The effect of supply network and management control system on the efficiency and profitability of manufacturing companies

Slamet Riyadi[a*], Mulyanto Nugroho[a] and Donny Arif[b]

[a]Universitas 17 Agustus 1945 Surabaya, Indonesia
[b]Universitas Maarif Hasyim Latif, Indonesia

CHRONICLE	ABSTRACT
	This research was conducted to analyze the influence of supply networks and management control systems on manufacturing companies' efficiency and profitability in East Java, Indonesia. With increasing competition, it takes the design of a system integrated to obtain profitability of the company. The study uses a quantitative descriptive method with a survey approach using a questionnaire data collection tool. Data analysis is operated using the theory of path analysis to determine the magnitude of the value of each construct calculated in the test equipment. From the results of the tests that have been conducted, only the supply network has no significant effect on efficiency. At the same time, other variables have a close and meaningful relationship. The study concluded that only one construct of the five hypotheses had an insignificant influence on bound variables. The main finding of this study is that companies should also have sensitivity to the social environment created as part of the supply network, as it can reduce the value of the Company's profitability if not designed appropriately and accurately.

1. Introduction

Companies in the era of the internet and digitization of the market very quickly impacted the very tight competition regarding production quality. Therefore, every manufacturing Company is expected to have a competitive advantage to survive. Good resource management will be able to improve the quality of goods produced to compete. This needs to be supported by the role of supply network strategy to generate innovation and efficiency. Supply network management can trim and conduct cross-border operations of organizations by ignoring networks in the form of partnerships and significant market share (Rezaei & Behnamian, 2021). In its development, the concept of a supply network focuses on solving business problems that are very important for customers related to distribution. Its primary purpose is as a tool of efficiency and flexibility to supply free products and reduce many unnecessary costs and time. The supply network integrates many companies into the supply network and measures healthy or undisturbed companies by a specific point in time (Basole & Bellamy, 2014). Many studies show that tight competition conditions strongly influence supply chain performance. Supply chain network problems need to be addressed by designing an efficient supply chain network system that involves different decision-making from supply to end consumers to be beneficial and reduce costs (Min et al., 2019). More companies engaged in manufacturing will increase the level of competition between companies. Wang et al. (2020) reported that decision-making results from consideration of overall network performance in terms of economy, environment, and social shows that obtain optimal solutions through Pareto and choose the most optimal solution based on its efficiency.

In contrast to traditional supply chain management that only focuses on handling economic performance by ignoring environmental and social performance, on overcoming it is necessary to approach remanufacturing, green manufacturing, reserve logistics, and so on (Eskandarpour et al., 2015). Thus, the optimization of the supply network can be a challenging task. The higher the intensity of competition and the improvement of the quality of products and raw materials, the better the designed control system to get maximum results. Therefore, the supply network strategy as the starting cornerstone of the production supply chain is also used as a management control system (MCS) to provide helpful information in decision making, planning, and evaluation. Chenhall and Moers (2015) argued that the management control system (MCS) is a formal activity that focuses on the financial and non-financial analysis of the business, which is used as the basis of motivation, control, and tools for the conduct of business executives as well as a guide in decision making. MCS itself consists of several systems: financial system, human resources (HR), sales, and strategic MCS (Davila et al., 2015). With MCS, it is expected that all parts of the company have one common goal and act by the agreed objectives. Therefore, the use of a management control system in the company is expected to improve the efficiency and performance of the company reasonably. Other research confirms the results of management control can reduce the tradeoff between efficiency and flexibility to some extent. Still, empirically MCS in this study describes the design of structural equations in the manufacturing industry capturing energy flexibility and management control design to calculate efficiency. In this study, researchers conducted field observations by calculating and observing the costs incurred on distribution lines and worked many controls through MCS to improve efficiency to performance in all parts of the Company. The goal to be achieved is that the supply chain effect can be achieved well and effectively.

