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AN ASSESSMENT OF THE IMPLEMENTATION OF LEAN CONCEPT IN NIGERIAN MANUFACTURING COMPANIES

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Abstract

Lean concept emerged from the Japanese auto industry as a new process oriented method centered on optimal resource usage and waste elimination. Various researchers have tried to study lean implementation in different manufacturing environments all around the world. Over 50 medium and large Nigerian manufacturing companies were randomly selected to evaluate the level of use of lean tools in Nigeria. Data collection is via 5-point Likert scale questionnaires that were administered to key quality and production personnel in these organizations. Simple descriptive analysis indicates usage of lean tools is skewed towards Kaizen, Just in Time (JIT), and Failure Mode Effect Analysis. Others (Kanban, Jidoka, and Value Stream Mapping) enjoyed significant usage in the companies surveyed.

Key Words: Manufacturing, Lean, Production, Techniques

1. INTRODUCTION

Lean production techniques are based on methods pioneered in the Japanese car manufacturing industry (Womack, Jones, and Roos, 1990). The basic idea behind this system is the absolute elimination of wastes. These wastes, *transportation, inventory, motion, waiting, overproduction, overprocessing, and defects,* were thought by Ohno (1978) as necessary for removal in the Toyota Production System (TPS). The two pillars of the TPS were Just in Time and Autonomation. Just in Time exists as an inventory control mechanism where parts needed in an assembly reaches the assembly line only when needed and only as many as needed. If this was

practiced throughout an organization, it would result in "zero inventory". Autonomation means automating a process to include inspection.

Fig 1.1: Seven Wastes – *Overproduction, Defects, Inventory, Over Processing, Transporting, Waiting, Motion.*

The Toyota Production System (TPS) came into the fore around the time of the oil shock of the 1970s, when Toyota's profits kept surging and her fortunes soaring. The Japanese car manufacturing industry was making enormous sales to match its American rivals.
The term "*lean production"* was coined to describe the highly efficient production system which uses less of every resource to produce the same number of products with good quality.
Several researchers have attempted to define lean. Womack (1993) defined as an integrated set of socio-technical practices aimed at eliminating waste along the whole value chain within and across companies. Womack and Jones (1996) considered lean as a system where a company can achieve reduced costs, coupled with continuous improvements and customer satisfaction. Sawhney and Ehie (2006) denotes a lean system as one that reduces the time in the system of a product while meeting the flexibility requirements associated with the product mix. Maleyeff (2007) defines lean as a management approach that seeks to maximize value to both internal and external customers. According to Shah and Ward, (2007), lean manufacturing is "an integrated socio-technical system whose main objective is to eliminate waste by concurrently minimizing supplier, customer, and internal variability**.** Lean is also defined as the production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful and thus a target for elimination (Anvari, Ismail and Hojjati, 2011). It is a production philosophy that shortens the time line between the customer's order and shipment through the elimination of waste and adoption of continuous improvement in the production system (Abioye and Bello, 2012), and a process which uses optimized space, inventory, lesser defects (Sanyal, 2015). Lean can also be seen from the practical perspective as a set of management tools, or techniques for effective lean management (Natasha and Stefano, 2014).

Lean has a key role to play in new product development and the improvement of existing products and the improvement of existing products, including idea creation, design for manufacture, assembly and test, rapid prototyping, product portfolio management, market and competitor analysis, risk management, sales forecasting, setting key performance indicators and value analysis to reduce the cost of existing products.
Lean implementation has been studied all around the world. There have been more studies in lean in USA more than any other country globally (Bhamu and Sangwan, 2013). Contributions from academicians using industrial data have formed bulk of the research work in lean.

