

**LEAN MANUFACTURING READINESS
AMONGST SMEs IN BAUCHI REGION, NIGERIA:
AN ANALYSIS OF THE SOCIO-TECHNICAL
ENVIRONMENTAL FRAMEWORK**

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ENVIRONMENTAL FRAMEWORK**

by

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LIST OF ABBREVIATIONS

BCG	Boston Consulting Group
CC	Change Commitment
CE	Change Efficacy
CR	Customer Relations
CRM	Customer Relationship management
DV	Dependent Variables
EM	Employee relations
ILO	International Labor Organization
IPMA	Importance Performance Map Analysis
IV	Independent Variables
JIT	Just in Time
LM	Leadership/Top Management
LRF	Lean Readiness Factors
LSS	Lean Six Sigma
MV	Mediating Variables
NBS	National Bureau of Statistics
OC	Organizational Culture
ORFC	Organizational Readiness for Change
PC	Planning & Control
PLS/SEM	Partial least square/ Structural equation modelling
PM	Process management
PPC	Production planning & control
PWC	Price Westerhouse Coopers
SMEDAN	Small and Medium Enterprises Development Agency of Nigeria

SMEs	Small and Medium Scale Enterprises
SPK	System of Profound Knowledge
SR	Supplier Relations
STS	Socio-Technical Systems
TOC	Theory of Constraint
TQM	Total Quality Management
WTO	World Trade Organization

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**KESEDIAAN KEJAT TERHADAP SEKTOR PEMBUATAN DALAM
INDUSTRI KECIL DAN SEDERHANA DI DAERAH BAUCHI, NIGERIA:
SATU ANALISA KERANGKA SOSIO-TEKNIKAL PERSEKITARAN**

ABSTRAK

Kebanyakan PKS mengalami kesukaran semasa menggunakan Lean kerana kurangnya penilaian terhadap kesediaan organisasi untuk berubah. Selain daripada itu, terdapat kekurangan pembelian masuk terhadap pembuatan Lean dan pelaksanaan dalam sektor pembuatan PKS di Nigeria. Oleh itu, kajian ini menggunakan sistem sosio-teknikal dan teori perubahan Lewin untuk menilai kesediaan Lean dalam PKS pembuatan. Analisis data adalah berdasarkan kepada 300 responden yang diperolehi melalui soal selidik yang diedarkan kepada pengurus PKS dalam sektor pembuatan di Nigeria. Hipotesis telah diuji menggunakan pemodelan persamaan struktur separa kuasa dua terkecil (PLS-SEM) versi 3.3. Dapatan kajian menunjukkan bahawa budaya organisasi adalah signifikan terhadap hubungan di antara pembekal dan pelanggan. Kepimpinan/pengurusan atasan juga mempunyai hubungan yang positif dan signifikan dengan hubungan pelanggan. Sebaliknya, kepimpinan/pengurusan atasan tidak mempunyai hubungan yang signifikan dengan pembekal. Keputusan kajian juga menunjukkan bahawa hubungan pekerja adalah tidak penting terhadap pembekal dan pelanggan. Namun begitu, perhubungan di antara pembekal dan hubungan pelanggan adalah positif dan signifikan terhadap kesediaan organisasi untuk berubah (efikasi perubahan dan komitmen perubahan). Hubungan pembekal secara signifikan telah menjadi faktor pengantara terhadap hubungan di antara budaya organisasi dan komitmen perubahan. Walau bagaimanapun, hubungan pembekal tidak secara signifikan menjadi pengantara

budaya organisasi dan keberkesanan perubahan. Hubungan pembekal juga tidak menjadi faktor pengantara terhadap kepimpinan/pengurusan atasan dan hubungan pekerja dengan kesediaan organisasi (keberkesanan perubahan dan komitmen perubahan). Namun, hubungan pembekal telah menjadi factor pengantara terhadap hubungan di antara pengurusan proses dan perancangan dan kawalan ke atas kesediaan organisasi untuk berubah (keberkesanan perubahan dan komitmen perubahan). Manakala kesan tidak langsung pengurusan perhubungan pelanggan terhadap perhubungan pekerja dan kesediaan organisasi untuk perubahan (efikasi perubahan dan komitmen perubahan) adalah tidak ketara. Selanjutnya, pengurusan hubungan pelanggan telah menjadi pengantara terhadap perhubungan antara perancangan dan kawalan, serta pengurusan proses mengenai kesediaan organisasi untuk perubahan (keberkesanan perubahan dan komitmen perubahan). Secara teorinya, penyelidikan ini unik kerana ia menyepadukan dua model, iaitu, teori sistem sosio-teknikal dan model perubahan Lewin, untuk menyiasat kesediaan PKS untuk berubah kepada pembuatan Lean. Melalui pelbagai pengantaraan selari dengan pengurusan perhubungan pembekal dan pelanggan (faktor persekitaran), sekali gus membuka cara baharu kepada penyelidik untuk meneliti lebih lanjut tentang kesediaan Lean. Dari segi metodologi, kajian ini memberi sumbangan dengan menggunakan ramalan PLS, seterusnya menerangkan kuasa ramalan model yang luar daripada sampel. Selain itu, aplikasi Analisis Peta Prestasi Kepentingan (IPMA) telah menunjukkan kepentingan pengurusan perhubungan pelanggan dalam penilaian kesediaan dalam konteks PKS sector pembuatan di Nigeria. Kajian itu merupakan salah satu kajian pertama yang mengkaji PKS sektor pembuatan Lean di Nigeria dari segi sumbangan praktikal. Ia menawarkan penggubal dasar/pengurus PKS di Nigeria maklumat kritikal tentang faktor sosio-teknikal dan persekitaran yang penting untuk memahami kesediaan untuk

Lean. Kajian ini juga menawarkan kepada pengurus PKS di Nigeria pemahaman tentang kekuatan (faktor teknikal dan faktor persekitaran) dan kelemahan (faktor sosial faktor persekitaran) yang memerlukan perhatian yang khusus untuk menukar kepada pembuatan Lean dengan jayanya.