Problem Formulation:

1. Does the supply network affect the efficiency of manufacturing companies in East Java, Indonesia?
2. Is there an influence of management control systems on the efficiency of manufacturing companies in East Java, Indonesia?
3. Does efficiency affect the profitability of manufacturing companies in East Java, Indonesia?
4. Does the supply network affect the profitability of manufacturing companies in East Java, Indonesia?
5. Is there an influence of management control system on the profitability of manufacturing companies in East Java, Indonesia?

2. Literature Review

Supply Network to the efficiency and profitability of the Company

The Company does business with other companies by building a supply network, an important channel for companies to obtain information and resources (Shi et al., 2020). Therefore, companies with a sound supply network system will be more efficient and can help the company be more competitive, making it easier for companies to get financing from external parties (Basole & Bellamy, 2014). The supply network is also used as an instrument of continuous assessment in evaluating goods and services to reduce the use of resources and see the environmental impact from a product life cycle perspective (Álvarez-Rodríguez et al., 2020). Kao et al. (2017) explain that the supply network can provide two interpretations, the first as a non-directional relationship that is like two companies through the contract process and then the second as a directed relationship representing the logistic flow from supply to buyer. So the sophisticated supply network model is fundamental to understand because the logistics process of the supply chain system is strongly influenced by the most basic network structure (Liu et al., 2012). Such a relationship will bring the desired dynamic behavior and improve all systems' efficiency (Nugroho et al., 2021a,b). The supply network is also used as a preventive risk management strategy to protect the supply flow through proactive redundancy, e.g., getting oversupply, stockpiling raw materials (Parajuli et al., 2021). So in many theories, it is explained that the supply network has the power to take a structured approach to get the most out of each supply chain flow of goods and services.

The supply network has social responsibility in the supply chain context, defined as social and ethical behavior towards all stakeholders (Mahdiraji et al., 2020). From a supply chain perspective, the supply network is designed to improve communication between companies by developing long-term relationships and increasing the Company's profit margins collectively (Govindan et al., 2012). Many studies also say that to increase the profitability of one member of a network, it must sacrifice other members of that network, but decision making with a coordinated approach results in increased profitability of all members (Mahdiraji et al., 2020).

Control System (MCS) management of the Company's efficiency and profitability

The dynamics of the Company's condition are influenced by the internal and external environment of the Company that requires appropriate means for the assessment and supervision and potential strategy misapprehensions. These requirements are summarized in the form of management control, which means that the approach or concept used is comprehensively incorporated in the term Management Control System (MCS) (Rieckhof et al., 2015). Efficiency becomes a resource goal that can only be achieved if the Company is committed to the target at a strategic level and will send it to all levels of the Company with a management control system (MCS) (Rieckhof et al., 2015). Management control is necessary to ensure quick problem-

solving and maintenance of family conditions and corporate organizational culture (Akroyd & Kober, 2020). According to Daina et al. (2019), Company's performance and efficiency appropriately can be used as a guideline in controlling the Company's quality. The management control system aims to ensure that their organization's behavior is consistent with the organizational strategy carried out. The effectiveness, efficiency, and goals of improving profitability can be achieved.

Conceptual Framework

A conceptual framework is the basis of this research because it is used to picture research, research process, and mechanism. In this study, it was determined that four variables would be studied. A classification of 2 free variables, namely supplies network (X_1) and Management Control System (X_2). While Variable mediator with the symbol (Z), efficiency and variable bound or (Y) is profitability.
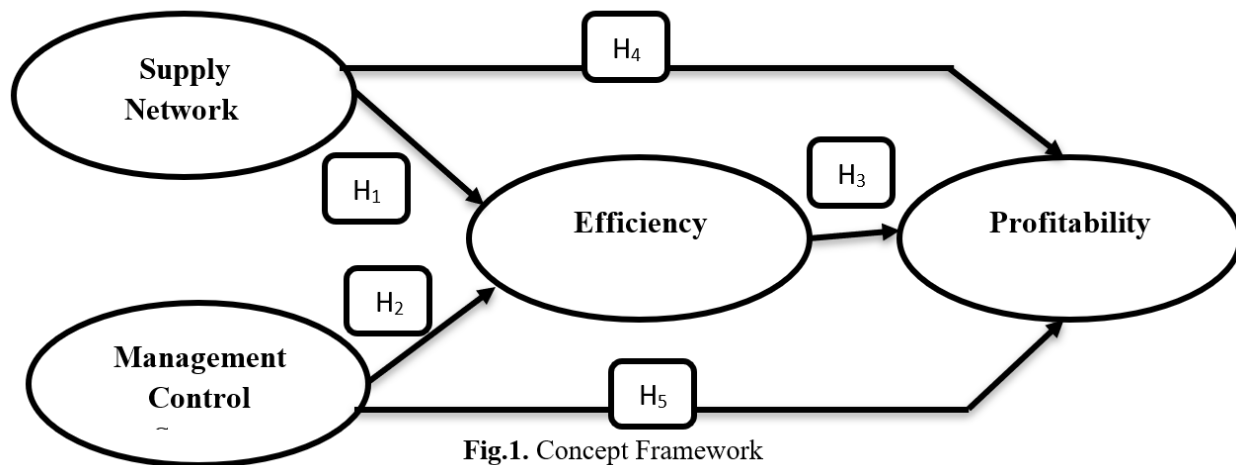

