



The role of process management among Nigerian manufacturing SMEs readiness to deploy Lean Initiatives: Serial and parallel mediation analysis

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Abstract

Failure to assess the Lean readiness of manufacturing Small & Medium Enterprises before deploying Lean initiatives has resulted in implementation failures. In Nigeria, Lean deployment among manufacturing SMEs remains low due to a lack of proper readiness assessment. The study aims to assess the role of process management in readiness of manufacturing SMEs to deploy lean through applying serial and parallel mediation of planning & control and customer relation on the relationship between leadership, employee relations and process management. Hence, four hundred and fourteen questionnaires were distributed to Managers of manufacturing SMEs. Using SMART PLS 3.3.2, the study develops a measurement model, structural model, and hypothesis test through bootstrapping. The study findings reveal that the nexus between leadership and process management is mediated serially through a causal link between planning & control and customer relations. So also, the nexus between employee relations and process management is serially mediated through a causal connection between planning & control and customer relations. All parallel indirect relationships were also positive and significant. The research has shown a unique insight into comprehending readiness to deploy lean through serial and parallel mediation of planning & control and customer relations. It proves that synergy and integration of process management and critical lean readiness factors are essential to successful lean deployment. It has shown that integration between all organization's organs to process management is fundamental for manufacturing SMEs to be fully prepared for Lean initiatives. The research will guide manufacturing SMEs to evaluate the level of readiness for lean deployment and mitigate unsuccessful implementation.

Keywords: Process Management, Lean readiness, serial mediation, parallel mediation, manufacturing SMEs

1. Introduction

In today's fast-changing world, businesses need to adapt and initiate production processes and effective and efficient techniques to deliver value to customers. Designing a Lean production process that eliminates all forms of waste and add value to customers, brings about higher productivity and improved performance (Rymaszewska, 2014; Womack & Jones, 2003). This brings the need for manufacturing SMEs to assess their readiness to deploy Lean initiatives, which is critical to quality enhancement and a foundation for operational excellence as

obsolete production methods are no longer viable for quality improvement (Antony, Psomas, Garza-Reyes, & Hines, 2020; Inuwa & AbdulRahim, 2020; Maware, Okwu, & Adetunji, 2021).

Lean manufacturing is often used interchangeably with Lean management, Lean production, or Lean system. Lean manufacturing is viewed as a socio-technical system integrated to remove waste by concurrently lessening or minimising customer, supplier, and internal variability (Marley & Ward, 2013; Shah & Ward, 2007). Lean tools and techniques include 5s (set, sort, shine, standardise &

sustain), total preventive maintenance (TPM), Kaizen, pull production, cellular production etc. It has been proven that Lean manufacturing is an effective technique and bedrock in actualising operational superiority and excellence in manufacturing. Lean aids firms in removing all forms of wastage in human effort, inventory, time to market, and manufacturing space (Mahendran & Senthil Kumar, 2018; Psomas, 2021b).

The successful implementation of Lean manufacturing by its originators, the Toyota Motors of Japan, brought about an increased interest in the area (Lean manufacturing) in recent years as both Scholars and business practitioners reiterate on the possibility of implementing Lean not only in large enterprises but also in manufacturing SMEs successfully (Inuwa & AbdulRahim, 2020; Moya, Galvez, Muller, Camargo, & Moya, 2019; Ogah, Ogbechie, & Oyetunde, 2020). However, Lean manufacturing still has its problems, as apparent in the rate of failed implementations (Schröders & Cruz-Machado, 2015), which is mainly associated with a lack of assessment of readiness and understanding of true principles and practice of Lean before implementation. Most manufacturing SMEs either derail from Lean practices or backslide to old ways due to their inability to deploy Lean successfully (Maware et al., 2021; Yadav, Jain, Mittal, Panwar, & Lyons, 2019). Further, existing works now mention a high rate of Lean initiatives failure (Al-Balushi et al., 2014; Garza-Reyes, Arturo, Wong, Lim, & Kumar, 2016; Rad, 2006).

This is mainly attributed to a lack of readiness before full implementation, which creates inconsistencies within the organisation, resulting in gradual return to the status quo. Between 60% to 70% of all improvement initiatives on quality were nosedived and could not achieve their expected goal (Ringen & Holtskog, 2013). Similarly, according to Schröders & Cruz-

Machado, (2015), failure rates as high as 60 to 90% are typical for improvement programs (Bhasin, 2011; Shin, Kalinowski, & El-Enein, 1998).

