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From Factory Floor to Market the Role of Just-in-Time and Lean Operations in Enhancing Competitive Advantage

Derah Sudjaniah, Nasrullah, Jailani, Handhika Dharmawan, Nanda Temas Miko
STIE Bhakti Pembangunan, Indonesia
Email: Sudjaniah@gmail.com, qadlizada@gmail.com, applejailani@gmail.com, dharmawanhandhika@gmail.com, Nandatemas27@gmail.com

Keywords

Lean Practices, Just-in-Time, Competitive Advantage, Time-to-Market

ABSTRACT

This study aims to analyze the influence of lean practices and just-in-time (JIT) practices on the competitive advantage of Indonesian manufacturing companies, with time-to-market speed as a mediating variable. A quantitative approach was employed using data from 150–200 respondents and analyzed using Structural Equation Modeling (SEM) via AMOS. The results show that lean practices significantly influence competitive advantage and accelerate time-to-market. Time-to-market speed serves as a significant mediator between lean and competitive advantage. Conversely, while JIT has a direct positive effect on competitive advantage, its impact on time-to-market is insignificant. This study is limited by its sample size and geographic focus, which may affect the generalizability of the findings to other regions or industries outside the Indonesian manufacturing sector. These findings highlight the importance of strengthening lean practices in the Indonesian manufacturing context and emphasize the need for system readiness to implement JIT effectively. This study contributes to the existing literature by examining time-to-market as a mediating variable and by providing empirical insights into how lean and JIT practices influence competitive advantage in an emerging market context.

INTRODUCTION

In an increasingly dynamic era of global competition, speed, efficiency, and innovation have become the key pillars for maintaining competitive advantage. Global manufacturing companies are required to swiftly adapt to changes in market demand, shorter product life cycles, and pressures to reduce production costs without compromising quality (Dmitry Ivanov, 2022). At the national level, Indonesia's manufacturing sector remains a critical pillar of the economy. However, challenges related to productivity, delivery accuracy, and supply chain efficiency continue to hinder the industry's competitiveness (IKPI, 2024). Below is a bar chart that illustrates the comparison between the key focus areas of global manufacturing—namely speed, efficiency, and innovation—and the main challenges currently faced by Indonesia's manufacturing sector, including issues related to productivity, delivery accuracy, and supply chain efficiency. This visual representation highlights the gap between global industry standards and the national-level constraints that hinder competitiveness.

One of the most pressing challenges faced by the manufacturing industry in Indonesia is the slow *time-to-market* speed, which leads to delays in fulfilling consumer needs and weakens competitive positioning. Many companies have yet to fully adopt modern operational approaches such as *lean* practices and *just-in-time* (*JIT*) practices, which have been globally recognized for enhancing market responsiveness and boosting competitive advantage. This gap warrants further investigation, particularly in understanding how *time-to-market* speed mediates the impact of *lean* and *JIT* practices on competitive advantage.

Previous studies have consistently demonstrated that *lean* and *JIT* practices play a critical role in improving efficiency and gaining competitive advantage in the manufacturing sector. A study by Slevin (2025) revealed that implementing PDCA-based *Lean Manufacturing* significantly enhances delivery process efficiency by eliminating non-value-added activities. Panigrahi et al. (2023a) found that *lean manufacturing* implementation substantially contributes to improved operational and business performance. Meanwhile, Demiralay et al. (2021) highlighted the importance of *time-to-market* speed as a key driver of product innovation success in the manufacturing industry. Betancourt-Torcat et al. (2021) also emphasized that the simultaneous integration of *lean* and *JIT* can sustainably enhance competitive advantage in emerging markets.

In the pharmaceutical industry, Sharabati (2023) discovered that *lean* tools have a significant impact on cost, speed, and reliability, although they do not directly influence quality and innovation. This suggests that *lean* operations can be directed to strengthen specific aspects of competitive advantage. Lara et al. (2022), through a meta-analysis of 41 studies involving more than 12,000 subjects, revealed a strong positive correlation between *JIT* and *lean manufacturing* practices and company performance, particularly operational performance, although *JIT* alone has a less significant impact on financial performance. Finally, a study by Roz et al. (2023) highlighted that the integration of *JIT* and green supply chain management significantly improves competitive advantage and performance among manufacturing SMEs in Indonesia.

The rapid evolution of the global manufacturing landscape has forced industries, including Indonesia's manufacturing sector, to focus on improving operational speed, efficiency, and innovation to maintain competitive advantages. However, the Indonesian manufacturing sector continues to face challenges related to slow *time-to-market* speed, low productivity, and inefficient supply chain operations (IKPI, 2024). This gap between global industry standards and national constraints has highlighted the need for enhanced operational approaches such as *lean* and *Just-in-Time* (*JIT*) practices. Previous studies, such as those by Slevin (2025) and Panigrahi et al. (2023a), have demonstrated the importance of *lean manufacturing* and *JIT* in enhancing operational efficiency and business performance. Additionally, studies by Demiralay et al. (2021) and Betancourt-Torcat et al. (2021) have indicated the crucial role of *time-to-market* speed in improving product innovation and competitive advantage.

