European Journal of Business and Management www.iiste.org
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.7, No.32, 2015

Productivity Improvement of Small and Medium Scale Enterprises using Lean Concept: Case Study of a Bread Factory

Paul A. Ozor Chibuike L. Orji-Oko Chimaobi K. Olua
Department of Mechanical Engineering, University of Nigeria, Nsukka Nigeria

Abstract
The immediate impact of the economic downturn and challenging market condition on small and medium scale enterprises (SME) is an urgent demand to implement the effective resource utilization and processing system that will improve productivity. Effective adaptation to the highly competitive environment entails integrating different thought concepts and inventive ideas into the SME processes to reduce manufacturing costs, wastes and improve quality. This paper explores the use of lean concept in SME to improve productivity by reducing operator motion distances, processing time and cost of energy supply. The project reviewed productivity improvement opportunities in Campus bread factory Nsukka using lean concept. The problems in the existing layout were carefully delineated through direct observation of production processes and detailed work study. The resulting data were analyzed to enable the proposal of pertinent modifications in the process. When compared with the existing methods, the new developed method revealed at least 15.62% reduction opportunity in the distance travelled by the operator and decreased the process time by 13.09%. The results also showed that 35.99% reduction of cost of power generation is achievable. A new layout is proposed based on the research realities.
Keywords: Resource utilisation, Waste reduction, Lean concept, Productivity improvement

1. Introduction

Lean concept is closely related to productivity as good implementation of the methodology translates to improvement in productivity. The mantra of lean concept generally is that the same thing can be achieved using fewer people and lesser resources. This implies that people and resources can be redeployed to create even more value. Its applicability to small and medium scale enterprise (SME) is investigated in this study. An example SME namely; Campus bread factory is used as case study. Bread is a popular stable food in Nsukka in particular and most parts of Nigeria in general. Freshly processed and baked bread is enjoyed by all and sundry since it commands good aesthetic appeal and tastes well. In addition, bread is one of the most ubiquitous foods to get your hands on in time of breakfast. However, bread industry is witnessing unprecedented spate of increase in competitive environment and demand for its products owing mostly to the emergence of new local foods within and around Nsukka. Even though the optimal resource and product mix for maximum profit in bread baking business has been reported (Okolie et al., 2013), there is still no corresponding increase of investors in the industry to cater for the upsurge in its demand. Hence the increasing cost of its major raw materials coupled with the need to improve the productivity of the business in Nsukka municipality necessitates a complementary study to the work of (Okolie et al., 2013). This places great emphasis on better material handling measures and productivity improvement of bread factories. Customer's demand must be met to sustain their goodwill and this ought to be done with least expenditure on inputs, without sacrificing quality and with minimum wastage of resources. From the foregoing, the bread industry should as a matter of necessity embrace the application of lean concept as an antidote for all forms of wastage in their product cycle. This step will ultimately increase productivity of the enterprise through a proper utilization of man, machine, material and money (MMMM). Lean Thinking represents one of the newest schools of thought in manufacturing since the first presentation of the concept of lean manufacturing in the book "The Machine That Changed the World" (Womack and Daniel, 2003). Lean manufacturing practice has been described as an integrated system that is intended to maximize the performance of the production and delivery processes in providing customer value while minimizing waste (Waston et al., 2011). Performance dimensions are measured by conformance to quality standards, costs, and variability in processing times and delivery reliability. Previous authors posit that a good means of appreciating lean concept is to view it as a collection of tips, tools, and techniques (i.e. best practices) that have been proven effective for driving waste out of the manufacturing process (Micietova, 2011). Some of the many benefits of lean concept are summarized in figure 1. Researchers have presented estimates of the values of the variables of figure 1 (Micietova, 2011). Lean production has been reported to be in direct contrast with the mass system of production where the major emphasis is on economies of scale that came from making large quantities of items in a batch and queue mode (Weigel, 2000). Lean production facilities may not necessarily be equipped with bulky machinery as in mass production facilities (Micietova, 2011). Instead, it utilizes compact, movable, and easily set up machines. The most important consideration of lean production is that the practices can work synergistically to create a streamlined, high quality system that produces finished products at the pace of customer demand with little or no waste (Shah and Ward, 2003). Some of the obstacles to adopting lean manufacturing have a general applicability to other type of business (Heymanns). The implementation of lean philosophy through layout modification for reduction wastages in motor manufacturing industry have been demonstrated through the use of Value Stream Mapping (VSM) and Taguchi method of parameter of design analysis (Vendan and Sakthidhasan, 2010). The work prescribed better wages for workers, higher profit for owners and better quality for customer as improvement strategies. Lean manufacturing methodologies have also been applied to productivity improvement in a tyre manufacturing firm through method and time studies, as well as VSM (Vieira, 2010). Several problems leading to productivity inefficiency were identified, with particular attention to the lack of flexibility of the productive line, excesses of stocks, lack of available space in the factory, ineffective communication between sectors as well as gaps in the planning and control activities. Solutions that permit bringing a new perspective of productive thinking and a new attitude to the production lines were suggested. A successful lean implementation is expected to deliver far superior performance for customers, employees, shareholders and society at large (Bhasin, 2012). Lean concept had been applied to improve the patient's care with existing resources in a healthcare system (Jones and Mitchell). The concept of waste reduction applies equally well to service sector. Some lean drivers which include delivering maximum value, eliminating waste through analyzing root cause, measuring end- to- end response and process capability, transforming culture, engaging staff, building change capability and agility was adopted to improve the services in an international call centre.