Scholars have posited that there is still a dearth of research on Lean implementation within the African continent (Alkhoraif, Rashid, & Mclaughlin, 2019; Belhadi, Bin, Sha, Touriki, & Fezazi, 2018; Psomas, 2021a). Similarly, Mutingi (2018) stated a shortage of research in quality management in Africa as a continent and recommended that scholars further research quality practices deployment in SMEs. Furthermore, little research was conducted in Nigeria on Lean manufacturing implementation in SMEs. For instance, Enoch (2013) points out that Lean practices within SME's manufacturing sector are non-existent. Also, a study by (Ajiboye et al., 2012; Ogah et al., 2020; Umude-Igburu & Price, 2015) posits that there is a necessity for extra awareness and enlightenment on the application practices of Lean quality techniques in Nigerian SMEs. Also, to the researcher's knowledge, no study empirically assessed and examined readiness for lean implementation within manufacturing SMEs in the Nigerian context.

Conventionally, the manufacturing sector in Nigeria is dominated by small and medium enterprises (Ministry of Budget & National Planning, 2017). It is posited that between 2010 - 2018, the manufacturing industry offers employment to 5.3 million Nigerians making 11 percent of the total workforce in the country (Ministry of Budget & National Planning, 2017).

However, poor quality practices still linger in manufacturing firms in Nigeria (Ogah et al., 2020). This might be due to non-implementation of Lean manufacturing (Inuwa & AbdulRahim, 2020; Marire, Nwankwo, & Agbor, 2014); as most manufacturing SMEs in Nigeria still practice mass production system (Ajiboye, Alabi, & Adedokun, 2012). It is ascertained that they still have quality control problems,

including inadequate plant maintenance, lack of skilled operators and inspectors, and a virtual absence of modern equipment. This has been a problem with most manufacturers in Nigeria as they neglect to exploit techniques and practices which can make them perform their business operations efficiently (Ogah et al., 2020). Furthermore, the 2016 Global Manufacturing Competitiveness Index, as postulated by Deloitte Touche Tohmatsu Limited and US Council on Competitiveness (2016), showed that Nigeria descended to number 38 out of 40 countries with index rankings of 23.1% out of 100%. Schwab & World Economic Forum (2018) backed the above, where Nigeria was ranked as 115th out of 140 countries globally in terms of competitiveness and industrialization. Consequently, the study aims to assess the readiness of manufacturing SMEs in Nigeria to deploy lean by examining the serial and parallel mediating effect of planning & control and customer relations. It is therefore of great importance and urgency to introduce the concept of Lean manufacturing to Nigerian manufacturing SMEs by evaluating their readiness level through a socio-technical approach to save them and the economy from total collapse.

2. Literature Review and Hypothesis Development

2.1 Process Management

Process management is defined as a set of methodological and behavioural practices that focus on effective process management (Patyal, Ambekar, Prakash, Roy, & Hiray, 2020). The process management construct in Lean manufacturing management focuses on operational activities through which the final product or service is received by adding value to processes, improving individual productivity, diminishing the operating cost and cycle-time and improving the overall quality of the organisation's operations (Abbas & Kumari, 2021). Consequently,

manufacturing SMEs with process management that effectively creates value by removing non-value-adding activities is believed to keep a quality practice and serve as a foundation for deploying Lean effectively (Al-Najem, 2014; Garza-Reyes et al., 2018). Similarly, the small size of manufacturing SMEs typically has smaller processes and workflow, making it much easier to identify and detect non-value-added processes, thus resulting in more effective and efficient means of waste elimination (Ramadas & Satish, 2018).

Uluskan et al. (2018) conducted a study within American manufacturing firms to assess organisational readiness for change due to Lean six sigma implementation; the study's findings showed that process management has a significant and positive effect on customer relations. The study conducted within the Yemeni petroleum sector to examine the impact of total quality management on individual readiness for change also reveals that process management significantly impacts readiness for change (Qais Ahmed et al., 2017). Also, Lim, Kim, Kim, Kim, & Maglio (2019) anticipated the customer process management model signifying stages a service provider can take when rendering information to its customers to expand their processes and generate extra value.

The study conducted within Nigerian manufacturing SMEs to assess the influence of quality management tools on customer satisfaction shows that process management has a positive and significant impact on customer satisfaction (Udofia, 2019). Also, a recent study conducted within manufacturing SMEs in Nigeria by Shuaib et al. (2021) shows that quality management practices significantly impact process management innovation.