**LEAN MANUFACTURING READINESS AMONGST SMEs IN BAUCHI
REGION, NIGERIA: AN ANALYSIS OF THE SOCIO-TECHNICAL
ENVIRONMENTAL FRAMEWORK**

ABSTRACT

Most SMEs have experienced difficulties during Lean deployment due to a lack of assessment of organizational readiness to change. Similarly, there is shortage of Lean manufacturing buy-in and lack of implementation within manufacturing SMEs in Nigeria. Consequently, the study applies socio-technical systems and Lewin's change theories to evaluate Lean readiness within manufacturing SMEs. Analysis of data was based on 300 responses obtained through questionnaires distributed to SME managers within the manufacturing sector in Nigeria. The hypothesis was tested using the partial least square- structural equation modelling (PLS-SEM) 3.3 version. The findings reveal that organizational culture is positive and significantly related to supplier and customer relations. Leadership/top management also has a positive and significant relationship with customer relations. On the contrary, leadership/top management does not predict supplier relations. Also, employee relations have an insignificant relationship with suppliers and customers relations. It was found that the relationship between supplier and customer relations was positive and significant on organizational readiness for change (change efficacy and change commitment). Supplier relations significantly mediate the relationship between organizational culture and change commitment. However, supplier relations do not significantly mediate organizational culture and change efficacy. Also, supplier relations do not mediate between leadership/top management and employee relations with organizational readiness (change efficacy and change commitment). Supplier

relations mediate process management and planning & control on organizational readiness for change (change efficacy and change commitment). Customer relations significantly mediates organizational culture and leadership/top management on organizational readiness to change (change efficacy and commitment). While the indirect effect of customer relations on employee relations and organizational readiness for change (change efficacy and change commitment) is not significant. Further, customer relations also mediate the relationship between planning and control, and process management on organizational readiness for change (change efficacy and change commitment). Theoretically, the research is unique as it integrates two models, namely, socio-technical system theory and Lewin's change model, to investigate SMEs' readiness to change to lean manufacturing. Through multiple parallel mediations of supplier and customer relations (environmental factors), thus opening new ways for researchers to further examine Lean readiness. Methodologically, the study contributed by applying PLS predict, further explaining the model's out-of-sample predictive power. Also, the Importance Performance Map Analysis (IPMA) application has further shown the importance of customer relations in lean readiness assessment within the context of manufacturing SMEs in Nigeria. The study is one of the first studies to examine Lean manufacturing SMEs in Nigeria in terms of practical contribution. It offers policymakers/SME managers in Nigeria critical information on socio-technical and environmental factors that are key to understanding readiness for Lean. The study offers SMEs managers in Nigeria an understanding of areas they have a strength (technical factors and environmental factors) and areas of weakness (social factors environmental factors) that need their attention to change to Lean manufacturing successfully.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The research focuses on assessing organizational readiness for change to Lean manufacturing within SMEs in Nigeria to ensure that manufacturing SMEs have the needed readiness and socio-technical integration to deploy and implement Lean successfully. Changing to Lean manufacturing is necessary for manufacturing SMEs to reduce wastages, add value to their product, and compete locally and globally. Based on the socio-technical system and Lewin's change theories, the study examines the relationship between organizational culture, leadership/top management, employee relations, planning and control, and process management (socio-technical factors) on organizational readiness for change (change efficacy and change commitment) through multiple parallel indirect effects of supplier and customer relations (environmental factors).

Thus, the first chapter of the study; covers the introduction, background of the study, which gives a brief background of Lean manufacturing and organizational readiness for change to Lean. It includes a brief familiarity of Small and medium-sized enterprises (SMEs) in Nigeria and the level of implementation of Lean within SMEs. The chapter further outlines the problems statement based on the study's contextual, theoretical, and methodological gaps, which led to the development of research objectives and questions. The chapter highlights the study significance, scope of the research, and the definition of terms were all outlined and discussed.

1.2 Background of the Study

Businesses, all across the globe, irrespective of their sizes and nature, are changing their organizations rapidly to enhance quality, endure competitiveness, and meet up with current global trends of excellence in operations coupled with speedy and timely delivery to customers (Alexander et al., 2019; Küpper, Heidemann, Ströhle, Spindelndreier, & Knizek, 2017). For organizations to achieve competitiveness in today's market, archaic production and other manufacturing operations (crafts and mass production) are no longer profitable and result-oriented (Maware, Okwu, & Adetunji, 2021; Ekpenyong Ekpenyong Udofia, Adejare, & Olaore, 2021; Vamsi, Jasti, & Kodali, 2015). This leads to increased production costs combined with excess waste and non-value-adding (Maware et al., 2021; Vamsi et al., 2015). Therefore, the need for business organizations to assess their readiness for change to transform and familiarise themselves with improved quality practices like Lean manufacturing is paramount to their survival.