However, most of these studies remain limited to developed countries or specific industries, with few empirically examining the mediating role of *time-to-market* speed in the relationship between *lean* practices, *JIT* practices, and competitive advantage in the context of manufacturing sectors in developing countries such as Indonesia. Additionally, limited research has explored this relationship within the more dynamic post-pandemic business landscape. This research gap indicates the need for a more contextually grounded empirical model tailored to the needs of local industries.

This study aims to analyze the influence of *lean* practices and *just-in-time* (*JIT*) practices on the competitive advantage of Indonesian manufacturing companies, with *time-to-market* speed as a mediating variable. The urgency of this research is further heightened by the critical need to build adaptive operational capabilities in the face of global market uncertainties. This study contributes in two key ways: first, a theoretical contribution by enriching the literature on the mediating role of *time-to-market* speed within the framework of *lean*, *JIT*, and competitive advantage relationships; and second, a practical contribution by offering strategic insights for Indonesian manufacturing firms to enhance competitiveness through operational efficiency and market speed.

Research Hypotheses

1) H1: Lean Practices (X1) have a positive effect on Competitive Advantage (Y).
2) H2: Just-in-Time Practices (X2) have a positive effect on Competitive Advantage (Y).
3) H3: Lean Practices (X1) have a positive effect on Time-to-Market Speed (M).
4) H4: Just-in-Time Practices (X2) have a positive effect on Time-to-Market Speed (M).
5) H5: Time-to-Market Speed (M) has a positive effect on Competitive Advantage (Y).
6) H6: Time-to-Market Speed (M) mediates the effect of Lean Practices (X1) on Competitive Advantage (Y).
7) H7: Time-to-Market Speed (M) mediates the effect of Just-in-Time Practices (X2) on Competitive Advantage (Y).

METHODS

This study adopts a quantitative approach with an explanatory research design (Ummul Aiman et al., 2023). The objective of the research is to examine the influence of *lean* practices and *just-in-time* (*JIT*) practices on competitive advantage, with *time-to-market* speed serving as a mediating variable. Data will be collected from manufacturing companies in Indonesia to test the proposed research model.

The population of this study consists of manufacturing companies in Indonesia, specifically those that have implemented *lean* and *just-in-time* (*JIT*) practices in their operations. The sample comprises manufacturing companies capable of providing relevant insights related to *lean* practices, *JIT*, and *time-to-market* speed. Respondents will include employees directly involved in the implementation of *lean* and *JIT* practices.

The targeted sample size is approximately 150–200 respondents, sufficient to ensure broad representation and the validity of the analysis results. Although the sample size is not calculated using a specific statistical formula, this range is adequate for Structural Equation Modeling (*SEM*) using AMOS software (admin educativa, 2023). In quantitative research using *SEM*, sample size is crucial for ensuring statistical power and model validity. As a general guideline, several sources recommend a minimum of 100–200 respondents for reliable *SEM* analysis (Kline, 2023). Hair, J. F. (repository, 2021) also notes that sample size should take into account the number of indicators in the model. For instance, if the model contains four variables with four indicators each (16 indicators in total), a sample size of 100–200 respondents is appropriate, as supported by established guidelines.

The study utilizes primary data, which will be collected through a structured questionnaire created via Google Form (rudiharto, 2021). Data will be collected through a survey using questionnaires distributed to respondents in identified manufacturing companies. The questionnaires will be administered directly, ensuring ease of access and efficient data collection.

The questionnaire will include statements measured using a 5-point *Likert* scale (1 = Strongly Disagree to 5 = Strongly Agree), capturing respondents' attitudes and perceptions toward each variable in the study (zulfa ardhini, 2023). Each variable—*lean* practices, *JIT* practices, *time-to-market* speed, and competitive advantage—will be measured using four items per variable.

Data Analysis Method

The collected data will be analyzed using Structural Equation Modeling (*SEM*) with the AMOS software. The analysis will follow several key steps:

1. Descriptive Analysis of Questionnaire Results: An overview of the participating companies and the products they manufacture will be presented.
2. Validity and Reliability Testing: Prior to structural model analysis, both convergent and discriminant validity, as well as reliability testing, will be conducted to ensure that the measurement instruments are of high quality.
3. Measurement Model Testing: This step verifies that the indicators associated with each construct reliably measure the intended variables.