The automotive industry has received a share of application of Lean concept (Hemanand, 2011), with the objective of waste reduction. In the methodology, problems in the process layout were identified through time study and analyzed through simulation. The layout was modified and simulated to enable comparison of results with the current layout. A new material handling system was designed and developed to reduce the motion wastes and unwanted transportation. The approach increased productivity by 11.95%. A typical lean production system was designed for fishing net manufacturing using lean principles and simulation optimization (Taho et al., 2015). The seven lean guidelines used are defined in the third phase out of the proposed five phases (Rother and Shook, 1998) of VSM implementation. Expectedly, the benefits of lean concept shown in figure 1 have spurred many researchers to turn to the topic. But the authors have no evidence of any previous work applying lean manufacturing principles to SMEs, especially with particular case of bread production. Bread production is somewhere between job order and batch order environment because the bread sizes (product mix) and ingredients change according to the social class and income of consumers in the given area where the product will be supplied. For instance, there is a distinct variation in quality between bread supplied to boarders (students) in educational institutions and those supplied to government employees living in government residential areas. Furthermore, there may be some occasion where distributors run out of stock of a particular bread size. To retain customers' goodwill, sudden order may be placed which ought to be produced irrespective of obvious constraints. There are significant power outages Campus bread factory, and the need for a sustainable power option for the bread industry is clearly evident. Bread manufacturers in the study area must embrace a paradigm shift from conventional production practices to a proper production structure and economy of resources responsive to investment profit requirements and the demand of various bread consumers. The approach is simply a lean concept of bread production proposed in this paper.

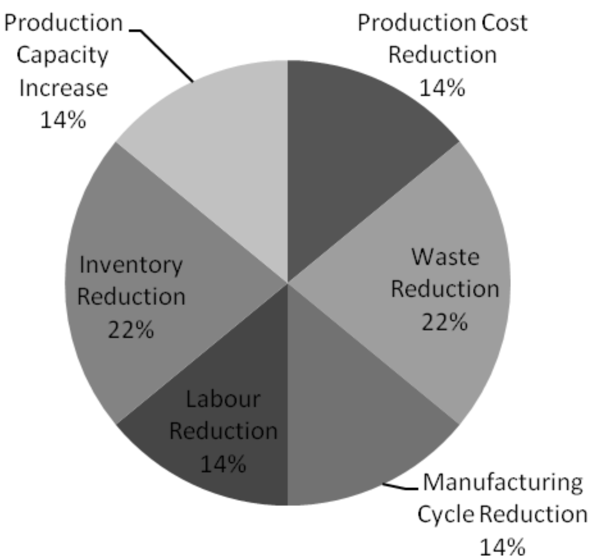


Figure 1: Benefits of Lean Production

2. Materials and Methods

The data for the study was collected from the case study SME. Direct observation, measurement of current layout of the factory and consultations with management and personnel of Campus bread factory Nsukka were conducted. The request for detailed work study to pick out possible areas of improvement in the factory was granted. There were no hitches in providing answers to questions bordering on bread baking methods currently in use in the factory. The time study was conducted using a stop watch. All the procedural steps taken in the work are presented in the block diagram of figure 2.