Lean manufacturing is often used interchangeably with Lean management, Lean production, or Lean system defined by Shah & Ward, (2007), as a socio-technical system that is integrated to remove waste by concurrently lessening or minimizing customer, supplier, and internal variability". It has been proven that Lean manufacturing is an effective technique and a bedrock in the actualization of operational superiority and excellence in manufacturing as it aids firms to remove all forms of wastages in human effort, inventory, time to market, and manufacturing space (Shah & Ward, 2007; Womack & Jones, 1997; Womack & Jones, 2003).

The successful implementation of Lean manufacturing by its originators, the Toyota Motors of Japan, brings about an increased interest in the area (Lean manufacturing) in recent years by both Scholars and business practitioners on the

possibility of implementing Lean not only in large enterprises but also in manufacturing SMEs successfully, e.g., (Al-Najem, Dhakal, Labib, & Bennett, 2013; Belhadi, Bin, Sha, Touriki, & Fezazi, 2018; Moya, Galvez, Muller, Camargo, & Moya, 2019).

Moreover, Lean manufacturing strategies have been mainly conceived to be deployed in large organizations, which made SMEs deal with such a type of project as a risky decision that requires organizational readiness for change assessment before deployment (Maware et al., 2021; Moya, Galvez, Muller, Camargo, & Moya, 2019). 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 organizational readiness for change to Lean. Such failure can be due to the inability of unfreezing their organization to create and assess their readiness and preparedness before implementing the change (Maware et al., 2021; Yadav, Jain, Mittal, Panwar, & Lyons, 2019; Yadav, Jain, Mittal, Panwar, & Sharma, 2018).

Also, a recent study by Vaishnavi & Suresh, (2020) and Boston consulting group, (2020) have asserted that many research studies are being done on the success and failure rate of Lean manufacturing implementation, with a dearth research on Lean readiness.. Small and medium-sized enterprises continue to face obstacles in changing their organizations into Lean organizations (Maware et al., 2021). Similarly, unsuccessful deployment still exists on Lean within manufacturing SMEs (Achanga, Shehab, Roy, & Nelder, 2006; Almanei, Salonitis, & Xu, 2017; Belhadi, Bin, Sha, Touriki, & Fezazi, 2018; Knol, Slomp, Schouteten, Lauche, Knol, et al., 2018; Norshahrizan Nordin & Adom, 2016). Such continues failure may be attributed to studies either focus only on the social aspect of Lean readiness (organizational culture,

leadership, employee relations), e.g. (Gurumurthy, Mazumdar, & Muthusubramanian, 2014; Ramakrishnan & Testani, 2012; Shokri, Waring, Nabhani, Shokri, & Waring, 2016) or technical aspects (process management, planning & control) and environmental readiness (supplier relations and customer relations) aspects separately with missing links, e.g. (Al-Najem, Jose Arturo, & Ahmed, 2018; Shafiq & Soratana, 2020; Uluskan et al., 2018), instead of applying socio-technical and environmental elements, to have a clear understanding of Lean readiness level and organizational readiness for change.

This results from poor comprehension of organizational readiness to change to Lean manufacturing that requires proper scrutiny by most change agents before Lean deployment. Hence, resulting in unsuccessful deployment and transformation, which create many setbacks for many businesses (Gurumurthy et al., 2014; Moya et al., 2019). Due to overlooking key aspects of active employee participation, top management's commitment to change improves planning and harmony. Therefore, Firms need to understand better areas that they are prepared fully and partially prepared or not prepared for change. Accordingly, it is salient to conduct and assess organizations' change readiness in a systematic manner supported by strong analytics (Boston consulting group, 2020).

The research focuses on organizational readiness to change to Lean manufacturing among SMEs in the Nigerian manufacturing sector by understanding the socio-technical environmental factors seen as the foundation for Lean deployment. The manufacturing sector is selected due to its role in economic development and sustainability (Ministry of Budget & National Planning, 2017).

SMEs are a very important part of the Nigerian economy contributing to 76% of the entire country's workforce and 49% GDP contribution (PWC, 2020). Studies

show that approximately SMEs represent about 90% of the manufacturing/ industrial sector in terms of number of enterprises (Ministry of Budget & National Planning, 2017; PWC, 2020). According to the Bank of Industry (2018), Nigeria manufacturing SMEs majorly engage in less advanced manufacturing, which is simple to manufacture. Products that SMEs in the manufacturing sector manufacture tend to target end consumers rather than other businesses. It is said that SMEs in Nigeria have significant untapped growth potential with strong export and employment potentials which can be achieved through the right amount of economic enabling (Olaore, Bimbo, & Udofia, 2020; Oyelaran-oyeyinka, 2020).

