Lean Technical Factors and Customer Relations: An Assessment of Readiness to Deploy Lean Manufacturing within SMEs

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Abstract

The study aims to assess lean readiness level within manufacturing SMEs from technical perspective by examining the relationship between process management and planning & control on customer relations. The research applied quantitative survey approach by administering questionnaire to SMEs managers. Responses received were analyzed using SMART-PLS 4 to examine measurement model, structural model, and path coefficient. The findings of the study show that process management and planning & control have a positive and significant relationship on customer relations. The study implies that manufacturing SMEs in Nigeria have an appreciable lean readiness from technical perspective. It also indicates that processes, planning and control activities within SMEs are compatible with lean practices and techniques. The study is among the few that assess lean readiness from technical perspective, hence given a new insight in evaluation of lean readiness.

Keywords: *Process management, planning & control, customer relations*

1.1 Introduction

Lean manufacturing is associated with lots of benefits for manufacturing SMEs, e.g., waste reduction, improved efficiency, and customer satisfaction, it often fails due to the dearth of an effective pre-implementation methodology and planning (Psomas & Antony, 2019; Sieckmann, Ngoc, Helm, & Kohl, 2018). It is argued that the failure of organizational change programs is traceable primarily to the inability of organizational members to unfreeze effectively, thus creating readiness for change before carrying out change initiatives (Armenakis, Harris, & Mossholder, 1993; Holt, Armenakis, Feild, & Harris, 2009). Additionally, the Lean quality initiative failed mainly as a result of shortage of knowledge of quality program by the initiators (Rad, 2006). This results from poor comprehension in aspects of Lean readiness that require proper scrutiny by most change agents before Lean deployment due to non-holistic examination and appraisal of Lean readiness factors from technical perspective. Hence, resulting in unsuccessful deployment and transformation, which create many setbacks for many businesses (Gurumurthy, Mazumdar, & Muthusubramanian, 2014; Moya, Galvez, Muller, Camargo, & Moya, 2019).

Therefore, Firms need to understand better areas that they are prepared fully and partially prepared or not prepared for change. Further, Lean application can be simple in SMEs. Yadav,

Jain, Mittal, Panwar, & Lyons, (2019) argued that SMEs have simple processes and better access to customers with faster process flows which enhance technical readiness for change to Lean (Pakdil & Leonard, 2017). However, it can also be problematic because both managers and employees lack a basic understanding of Lean and its advantages to their organization and its compatibility with their characteristics (Pearce, Pons, & Neitzert, 2018). Consequently, for manufacturing SMEs to be Lean ready from technical perspective, it will be essential to have a compelling value chain that facilitates and enhances planning and control, process flows within the organization, and greater customer satisfaction which will in turn result to just in time as well as pull production thereby reducing waste and maximizing efficiency (Hoque, Hasle, & Maalouf, 2020; Shafiq & Soratana, 2020).

Moreover, in manufacturing SMEs, implementing Lean and reaping its full Lean benefit has become an issue of concern as most SMEs fail in implementation, which at the long run affects their financial and human resources and discourage them from a further trial (Maware, Okwu, & Adetunji, 2021; Moya et al., 2019; Shokri, Waring, Nabhani, Shokri, & Waring, 2016). Studies have been conducted on how SMEs can successfully implement Lean (Agrahari, Dangle, & Chandratre, 2015; Belhadi et al., 2018; Ogah, Ogbechie, & Oyetunde, 2020; Saumyaranjan & Yadav, 2018; Yadav et al., 2019). However, it is still on record that most Lean implementations did not fully succeed (Achanga et al., 2006; Yadav et al., 2018). Some fail due to inadequate or lack of assessment of readiness factors like process management and planning and control (Ogah et al., 2020; Rüttimann & Stöckli, 2015). Also, it is argued that given more attention to the human aspects without equal recognition of the technical factors (process management and planning and control) failed manufacturing SMEs to have adequate readiness and implement lean successfully (Abdallah, Alkhaldi, & Aljuaid, 2021; Arumugam, Kannabiran, & Vinodh, 2020; Bouranta, Psomas, & Antony, 2021; Pearce et al., 2018; Sahoo, 2019).Such divergent views give rise to mixed and inconsistent findings on Lean implementation within manufacturing SMEs. The issue of choosing appropriate Lean tools and techniques or points of implementation results in misunderstanding among SMEs managers, resulting in a lot of implementation failure and lack of buy-in (Enoch, 2013).