2.2 Planning & Control

Planning and control significantly impact quality management and implementation activities (Abbas & Kumari, 2021). Planning and control practices in Lean

manufacturing are usually concerned with scheduling strategies for production and customer demand management (Iranmanesh et al., 2019). The main focus of planning and control is to allocate priorities and coordinate activities that include job orders and their operations to machines and other resources to be processed (Schuh, Prote, Luckert, Hünnekes, & Schmidhuber, 2019). Production planning is a series of operational activities before the final production process; these include production scheduling, economic batch quantities, dispatch of priorities, and operation sequence (Ilamosi, Ezekiel, 2019). Moreover, planning is regarded as a technique for designing a strategy that will realise a targeted objective capable of proffering a solution to challenges an organisation faces and enabling the cause of actions (Mercier, Knizek, Caffrey, Sieke, & Dunn, 2018).

Further, a study in Tanzanian manufacturing to explore factors for effective Lean implementation shows that planning & control and customer relations are among the key determinants of successful Lean deployment (Pontevedra et al., 2019). Similarly, in Thailand study aimed to assess the role of customer relationships planning and control and control online businesses finds that understanding customer demand results in better planning and practices (Aungkulanon, 2019). The findings of research conducted within the Turkish automotive sector to examine Lean readiness levels reveal that planning and control are crucial determinants for Lean readiness assessment (Garza-Reyes, Ates, & Kumar, 2015). Also, a study carried out within manufacturing SMEs producing table water in Nigeria finds that planning and control have a positive and significant impact on customers' satisfaction (Elaho & Ejechi, 2019). Additionally, it was found that production planning & control significantly reduce operational costs

among manufacturing firms in Nigeria (Ilamosi, 2019). A study conducted in Nigeria in the manufacturing SMEs sector finds a positive and significant relationship between production planning and control and operational efficiency (Emanuel, Aziegbe & Worlu, 2021).

2.3 Customer Relations

Customer relationship management is a strategy and comprehensive practice that a business organisation implements to retain, get, identify, and support profitable customers through sustained and fashioned lasting relationships with them (customers) (Amuna, Shobaki, Naser, & Badwan, 2017). Customer relationship management refers to how a firm continuously satisfies customer needs and expectations (Patyal et al., 2020). In the struggle for competitiveness, a business seeks to realise superior customer relations utilising the least possible resources, making it mandatory for managers to define clearly the customer relations approach, grounded on a sound scientific validation, without ignoring their customer experience (Metz, Ilieş, & Nistor, 2020).

Research carried out among textile manufacturing firms in the United States to examine the impact of quality management practices on organisational readiness for change finds that customer relations strongly impact change efficacy (Uluskan et al., 2018). In Yemen, a study was conducted to analyse the role of total quality management on individual readiness for change in the petroleum sector; the study reveals that customer relations significantly impact organisational readiness for change (Ahmed et al., 2017). Similarly, Aliyu, Nilejbe, & Umar (2018) find that customer relations management is among the vital marketing strategies that enhance the performance of SMEs in Nigeria. Bukola, Abosede, & Adesola (2019), in a study among Nigerian SMEs, finds that customer relations management measured by customer orientation, service quality, and

personalised services have a significant influence on SMEs' performance. In the study, customer satisfaction and performance were found to have a positive and meaningful relationship among Nigerian SMEs (Ahmed & Umar, 2021).

2.4 Employee Relations

Employee relations refer to how employees in organisations participate in various quality management activities (Patyal et al., 2020). Employee relations refer to employees' participation in improving quality and performance (Uluskan et al., 2018). It involves activities like; employees' responsibility for the quality, feedback on their quality performance, participation in quality decisions and rewards for superior quality that can enhance employees' readiness for change to Lean (Uluskan et al., 2018). It is apparent from the studies of Lean readiness that the role played by employees is very significant to the actualisation of successful deployment of Lean in manufacturing firms. (Shokri, Waring, Nabhani, et al., 2016; Uluskan et al., 2018; Vaishnavi & Suresh, 2020).

Also, employee relations have a positive and significant relationship with customer relations management practices (Yapanto et al., 2021). The study carried out in the tourism sector to examine the impact of employee commitment on customers' attitude-based loyalty finds that employee commitment influences customer satisfaction and behavioural intentions (Agyeiwaah, Dayour, & Zhou, 2021). However, in Nigerian manufacturing SMEs, a study aimed to determine SME managers' human resource management practices found that employee relations are among the main challenges SMEs face (Felicia & Ibeneme, 2019). Also, in similar research, it was found that human resources management due to poor motivation is a critical factor that hinders the performance of SMEs (PWC, 2020). Moreover, Adewale (2021) conducted a study on human resource management among SMEs

in Nigeria; the study's findings reveal that lack of employee training and involvement is a significant hindrance to growth.