However, despite SMEs potential to constitute a significant portion of GDP in the near future, Nigeria has historically shown a lack of commitment to building a strong SME sector (PWC, 2020). The sector continues to be weighed down with challenges that ultimately impact the nation's growth (Oyelaran-oyeyinka, 2020). In countries at the same levels of development as Nigeria, SMEs contribute a much higher proportion to GDP than currently observed in Nigeria compared to other emerging markets (Central Bank of Nigeria, 2019; Oyelaran-oyeyinka, 2020). Manufacturing SMEs in Nigeria contribute approximately 1% of GDP compared to 40% in Asian countries and 50% in the US or Europe (PWC, 2020).

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 (PwC, 2018). Also, fierce competition for the Nigerian manufacturing sector come predominantly from Asia. Studies show that less than 20% of SME manufacturers export their products (Oyelaran-oyeyinka, 2020; World Bank Group, 2020). Recent World Bank statistics have also shown that Nigeria has 13%

manufacturing value added in terms of GDP, which is lower than China and Malaysia with 26% and 22%, respectively (World Bank Group, 2020).

Further, a recent report by United Nations industrial Development Organization, (2020) report ranked Nigeria as 99th in the Competitive Industrial Performance Index out of 152 countries. The said report also ranked Nigeria 116th per Manufacturing Value Added Per capita Index. World Economic Forum, (2018) backed the above, ranking Nigeria as 115th out of 140 countries globally in competitiveness and industrialization. Thus, reasons for the sector's decline were - 1.5% in 2015, -4.3% in 2016, -0.2% in 2017, 2.1% in 2018, to 0.8 in 2019, as reported by the Central Bank of Nigeria (2019). Furthermore, the 2016 Global Manufacturing Competitiveness Index, as postulated by Deloitte Touche Tohmatsu Limited and US Council on Competitiveness (2016), shows that Nigeria descent to number 38th out of 40 countries with index rankings of 23.1% out of 100%. The report further projects that Nigeria will remain in the exact status of 38 positions up to 2020.

Also, the country's dependence on imported goods worsens patronage on locally manufactured goods (Oyelaran-oyeyinka, 2020; PwC, 2018). This further shows that Nigeria's manufacturing sector is highly volatile and lacks the capacity and technical know-how to compete favourably at the local and global levels despite its potentialities. Such unwarranted circumstances have disadvantaged local manufacturing SMEs to sell their goods and compete with their foreign counterparts in quality and price (PwC, 2018). Hence, it shows an issue that needs to be treated with urgency to achieve complete economic diversification.

Furthermore, studies have shown that manufacturing SMEs in Nigeria implement quality practices in their businesses, e.g., (Eniola, Olorunleke, Akintimehin, Ojeka, & Oyetunji, 2019; Inuwa & AbdulRahim, 2020; Nwachukwu &

Hieu, 2021; Udofia, 2019; Udofia et al., 2021). However, poor quality practices still linger in manufacturing firms in Nigeria (Ogah, Ogbechie, & Oyetunde, 2020; Udofia et al., 2021). This might be due non- the implementation of Lean manufacturing (Inuwa & AbdulRahim, 2020; Marire, Nwankwo, & Agbor, 2014; Nwanya & Oko, 2019); this is because most manufacturing SMEs in Nigeria still have obsolete production systems leading to the manufacturing of inferior goods (Olaore et al., 2020; Udofia et al., 2021). 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 (Inuwa & AbdulRahim, 2020; Olaore et al., 2020).

Additionally, the quality control practice in Nigerian manufacturing firms has encountered difficulties due to the absence of awareness of Lean tools and initiatives, failure to recognize the importance of understanding customers' needs, and poor management attitude. The country's manufacturing sector has suffered a decline in production, which has brought about low productivity in some factories or some cases, complete business closure (Ekpenyong Ekpenyong Udofia et al., 2021). Nwanya & Oko, (2019) supported this, stating the non-existence of Lean manufacturing in SMEs with low awareness.

Moreover, the high cost of production and higher tax and levies from governments sometimes make manufacturing SMEs compromise quality. This issue brought about inferior quality products manufactured by local manufacturers with low

patronage from customers, which made the customers go for imported items that are cheap and of better quality which hampers the growth of the local economy. (Udofia et al., 2021). This day newspaper of 30th March 2018 reported that industry operators and other local manufacturers in Nigeria have mourned over the high clearing cost of Nigerian seaports where they describe the situation as a cankerworm that has resulted in the forceful closure of so many companies and sending others into extinction (Abiodun, 2018).

On the other hand, Studies have shown SMEs within the manufacturing sector in Nigeria have a quality target which they aim to achieve by employing practice that includes; creating a good corporate image, meeting consumer needs and creating consumers satisfaction to achieve lower cost (Gorondutse & Hilman, 2016; Shehu & Mahmood, 2014; Shuaib & He, 2021). Therefore, it is imperative to improve the quality of locally manufactured goods via the implementation of Lean. Further, manufacturing firms must ensure that they have the necessary resources, readiness, and top management support to realize success.

Consequently, it is of great importance and urgency to introduce the practice of Lean manufacturing to Nigerian manufacturing SMEs by evaluating their readiness level through a socio-technical approach and organizational readiness for change to save them and the economy from total collapse. Hence, the study aims to examine the relationship between Lean readiness factors, which includes social subsystem (organizational culture, leadership, and commitment employee relations) environmental subsystems (process management, planning, and control) with mediating role of environmental subsystems (customer and supplier relations) on organizational readiness to change to Lean with organizational among manufacturing SMEs in Nigeria.