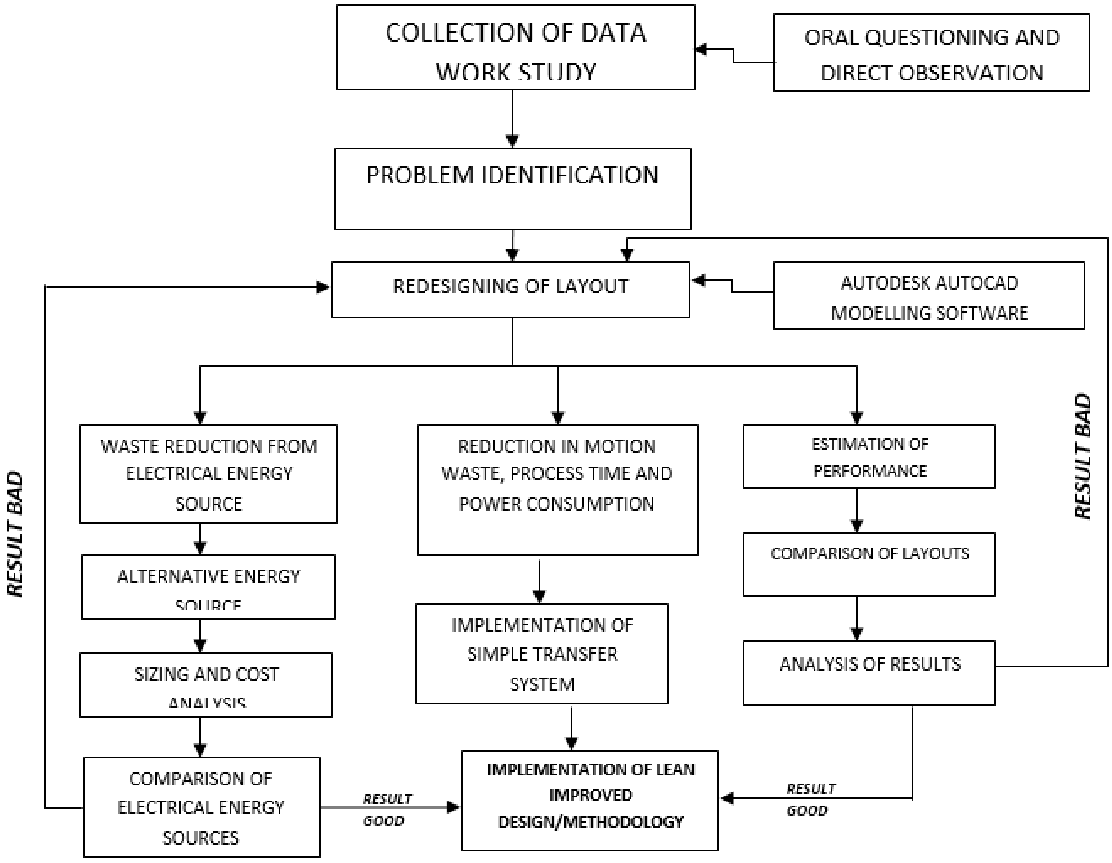


Figure 2: Block diagram of methodology followed in the study

2.1. Production processes

The bakery bakes eleven different sizes of bread loaves. These sizes of loaves come in different ingredients mix and different amount of four major kinds of processes: mixing, milling, molding and baking. There are total of ninety six (96) workers performing different operation as staff of Campus bread factory. The various operations are presented in the organization structure of figure 3.

2.2 Current layout

The production process of each batch of bread was work studied to establish the current layout and its performance. Work study is a fundamental tool for understanding the operational behaviour of production lines for each company and contributes to a qualitative and quantitative analysis of them (Vieira, 2010). Process flow and sequence of the production of a batch of bread from raw material to final finished product is shown in Table 1.

European Journal of Business and Management
ISSN 2222-1905 (Paper) ISSN 2222-2839 (Online)
Vol.7, No.32, 2015