2.5 Leadership

Leadership commitment refers to the ability of the organisation's upper level to lead the organisation to realise sustainable long-term business success (Patyal et al., 2020). Leadership is a procedure in which the deliberate influence of the leader is exercised on their followers or subordinates; it is considered a phenomenon concerning interaction among people (Parry & Bryman, 2006). Support from leadership and management is the critical bedrock for introducing Lean and change in an organisation. Numerous literatures have reported its implication in times of change and transformation within an organisation (Boston consulting group, 2020; Laureani & Antony, 2012; Yadav, Rahaman, & Lal, 2017; Yadav, Jain, Mittal, Panwar, & Lyons, 2019).

A study conducted in Mexico within the manufacturing firms aims to identify the impact of quality management practices in Mexico and finds that management commitment is a crucial predictor of customer satisfaction (García-Alcaraz et al., 2021). Also, Aali, Ibrahim, Mirabi, & Zare (2020) reveal that organisational leadership dramatically impacts customer satisfaction and loyalty. Similarly, a study carried out within Nigerian commercial banks indicates that top management commitment significantly increases customer satisfaction (Olusanjo, 2019). The study conducted among manufacturing SMEs in Nigeria aimed at exploring the role of leadership style on performance shows that SME leadership significantly impacts performance (Samson & Ilesanmi, 2019). A similar study by Ogah et al. (2020), aimed at determining the impact of leadership on implementing Lean among manufacturing firms, reveals that leadership impacts Lean implementation significantly.

2.6 Serial and Parallel mediation effect

The study is inspired by frameworks set forth by (Al-Najem et al., 2013; Shafiq & Soratana, 2020; Shokri, Waring, Nabhani, et al., 2016; Uluskan et al., 2018). These frameworks follow a similar dimension in examining Lean readiness in firms. In this research, however, we cannot use the frameworks as they stand as they are believed to have some weaknesses. Al-Najem et al. (2013) model is short of the entire path model to examine the relationship between variables on Lean readiness factors with link to organisational readiness for change and its dimensions. Impliedly, the six dimensions of Lean readiness factors developed by Al-Najem et al. (2013), assess the level of (leadership commitment, employee involvement, planning & control, process management, supplier relationship, and customer relationship) without the aspect of organisational readiness for change to Lean, which is an essential determinant for change readiness. Thus, the framework is believed to be deficient since it does not examine relationships to assess the level of integration through direct and indirect effects between lean readiness factors.

Further, a study was also carried out by Shokri, Waring, & Nabhani, (2016), aimed at examining the relationship between the readiness of managers and employees to embark on Lean deployment in manufacturing SMEs in which it was found that there is a strong positive association between the core competence of people and organisational culture with readiness for commencing in the manufacturing SMEs studied. The study focuses on a more direct relationship without testing the mediation effect among lean readiness factors. Similarly, Uluskan et al., (2018), run a full path model to test the link of readiness factors for Lean-to organisational readiness for change to Lean. However, their study (2018) overlooks the mediation effect of readiness factors to understand their integration. Shafiq & Soratana, (2020), in a recent study aimed at assessing the

readiness for Lean in a humanitarian organisation, develop a framework comprising of CSFs that are significant, which include process management, planning, and control management, customer relationship management, human resource management, communication, and coordination management and with positive organisational culture as an intervening variable readiness assessment. However, the study focuses on a single intervening role of organisational culture. Hence, it may not yield the needed result in adequate readiness assessment. A

single/straightforward mediator variable does not allow the investigator to model multiple mechanisms simultaneously in a single integrated model (Hayes, 2013; Hayes, 2018; Preacher & Hayes, 2008).

Consequently, to cover the mediation gap in Lean readiness research, this study applies multiple serial mediations of planning & control and customer relations to examine the integration both directly and indirectly for practical evaluation of lean readiness. The importance of planning & control and customer relations is crucial and lean readiness assessment within manufacturing SMEs, as previous scholars have emphasised effective planning & control, which will lead to more excellent customer relations and enhance satisfaction (Al-Najem, Garza-Reyes, & ElMelegy, 2019; Garza-Reyes, Ates, & Kumar, 2015; Garza-Reyes et al., 2018; Shafiq & Soratana, 2020). Hence the need to test the serial and parallel mediation effect.