1.3 Problem Statement

The section for the problem statement highlights; contextual gap, showing the problems related to manufacturing SMEs in Nigeria regarding lack of lean readiness. The gap, in theory, is a lack of socio-technical and environmental factors integration which leads to incomplete assessment of organizational readiness for change to Lean manufacturing. The methodological gap is the lack of a full path structural model to examine the synergy between socio-technical and environmental factors on organizational readiness for change. Hence the absence of empirical evidence and limited literature.

Gap1: Contextual Gap

Lean manufacturing is well known for reducing waste and adding value to products (Antony, Psomas, Garza-Reyes, & Hines, 2020; Psomas & Antony, 2019). However, it is ascertained that despite its importance, Manufacturing small and medium-sized enterprises in Nigeria have complexities changing their organizations into Lean manufacturing (Maware et al., 2021). It has been revealed that studies on implementing Lean manufacturing are scarce, especially in developing countries such as Nigeria (Inuwa & AbdulRahim, 2020; Ogah et al., 2020; Psomas, 2021b).

In Nigeria, it is acknowledged that manufacturing SMEs has underperformed due to non-implementation of Lean manufacturing (Nwanya & Oko, 2019). This may be largely due to poor adoption of quality skills, lack of effective production strategy, lack of human resources training, poor process, ineffective inventory management and harsh business environment, which brings about the high rate of enterprise mortality (Anastesia, Chika, Hillary, Chijindu, & Penninah, Ijeoma, 2018). The dearth of meaningful and imparting training and leadership development still exists (Olaore et al., 2020). SMEs leadership/ top managers are often left to search for a way to survive

amid many operational difficulties and setbacks inherent in the Nigerian business environment.

The researcher believes that the absence of research on Lean manufacturing within SMEs in Nigeria can be considered one main factor for underperformance within the said sector and its inability to manufacture a quality product compared to their foreign counterparts. A study can backs the above assertion posits that manufacturing SMEs face challenges in regards to practices of process management, supplier relation, customers relation, and employee performance, which negatively impact the actualization of quality goals (PWC, 2020; Udofia et al., 2021).

Therefore, the current research believes that the deployment of Lean manufacturing can help mitigate the quality issues faced by SMEs in Nigeria. In the same vein, the need to assess and examine their organizational readiness for change to Lean through socio-technical and environmental factors becomes sacrosanct. Also, a study by (Ogah et al., 2020; Umude-Igbru & Price, 2015) posits that there is a necessity for extra awareness and enlightenment on the application practices of Lean quality techniques in Nigerian SMEs. Similarly, it is indicated by Antony et al., (2020) & Maware et al., (2021), that investigation should focus on the Lean pre-implementation stage to have a good understanding of readiness factors.

Gap 2: Theoretical Gap

Lack of a practical framework to assess Lean readiness exists in research (Pearce & Pons, 2019; Uluskan et al., 2018). Though a few studies have assessed readiness for change to Lean with different frameworks, full application, and inclusion of critical aspects of social, technical, and environmental (variables) approach is lacking. For instance, (Achanga et al., 2006; Bouranta, Psomas, & Antony, 2021; Connor & Cormican, 2021; Douglas, Muturi, Douglas, & Ochieng, 2017; Shokri,

Waring, & Nabhani, 2016) apply a social aspect of Lean only (e.g., human resources, leadership/managers, and organizational culture). While Al-Najem, Dhakal, Labib, & Bennett, (2013) & Garza-Reyes et al., (2018), apply both socio-technical aspects (e.g., leadership commitment, employee human resource, process management, planning/control, supplier relations, and customers).

So also, Uluskan, et-al, (2018) developed a model for assessing organizational readiness for change to Lean; organizational culture and supplier relations are not included in the study. Similarly, Shafiq & Soratana, (2020) found a single mediating variable as organizational culture in assessing Lean readiness. The single mediator variable does not give room for the investigator to model multiple mechanisms simultaneously in a single integrated model (Hayes, 2013; Hayes, 2018; Preacher & Hayes, 2008).

However, their studies are limited by the absence of social, technical, and environmental integration to assess organizational readiness for change. In the same vein, Mutingi, (2018), & Yadav et al., (2019), suggested that studies should develop a better framework for Lean before deployment in SMEs. In line with the above statement, this study put forward an integrated framework that will assess manufacturing SMEs ' readiness for change to Lean through multiple parallel mediations of supplier and customer relationships through understanding socio-technical and environmental factors and organizational readiness for change to Lean manufacturing among SMEs in Nigeria.

Gap 3: Methodological Gap

Lean as a body of knowledge has shown that most research conducted is qualitative, and case studies heavily rely on the researcher's subjectivity (Pearce & Pons, 2019; Puram, & Gurumurthy, 2021). Hence, quantitative/empirical analyses

are needed to substantiate and support current literature for broader generalizability (Puram, & Gurumurthy, 2021; Yadav et al., 2019).

Most studies that emphasize qualitative methods include (Achanga et al., 2006; Dibia, 2017; Mahendran & Senthil Kumar, 2018; Rymaszewska, 2014). Also, studies by (Belhadi et al., 2018; Danese, Manf, & Romano, 2018; Gupta & Jain, 2013a; Hu, Mason, Williams, & Found, 2015; Randhawa & Ahuja, 2017) applied a method of literature reviews/ conceptual papers. Gurumurthy et al., (2014), involved a graph-theoretical approach (GTA). Analytical hierarchy methodology was used by (Badurdeen, Wijekoon, & Marksberry, 2011).