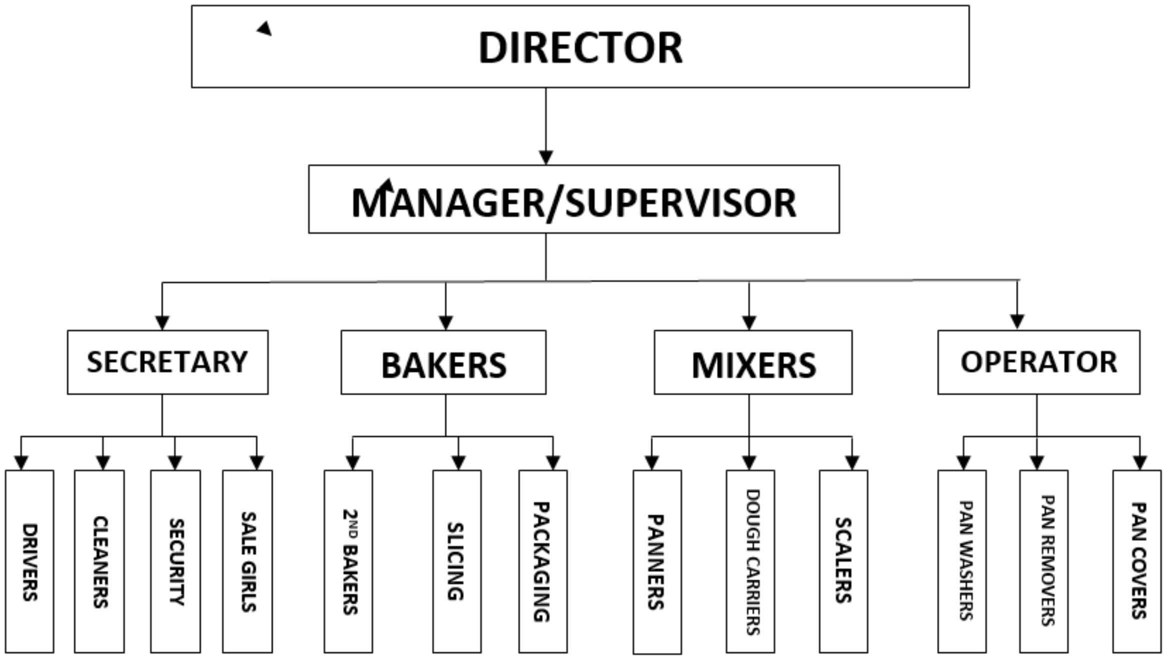


Figure 3: Organisational structure of the Bread factory

Table 1: Flow Chart for Process Sequence

Operations	Process Description	Process Symbol
1.	Measuring out of ingredients	⧈
2.	Mixing process	◯
3.	Milling process	◯
4.	Slicing and weighing	▭
5.	Inspection	▭
6.	Cutting of the dough	◯
7.	Inspection	▭
8.	Moulding of the dough	◯
9.	Panning of the dough	◯
10.	Time space for the dough to rise	D
11.	Inspection	◯
12.	Applying oil to the dough and baking pan	◯
13.	Baking	◯
14.	Out of oven and cooling	D
15.	Sclicing and packaging	◯
16.	Store/counter	▽
17.	Distribution	⇨

OPERATION ◯ = 10 INSPECTION ▭ = 3 TRANSPORT ⇨ = 1 DELAY D = 2

STORAGE ▽ =1 Operation cum Inspection ⧈ = 1

2.3 Time study

Time study is defined as a work measurement technique for recording the times and rates of performing the elements of a specified job carried out under specified conditions, and analyzing the data so as to obtain the time necessary for carrying out the job at a defined level of performance (Hemanand et al, 2011). Time study was carried out for the operations involving machine and man for a batch production of bread in the layout by direct observation and the observed data is listed in Table 2.

Table 2: Details of Time Study

Operation number.	M/C Type	Number of operators	Number of batches	Man working time in seconds	Man idle time in seconds	Machine working time in seconds	Machine idle time in seconds	Cycle time in seconds
1	Measuring out proportion	1	1	1170	30	0	0	1200
2	Mixing Machine	2	1	720	102	818	24	842
3	Milling Machine	3	1	500	45	495	50	545
4	Scaling Machine	2	1	282	0	282	0	282
5	Cutting Machine	1	1	300	0	300	0	300
6	Moulding Machine	1	1	693	61	720	34	754
7	Panning	7	1	940	0	0	0	940
8	Baking	12	1	1125	215	1300	240	1540
9	Inspection	1	1	235	0	0	0	235
10	Slicing /Packaging	17	1	450	15	421	44	465

2.4 TAKT TIME CALCULATION

Takt time is the average time allowed for the production of a batch of bread required to meet customers demand. It is employed in synchronizing the pace of production with the pace of sales (Taho et al, 2015). Takt time is calculated based on machine available time and the required number of batches. Equation (1) is used to compute the takt time while detailed calculation is also provided.

$$Takt\ Time = \frac{Available\ Working\ Time\ per\ day}{Customer\ Dmand\ rate\ per\ day} \quad (1)$$

The procedure followed to determine the takt time in the production of a batch of bread in campus bread factory is as follows:

Total available time per day 12hours
Total working days per month 26 days
Customer demand per day 26 batches
Available working time (Excluding lunch and allowance) 11hours = 660minutes