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). Nevertheless, the country's economy depends highly on crude oil, making it a single commodity for economic activities. Crude oil renders more than 95% of exports and exchange in foreign incomes, while the manufacturing sector contributes only less than 1% of total exportations. (Ministry of Budget & National Planning, 2017). Furthermore, studies have shown that manufacturing SMEs in Nigeria implement quality practices in their businesses, e.g., (Eniola, Olorunleke, Akintimehin, Ojeka, & Oyetunji, 2019).

However, poor quality practices still linger in manufacturing firms in Nigeria (Ogah et al., 2020). This might be to due non- the implementation of Lean manufacturing (Inuwa & AbdulRahim, 2020; Marire, Nwankwo, & Agbor, 2014). Most manufacturing SMEs in Nigeria still practice mass production system which is associated with poor processes and lack of effective planning and control (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). Business operations like forecasting of production, management of inventories, and continuous improvements techniques are some of the practices that are incompletely employed in Nigeria and other African countries. Therefore, the study aims to examine the role of process management and planning and control on customer relations to assess manufacturing SMEs level of readiness to implement technical lean practices to meet and exceed customer expectations.

2.1 Literature Review and Hypothesis Development

2.1 Lean Technical Factors

The technical system is defined as "the tools, techniques, devices, artifacts, methods, configurations, procedures and knowledge used by organizational members to acquire inputs, transform inputs into outputs and provide outputs or services to clients or customers" (Barko & Pasmore, 1986). Technical subsystem readiness factors are concerned with those practices involving automation in manufacturing processes that require some technical know-how (Abdallah et al., 2021; Malatji et al., 2019). For instance, a good process design should include some automation to ensure speed and accuracy. Also, in scheduling and forecasting demand, market firms should be able to use computer applications to predict and analyse the market, bringing about effective planning and control systems (Sahoo, 2019). Therefore, synergy is required through the technical system between process management and planning and control to enhance better customer relations and satisfaction (El Manzani, Sidmou, & Cegarra, 2018; Walker, Stanton, Salmon, & Jenkins, 2008).

2.2 Customer Relations

Customer relationship management is viewed as a strategy and comprehensive practice that a business organization implements to retain, get, identify, and support profitable customers through sustained and fashioned lasting relationships with them (customers) (Amuna, Shobaki, Naser, & Badwan, 2017). In the struggle for competitiveness, a business seeks to realize superior customer relations utilizing 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, Ilieș, & Nistor, 2020). It is paramount for firms to understand customer's needs as it will help such firms provide an immediate response to the needs of the customer and adapt to present-day business ecosystems (Tseng, 2016). Involvement of customers in designing a product by suggesting how the product can be upgraded results in customer relationships, which is beneficial to the business as it increases loyalty and satisfaction from the customer (Nyadzayo & Khajehzadeh, 2016).

Awareness of customers, customer involvement and feedback, are fundamental managerial initiatives and quality practices that serve as a bedrock for positive Lean deployment in SMEs (Al-Najem, Dhakal, Labib, & Bennett, 2013; Garza-Reyes, Betsis, Kumar, & Radwan Al-Shboul, 2018).Uluskan et al., (2018), revealed that customer relationship management and change efficacy are related significantly, indicating that customer-centred firms are more likely to exhibit a high level of readiness for change to Lean initiatives. Similarly,(Ahmed et al.,

2017), researched to test the relationship between total quality management practices and individual readiness for change, finds that customer focus and satisfaction are positively related to readiness for change.

2.3 Process Management and Customer relations

Various academics have recognized such importance of been customer-focused through interacting and engaging with the customer within and outside the process management field. For instance, in a detailed study of what creates the fundamental of process management, Rosemann & Vom Brocke, (2015) emphasized assessing the priorities through customer interaction. Vom Brocke & Sinnl, (2011), also acknowledged "orientation of customer " as one of the central principles of process management. In the same vein, it was accentuated it is vital to apply "outside-in" methodology to process management which is initiated with the need of the customers in cognizance (Lee Eden, 2011; Santos, Bronzo, Oliveira, & Resende, 2014).Bhatt & Troutt, (2005) examines the connection between business process improvement initiatives, information systems integration, and customer focus. The outcomes of this study support the hypothesis that business process improvement directly affects customer responsiveness and product/service innovation. 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. A study conducted by (Lau, Nakandala, Samaranayake, & Shum, 2016) intends to develop a customer relationship management and business process management model to identify airline customers with varied relationship and profit potential levels. The study finds that companies present suitable service levels to deal with diverse classes of customers and advance customer relation process to exploit customer profit and value potential.