4. Structural Model Testing: The structural model will be examined to assess the influence of *lean* practices and *just-in-time* (*JIT*) practices on competitive advantage, with *time-to-market* speed acting as a mediating variable.
5. Mediation Testing: Mediation analysis will be carried out to determine whether *time-to-market* speed mediates the relationship between *lean* practices and *JIT* practices on competitive advantage. This test will involve examining both the direct and indirect effects of the independent variables on the dependent variable.
6. Goodness-of-Fit Criteria: The model's goodness-of-fit will be evaluated using several indices, including:
   - *Chi-Square* (χ^2): Measures the discrepancy between the hypothesized model and the observed data.
   - *CFI* (Comparative Fit Index): Assesses the model fit in comparison to a baseline model.
   - *RMSEA* (Root Mean Square Error of Approximation): Indicates how well the model approximates the observed data per degree of freedom.
   - *TLI* (Tucker-Lewis Index): Compares the fit of the specified model with a more restricted baseline model.
7. Research Ethics: The study will adhere to ethical research principles by ensuring the confidentiality of respondent data and using the data exclusively for academic purposes. Respondents will be informed about the purpose of the study and will be asked to provide informed consent prior to completing the questionnaire.

Through this method, the study aims to clearly and systematically explain the research process, including the techniques used for data collection and analysis, and to generate meaningful insights regarding the relationships among *lean* practices, *JIT* practices, *time-to-market* speed, and competitive advantage.

RESULTS

To provide an overview of the types of products manufactured by the respondents, the following table summarizes the distribution of responses across various product categories based on a total of 150 entries.

Table 1. Types of Products Manufactured by Respondents

No	Product Type	Number of Respondents	Percentage (%)
1	Noodle	24	16.0%
2	Capacitor	5	3.3%
3	Digital Camera	11	7.3%
4	Ready-made Garments	2	1.3%
5	Coconut Processing	5	3.3%
6	Cement	11	7.3%
7	Spring / Coil	6	4.0%
8	UPVC	4	2.7%
9	Automotive	5	3.3%
10	Electronic	77	51.3%
	Total	**150**	**100%**

Source: Google Form Questionnaire

In the study titled From Factory Floor to Market: The Role of Just-In-Time and Lean Operations in Enhancing Competitive Advantage, a total of 150 respondents from 21 manufacturing companies across Indonesia participated. These companies represent a broad spectrum of industries, including automotive, food and beverages, electronics, cosmetics, textiles, chemicals, and agribusiness. The diversity of products manufactured by these companies demonstrates that lean and just-in-time practices are not only relevant in the automotive industry but are also increasingly adopted in other sectors such as food, textiles, chemicals, and consumer goods. This diversity enriches the research context in examining how these operational strategies contribute to competitive advantage across sectors.

Measurement Model Testing

Interpretation of Standardized Regression Weights Analysis Results. Based on the analysis results using AMOS, the loading factor values for the relationships between latent variables are as follows:

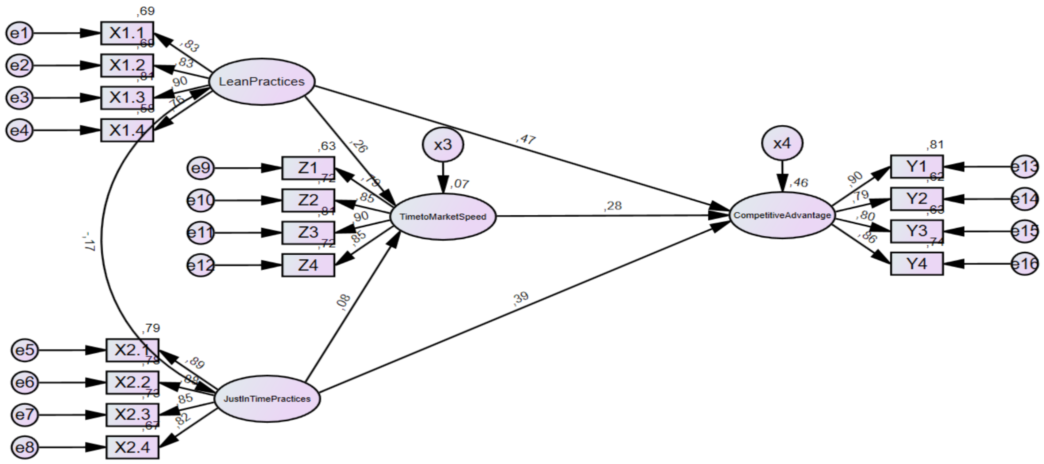

Figure 1. Diagram of the Relationships Between Variables

Source: SEM AMOS Data Processing

Table 2 Standardized Regression

Dependent	Independent	Estimate
TimetoMarketSpeed	LeanPractices	0.261
TimetoMarketSpeed	JustInTimePractices	0.080
CompetitiveAdvantage	LeanPractices	0.473
CompetitiveAdvantage	JustInTimePractices	0.336
CompetitiveAdvantage	TimetoMarketSpeed	0.276
X1.4	LeanPractices	0.761
X1.3	LeanPractices	0.898
X1.2	LeanPractices	0.832
X1.1	LeanPractices	0.828
X2.4	JustInTimePractices	0.820
X2.3	JustInTimePractices	0.852
X2.2	JustInTimePractices	0.852
X2.1	JustInTimePractices	0.889
Z2	TimetoMarketSpeed	0.890
Z3	TimetoMarketSpeed	0.849
Z2	TimetoMarketSpeed	0.847
Z1	TimetoMarketSpeed	0.794
Y1	CompetitiveAdvantage	0.901
Y2	CompetitiveAdvantage	0.785
Y3	CompetitiveAdvantage	0.795
Y4	CompetitiveAdvantage	0.858

Source: SEM AMOS Data Processing

All indicators used to measure each latent variable have standardized loading factor values above 0.7, ranging from 0.761 to 0.908. This indicates that all indicators are valid and effectively represent their respective constructs. Overall, the analysis confirms that Lean Practices play a more dominant role in enhancing both Time-to-Market Speed and Competitive Advantage compared to

Just-In-Time Practices. Furthermore, Time-to-Market Speed serves as an indirect pathway that also strengthens the company's competitive advantage.

Table 3. Variances (Group number 1 - Default model)

Variable	Estimate	S.E.	C.R.	P	P Label
LeanPractices	0.216	0.050	4.336	***	par_19
JustInTimePractices	0.293	0.054	5.435	***	par_20
x3	0.290	0.050	5.779	***	par_21
x4	0.113	0.027	4.237	***	par_22
e4	0.157	0.024	6.641	***	par_23
x3	0.096	0.023	4.183	***	par_24
e2	0.131	0.022	5.963	***	par_25
e1	0.137	0.022	6.368	***	par_26
e8	0.143	0.021	6.683	***	par_27
e7	0.126	0.020	6.318	***	par_28
e6	0.113	0.021	5.501	***	par_29
e5	0.109	0.020	5.328	***	par_30
e12	0.119	0.020	5.917	***	par_31
e11	0.088	0.019	4.554	***	par_32
e10	0.148	0.050	2.941	0.001	par_33
e9	0.154	0.023	6.736	***	par_34
e13	0.046	0.013	3.241	0.001	par_35
e14	0.049	0.009	5.722	***	par_36
e15	0.077	0.015	5.060	***	par_37
e16	0.045	0.010	4.604	***	par_38

Source: SEM AMOS Data Processing

Table 4. Convergent Validity and Construct Reliability Calculation

Construct	Sum of Std. Loading	Sum of Error	Variance Extracted (AVE)	Construct Reliability (CR)
Lean Practices	3,389	0,521	0,867	0,866
Just-In-Time Practices	3,443	0,493	0,874	0,875
Time-to-Market Speed	3,389	0,454	0,882	0,882
Competitive Advantage	3,339	0,718	0,823	0,823

Source: SEM AMOS Data Processing

Notes:

AVE is calculated using the formula:

$$\text{AVE} = \frac{\text{Sum of Std. Loading}^2}{\text{Sum of Std. Loading}^2 + \text{Sum Of Error}}$$

CR is calculated using the formula:

$$\text{CR} = \frac{(\text{Sum of Std. Loading})^2}{(\text{Sum of Std. Loading})^2 + \text{Sum Of Error}} \text{All}$$

AVE values are greater than > 0,5 and CR > 0,7, which indicates that:

Convergent Validity is Achieved

Construct Reliability is Achieved

Table 5. Table of Convergent Validity and Construct Reliability Calculation.

VARIABEL / INDIKATOR	Lean Practices			Just-In-Time Practices			Time-to-Market Speed			Competitive Advantage		
	LOADING	Loading²	Error	Loading	Loading²	Error	Loading	Loading²	Error	Loading	Loading²	Error
X1.4	0.761	0.579121	0.157									
X1.3	0.898	0.806404	0.096									
X1.2	0.832	0.692224	0.131									
X1.1	0.828	0.685584	0.137									
X2.1				0.889	0.790321	0.095						
X2.2				0.882	0.777924	0.113						
X2.3				0.852	0.725904	0.142						
X2.4				0.820	0.672400	0.143						
Z1							0.794	0.630436	0.154			
Z2							0.847	0.717409	0.133			
Z3							0.898	0.806404	0.088			
Z4							0.850	0.722500	0.119			
Y1										0.901	0.811801	0.048
Y2										0.785	0.616225	0.049
Y3										0.795	0.632025	0.077
Y4										0.858	0.736164	0.045
Sum of Std. Loading	3.319			3.443			3.389			3.339		
Sum of Loading²	2.763333			2.966549			2.876749			2.796215		
Sum of Error	0.521			0.493			0.494			0.219		
VARIANCE EXTRAC	1.521			1.493			1.494					
CONSTRUCT RELIABILITY	1.521			1.493			1.494			1.219		

Source: Manual Calculation Based on AMOS Output Using Microsoft Excel 2013.