$$Takt\ Time\ =\ 1523\ seconds\ /\ batch$$

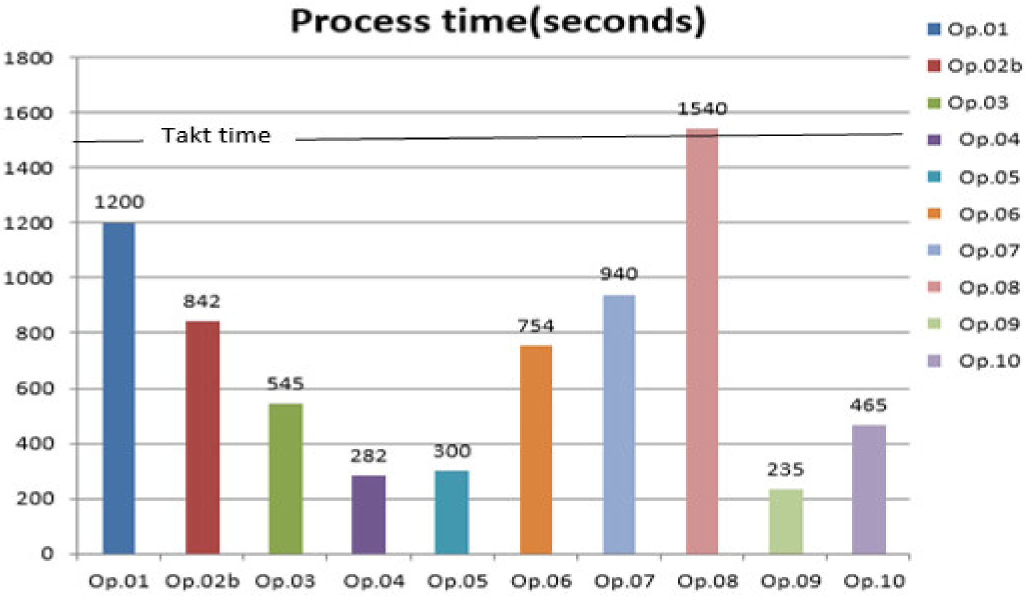
2.5 Cycle time calculation

All the categories of bread produced at the case study factory were time studied 5 times in each case. An average of these values were determined and presented in table 3 as the cycle time. The same result is presented in figure 4.

Table 3: Processing Time

Operation number.	Process description	Cycle time in seconds
01.	Measuring out of ingredients	1200
02.	Mixing together of ingredients	842
03.	Milling to give the dough a wholesome mix	545
04.	Weighing the dough to ensure uniformity	282
05.	Cutting the dough into loaf size pieces	300
06	Moulding of the dough	754
07	Putting the dough into the required pan size	940
08	Baking	1540
09	Inspection	235
10	Slicing and Packaging	7103

Figure 4: Campus Bread Operations Processing Time



2.6 Problems identified in the current layout

The current layout is depicted in Figure 5. The major problems identified in the layout are as follows:
Arrangement of machines in the current layout is not in good order to facilitate smooth process flow. This creates room for waste and unnecessary time duration in manufacturing lead time. From Figure 5, it is observed that the operator and material movement in the current layout is disorderly and uncoordinated due to irregular arrangement of the machines.