H1: Process management have a positive and significant effect on customer relations.

2.4 Planning & Control and Customer Relations

The role of planning is to identify an anticipated challenge and mitigate solutions towards those future challenges effectively (Al-Najem et al., 2013). Also, quality control is an aspect that strongly influences the competitiveness of businesses and constantly demands managerial attention; it comprises a structure of responsibilities, methods, and means through which an organization uses to agree and maintain the product characteristics to the expectations of the internal and external customer (Bij & Ekert, 1997). Planning activities that are carried out in response to customer demand and raw materials supplied on the right and exact quantity needed will save the cost of storage and transportation.

A study carried out within the manufacturing sector in Nigeria by Adetayo, Dionco-Adetayo, & Oladejo, (2004), finds that the production planning and control practices have impacted the efficient utilization of the resources, waste reduction, reduced waiting time and processing, thus contributing to the profitability of the industry. It is concluded further that effective production planning and control practices contribute significantly to consumer satisfaction. It was also posited that the performance of the production planning procedure improved through the application of Lean six sigma (Chang, Yen, Chou, Wu, & Lee, 2012). Involving customers in product design and give them room for suggestions on product improvement set a pace for customer satisfaction, thereby resulting in loyalty (Nyadzayo & Khajehzadeh, 2016). Not only

has it given firms the ability to be responsive to customer demand which played a significant role in overall operational performance (Tehseen & Ramayah, 2015). It is also asserted by Bhat & Darzi, (2015) that having knowledge about customers gives businesses to make an informed decision on product innovation and research and development, which is key to planning &control.

H2: Planning & Control have a positive and significant effect on customer relations.

2.5 Research Framework

Based on the review of literature and hypothesis development, the research framework is presented below. Process management and planning & control stands as the independent variables and customer relations as the dependent variable.

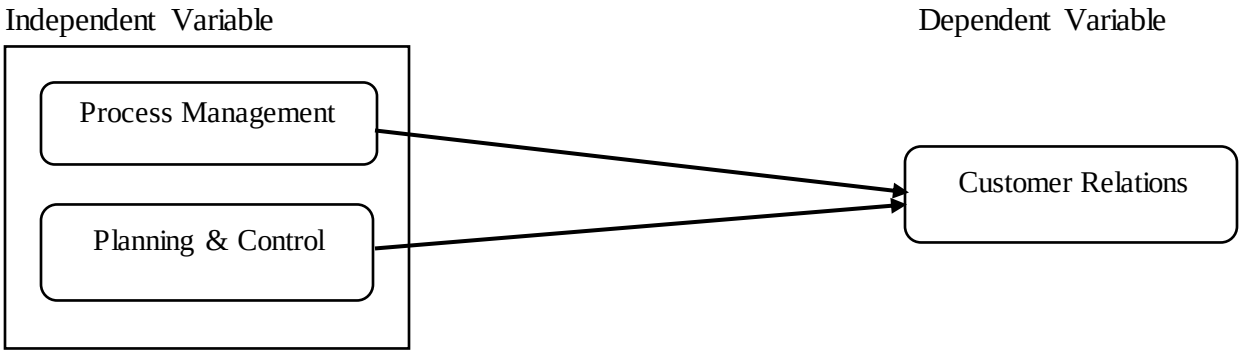

Figure 1. Research Framework

3.1 Methodology

The objective of the study is to examine the effect of process management and planning & on customer relation to evaluate level of lean deployment from technical perspective. The study applied quantitative survey approach, via questionnaire administration to SMEs organizations within Nigeria. Measurement of each variable is adopted from previous studies. Measurement items for this dimension are adopted from the study of Al-Najem et al. (2013), which comprises six items and a Cronbach Alpha of 0.929. The items were operationalized based on a 7-point Likert scale. Six items were adopted from the study of Uluskan et al., (2018), to measure process management. The items were operationalized based on a 5-point Likert scale. The measurement of planning and control was adopted from the study of Al-Najem et al. (2013), with five items. The items were operationalized based on a 5-point Likert scale.