H1: Leadership indirectly affects process management through the causal link between planning & control and customer relations.

H2: Employee relations indirectly affect process management through the causal link between planning & control and customer relations.

H3: Planning & control mediate the relationship between leadership and customer relations.

H4: Planning & control mediate the relationship between employee relations and customer relations.

H5: Customer relations mediate the relationship between leadership and process management

H6: Customer relations mediate the relationship between employee relations and process management.

H7: Customer relations mediate the relationship between planning & control and process management.

2.7 Research Framework

Based on the review of the literature and the development of the hypothesis, the research framework is presented below.

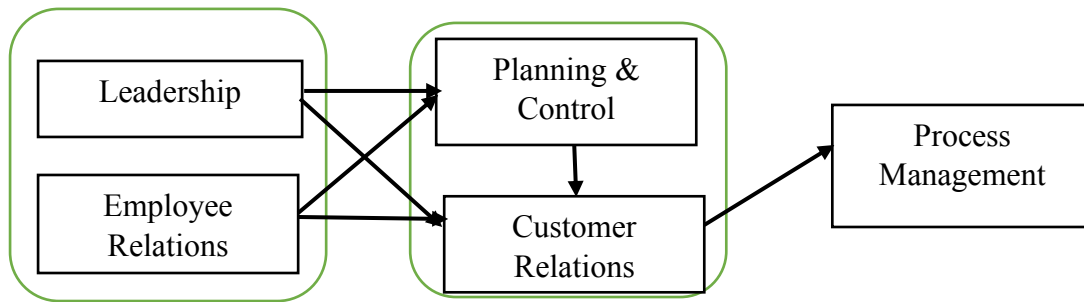


Figure 2.1 Research Framework

3. Methodology

This research aims to put forward an integrated structural path model by examining lean readiness through serial mediations of planning & control and customer relations within Nigerian manufacturing SMEs. Instruments developed for this study were a survey questionnaire with 26 items that measure the five constructs, with 9 demographic variables, making an aggregate of 35 items in the whole questionnaire. All constructs were subjected to measurements using the Likert scale. The independent variables (leadership/top management and employee relations) were based on a 5-point Likert scale ranging from Strongly Disagree =1, Disagree =2, Neutral =3, Agree =4, and Strongly Agree =5. Also, for mediating variables, planning & control are based on five Likert scales, while customer relations is based seven-point Likert scale, ranging from Strongly Disagree =1; Somewhat Disagree =2; Slightly Disagree =3; Neutral =4; Somewhat Agree =5; Slightly Agree =6; Strongly Agree =7. The dependent variable process management is also a five-point Likert scale.

Further, the measurement for leadership, planning & control, and customer relations

was adopted from the study of Al-Najem et al. (2013); all three variables have a Cronbach alpha of 0.92. Process management and employee relations were

adopted from the study of Uluskan et al. (2018) with Cronbach alpha of 0.89 and 0.090, respectively. Prior administration of questionnaires, a detailed discussion with experts on SMEs and quality management was conducted twice. Their observations and suggestions were incorporated, followed by circulating the questionnaires as the final survey. The survey is a cross-sectional study, and data was gathered through the personal delivery of a self-administered survey questionnaire distributed to Manufacturing SME organisations through owner/ managers. A convenience sampling technique was used across six States in each geopolitical zone in Nigeria (Bauchi and Plateau, Kano, Imo, Osun, and Rivers states). According to a survey report by SMEDAN/NBS (2017), there is a total population of 17,094 manufacturing SMEs across the whole country (Nigeria). Hence, per Krejcie & Morgan (1970), a sample of 375 respondents is enough to represent the population.

Further, after a 10% increment suggested by Hair, Wolfinbarger, Money, Samouel, and Page (2015), the sample can be increased by a certain percentage to handle the possible occurrence of a low response rate during data collection. 414 questionnaires were distributed, 337 were returned, 36 were found not completed, and one univariate outlier was found. Therefore, three hundred (300) questionnaires were useful, representing 72% of the total questionnaires distributed. Hence, Baruch (1999) states that social and management sciences research frequently has a 55.6% response rate. Likewise, others have considered a 60% good response rate (Babbie, 2007; Grove, 2006). Following the debate, a response rate of 72% from this study is quite tolerable and suitable for data analysis.