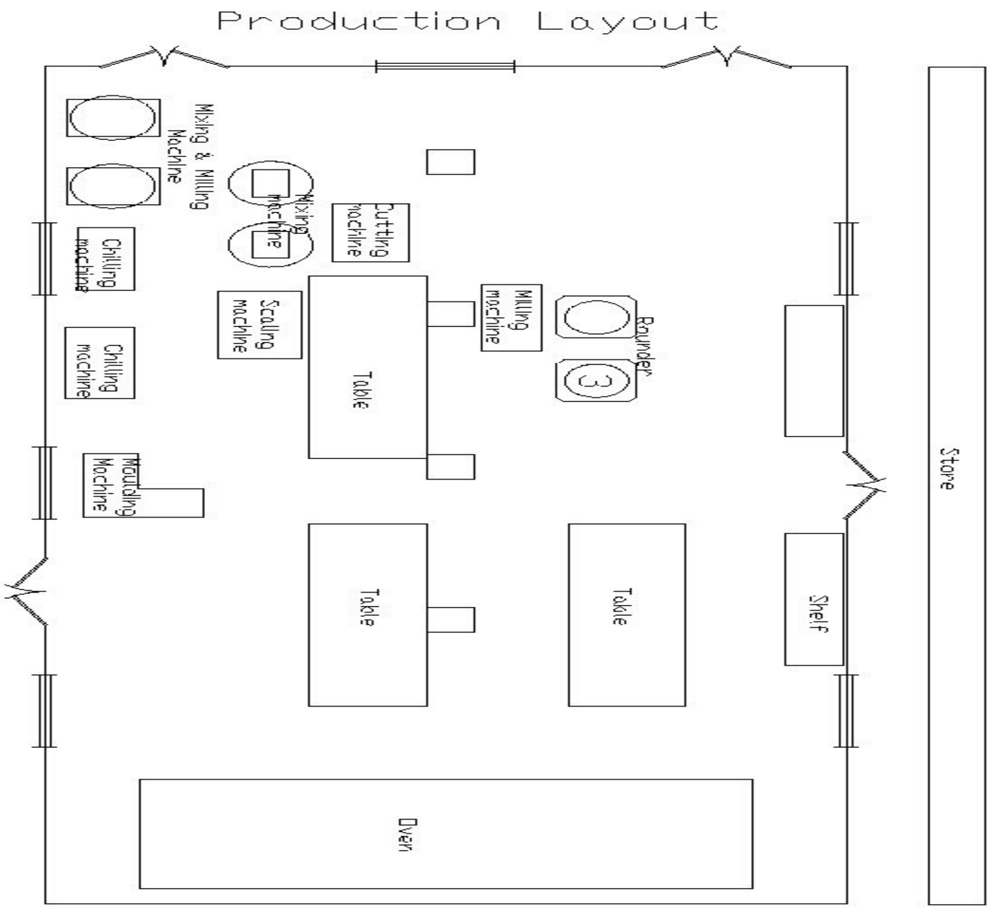


Figure 5: Current Layout

2.6.1 Waste in transportation by manual operation

In this layout material handling is done with a tray pan used in carrying the dough and baked bread from one station to another. This consumes considerable time and results in increased total manufacturing lead time. The dough is moved from one station to another by operator causing motion and transportation wastes totalling about 42.9m as given in Table 4. This causes delay in production, fatigue and sometimes damage of the dough.

Table 4: Distance travelled by Operator

SI. No.	Stations	Distance travelled in meters
1.	Op.01-02b	1.8
2.	Op.01-02a	2.0
3.	Op.02a-03	2.3
4.	Op.03-04	2.1
5.	Op.02b-04	3.6
6.	Op.04-05	2.5
7.	Op.05-06	5.7
8.	Op.06-07	7.5
9.	Op.07-08	2.3
10.	Op.06-08	2.4
11.	Op.08-09	2.5
12.	Op.09-10	8.2
	Total	42.9