In examining its implementation on a country wide basis, Sánchez and Pérez (2001) assessed the influence of certain of lean indicators in 107 Spanish companies; Soriano-Meier and Forrester (2002) studied over 30 United Kingdom Ceramics manufacturing firms to measure the degree on lean implementation. Fullerton and Wempe (2008) examined how Non-Financial Manufacturing Performance (NFMP) impacts the lean manufacturing and financial performance relationship in 121 US manufacturing companies. Rahman, Laosirihongthong, and Sohal (2010) examined the extent of lean management practices adopted by 187 manufacturing organizations in Thailand. Tubino, Poler and Da Silva (2011) explored 79 Brazilian companies for their implementation of lean manufacturing (LM) practices. Abioye and Bello (2012) examined the level of lean implementation in 58 Nigerian small scale manufacturing companies. Thanki and Thakkar (2013) reported the current level of awareness of lean in 32 Indian firms. Herzog and Tonchia (2014) surveyed lean in 72 Slovenian manufacturing companies.

Alawode and Ojo (2008) discussed the implementation of the Just in Time (JIT) strategy (which is a variant of lean) in the Nigerian manufacturing landscape and how its benefits can be harnessed.

In non-manufacturing sector, Olatunji (2008) examined the exportation of lean to the Nigerian construction industry by exploring practitioners' extent of knowledge and scope of application of lean techniques. Tai (2012) explored the implementation of lean operations (LO) in a gas company as a way of using Total Quality Management (TQM) and Just-In-Time (JIT) manufacturing to contribute to the organization's profitability and competitive advantage. Uzochukwu and Ossai (2016) adapted lean production system in the oil and gas industry with a view to resolving severe organizational performance problems in the sector.

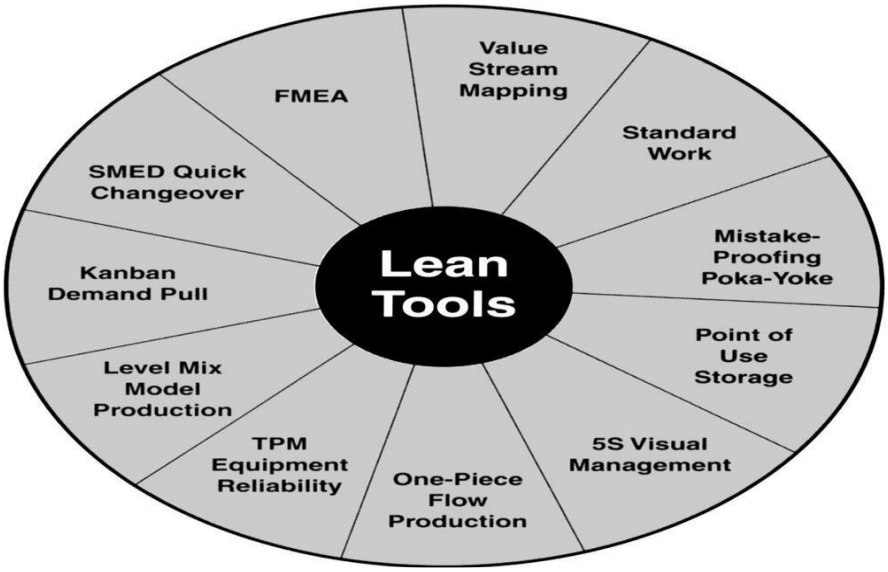

Figure 1.2: Lean tools
Source: Business Excellence http://www.bexcellence.org/Lean-manufacturing.html

2. RESEARCH METHODOLOGY

The data collection is via questionnaire developed based on different lean tools identified by Shah and Ward (2003) as used by Rahman et al (2010), and Bhamu and Sangwan, (2013). A 5 –

point Likert scale (never used, seldom used, sometimes used, often used, almost always used) was adopted. This method of data collection for this research is suitable for analyzing lean manufacturing tools and techniques used in manufacturing companies in Nigeria. The population for this study which is manufacturing landscape in Lagos State, Nigeria was narrowed down to a few selected companies in and around Ikeja Local Council Development Area. 150 questionnaires were administered to key quality management personnel in selected manufacturing companies in the study area. A total of 136 questionnaires were returned which represents a response rate of 90.67%.