Fig.1. Concept Framework

3. Method

This research uses a survey research design to the companies' leaders of the supply network of manufacturing companies in East Java Province, Indonesia. By using a closed questionnaire device with two stages, we first analyze the measurement model, and the second examine the structural model.

3.1 Population and Samples

The population in this study is a company engaged in manufacturing in east Java, Indonesia, with 5024 companies.

The samples used in this study were manufacturing companies. By using the survey method to know and determine the sample size. Based on these considerations, the number of samples is calculated using the Slovin formula:

$$n = \frac{N}{1+Ne^2}$$

information

n = number of samples of manufacturing companies
N = number of manufacturing company populations
e^2 = Specified precision (Margin of error 10%)

$$n = \frac{5024}{1+(5024 \ x \ 0.1^2)}$$

n = 98 Respond

Data Processing and Data Analysis

This study uses the Partial Least Square (PLS) approach, using three-parameter estimations: first, weight estimate used to measure latent variable scores. The second is the estimation of the path by connecting latent variables and indicators. And the third relates to the means and values of the regression constants of latent variable indicators.

4. Result

Validity Test

Indicators are declared valid if they have a loading factor above 0.50 against the construct. The following is testing the first smartPLS output:
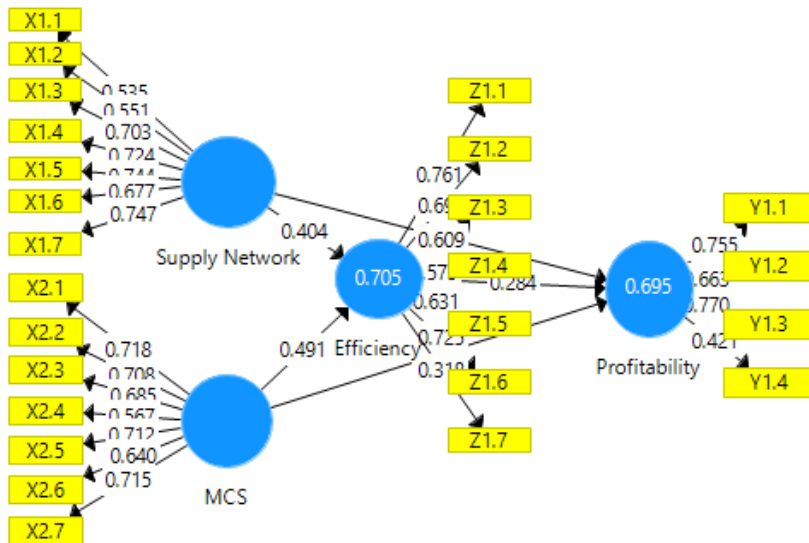