4. Results and Discussion

The Structural Equation Modelling (SEM) method employing Partial Least Squares (PLS) was used in the evaluation of the models developed for this study (Ringle, Wende, & Becker, 2015). Additionally, the two-stage analytical procedure (Anderson & Gerbing, 1988; Hair, Hult, Ringle, & Sarstedt, 2017) that consists of (a) measurement models assessment and (b) evaluations of current structural models were applied after carrying out descriptive analyses.

Starting with the demographic profile of the respondents, the statistics show that from the three hundred participants, 285 (86%) are male, while the female figure stands at 42 (14%). In terms of age, most of the respondents, 130 (43.3%), are between 20 to 29 years. Ninety-one respondents (30.35%) are within the age range of 30 - 39, while 67 respondents (22.3%) fall within the age range of 40-49 and 12 respondents (4.0%) fall above the age of 50 and above. Regarding nature of employment, 225 (75.0%) are in full-time employment, and 75 (25%) are part-time. Regarding the demographic profile of the

respondents' organisations, 200 (66%) fall under small manufacturing enterprises, while 100 (34%) fall within the category of medium manufacturing enterprises.

4.1 Assessment of Measurement and Structural Models

Construct validity and reliability (comprising convergent and discriminant validity) were used in tests of the measurement models. Cronbach's alpha coefficients were evaluated to determine the reliability of all the core variables in this study's measurement scheme (construct reliability). The value of every individual Cronbach's alpha coefficient in this research fell in-between 0.827 and 0.716, which exceeds the suggested value of 0.7 (Nunnally & Bernstein, 1994). Additionally, the value of every composite reliability (CR) factor fell in-between 0.834 and 0.739, as stipulated by Hair, Risher, Sarstedt, & Ringle (2019), with values between 0.70 and 0.90 ranging from "satisfactory to good. Therefore, as illustrated in Table 1, construct reliability has been satisfied as CR and Cronbach's Alpha were relatively error-free for all the constructs. Assessment of Indicator reliability was done by using factor loadings. It is well above the 0.5 widely recommended in the literature (Bagozzi, Yi, & Phillips, 1991; Hair, Black, Babin, & Anderson, 2010). In the case of this study, items with loading lower than 0.5 were removed. Hence, item loading after deletion falls within the range of 0.799 and 0.602

Convergent validity is assessed based on Average variance extracted values (AVE) were used in this research to identify the degree to which the measures correlate positively with corresponding alternative measures of the identical construct. The value for every AVE fell in-between 0.559 to 0.536, which is within the suggested value of 0.50 (Hair et al., 2019). Therefore, all constructs have fulfilled the convergent validity satisfactorily.

Table 3.1 Assessment of Measurement Model

Construct	Item	Loadings	CA	A	CR	AVE
Customer relations (CR)	CR1	0.746	0.827	0.834	0.874	0.536
	CR2	0.686				
	CR3	0.701				
	CR4	0.736				
	CR5	0.794				
	CR6	0.724				
Employee relations (EM)	EM1	0.799	0.733	0.739	0.834	0.559
	EM2	0.779				
	EM3	0.766				
	EM4	0.633				
Leadership/top management (LM)	LM1	0.797	0.733	0.758	0.831	0.554
	LM2	0.795				
	LM3	0.740				
	LM4	0.632				
Planning & control (PC)	PC1	0.839	0.716	0.754	0.823	0.542
	PC2	0.679				
	PC3	0.802				
	PC4	0.602				
Process management (PM)	PM1	0.756	0.765	0.782	0.840	0.514
	PM2	0.770				
	PM3	0.758				
	PM4	0.670				
	PM5	0.619				