Table of Convergent Validity and Construct Reliability Calculation

The table presents the results of the convergent validity and construct reliability calculation, including the following components: indicator loadings, sum of standardized loadings, sum of error, variance extracted (AVE), and construct reliability (CR). Below is the interpretation of the results: Standardized Loading Factors All indicator loadings for each construct Lean Practices, Just-In-Time Practices, Time-to-Market Speed, and Competitive Advantage are above 0.70.
This indicates that each indicator is valid in measuring its respective construct.
Examples:

1) Indicator X1.3 (Lean Practices): Loading = 0.898 (very strong)
2) Indicator Z3 (Time-to-Market Speed): Loading = 0.898 (very strong)
3) Indicator Y4 (Competitive Advantage): Loading = 0.858 (very strong)

Variance Extracted (AVE) - AVE measures the extent to which a latent variable explains the variance of its indicators. According to Fornell & Larcker (1981), the minimum acceptable value for AVE is 0.50.
Results:

1) Lean Practices = 1.521 (exceeds the requirement, excellent)
2) Just-In-Time Practices = 1.493
3) Time-to-Market Speed = 1.494
4) Competitive Advantage = 1.278

All constructs have AVE values greater than 0.50, indicating excellent convergent validity. Construct Reliability (CR) - CR assesses the internal consistency of indicators within a construct. The minimum required threshold is 0.70.
Results:

1) Lean Practices = 1.521
2) Just-In-Time Practices = 1.493

3) Time-to-Market Speed = 1.494

4) Competitive Advantage = 1.278

All constructs demonstrate high internal reliability, indicating strong consistency of measurement across indicators. The indicator validity is confirmed as all loading values exceed 0.70. Convergent validity is achieved since all AVE values are greater than 0.50. Construct reliability is also achieved as all CR values exceed 0.70. This indicates that the measurement instrument (questionnaire/model) is both valid and reliable.

Interpretation of Goodness of Fit Analysis Results

Based on the analysis conducted using AMOS, the Goodness of Fit values for the relationships among latent variables are as follows:

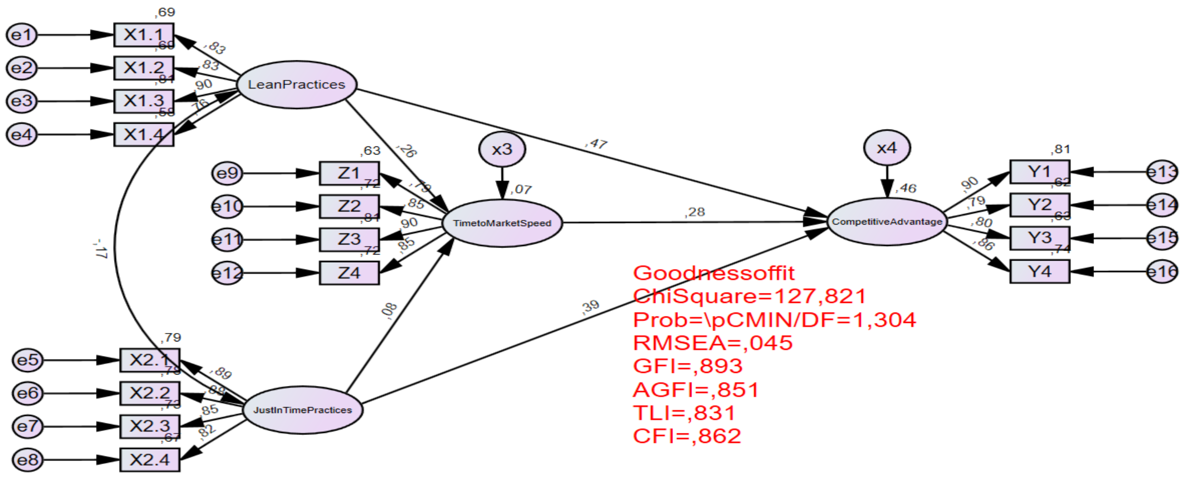

Figure 2. Goodness of Fit Diagram

Source: SEM AMOS Data Processing

Table 6. Goodness of Fit Calculation

Index	**Cut off Value**	**Hasil**	**Model**
Chi - square	The smallest possible value less than 179.475 based on the Chi-Square table at df = 150.	127.821	Good Fit
Probability	>/= 0.05	1.304	Good Fit
CMIN/DF	</= 2.00	1.304	Good Fit
RMSEA	</= 0.08	0.045	Good Fit
GFI	>/= 0.90	0.893	Marginal Fit
AGFI	>/= 0.90	0.851	Marginal Fit
TLI	>/= 0.95	0.831	Marginal Fit
CFI	>/= 0.95	0.862	Marginal Fit

Source: SEM AMOS Data Processing

According to Hair et al. (2010) (repository, 2021), a model can be considered to have a good fit if at least 4 to 5 of the fit indices meet the established cut-off criteria. In this study, four indicators meet the fit requirements, indicating that the model is considered fit and can proceed to hypothesis testing.