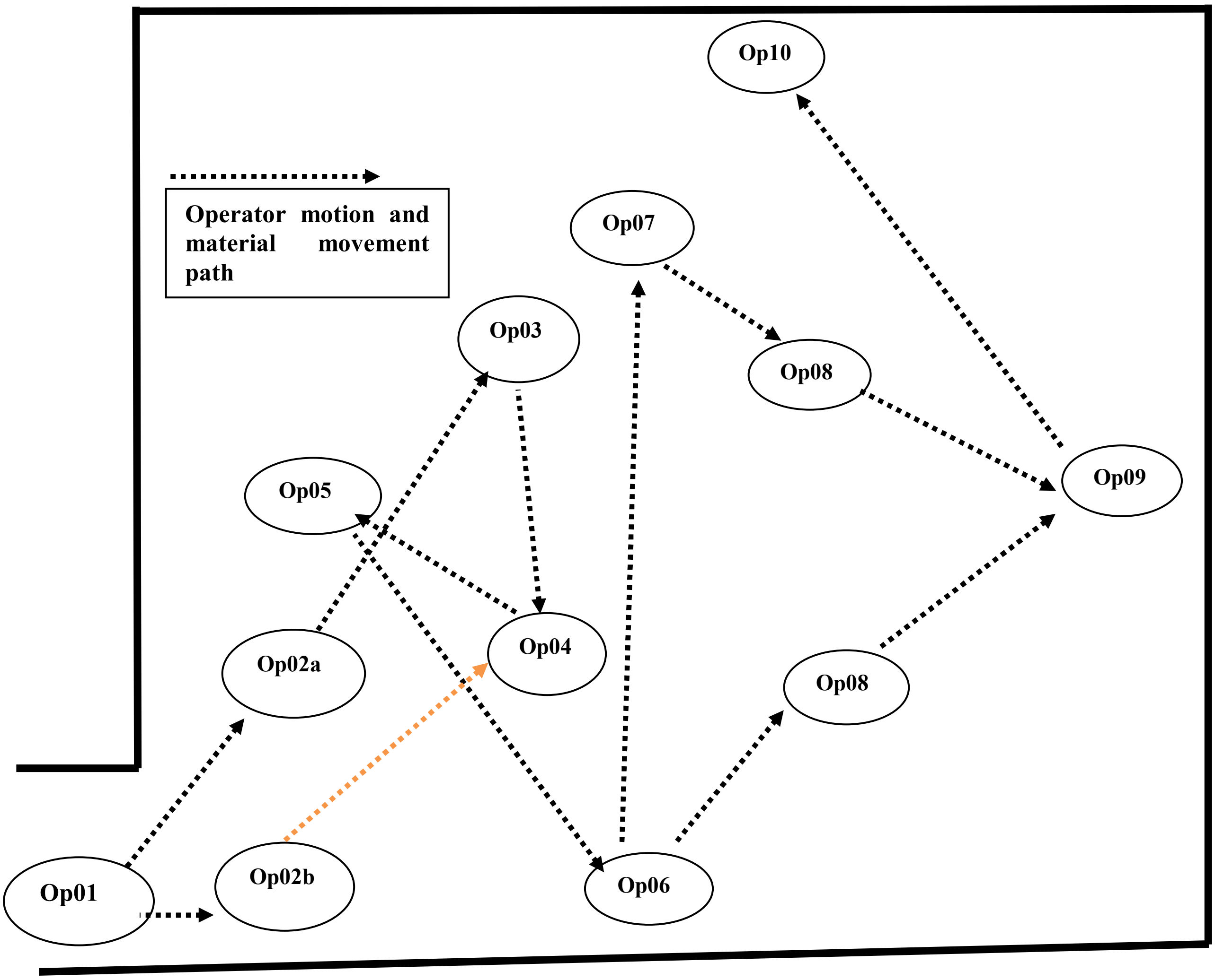


Figure 5: Operator and material movement in current layout

The material and operator movement in the current layout is clumsy and restrictive as depicted in figure 6. This has to be reduced with a suitable and cost effective material handling system. This will no doubt reduce the clumsiness of operation process in the current layout and optimize time.

2.7 Electrical Energy Sources in the Current Layout

In the current layout, the electrical power need of 7045watts is given in table 5. The electrical power is generated by petrol generator, diesel generator or power holding company of Nigeria (national grid). The least power supply option account for a running cost of about six hundred and fifty thousand naira (N650, 000) every month excluding repairs and maintenance cost.

Table 5: Energy capacity of the factory

S/N	Equipment	Number	Individual capacity(W)	Total Capacity(W)
1.	Milling/mixing machine	1	500	500
2.	Mixing machine	2	550	1100
3.	Chilling machine	1	2540	2540
4.	Slicing machine	6	180	1080
5.	Moulding machine	2	750	1500
6.	Electric bulbs (CFL)	13	25	325
	Total			7045

For a year the energy capacity of the current layout will cost N7, 800, 000 excluding repairs and maintenance cost. This amount is prohibitive and need to be reduced with a suitable cost effective alternative energy source.

3. Proposed layout

Owing to the problem identified in the existing layout, a new layout is proposed based on the work study and rigorous analysis of the current method.

3.1 Features of the proposed layout

The features of the new layout are listed hereunder.

1). All machines are arranged sequentially in accordance to the process flow of production diagram of figure 6. It reduces transportation waste by the amount of 6.7m as shown in Table 6.

2). A four coach trolley is recommended for the proposed layout after adjustment of the gangways to facilitate efficient material (dough) handling from one station to another. This exercise can reduce the cycle time by 930seconds. The summary of the reduction in cycle time is presented in table 7. What obtains is the manual use of tray by operators in carrying the dough manually from one station to another.

Table 6: Operator motion distance comparison

Serial Number	Stations	Current layout in meters	Proposed layout in meters	Difference in distance travelled in meters
1.	Op.01-02b	1.8	1.8	
2.	Op.01-02a	2.0	2.0	
3.	Op.02a-03	2.3	1.7	
4.	Op.03-04	2.1	2.6	
5.	Op.02b-04	3.6	3.5	
6.	Op.04-05	2.5	2.5	
7.	Op.05-06	5.7	2.5	
8.	Op.06-07	7.5	2.6	
9.	Op.07-08	2.3	2.6	
10.	Op.06-08	2.4	2.7	
11.	Op.08-09	2.5	2.5	
12.	Op.09-10	8.2	8.2	
	Total(meters)	42.9	36.2	6.7