Further, before the questionnaire administration, the research instruments have undergone thorough checks by experts in the field of quality management and SMEs to ensure that the questionnaire's content in terms of wording and understanding is appropriate for the research. Also, respondents' focus groups were selected to crosscheck the items for any observations and corrections. The study population cut across manufacturing SMEs in Nigeria; as contained in a

survey report by SMEDAN/NBS (2017), there are 17,094 manufacturing SMEs in Nigeria. Manufacturing SMEs (organizations) are the unit of analysis in which SMEs Managers serve as representatives, considering manager's roles and responsibilities for daily decision making within their respective firms, as contained in a survey report by SMEDAN/NBS, (2017) as the population to determine the sample size. Therefore, in line with the study of Krejcie & Morgan (1970), a

sample size of 375 is accepted to represent the population. Further, as Hair, Jr (2015) suggested, a sample can be increased by a certain percentage to handle the possible occurrence of a low response rate during data collection. In addition, Adomi, Ayo and Nakpodia's (2007) study shows that Nigerians are reluctant to fill out and return questionnaires. 10% of 375 samples were added, which makes 414 questionnaires administered to ensure that the required responses for data analysis.

Therefore, from the 414 questionnaires, 69 were allocated and distributed through convenience sampling to the respondents in each state of the selected six states (Bauchi, Kano, Plateau, Imo, Rivers, and the Osun States), the country's six geopolitical zones. Also, the researcher administers the questionnaire in person to the respondents using a cross-sectional research approach. Four hundred fourteen questionnaires were distributed, 337 were returned after following ups, and 36 were not completed, including one univariate outlier. Consequently, three hundred (300) questionnaires were useful, indicating 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 o (Babbie, 2007; Grove, 2006).

4.1 Data Analysis

Data was entered using Statistical Package for Social Science (SPSS). Also, data screening was carried out to spot and confirm that the data is cleansed and can reflect the actual phenomenon of the study. After cleaning of data, descriptive statistics, frequencies, and percentages were used to analyse the demographic variables of the respondents, as presented in the table below.

Table 1. Respondents Demographic Profile

Demographic Variable	Classification	Frequency	Percentage
Gender	Male	258	86
	Female	42	14
Total Valid		300	100
Working experience	Less than 5 years	135	55.0
	5 years and above	65	45.0
Total Valid		300	100
Qualification	Primary certificate	19	6.3

	Secondary certificate	90	30.0
	Diploma	57	19.0
	National Diploma	28	9.3
	Higher National Diploma	22	7.3
	Degree	67	22.3
	Masters	7	2.3
	Ph.D.	2	0.7
	Others	8	2.7
Total valid		300	100
Business category	Small	200	66.0
	Medium	100	34.0
Total valid		300	100

Furthermore, the Partial Least Squares -Structural Equation Modelling (PLS-SEM) method using SMART PLS 4 is used in the model evaluation for this study, as opined by (Ringle, Wende, & Becker, 2015). Applying a two-stage analytical procedure consisting of (a) measurement models assessment and (b) evaluations of current structural models was applied after carrying out descriptive analyses (Anderson & Gerbing, 1988; Hair, Hult, Ringle, & Sarstedt, 2017).

4.1.1 Measurement Model Assessment

All constructs are based on reflective measurement; thus, assessing a reflective measurement model encompasses two main procedures: internal consistency assessment and convergent validity and discriminant validity assessment. Starting with the convergent validity, the indicator (items) reliability is expected to have an outer loading of 0.708 or higher. Conversely, loadings greater than 0.4, 0.5, 0.6, and 0.7 are all acceptable, provided that the average variance extracted (AVE) and composite reliability CR threshold 0.50 and 0.70 are all satisfied. Using the Hair et al. (2014) criteria, items with loadings lower than five were deleted. Both CR and AVE meet the required threshold, as presented in the table below.

Table 2. Convergent Validity

Constructs	**Items**	**Loading**	**CR**	**AVE**
Customer Relations (CR)	CR1	0.745	0.874	0.536
	CR2	0.689		
	CR3	0.697		
	CR4	0.740		
	CR5	0.790		
	CR6	0.727		
Process Management (PM)	PM1	0.756	0.840	0.514
	PM2	0.770		
	PM4	0.758		
	PM5	0.670		
Planning & Control (PC)	PC1	0.770	0.824	0.542
	PC2	0.732		
	PC3	0.715		
	PC4	0.690		

As shown in the table above, customer relations (CR) have an AVE of 0.536 and composite reliability of 0.874. Process management has 0.514 and 0.840 as AVE and composite reliability, respectively. Also, planning & control have an AVE of 0.542 and composite reliability of 0.824. This shows that all the constructs and their respective indicators have an acceptable level of convergence. The figure below also presents the indicators' outer loadings in the measurement model.