Fig. 2. Nilai Loading Factor Original

The first PLS algorithm shows some indicators of variables that must be removed from the model since it has a value of less than 0.50, namely, Z1.7 of variable efficiency indicator and Y1.4 of profitability variable.
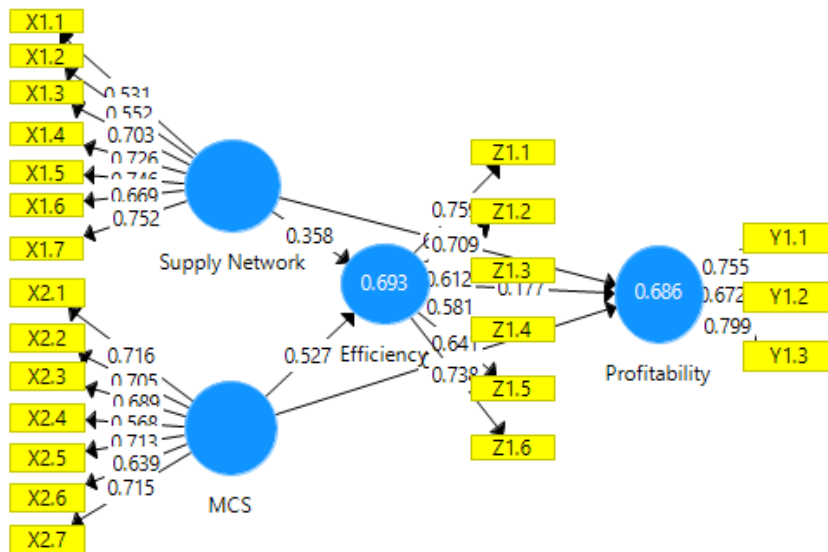

Fig. 3. Nilai Loading Factor Dropping

The results of the second smartPLS algorithm show loading factor have met the recommended value of 0.5. Thus, all indicators that have been done the second outer loading test have met the convergent validity.

Reliability Test

This test is done by looking at the value of composite reliability of the indicator block that measures the construct. If the value issued above 0.7 is considered satisfactory and meets the criteria of discriminant validity.

Table 1
Composite Reliability

Variable	X1 (Supply Network)	X2 (MCS)	Z (Efficiency)	Y (Profitability)
Composite Reliability	0.787	0.834	0.851	0.857

Table 1 shows the value by the rules of research reliability testing with a value above 0.7. Thus, all constructs in this study are declared feasible and reliable.

Inner Model

Testing continued after meeting the outer model criteria, and subsequently structural model (Inner Model) testing with R-Square value on the construct:
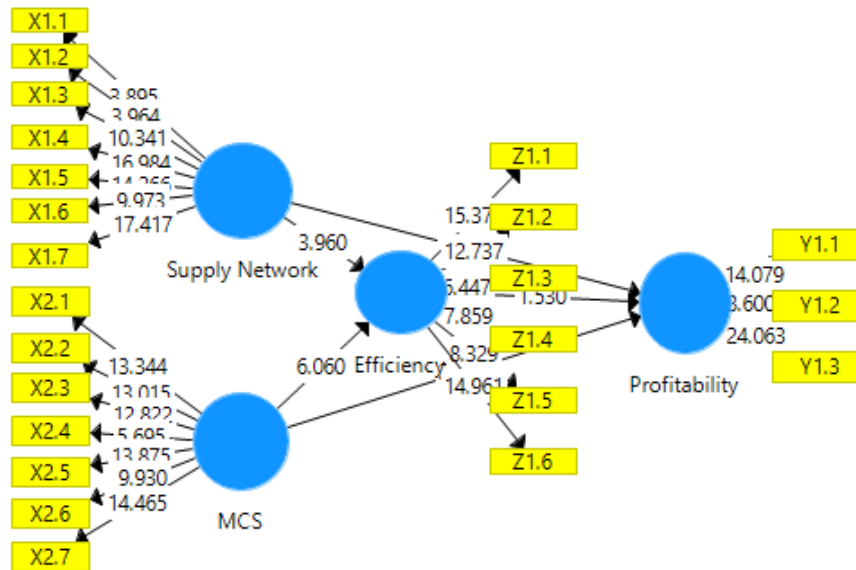
Table 2
R-Square

	R-Square
Z (Efficiency)	0.693
Y (Profitability)	0.686

This value provides a percentage proportion of the total variation in the independent variable described by the variable dependent.