2.1 DATA INTERPRETATION AND RESULTS

General Information of Respondents

Table 2.1: Sex of respondents

	SEX OF RESPONDENTS	Percent
1	Male	71%
2	Female	29%
	Total	**100%**

The percentage of male respondents is 71% and 29% were female

Table 2.2: Years of experience of respondents

Year of Experience	Percent
0-2	21%
3-5	26%
6-10	38%
11-above	15%
Total	**100**%

Twenty one percent (21%) of respondents have manufacturing experience of 0-2years. Twenty six percent (26%) have experience of 3-4years, thirty eight percent (37%) have manufacturing experience of 6-10years, and fifteen percent (15%) have experience of 11-above.

Table 2.3: Educational Qualification of Respondents

Qualification	Number Of Respondents	Percent
WAEC/OND	18	13.3%
HND/BSc	67	49.6%
PGD	21	15.6%
MSc	27	20.0%
PhD	2	1.5%
Total	**135**	**100**%

From the total respondents, 13.3% of the respondents have WAEC/OND, 49.6% of the respondents have HND/BSc, 15.6% of the respondents have PGD, 20% of the respondents have MSc, while 1.5 % of the respondents have Phd.

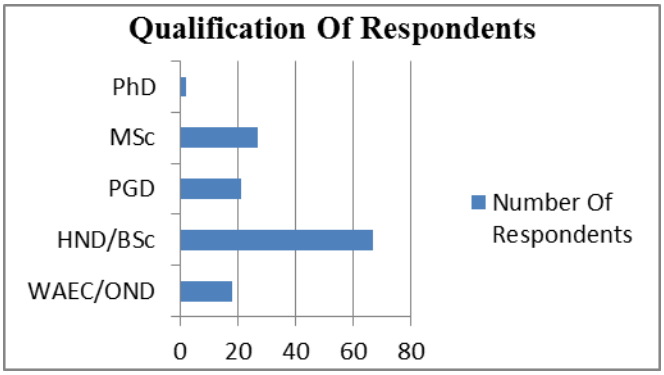

Fig2.1: Graph of the Qualification of the Respondents

LEAN MANUFACTURING TOOLS AND TECHNIQUES

Table 2.4: Value Stream Mapping (VSM)

		Percent
Valid	never used	1.3%
	seldom used	5.0%
	sometimes used	27.5%
	often used	47.5%
	almost always used	18.8%
	Total	**100.0%**

The table shows the use of value stream mapping. 47.5% often used VSM, while 27.5% sometimes used VSM. 18.5% used VSM, while 19% never used VSM.

Table 2.5: Kaizen

		Frequency	Percent
Valid	never used	3	3.8%
	seldom used	6	7.5%
	sometimes used	14	17.5%
	often used	17	21.3%
	almost always used	40	50.0%
	Total	**80**	**100.0%**

Half of the respondents always used Kaizen (50%). About 21% often used Kaizen, close to 18% sometimes used Kaizen.

Table 2.6: Kanban

Kanban			
		Frequency	Percent
Valid	never used	6	7.5%
	seldom used	10	12.5%

	sometimes used	22	27.5%
	often used	27	33.8%
	almost always used	15	18.8%
	Total	80	100.0%

About 52% respondents used Kanban to a high degree and about 8% never used Kanban.

Table 2.7: Just In Time

Just In Time			
		Frequency	**Percent**
Valid	never used	4	5.0%
	seldom used	3	3.8%
	sometimes used	20	25.0%
	often used	24	30.0%
	almost always used	29	36.3%
	Total	**80**	**100.0%**

Two thirds of the companies indicated significant use of JIT, while about 5% have never used JIT.

Table 2.8: Single Minute Exchange of Die

		Percent
Valid	never used	10.0%
	seldom used	7.5%
	sometimes used	30.0%
	often used	32.5%
	almost always used	20.0%
	Total	**100.0%**

20% of respondents always used SMED. About 33% often used SMED while 10% of companies never used this tool.

Table 2.9: Mistake Proofing

		Percent
Valid	never used	5.0%
	seldom used	20.0%
	sometimes used	16.3%
	often used	30.0%
	almost always used	28.8%
	Total	**100.0%**

Up to 60% of these companies considerably used Mistake proofing and 5% never used Mistake proofing.