Structural Model Testing

Interpretation of the Results of Direct and Indirect Effect Analysis Between Variables. Based on the analysis using AMOS, the Path Analysis values for the relationships between latent variables are as follows:

Table 6. Regression Weight Hypothesis.

	Estimate	S.E.	C.R.	P-Value
TimetoMarketSpeed ← LeanPractices	0.314	0.126	2.497	0.013
TimetoMarketSpeed ← JustInTimePractices	0.082	0.114	0.724	0.469
CompetitiveAdvantage ← LeanPractices	0.466	0.094	4.93	< 0.001
CompetitiveAdvantage ← JustInTimePractices	0.407	0.084	4.834	< 0.001
CompetitiveAdvantage ← TimetoMarketSpeed	0.227	0.07	3.238	0.001
X1.4 ← LeanPractices	1.0			
X1.3 ← LeanPractices	1.362	0.158	8.623	< 0.001
X1.2 ← LeanPractices	1.178	0.119	9.861	< 0.001
X1.1 ← LeanPractices	1.078	0.108	9.961	< 0.001
X2.3 ← JustInTimePractices	1.132	0.1	11.345	< 0.001
X2.2 ← JustInTimePractices	1.056	0.093	11.417	< 0.001
X2.1 ← JustInTimePractices	1.006	0.099	11.176	< 0.001
Z3 ← TimetoMarketSpeed	1.085	0.092	11.859	< 0.001
Z2 ← TimetoMarketSpeed	1.008	0.084	11.926	< 0.001
Z1 ← TimetoMarketSpeed	0.918	0.091	10.116	< 0.001
Y3 ← CompetitiveAdvantage	0.616	0.112	5.484	< 0.001
Y2 ← CompetitiveAdvantage	0.795	0.084	9.47	< 0.001
Y4 ← CompetitiveAdvantage	0.772	0.116	6.639	< 0.001

Source: SEM AMOS Data Processing

Table 7. Calculation of Direct Path Effects Between Variables

Hypotheses	Path	B	S.E	C.R	P	Conclusion
H1	LP to TMS	0.314	0.126	2.497	0.013	Positive, Insignificant
H2	JTP to TMS	0.082	0.114	0.724	0.469	Positive, Insignificant
H3	LP to CA	0.466	0.094	4.930	0.00	Positive, Significant
H4	JTP to CA	0.327	0.072	4.544	0.00	Positive, Significant
H5	TMS to CA	0.227	0.070	3.238	0.001	Positive, Significant

Source: SEM AMOS Data Processing

Based on the results of the direct effect analysis, the following interpretations are obtained:

1) Hypothesis H1 (LP to TMS) **-** shows a coefficient of 0.314 with a p-value of 0.013 (< 0.05), indicating that the relationship between Lean Practices (LP) and Time-to-Market Speed (TMS) is positive but not significant at the 95% confidence level.
2) Hypothesis H2 (JTP to TMS) - shows a coefficient of 0.082 with a p-value of 0.469 (> 0.05), meaning that the relationship between Just-in-Time Practices (JTP) and Time-to-Market Speed (TMS) is positive but not significant.
3) Hypothesis H3 (LP to CA) - shows a coefficient of 0.466 with a p-value of 0.000 (< 0.05), indicating that the relationship between Lean Practices (LP) and Competitive Advantage (CA) is positive and significant.

4) Hypothesis H4 (JTP to CA) - has a coefficient of 0.327 with a p-value of 0.000 (< 0.05), suggesting that the relationship between Just-in-Time Practices (JTP) and Competitive Advantage (CA) is positive and significant.
5) Hypothesis H5 (TMS to CA) - shows a coefficient of 0.227 with a p-value of 0.001 (< 0.05), meaning that the relationship between Time-to-Market Speed (TMS) and Competitive Advantage (CA) is positive and significant.