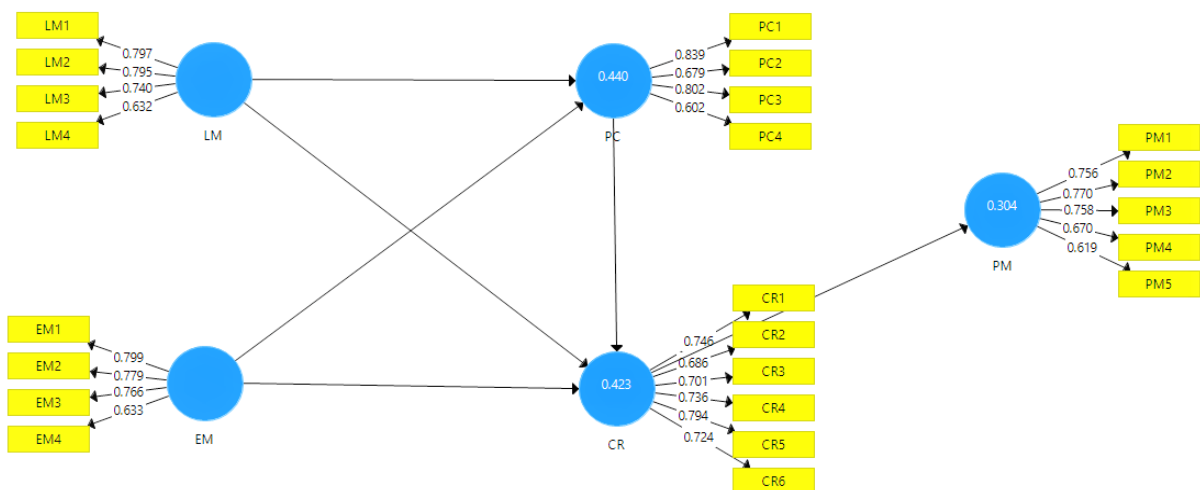


Figure 3.1 Measurement Model

The discriminant validity assessment conducted in this study using the HTMT criterion Henseler et al. (2015) & Gold, Malhotra, & Segars suggests that all the values above 0.90 indicate the existence of

a discriminant validity issue. Hence, all factors below 0.90 indicate no discriminant validity problems, as presented in the table below.

Table 3.2 HTMT, R^2 & Q^2

Construct	CR	EM	LM	PC	PM
Customer relations (CR)					
Employee relations (EM)	0.640				
Leadership (LM)	0.704	0.656			
Planning & control (PC)	0.697	0.851	0.653		
Process management (PM)	0.662	0.795	0.647	0.651	
R square (R^2)	0.423	-	-	0.440	0.304
Predictive relevance (Q^2)	0.219	-	-	0.230	0.149

Further, the structural model, i.e., R^2 , (f^2), and Q^2 . It is argued by Hair et al., (2017) that there is no standard threshold for R^2 , while Hair, Sarstedt, Hopkins, & Kuppelwieser, (2014) postulated that an R^2 at 0.20 is high in organisational studies. Therefore, it can be deduced here that this study has achieved a significant R^2 , ranging from 0.440 to 0.304. According to Cohen (1988), an effect size value (f^2) of 0.02, 0.15, and 0.35 is a small, moderate, and large effect size. Any predicting construct having an effect size (f^2) value lower than 0.02 does not affect the related endogenous construct in the model. Regarding this

study's effect size, employee relations, leadership, and planning & control have an f^2 of 0.023, 0.143, and 0.074 respective on customer relations. Employee relations and leadership have an (f^2) of 0.341 and 0.078 on planning and control while customer relations have an f^2 of 0.436 on process management. Hence, (f^2) all exogenous constructs have shown a good (f^2). Concerning predictive relevance Q^2 , it is posited that a Q^2 with a value above (0) is an indication of acceptable Q^2 of the predicting constructs on the endogenous target variable (Hair et al., 2017).

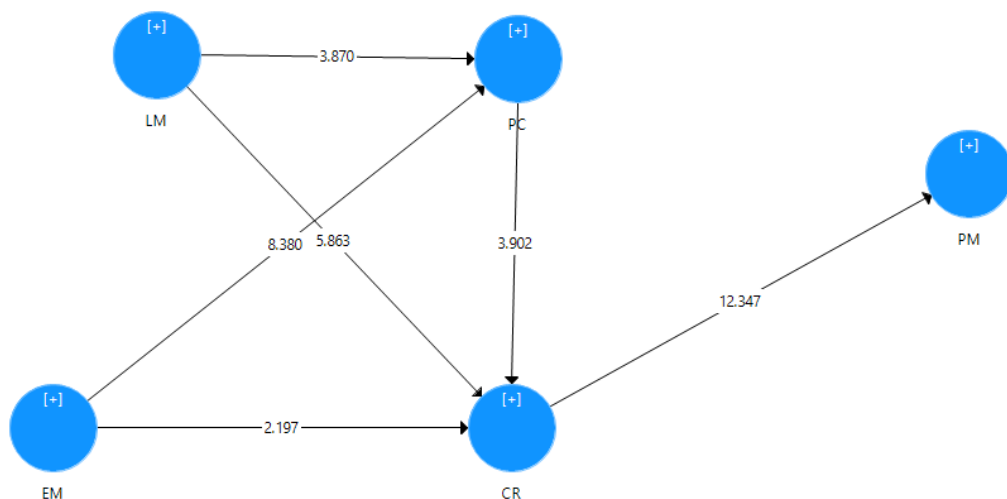


Figure 3.2 Structural Model

4.2 Hypothesis Testing

Bootstrapping of the sample distribution was used in testing the significance of indirect effects using 5000 subsamples (Hair et al., 2017). Also, the study applies