Table 2.10: Cellular Manufacturing

		Percent
Valid	never used	6.3%
	seldom used	17.5%
	sometimes used	22.5%
	often used	32.5%
	almost always used	21.3%
	Total	**100.0%**

21% almost always used CM. 32.5% of respondents often used Cellular Manufacturing, while 22.5%respondents sometimes used Cellular Manufacturing, while 6.3% never used Cellular Manufacturing.

Table 2.11: Jidoka

		Percent
Valid	never used	11.3%
	seldom used	15.0%
	sometimes used	26.3%
	often used	30.0%
	almost always used	17.5%
	Total	**100.0%**

30% respondents often used Jidoka, while 26.3% respondents sometimes used Jidoka. 17.5% respondents almost always used Jidoka, while 11.3% respondents never used Jidoka.

Table 2.12: 5S (Sort, Straighten, Shine, Standardize, Sustain)

		Percent
Valid	never used	10.0%
	seldom used	3.8%
	sometimes used	22.5%
	often used	37.5%
	almost always used	25.0%
	Total	**100.0%**

37.5% respondents often used 5S, while 18% respondents sometimes used 5S. 20% respondents almost always used 5S, while 3% respondents seldom used 5S and 8% respondents never used 5S.

Table 2.13: Fishbone Diagram

		Percent
Valid	never used	8.8%
	seldom used	15.0%
	sometimes used	25.0%
	often used	36.3%
	almost always used	15.0%
	Total	**100.0%**

More than half of companies used fish bone diagram as a lean tool, while about 9% never used this tool.

Table 2.14: Design of Experiments

		Percent
Valid	never used	6.3%
	seldom used	11.3%
	sometimes used	17.5%
	often used	38.8%
	almost always used	26.3%
	Total	100.0%

About 64% of conspicuously respondents used Design of experiments, while 6.3% respondents never used Design of experiments.

Table 2.15: Statistical Process Control

		Percent
Valid	seldom used	12.5%
	sometimes used	15.0%
	often used	33.8%
	almost always used	38.8%
	Total	**100.0%**

Table 2.16: Control Charts

	Percent
never used	1.3%
seldom used	7.5%
sometimes used	17.5%
often used	36.3%
almost always used	37.5%

Total	100.0%

Results from the data showed that almost all the companies use control charts. Seventy-four percent (74%) of the respondents conspicuously use Control charts, while one percent (1%) never used Control charts

Table 2.17: Quality Function Deployment

	Percent
never used	2.5%
seldom used	2.5%
sometimes used	21.3%
often used	33.8%
Almost always used	38.8%
Total	100.0%

Summary

	VSM	KAI	KAN	JIT	SMED	MS	CM	JID	5S	FMEA	FB	DOE	SPC	CC	QFD	Cum%Use
never used	1.3	3.8	7.5	5.0	10.0	5.0	6.3	11.3	10.0	5.0	8.8	6.3	12.5	1.3	2.5	
seldom used	5.0	7.5	12.5	3.8	7.5	20.0	17.5	15.0	3.8	15.0	15.0	11.3	15.0	7.5	2.5	
sometimes used	27.5	17.5	27.5	25.0	30.0	16.3	22.5	26.3	22.5	25.0	25.0	17.5	33.8	17.5	21.3	
often used	47.5	21.3	33.8	30.0	32.5	30.0	32.5	30.0	37.5	30.0	36.3	38.8	38.8	36.3	33.8	
almost always used	18.8	50.0	18.8	36.3	20.0	28.8	21.3	17.5	25.0	25.0	15.0	26.3	-	37.5	38.8	

3. CONCLUSION

The current level of lean implementation in industries is examined. It also showed that certain techniques could work universally. It has been concluded that major manufacturing industries have been trying to adopt manufacturing initiatives in order to stay alive in the new competitive market place. Lean manufacturing is one of these initiatives that focus on cost reduction by identifying and eliminating on value added activities .In Nigerian industry a lot of scope is there to improve inventory control, reduce lead time, set-up timer which will lead to competitiveness of Nigerian industry.

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