1. The value of 0.693 (Z) variable efficiency indicates that the supply network and management control system can be explained with variable efficiency with a percentage of 69.3%, while the remaining 30.7% is not described in this study.
2. The value of 0.686 (Y) variable profitability indicates that the supply network and management control system can be explained by variable profitability with a percentage of 68.6%, while the remaining 31.4% is not described in this study.

To prove the hypothesis in this study can be seen from the results of the calculation bootstrapping report below:

Fig. 3. Output Bootstrapping

Table 3
Path Coefficient (Mean, STDEV, T-Values)

	Original Sample	Sample mean	T-Statistic	P Values	Information
Supply network ➜ Efficiency	0.177	0.170	1.530	0.127	Not Significant
MCS ➜ Efficiency	0.527	0.527	6.060	0.000	Significant
Supply network ➜ Profitability	0.490	0.494	5.949	0.000	Significant
MCS ➜ Profitability	0.225	0.230	2.626	0.009	Significant
Efficiency ➜ Profitability	0.358	0.360	3.960	0.000	Significant

Table 3 shows the significance of the relationship between variables studied with the following criteria:

    a.   If t-count > t-table, then the hypothesis is accepted.
    b.   If t-count > t-table, then the idea is rejected.

The t-table value of DF = 98 has a value of 1.66055

The result of the table above is described below:

Hypothesis 1: *Effect of supply network (X_1) on efficiency (Z)*
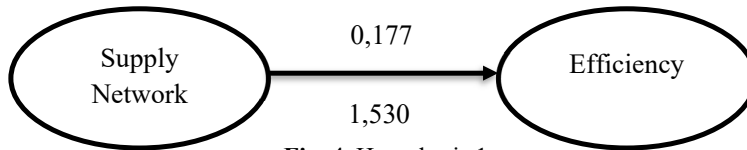

Fig. 4. Hypothesis 1

The results of the coefficient table path show that the supply network had an insignificant influence on efficiency with a t-count of 1,530 < 1.66055. The original positive value of 0.177 indicates the direction of the variable supply network to the efficiency is in the same order.

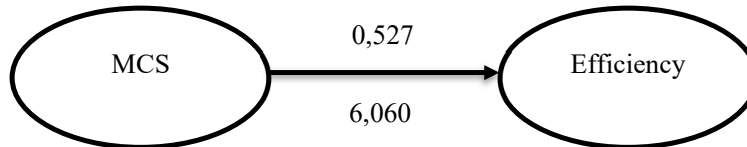**Hypothesis 2:** *Effect of MCS (X_2) on efficiency (Z)*

Fig. 5. Hypothesis 2

The results of the coefficient table path show that MCS has a significant influence on efficiency with a t-count of 6,060 > 1.66055. The original value of 0.527 indicates the direction of the MCS variable to efficiency is in the same order.

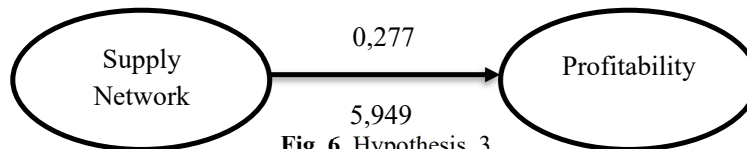**Hypothesis 3:** *Effect of supply network (X_1) on profitability (Y)*

Fig. 6. Hypothesis 3

The results of the table path coefficient show that the supply network has a significant influence on profitability with a t-count of 5,949 > 1.66055. The original value of 0.490 indicates the direction of the variable supply network to profitability is in the same order.

Hypothesis 4: *Effect of MCS (X_2) on profitability (Y)*
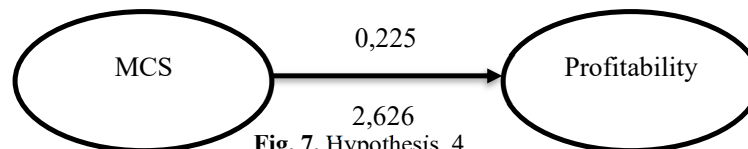

Fig. 7. Hypothesis 4

The results of the coefficient table path show that MCS has a significant influence on profitability with a t-count of 2,626 > 1.66055. The original value of 0.225 indicates the direction of the MCS variable against profitability is unidirectional.