the transmittal mediation approach as suggested by (Memon, Ali, Cheah, Ramayah, Ting, & Chuah, 2018; Rungtusanatham, Miller, & Boyer, 2014). Thus, the study only tests the indirect

effects (parallel and serial mediations). All relationships hypothesised in this study are directional, and therefore, the one-tailed test was used to assess the t-values and the significant effect of all the path coefficients. Thus, the path with values from 1.65 and

above was significant using the 5% significance level, and the hypotheses are accepted (Hair et al., 2017). Consequently, the result of the hypothesis is present in the table below.

Table 3.3 Result of Hypothesis

Hypothesis	Relationship	Std Beta	Std Error	T Value	P Values	Decision
H1	LM -> PC -> CR -> PM	0.037	0.014	2.702	0.004	Accepted
H2	EM -> PC -> CR -> PM	0.078	0.024	3.199	0.001	Accepted
H3	LM -> PC -> CR	0.066	0.024	2.785	0.003	Accepted
H4	EM -> PC -> CR	0.139	0.042	3.353	0.000	Accepted
H5	LM -> CR -> PM	0.192	0.035	5.486	0.000	Accepted
H6	EM -> CR -> PM	0.090	0.042	2.024	0.022	Accepted
H7	PC -> CR -> PM	0.152	0.041	3.747	0.000	Accepted

4.3 Discussion

The study examines the serial and parallel indirect effect of lean readiness factors within manufacturing SMEs in Nigeria. The study reveals that leadership and process management are positively and significantly related through a causal chain of planning & control and customer relations. Such finding is an indication that manufacturing SMEs in Nigeria have a strong leadership commitment that concentrates on ensuring production, planning, and scheduling are in line with customer needs which makes processing more effective. Also, employee relations and process management have a positive and significant effect through the serial indirect effect of planning & control and customer relations, indicating robust integrations which can serve a readiness to deploy lean manufacturing successfully. The findings of serial indirect effect are unique, as previous research applies only simple mediation of organisational culture on lean readiness (Shafiq & Soratana, 2020). The study findings relate to similar research, e.g. (Bukola et al., 2019; Ogah et al., 2020; Patyal et al., 2020).

The findings on the parallel mediation effects reveal that planning & control

significantly mediate the relationship between leadership and employee relations on customer relations. It shows that synergy exists between leadership and employee relations, which facilitate effective planning of production activities geared towards customer satisfaction. The study also revealed that customer relations mediate the relationship between leadership and employee relations in process management. They indicate a harmonious relationship between SMEs managers and their employees, resulting in effective customer relations management and high-performing processes that deliver value. Also, customer relations mediate the relationship between planning & control and process management, which further signifies alignment and synergy, leading to higher customer satisfaction through effective customer involvement in production planning and processes. The findings relate to previous studies like (Ahmed & Umar, 2021; Elaho & Ejechi, 2019; Udofia, Adejare, & Olaore, 2021; Uluskan et al., 2018).

5. Research Implications

Theoretically, the research provided a new insight by applying multiple parallel and serial mediation to examine further the

level of manufacturing SMEs' readiness to deploy lean initiatives successfully and mitigate failed deployment. The application of multiple mediations will help understand the intricacies and interconnectedness of lean readiness factors. The study will guide SMEs managers in properly analysing their firm's readiness to deploy lean initiatives. It shows them areas of success and areas that require better improvement and synergy before lean deployment. It will also provide government agencies like Standard organisation of Nigeria and the Bank of Industry on readiness to deploy lean initiatives within manufacturing SMEs in Nigeria. Methodologically, the study contributed by applying PLS-SEM to integrate and simultaneously run parallel and serial mediations, providing unique findings in lean manufacturing.

The research is limited to manufacturing SMEs. Hence future studies can apply the same model to SMEs within the service sector, public sector, or large enterprises. Also, moderation variables like government policy can be added. The study concludes that manufacturing SMEs in Nigeria have shown a high readiness to deploy lean manufacturing initiatives within their businesses. The assessment of readiness for lean before full deployment will ensure that SMEs know their areas of weaknesses, threats, opportunities, and strengths.

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