenthesis.

Table A4. Balancing test and percentage biases before and after propensity score matching

Variable	Sample	Sample Average			%reduct
		Treated	Control	%bias	bias
Firm Size	Unmatched	0.135	0.009	50.2	
	Matched	0.135	0.124	4.5	91.1
Training	Unmatched	0.157	0.081	23.7	
	Matched	0.157	0.135	7	70.6
Certification	Unmatched	0.202	0.073	38.2	
	Matched	0.202	0.213	-3.3	91.3
Digital Payment	Unmatched	0.607	0.353	52.3	
	Matched	0.607	0.640	-7	86.7
Collaborative Ability	Unmatched	0.596	0.283	66	
	Matched	0.596	0.584	2.4	96.4
CEP	Unmatched	0.663	0.556	22	
	Matched	0.663	0.708	-9.2	58
School Year	Unmatched	12.225	10.372	51.9	
	Matched	12.225	12.000	6.3	87.9
Age	Unmatched	47.528	47.173	3.4	
	Matched	47.528	48.697	-11.1	-229.3
Gender	Unmatched	0.742	0.619	26.4	
	Matched	0.742	0.730	2.4	90.8

Table A5. Nearest Neighbor Result Estimation

	Nearest Neighbor	
	ATT	ATE
Productivity Participation	**0.281***	0.137
	(0.15)	(0.21)
Revenue Participation	**0.680****	**0.602****
	(0.17)	(0.28)
Export Participation	1.404	**6.503***
	(3.15)	(3.75)
Imported Input Participation	0.187	0.215
	(2.45)	(0.36)
Total Cost Participation	**0.891****	**0.789****
	(0.20)	(0.29)
Profit Participation	**0.904****	**0.776****
	(0.21)	(0.29)

Table A6. Original factor loadings

	SC Commitment	SCF	SCNF	SME Performance
BC1	0.729			
BC2	0.738			
BC3	0.766			
BC4	0.828			
BC5	0.864			
BC6	0.757			
BC7	0.739			
BUF1		0.675		
BUF2		0.778		
FAF1		0.820		
FAF2		0.782		
(INF) 1		0.693		
(INF) 2		0.680		
(INF) 3		0.683		
(POF) 1		0.796		
(POF) 2		0.823		
(RCF) 1		0.753		
(RVF) 1		0.790		
(RVF) 2		0.799		
(RVF) 3		0.861		
(SCNF1)			0.831	
(SCNF2)			0.785	
(SCNF3)			0.858	
(SCNF4)			0.868	
(SCNF5)			0.782	
(SCNF6)			0.888	
(SCNF7)			0.854	
(SCNF8)			0.802	
(SCNF9)			0.822	
(SMEFP1)				0.507
(SMEFP2)				0.628
(SMEFP3)				0.748
(SMEFP4)				0.494
(SMEFP5)				0.451
(SMEFP6)				0.794
(SMEOP1)				0.697
(SMEOP10)				0.812
(SMEOP11)				0.851
(SMEOP2)				0.725
(SMEOP3)				0.727
(SMEOP4)				0.755
(SMEOP5)				0.850
(SMEOP6)				0.890
(SMEOP7)				0.775
(SMEOP8)				0.889
(SMEOP9)				0.869
(TRK) 1		0.477		
(TRK) 2		0.366		
(TRK) 3		0.469		

Table A7. Factor loading after taking out invalid measures

	SC Commitment	SCF	SCNF	SME Performance
(BC1)	0.730			
(BC2)	0.739			
(BC3)	0.767			
(BC4)	0.828			
(BC5)	0.864			
(BC6)	0.756			
(BC7)	0.737			
(BUF) 1		0.669		
(BUF) 2		0.790		
(FAF) 1		0.824		
(FAF) 2		0.786		
(INF) 1		0.704		
(INF) 2		0.684		
(INF) 3		0.695		
(POF) 1		0.812		
(POF) 2		0.839		
(RCF) 1		0.762		
(RVF) 1		0.787		
(RVF) 2		0.807		
(RVF) 3		0.858		
(SCNF1)			0.831	
(SCNF2)			0.785	
(SCNF3)			0.858	
(SCNF4)			0.868	
(SCNF5)			0.782	
(SCNF6)			0.888	
(SCNF7)			0.854	
(SCNF8)			0.802	
(SCNF9)			0.822	
(SMEFP1)				0.510
(SMEFP2)				0.632
(SMEFP3)				0.754
(SMEFP6)				0.800
(SMEOP1)				0.680
(SMEOP10)				0.819
(SMEOP11)				0.861
(SMEOP2)				0.717
(SMEOP3)				0.718
(SMEOP4)				0.756
(SMEOP5)				0.859
(SMEOP6)				0.897
(SMEOP7)				0.775
(SMEOP8)				0.892
(SMEOP9)				0.868

Table A8. Construct reliability and validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
SC Commitment	0.889	0.894	0.913	0.602
SCF	0.944	0.951	0.950	0.597
SCNF	0.945	0.948	0.953	0.694
MSME Performance	0.951	0.960	0.957	0.602

Table A9. Heterotrait-monotrait ratio (HTMT)

	SC Commitment	SCF	SCNF	SME Performance
SC Commitment				
SCF	0.511			
SCNF	0.438	0.714		
SME Performance	0.686	0.402	0.525	

Table A10. Variance inflation factor (VIF)

	VIF
SC Commitment -> SME Performance	1.000
SCF -> SC Commitment	1.900
SCNF -> SC Commitment	1.900