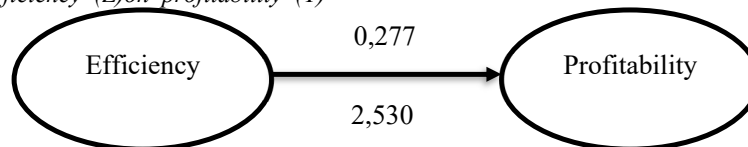**Hypothesis 5:** *Effect of Efficiency (Z)on profitability (Y)*

Fig. 8. Hypothesis 5

The results of the coefficient table path show that efficiency has a significant influence on profitability with a t-count of 2,530 > 1.66055. The original value of 0.277 indicates the direction of variable efficiency to profitability is unidirectional.

5. Discussion

1. Effect pf supply network (X_1) on efficiency (Z)

   Based on the PLS statistics table calculation results, the coefficient path explains the theoretical findings of supply network (X_1) has an insignificant influence on efficiency (Z) with a value of 0.177 P-Value 0.127. With a positive original sample value, it shows the direction of the relationship is in order. This conformity is also conducted by Shi et al. (2020) that the supply network structurally does not affect the efficiency of the Company in terms of overinvestment and negatively affects underinvestment, which means that the position of an extensive supply network does not reduce the underinvestment of the Company by reducing conflicts to the Company's agency system. The influence of supply network with efficiency shows the dynamics of the environment with supply demonstrated as one of the indicators, that the Company tends to delay in responding to substitution goods more and more to show the level of uncertainty of the Company is decreasing when viewed from the point of view of two variables studied this time. The Company must also have sensitivity to environmental threats to the network built, such as shipping constraints and stock of goods from other companies. With the uncertainty and danger of the number of substitute goods, it will be more challenging to calculate its profitability, which triggers a nominal value of the supply network to efficiency.

2. Effect of management control system (X_2) on efficiency (Z)

   Based on the pls statistics table calculation results, the coefficient path explaining the theoretical findings of MCS (X_2) has a significant influence on efficiency (Z) with a value of 0.527 P-Value 0.000. With a positive original sample value, it shows the direction of the relationship is in order. MCS consists of a system used by managers to assist them in making decisions on employee behavior consistent with organizational objectives. Efficient management behavior patterns require MCS to integrate differences and manage all conflicts to a minimum. This research is also by what was conducted by, which explained that efficiency to resources could be achieved if the Company commits to the strategies and targets to be completed. All companies must be integrated by transferring them to MCS. Thus, MCS can drive corporate change to be efficient to existing resources.

3. The indirect effect of supply network (X_1) on profitability (Y)

   Based on the PLS statistics table calculation results, the coefficient path explains the theoretical findings of supply network (X_1) significantly influence profitability (Y) with a value of 0.490 P-Value 0.000. With a positive original sample value, it shows the direction of the relationship is in order. The Supply network is designed to support the company's development from a severe threat; this system repositions every company's priority objective in the supply network to be competitive, facing the dangers caused by environmental dynamics factors. With this system, the distribution process becomes more structured, and business performance becomes smooth. The results achieved in this study answer the hypothesis that has been done at the beginning of the study that this is proven. This research is also conducted by those conducted by Zikopoulos and Tagaras (2015), who found that the supply network must be appropriately managed to reduce the cost of returning goods that occur at the time of distribution due to damage. This is done with the correct cost calculation and accuracy to obtain optimal system configuration and profitability.