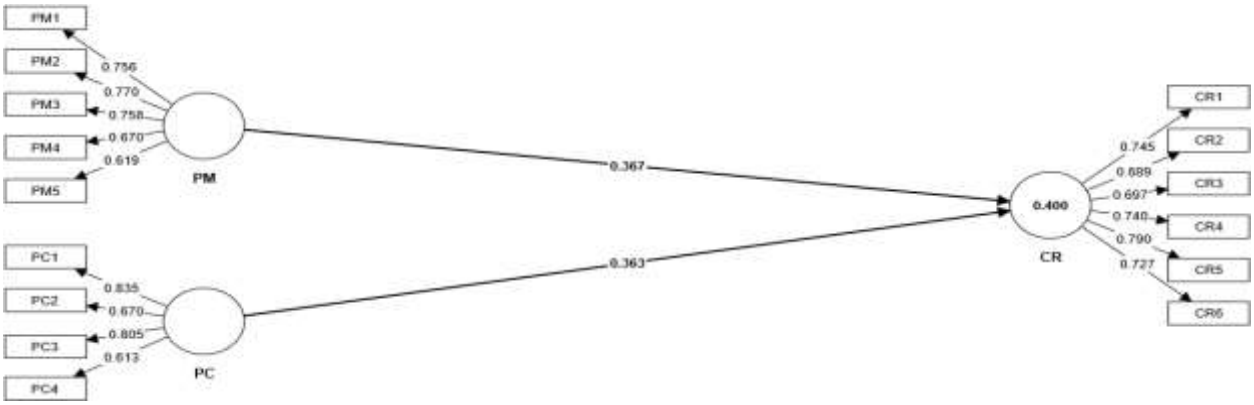

Figure 2. Measurement Model

Henseler et al. (2015) proposed a more robust procedure known as Heterotrait-Monotrait Ratio (HTMT) for detecting discriminant validity among constructs. Henseler et al. (2015) assert that all the values above 0.90 depict discriminant validity issues. It is also the position of Gold, Malhotra, and Segars (2001). Similarly, Kline (2011) suggests that a value not above 0.85 also indicates the absence of discriminant validity. Hence, values for the HTMT fall within the acceptable threshold, as shown in the table below.

Table 4. Heterotrait-Monotrait (HTMT)

Constructs	**CR**	**PM**	**PC**
Customer Relations (CR)			
Process Management (PM)	0.697		
Planning & Control (PC)	0.662	0.651	

4.1.2 Assessment of structural model

The structural model consists of R^2, (f^2), *and VIF*. Regarding R^2, it is argued by Hair et al. (2017) that there is no standard threshold, while Hair, Sarstedt, Hopkins, & Kuppelwieser (2014) postulated that an R^2 at 0.20 is high in organizational studies. Therefore, it can be deduced that this study has achieved an acceptable R^2 of 0.396 effects on the endogenous construct of customer relations. Regarding effect size (f^2), Cohen (1988) asserts that 0.02, 0.15, and 0.35 are slight, moderate, and large effect sizes. Hence, any predicting construct having an effect size (f^2) value lower than 0.02 does not affect the related endogenous construct in the model. This study's effect size shows that process management has 0.168 on customer relations. Also, planning &control on customer relations have an (f^2) of 0165. Hence, (f^2)all exogenous constructs have shown an acceptable effect size range (f^2) on the endogenous variables. The variance inflation factor (VIF) was used in assessing multi-collinearity among the constructs under investigation. Hair et al. (2019) suggested that VIF values should be close to 3 and lower. The result shows that the multi-collinearity assessment of process management and planning &control on customer relations is 1.336, respectively. It shows that the VIF values among all the constructs are lower than the threshold, which shows an absence of collinearity amongst the constructs of this study.