Kumar, Dhingra, & Singh, (2018) used the fuzzy logic method while Moya, Galvez, Muller, Camargo, & Moya, (2019) applied maturity grids and structured as a multi-criteria model in assessment for readiness to deploy Lean. More recent studies conducted in the health care sector by Vaishnavi & Suresh, (2020), use the total interpretive structural modelling technique. Furthermore, reliability tests and independent-sample t-test methodologies were applied in the work of Al-Najem et al., (2013). Also, a mixture of non-parametric Mann-Whitney and descriptive statistics methods was used (Connor & Cormican, 2021; Garza-Reyes, Ates, & Kumar, 2015; Garza-Reyes et al., 2018).

However, applying these methodologies and approaches is viewed as inadequate and fads, as they fail to provide a complete integrated structural model of regression analysis to observe relationships (Pearce & Pons, 2019; Uluskan et al., 2018). Consequently, it can be argued that there is a deficiency of regression analysis and structural equation modelling to integrate critical variables that are paramount in the examination of organizational readiness to deploy Lean manufacturing. Also, it is suggested that future researchers should examine causal relationships to identify

nexus between various aspects of Lean manufacturing employing advanced statistical tools like structural equation modelling so as have a better understanding and make discoveries (Antony, Psomas, Garza-reyes, et al., 2020; Arumugam, Kannabiran, & Vinodh, 2020a; Patel, Sambasivan, Panimalar, & Krishna, 2021; Psomas, 2021b; Reynders, Kumar, & Found, 2020).

Accordingly, this study applies PLS/SEM through multiple mediator variables (supplier and customer relations) and environmental readiness factors to fill such a gap. Through parallel mediation aimed to examine their direct and indirect effect on social and technical characteristics of Lean readiness to organizational readiness for change.

1.4 Research Objectives

1. To examine the relationship between social readiness factors (organizational culture, leadership/management commitment, employee relations) on environmental readiness factors (supplier relations and customer relations).
2. To examine the relationship between technical readiness factors (planning & control and process management) on environmental readiness factors (supplier relations and customer relations).
3. To examine the relationship between environmental readiness factors (supplier relations and customer relations) and organizational readiness for change (change commitment and change efficacy).
4. To examine the mediation effect of environmental readiness factor (supplier relations) on the relationship between socio/technical subsystem factors (organizational culture, leadership/management commitment, employee relations,

planning & control, and process management) and organizational readiness for change (change commitment and change efficacy).

5. To examine the mediation effect of environmental readiness factor (customer relations) on the relationship between socio/technical subsystem factors (organizational culture, leadership/management commitment, employee relations, planning & control, and process management) and organizational readiness for change (change commitment and change efficacy).

1.5 Research Questions

1. What is the relationship between social readiness factors (organizational culture, leadership/management commitment, employee) on environmental readiness factors (supplier and customer relations)?
2. What is the relationship between technical readiness factors (planning & control and process management) on environmental readiness factors (supplier relations and customer relations)?
3. What is the relationship between environmental readiness factors (supplier and customer relations) and organizational readiness for change (change commitment and change efficacy)?
4. What is the mediation effect of environmental readiness factor (supplier relations) on the relationship between socio/technical readiness factors (organizational culture, leadership/management commitment, employee relations, planning & control, and process management) and organizational readiness for change (change commitment and change efficacy)?
5. To examine the mediation effect of environmental readiness factor (customer relations) on the relationship between socio/technical subsystems factors

(organizational culture, leadership/management commitment, employee relations, planning & control, and process management) and organizational readiness for change (change commitment and change efficacy).

1.6 Significance of the Study

The significance of the study consist of practical, theoretical, and methodological contribution is discussed in the next section.

1.6.1 Practical Significance

Practically, the study aid manufacturing SMEs in Nigeria to assess their readiness to deploy Lean successfully and ensure that quality is being improved while wastages and non-value adding activities are eliminated. It is argued that manufacturing SMEs are having issues changing their organization to Lean manufacturing (Maware et al., 2021). The study gives SMEs managers are clue on the importance of socio-technical and environmental factors on their organizational readiness for change to Lean manufacturing. Impliedly, the study gives an insight into where social gaps existed, particularly on employee relations and leadership top management, on aspects of environmental factors that require urgent remedy to avoid change readiness failure that may lead to unsuccessful lean deployment. It has also shown a strong integration of technical factors, planning and control with process management on environmental factors, indicating a high level of technical and environmental readiness to change to Lean manufacturing.

Overall, the research highlights how manufacturing SMEs can integrate environmental factors (customer and supplier relation) to actualize Lean readiness and successful Lean implementation. Further, the study has offered a practical significance for SMEs by providing a framework that will help them assess organizational readiness

for change to Lean before deployment. Hence, boosting overall quality and mitigating issues of failed implementation. Studies have posited that most change initiatives failed due to the non-assessment of organizational readiness for change (Boston consulting group, 2020; Maware et al., 2021; Ogah et al., 2020).