4. The indirect influence of management control system (X_2) on profitability (Y)

   The PLS statistics table calculation results show that the coefficient path explains the theoretical findings of MCS (X_2) significantly influence profitability (Y) with a value of 0.225 P-Value 0.009. With a positive original sample value, it shows the direction of the relationship is in order. The significant influence of variable MCS indicates that the system that has been established can be integrated well and can provide suitable decision-making options to get the predicted value of profit desired by the Company. This research is the same as that conducted by Akroyd and Kober (2020). Applying the initial identification of recruitment to have a solid emotional closeness will form a new organizational cultural character; this will increase the rhythm of work, and interaction will be well established with each other. Thus the Company's goal to focus more on suitable performance activities will be achieved by the embodiment of the value of emotional closeness as the basis taken for improving the Company's performance and profitability.

5. Effect of efficiency (Z) on profitability (Y)

   Based on the results of PLS statistics table calculations show that the coefficient path explains the theoretical findings of efficiency (Z) has a significant influence on profitability (Y) with a value of 0.277 P-Value 0.000. With a positive original sample value, it shows the direction of the relationship is in order. The two variables above have a significant relationship that cannot be separated from the supply network and management control system integrated well in the

internal or external Company. Every Company has a unique way to get the most out of it. In this research, the role of the company manager is very central to get fast information and make the right decisions through a coordinative work system and the speed of communication networks. With the running of all systems efficiently, profitability will run well.

6. Conclusion

1. Effect of supply network (X_1) on efficiency (Z)
   Based on the PLS statistics table calculation results, the coefficient path explains the theoretical findings of supply network (X_1) has an insignificant influence on efficiency (Z) with a value of 0.177 P-Value 0.127. With a positive original sample value, it shows the direction of the relationship is in order.
2. Effect of management control system (X_2) on efficiency (Z)
   Based on the results of PLS statistics table calculation shows that coefficient path explains the theoretical findings of MCS (X_2) significantly influence efficiency (Z) with a value of 0.527 P-Value 0.000. With a positive original sample value, it shows the direction of the relationship is in order.
3. The indirect effect of supply network (X_1) on profitability (Y)
   Based on the PLS statistics table calculation results, the coefficient path explains the theoretical findings of supply network (X_1) has a significant influence on profitability (Y) with a value of 0.490 P-Value 0.000. With a positive original sample value, it shows the direction of the relationship is in order.
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References

Akroyd, C., & Kober, R. (2020). Imprinting founders' blueprints on management control systems. *Management Accounting Research*, *46*, 100645. https://doi.org/https://doi.org/10.1016/j.mar.2019.07.002

Álvarez-Rodríguez, C., Martín-Gamboa, M., & Iribarren, D. (2020). Sustainability-oriented efficiency of retail supply chains: A combination of Life Cycle Assessment and dynamic network Data Envelopment Analysis. *Science of The Total Environment*, *705*, 135977. https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.135977

ARIF, D., YUCHA, N., SETIAWAN, S., OKTARINA, D., MARTAH, V., & MUTTAQIIN, N. (2020). Applications of Goods Mutation Control Form in Accounting Information System: A Case Study in Sumber Indah Perkasa Manufacturing, Indonesia. *The Journal of Asian Finance, Economics and Business*, *7*(8), 419–424.

Basole, R., & Bellamy, M. (2014). Supply Network Structure, Visibility, and Risk Diffusion: A Computational Approach. *Decision Sciences*, *45*. https://doi.org/10.1111/deci.12099

Chenhall, R. H., & Moers, F. (2015). The role of innovation in the evolution of management accounting and its integration into management control. *Accounting, Organizations and Society*, *47*, 1–13. https://doi.org/https://doi.org/10.1016/j.aos.2015.10.002

Daina, L. G., Sabău, M., Daina, C. M., Neamțu, C., Tit, D. M., Buhaș, C. L., Bungau, C., Aleya, L., & Bungau, S. (2019). Improving performance of a pharmacy in a Romanian hospital through implementation of an internal management control system. *Science of The Total Environment*, *675*, 51–61. https://doi.org/https://doi.org/10.1016/j.scitotenv.2019.04.231

Davila, A., Foster, G., & Jia, N. (2015). The Valuation of Management Control Systems in Start-Up Companies: International Field-Based Evidence. *European Accounting Review*, *24*(2), 207–239. https://doi.org/10.1080/09638180.2014.965720

Eskandarpour, M., DEJAX, P., Miemczyk, J., & Péton, O. (2015). Sustainable supply chain network design: An optimization-oriented review. *Omega*, *54*. https://doi.org/10.1016/j.omega.2015.01.006

Govindan, K., Diabat, A., & Popiuc, M. N. (2012). Contract analysis: A performance measures and profit evaluation within two-echelon supply chains. *Comput. Ind. Eng.*, *63*, 58–74.