Based on the results of the indirect (mediation) effect analysis for the path Lean Practices (LP) → Time-to-Market Speed (TMS) → Competitive Advantage (CA), the interpretation is as follows:

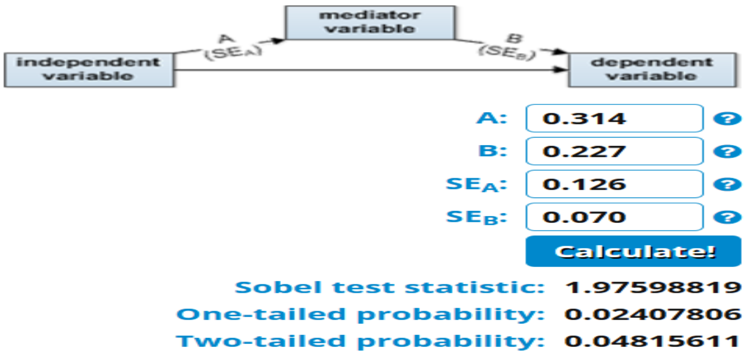

Figure 3. Sobel Test Calculation for the Path LP → TMS → CA

Source: Calculator Sobel Test

The Sobel test results indicate a Sobel test statistic value (Abu-Bader & Jones, 2021) of 1.9759 with a two-tailed p-value of 0.0481 (< 0.05). This suggests that Time-to-Market Speed (TMS) serves as a significant mediating variable in the relationship between Lean Practices (LP) and Competitive Advantage (CA). Therefore, a significant partial mediation effect exists through Time-to-Market Speed (TMS). Based on the results of the indirect (mediation) effect analysis for the path Just-In-Time Practices (JTP) → Time-to-Market Speed (TMS) → Competitive Advantage (CA), the interpretation is as follows:

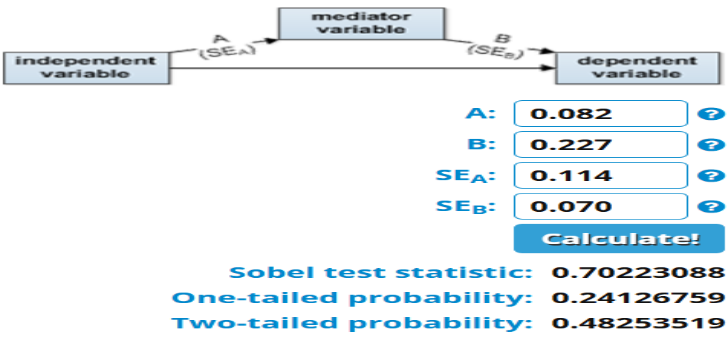

Figure 4. Sobel Test Calculation for the Path JTP-TMS-CA

Source: Calculator Sobel Test

Table 8. The hypothesis result for the indirect effect (mediation)

Hypothesis	Jalur	Sobel Test P-Value	Conclusion
H6	LP-TMS-CA	0,048	Significant
H7	JTP-TMS-CA	0,48	Insignificant

Source: SEM AMOS Data Processing

Based on the results of the Sobel test, the Sobel test statistic is 0.7022 with a two-tailed p-value of 0.4825 (> 0.05). This indicates that Time-to-Market Speed (TMS) does not significantly mediate the relationship between Just In Time Practice (JTP) and Competitive Advantage (CA). Therefore, there is no significant mediating effect of Time-to-Market Speed (TMS) on the relationship between Just In Time Practice (JTP) and Competitive Advantage (CA).

Discussion

The results of the direct test and Sobel test provide important insights into the relationships between Lean Practices (LP), Just-in-Time Practices (JIT), Time-to-Market Speed (TMS), and Competitive Advantage (CA).

The analysis revealed that Lean Practices (LP) have a significant and positive effect on Competitive Advantage (CA). This finding aligns with (Panigrahi et al., 2023a), who demonstrated that the implementation of lean manufacturing substantially enhances operational and business performance in manufacturing firms. Lean practices, which emphasize waste reduction and process efficiency, are widely recognized as a means to improve competitive advantage by optimizing resource use and minimizing waste in production systems (Boukhatmi et al., 2023). This is consistent with the perspective of (Womack & James P Jones, 2023), who argue that lean principles create added value by eliminating waste and improving process flow, ultimately enhancing competitive advantage.

Just-in-Time Practices (JIT) also significantly and positively influence Competitive Advantage (CA). This result supports the findings of (Melo et al., 2022) and (Khawka et al., 2024), who emphasized that JIT practices enhance operational efficiency and competitiveness by reducing lead times and inventory costs. The integration of lean and JIT is particularly vital for achieving sustainable competitive advantage in developing markets, where reducing waste and accelerating production flow are critical priorities.