1.6.2 Theoretical Significance

Though few studies in the past assess organizational readiness for change to Lean, e.g. (Rodgers, Anthony, & Cudney, 2021; Shafiq & Soratana, 2020; Shokri, Waring, Nabhani, et al., 2016; Uluskan et al., 2018), most of the said prior studies are subject to some theoretical deficits. They do not provide an integrated framework covering social, technical, and environmental readiness factors and organizational readiness for change.

Hence, this theoretical study significance is integrating socio-technical system theory with extensions of multiple parallel mediations environmental factors (supplier and customer relations) and Lewin's change theory. The study examines Lean readiness factors based on social readiness factors consisting of organizational culture, leadership/top management, and employee relations. Technical readiness factors comprise planning & control, process management, and environmental readiness factors as supplier and customer relations. At the same time, organizational readiness for change was examined based on change efficacy and commitment dimensions.

Based on the researcher's knowledge, no study was found that integrates and assesses organizational readiness for change to Lean through multiple parallel mediations. Therefore, applying multiple parallel mediations has given a new theoretical insight into Lean readiness assessment research. It has shown how supplier and customer relations (environmental readiness factors), when put together, are

essential to understanding readiness for Lean through socio-technical and environmental integration.

1.6.3 Methodological Significance

Scholars have called on the need to apply advanced statistical tools like PLS-SEM in Lean research e.g. (Pearce & Pons, 2019; Psomas, 2021b; Yadav et al., 2019), to better understand complex relationships concerned with Lean manufacturing. According to the researchers' knowledge, Shafiq & Soratana (2020) is the only study that applied PLS-SEM. However, the said study does not apply other key methodological aspects of PLS-SEM analysis like the PLS predict and Importance Performance Map Analysis (IMPA), which are also important in having more robust findings (Hair et al., 2020; Shmueli et al., 2019).

Therefore, the application of PLS predict has led to further understanding of the models out of sample predictive power and the data quality. Also, the IMPA application will aid the managers of SMEs in the Nigerian manufacturing sector to understand which variable is of most importance among the socio-technical and environmental factors during Lean readiness assessment. Hence, the methodological significance of the study.

1.7 Novelty of the Study

The research has offered novelty by introducing multiple indirect effects of supplier and customer relation as environmental factors on the relationship between socio-technical factors and organizational readiness for change to Lean from the dimension of change efficacy and change commitment. Also, the relationship between process management and planning & control on supplier relations is novel as the researcher could find studies that made similar findings. Overall, it can be concluded

that the study has offered novel contributions in Lean readiness assessment within the manufacturing sector.

1.8 Scope of the Study

The study aims to assess organizational readiness for change to Lean manufacturing among SMEs in the manufacturing sector through understanding their socio-technical and environmental factors. Based on the study, the social factors include organizational culture, leadership/top management, and employee relations. Technical factors include planning and control and process management. Hence, the socio-technical factors are considered the independent variables for the study, while environmental factors comprising supplier and customer relations are the mediating variables.

The dependent variables for the study are organizational readiness for change with two dimensions of change efficacy and change commitment. Previous studies focus on testing direct relations between socio-technical factors and organizational readiness for change, e.g. (Shafiq & Soratana, 2020; Shokri, Waring, Nabhani, et al., 2016; Uluskan et al., 2018), leading to inadequate assessment of socio-technical and environmental readiness. Thus, applying multiple parallel mediations of supplier and customer relations as the environmental factor gives further understanding of social, technical, and environmental integrations, which is sacrosanct to organizational readiness for change to Lean manufacturing.

The study focuses on manufacturing SMEs in Nigeria. Manufacturing SMEs in Nigeria face quality issues that hinder them from competing favourably locally and internationally (Olaore et al., 2020; Udofia et al., 2021). They mostly practice obsolete

manufacturing techniques that add no value, with many wastages that affect their growth (Inuwa & AbdulRahim, 2020; Ogah et al., 2020; Psomas, 2021b). Manufacturing SMEs in Nigeria are also finding it difficult to change and implement Lean manufacturing (Maware et al., 2021).

Hence, the researcher feels that such quality issues can be addressed through the Lean manufacturing initiative as most manufacturing SMEs in Nigeria do not practice Lean. Therefore it is sacrosanct to understand the level of organizational readiness to change to Lean manufacturing to be deployed successfully and mitigate failure (Boston consulting group, 2020). The study commenced in November 2018. Data collection was done within three months, from 14th September 2020 to 13th December 2020. Survey questionnaires were administered to manufacturing SMEs managers across six States within the six geo-political zones of Nigeria to represent the population better. In the North-east Bauchi State, North-central Plateau State, North-west Kano State, Southeast Imo State, South-south Rivers State and South-west Oyo State.

The quantitative research design was applied using SMART PLS version 3.3 to examine the relationship between socio-technical factors (organizational culture, leadership/top management, employee relations, planning and control, and process management and environmental factors (supplier and customer relations). Also, environmental factors' indirect effect was examined on the relationship between socio-technical factors and organizational readiness for change (change efficacy and change commitment).

1.9 Definition of Terms

Lean Manufacturing: Lean manufacturing integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, internal customer variability (Shah & Ward, 2007).

Organizational Readiness for Change: Organizational readiness for change is categorized based on two dimensions, namely, Change commitment and Change efficacy (Shea, Jacobs, Esserman, Bruce, & Weiner, 2014). The first aspect of readiness, **change commitment**, shows organizational members' shared resolve to implement a change. The second aspect of readiness, **Change efficacy**, indicates organizational members' shared belief in their collective capability to implement a change (Shea et al., 2014).