4.1.3 Path coefficients

As widely suggested in the literature, five thousand (5000) subsamples are used to run the bootstrapping procedure (Hair et al., 2017; Wong, 2013). The essence of this analysis is to test the significant effect of all the direct relationships hypothesized in the previous section. It is to confirm whether the data collected supports the hypotheses or otherwise. Studies suggested that values from 1.65 be significant at 10%, while 1.96 and 2.57 are also considered significant at 5% and 1% significance levels, respectively, based on two-tailed tests (Hair et al., 2017; Hair, Ringle, & Sarstedt, 2011; Hair et al., 2020). Similarly, the one-tailed test's critical values of 1.28 are significant at 10%, while 1.65 and 2.33 are significantly based on 5% and 1% significance

levels, respectively (Hair et al., 2017). Hence, all the relationships hypothesized in this study are directional. Therefore, the one-tailed test was used. Process management is found to have a positive and significant relationship on customer relation with (β = 0.062, t-value = 5.859and p<0.000). A positive and significant relationship was also found between planning & control and customer relations with (β = 0.057, t-value = 6.4.69 and p<0.000). The figure below is the structural model.

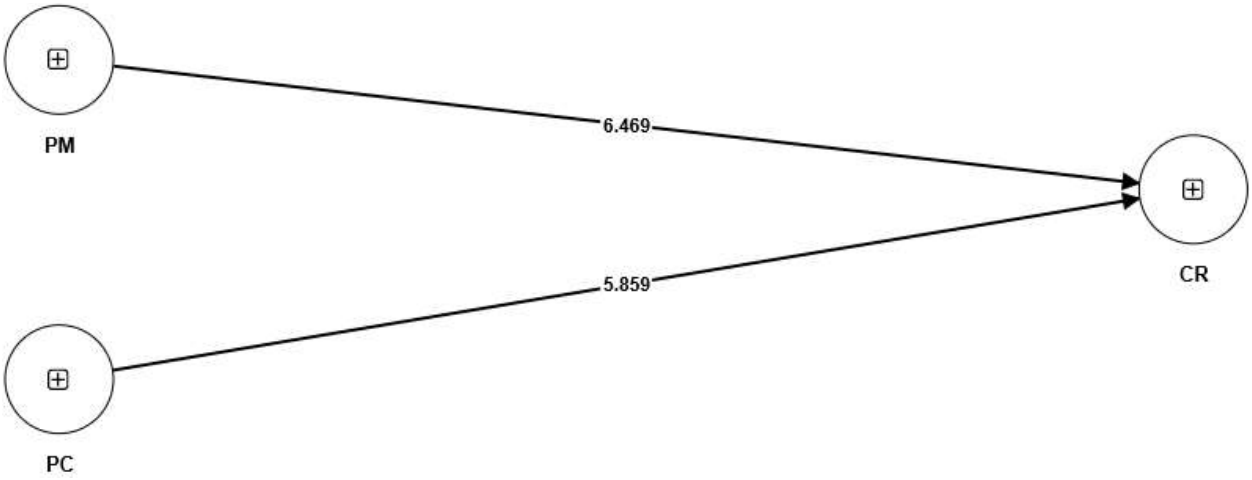

Figure 3. Structural Model

5.1 Discussions and Conclusions

The significant relationship between process management and supplier relations (H9) may be because of the nature of SME's processes, which are simple and coupled with easy access to raw materials. SMEs, unlike larger enterprises, have more flexible processes and do not need a vast number of raw materials in production processes. This made suppliers of SMEs supply raw materials timely since they are not required to supply in huge quantities. Manufacturing SMEs in Nigeria are not into producing industrial goods like machines that require tremendous expertise and technicalities. Also, a similar finding on the relationship between process management and customer relations in a study conducted by Bhatt & Troutt, (2005) aimed to examine the relationship between business process improvement initiatives, information systems integration, and customer focus finds business process improvement directly affects customer responsiveness.

Planning & control, the second component of technical readiness factors, shows a significant and positive relationship to customer relations (H1). The findings further indicate a strong synergy among technical and environmental readiness factors vital to readiness and ensuring successful Lean deployment. Impliedly, SMEs ensure that production planning and control activities within their limited available resources are done regarding the supplier's ability to meet their demand. The findings are similar to Adetayo et al. (2004) that effective production planning and control practices contribute significantly to consumer satisfaction. Studies reiterate the importance of planning and control in business success (Al-Najem et al., 2013). On the contrary, Elaho & Ejechi, (2019) conducted a study to empirically investigate the relationship between production

planning and customer satisfaction in table water firms in Nigeria were the findings of the study revealed that production planning does not significantly affect customer satisfaction.

5.2 Recommendation for future studies

Similar research can be conducted within the service sector or public corporations. Also, more variables can be included to further expand the field of knowledge.

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