Jia, P., Amoozad Mahdiraji, H., & Meidute-Kavaliauskiene, I. (2013). Leadership selection in an unlimited three-echelon supply chain. *Journal of Business Economics and Management*, *14*, 616–637. https://doi.org/10.3846/16111699.2012.761648

Kao, T.-W. (Daniel), Simpson, N. C., Shao, B. B. M., & Lin, W. T. (2017). Relating supply network structure to productive efficiency: A multi-stage empirical investigation. *European Journal of Operational Research*, *259*(2), 469–485. https://doi.org/https://doi.org/10.1016/j.ejor.2016.11.008

Liu, S., Li, C., Feng, Y., & Rong, G. (2012). Network Structure and Logistics Efficiency: A New Approach to Analyse Supply Chain System. In I. D. L. Bogle & M. B. T.-C. A. C. E. Fairweather (Eds.), *22 European Symposium on Computer Aided Process Engineering* (Vol. 30, pp. 392–396). Elsevier. https://doi.org/https://doi.org/10.1016/B978-0-444-59519-5.50079-4

Mahdiraji, H. A., Hafeez, K., Jafarnejad, A., & Rezayar, A. (2020). An analysis of the impact of negative CSR 'forced labour'

parameter on the profitability of supply chain contracts. *Journal of Cleaner Production*, *271*, 122274. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.122274

Min, S., Zacharia, Z. G., & Smith, C. D. (2019). Defining Supply Chain Management: In the Past, Present, and Future. *Journal of Business Logistics*, *40*(1), 44–55. https://doi.org/https://doi.org/10.1111/jbl.12201

Nugroho, M., Arif, D., & Halik, A. (2021a). *The effect of financial distress on stock returns , through systematic risk and profitability as mediator variables*. 7, 1717–1724. https://doi.org/10.5267/j.ac.2021.4.026

Nugroho, M., Arif, D., & Halik, A. (2021b). The effect of loan-loss provision, non-performing loans and third-party fund on capital adequacy ratio. *Accounting*, *7*(10), 943–950. https://doi.org/10.5267/j.ac.2021.1.013

Parajuli, A., Kuzgunkaya, O., & Vidyarthi, N. (2021). The impact of congestion on protection decisions in supply networks under disruptions. *Transportation Research Part E: Logistics and Transportation Review*, *145*, 102166. https://doi.org/https://doi.org/10.1016/j.tre.2020.102166

Rezaei, S., & Behnamian, J. (2021). A survey on competitive supply networks focusing on partnership structures and virtual alliance: New trends. *Journal of Cleaner Production*, *287*, 125031. https://doi.org/10.1016/j.jclepro.2020.125031

Rieckhof, R., Bergmann, A., & Guenther, E. (2015). Interrelating material flow cost accounting with management control systems to introduce resource efficiency into strategy. *Journal of Cleaner Production*, *108*, 1262–1278. https://doi.org/https://doi.org/10.1016/j.jclepro.2014.10.040

Shi, J., Yang, J., & Li, Y. (2020). Does supply network location affect corporate investment efficiency? *Research in International Business and Finance*, *51*, 101107. https://doi.org/https://doi.org/10.1016/j.ribaf.2019.101107

Wang, Y., Shi, Q., Hu, Q., You, Z., Bai, Y., & Guo, C. (2020). An efficiency sorting multi-objective optimization framework for sustainable supply network optimization and decision making. *Journal of Cleaner Production*, *272*, 122842. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.122842

Zikopoulos, C., & Tagaras, G. (2015). Reverse supply chains: Effects of collection network and returns classification on profitability. *European Journal of Operational Research, 246*(2), 435-449.