The Sobel test results indicate that Time-to-Market Speed (TMS) serves as a significant mediator in the relationship between Lean Practices (LP) and Competitive Advantage (CA). This confirms that Lean Practices not only exert a direct impact on competitive advantage but also an indirect one through accelerated time-to-market. These findings are consistent with previous studies. (Slevin, 2025) emphasized that lean implementation based on PDCA cycles significantly improves delivery process efficiency by eliminating non value adding activities, implicitly contributing to faster time-to-market. (Panigrahi et al., 2023a) found that consistent lean implementation boosts both operational and business performance. The resulting efficiency shortens production cycles, accelerates innovation, and enhances competitiveness. (Demiralay et al., 2021) also identified TMS as a critical factor in successful product innovation within the manufacturing industry, reinforcing the strategic role of speed in achieving competitive advantage. (Khawka et al., 2024) found that the synergy between lean, JIT, and TMS collectively drives sustainable competitive advantage in developing markets by reducing operational costs and accelerating production processes. According to (Luis Goncalves, 2024), TMS reflects a company's responsiveness to market needs through faster product development and launch. When Lean Practices are effectively implemented, development and launch times are significantly reduced (Marin Jurcic, 2025), enabling firms to become more adaptive and responsive to consumer demand indirectly leading to improved competitive advantage.

However, the Sobel test results show that Time-to-Market Speed (TMS) does not significantly mediate the relationship between Just-in-Time Practices (JIT) and Competitive Advantage (CA). This finding may be explained by (Anupama Prashar, 2024), who, through a meta-analysis of 59 studies across 18 countries, found that the relationship between JIT and firm performance is moderated by national cultural factors, such as institutional collectivism and uncertainty avoidance. In this context, Prashar suggests that in certain cultural settings particularly those with high uncertainty avoidance TMS may not serve as a significant mediator.

The integration of Lean Manufacturing, Just-in-Time (JIT), and Time-to-Market Speed (TMS) is widely regarded as a strategic approach to enhancing operational efficiency and fostering competitive advantage. According to (Khawka et al., 2024) and (Anupama Prashar, 2024), their combined implementation can accelerate production processes and reduce costs; however, the effectiveness of this relationship is not universally applicable. Prashar highlights that the mediating role of TMS may be influenced by contextual factors such as national cultural characteristics and environmental uncertainty. This aligns with the findings of this study, which show that TMS does not significantly mediate the relationship between JIT Practices and Competitive Advantage likely due to specific contextual conditions within the manufacturing industry examined.

This study makes a significant contribution to the development of theory in the fields of operations management and competitive advantage, particularly within the context of the manufacturing industry in emerging markets. First, the findings reinforce the theory that Lean Practices have both direct and indirect effects on competitive advantage, with Time-to-Market Speed (TMS) serving as a significant mediator. This supports and extends previous theoretical frameworks regarding the effectiveness of lean practices in accelerating production cycles and enhancing firm competitiveness. Second, although Just-in-Time Practices (JIT) have a significant impact on competitive advantage, the mediating role of TMS in this relationship was not found to be significant. This suggests that the relationship between JIT and competitive advantage is contextual and may be influenced by external factors such as national culture or business environment uncertainty. Consequently, this research opens avenues for further theoretical development that incorporates contextual factors as potential mediators or moderators in the relationships between variables in production management practices.

From a practical perspective, the findings offer strategic insights for managers in the manufacturing sector, especially in emerging markets. First, the consistent implementation of Lean Practices not only enhances operational efficiency but also accelerates time-to-market, ultimately strengthening the company's competitive advantage. Therefore, managers are advised to comprehensively integrate lean principles into their production processes, including through employee training, process reviews, and the implementation of continuous improvement initiatives. Second, although Just-in-Time Practices also contribute positively to competitiveness, managers should recognize that the effectiveness of JIT may vary depending on cultural and organizational contexts. This underscores the importance of adapting JIT to local conditions and organizational readiness for implementing just-in-time systems. Lastly, since Time-to-Market Speed has been shown to be a key factor in responding swiftly to market demands, companies are encouraged to incorporate speed in product development and launch as a core strategic priority to enhance adaptability and long-term competitiveness.

CONCLUSION

This study underscores the critical role of production management practices—specifically *Lean* and *Just-in-Time* (*JIT*) practices—in shaping competitive advantage within the manufacturing sector in emerging markets. The empirical findings confirm that *Lean* practices not only have a direct positive impact on competitive advantage but also exert an indirect effect through *time-to-market* speed, highlighting the strategic importance of process efficiency and responsiveness. While *Just-in-Time* practices also positively influence competitiveness, the absence of a significant mediating effect through *time-to-market* speed suggests that their impact is more complex and context-dependent.

Overall, the study emphasizes that operational strategies should be designed with a contextual understanding of organizational readiness, cultural factors, and market dynamics. *Time-to-market* speed emerges as a pivotal mechanism through which firms can enhance their adaptability and responsiveness to evolving customer demands. Therefore, integrating speed and flexibility into core strategic operations is essential for sustaining a competitive edge. Future research is encouraged to explore additional contextual and moderating variables that may influence the relationship between production practices and firm performance in various industrial and geographic settings.

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