Social Factors: Social Lean readiness practices can generally be defined as practices that are directed toward behavioural issues, managerial concepts and relations (Abdallah, Alkhalidi, & Aljuaid, 2021).

Organizational Culture: Tenji & Foley, (2019) posits that an organizational culture profile can be formulated and used as an indicator or assessment of an organization's readiness for quality initiative deployment. Such organizational culture comprises social relations that characterize the workplace regarding interpersonal relations, task orientation, and flexibility (Tenji & Foley, 2019).

Leadership/ top management commitment: Top management commitment is defined as the ability to Manager's involvement regarding appearance in the working area, identifying the right employees in the right place, providing job security, investing in consultancy and expert advice, and investing in training (Mohamad Al-Najem et al., 2013).

Employee Relations: Employee relations refers to employees' participation in improving quality and performance (Uluskan et al., 2018). It involves activities like; employees responsibility for quality, feedback on their quality performance, participation in quality decisions and reward for superior quality that can enhance employees' readiness for change to Lean (Uluskan et al., 2018).

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).

Planning & Control: According to Al-Najem et al., (2013), planning and control are referred to the use of quality control systems and scientific methods to solve problems, as well as visual mapping, help to ensure continuous improvement as it is key for enhancing the firm's performance and eventually leads to higher levels of customer satisfaction.

Process Management: Process management involves the design of process flows aimed at minimizing the chance of error through regular preventive maintenance of tools and machinery that will lead to an effective and standardized process flow which will serve as a foundation for the deployment of quality initiative (Uluskan et al., 2018).

Environmental Factors: The environmental dimension refers to the external entities influencing and impacting social and technical subsystems; it cuts across both the social and technical dimensions, including suppliers and customers. (Malatji et al., 2019; Washington & Hacker, 2000).

Supplier Relations: Supplier relations entails having a long-term and harmonious relationship with the supplier, which is key to achieving delivery of raw material on time (Al-Najem et al., 2013). Supplier quality, supplier proximity, number of suppliers, supplier involvement, and supplier feedback are key determinants of supplier relations concerning Lean readiness (Al-Najem et al., 2013).

Customer Relations: Customer relationship management is defined as understanding customer requirements based on quality, meeting and satisfying those needs, and ensuring customer feedback on delivery performance and satisfaction (Al-Najem et al., 2013).

1.10 Organization of Thesis

The thesis is made up of five chapters. The first chapter is composed of the introduction, study background, and study context. The chapter also highlighted the objectives of the research and research questions. Also, the first chapter includes the problem statement where research gaps were justified and the significance and novelty of the study in terms of practical, theoretical, and methodological contributions.

The second chapter critically presents reviews of previous literature associated with the concept of lean manufacturing, principles of Lean, Lean manufacturing within SMEs with organizational readiness for change, organizational readiness for change in the context of SMEs, and Lean readiness factors. Also, Social, technical, and environmental factors with their relationships and integration were discussed in chapter two. Related theories on Lean manufacturing and their limitation to this research were also discussed. Further, socio-technical system theory and Lewin's change theory as the theoretical underpinning of the study were also deliberated. The framework for the study and hypotheses were also developed.

In chapter three, the research methodology was detailed out where the researcher clarified the preferred methods and provided reasons for such choices from the literature. The chapter also outlines the basic mechanisms of the research design, population, unit of analysis, and sample size determination. Additionally, the development of survey instruments and measurement scales, data collection methods, procedures, and techniques for collected analysis was detailed. Chapter five, the last chapter of the research, presents the discussion of the result of this study based on the formulated hypothesis. It also outlines the research implications for managers/ industry, government, and researchers. Lastly, the conclusion, limitations of the study, and suggestions for future research were also discussed in this section.

1.11 Chapter Summary

The first chapter of the research highlights the introduction and background of the study and the study context. It includes the problem statement and research gaps the study's significance. It also presents the aims and objectives, the research questions, the definition of terms, the study's novelty, the study's scope, and how the thesis is organized.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In the second chapter, the study delves into numerous pieces of literature on aspects of Lean manufacturing. In this case, the study organizes its literature reviews and empirical findings based on relevant and available studies within reach. The chapter begins with the literature on the concept of Lean manufacturing, principles of Lean, enablers and inhibitors of Lean deployment in manufacturing SMEs and reviews on organizational readiness for change, Lean readiness factors from social, technical, and environmental subsystems on organizational readiness for change. Also, hypothesis development and the theoretical underpinnings of the study were discussed in detail to ascertain the main objective behind the thesis and the development of the research framework.

2.2 The Concept of Lean Manufacturing

Comprehensive research on Lean manufacturing was first done by Womack et al. (1990) in their book titled *The Machine That Changed the World*. It was the authors of this book that took their time in collaboration with other American, Japanese and European auto manufacturers, government institutions, and financial agencies to thoroughly research and investigate how the Toyota production system works (Emiliani, 1998, 2006; Martínez-lorente, Dewhurst, & Dale, 1998). These researchers' work first identifies how to change from the obsolete mass production system to modern-day Lean manufacturing after five years of research in the Western automotive industry (Samuel, Found, & Williams, 2015).