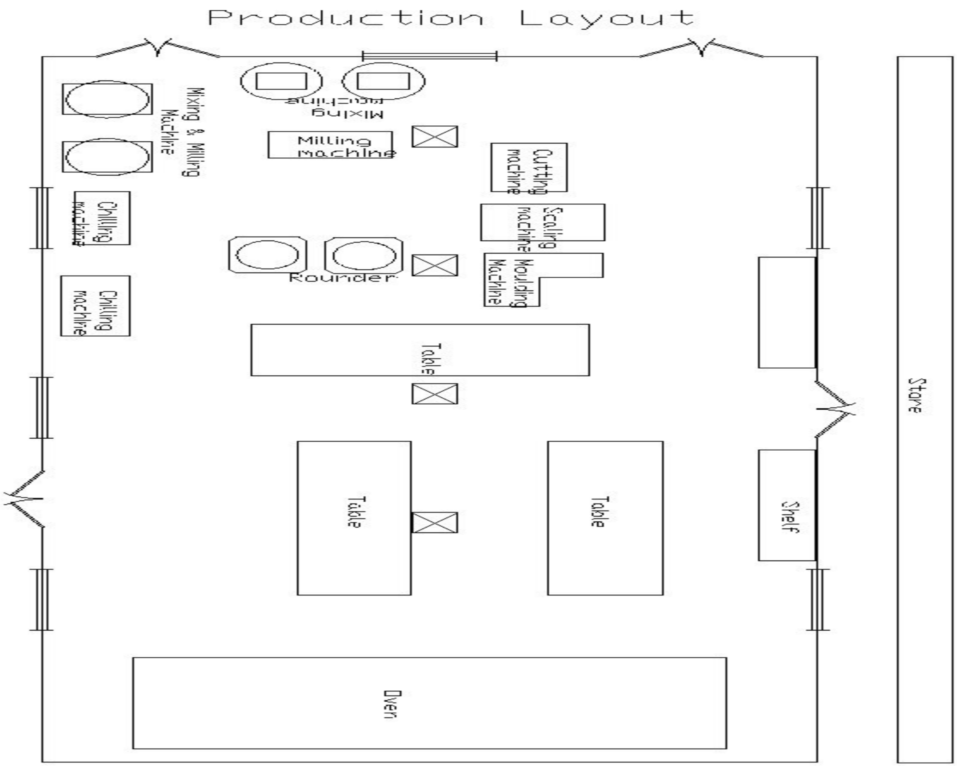


Figure 6: Proposed Layout

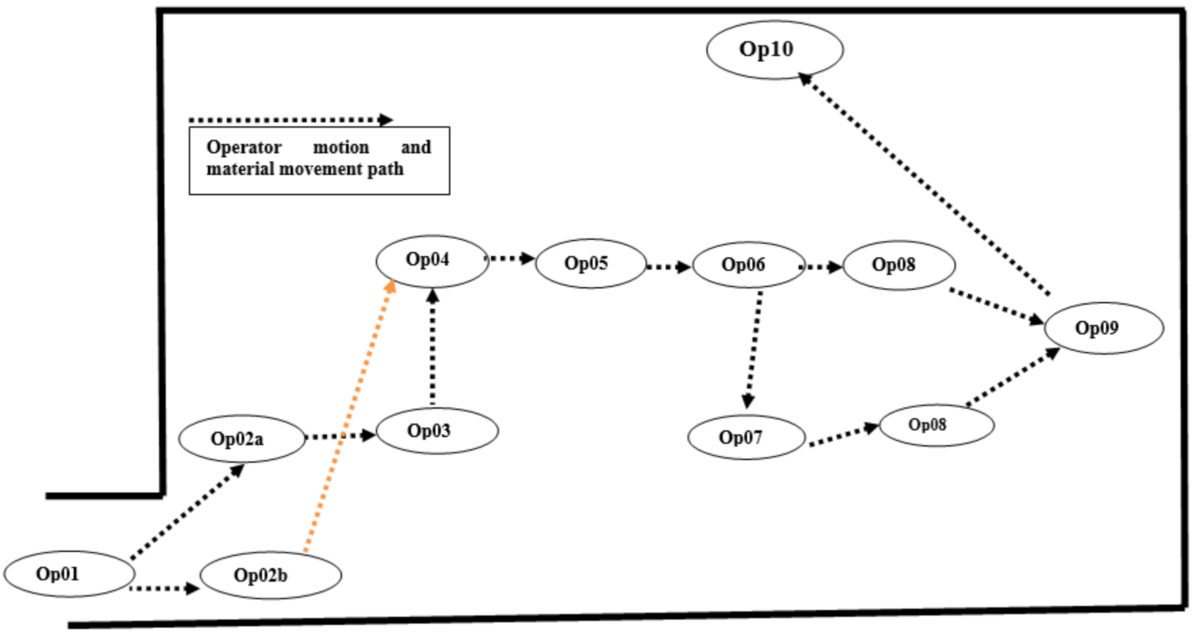


Figure 7: Material and Operator Movement in the Proposed Layout

Table 7: Processing Time Comparison

Operation Number	Process description	Current layout Cycle time in seconds	Proposed layout Cycle time in seconds	Difference in total process time in seconds
01.	Measuring out of ingredients	1200	1000	
02.	Mixing together of ingredients	842	842	
03.	Milling to give the dough a wholesome mix	545	403	
04.	Weighing the dough to ensure uniformity	282	282	
05.	Cutting the dough into loaf size pieces	300	253	
06.	Moulding of the dough	754	423	
07.	Putting the dough into the required pan size	940	820	
08.	Baking	1540	1495	
09.	Inspection	235	190	
10.	Slicing and Packaging	465	465	
	Total	7103	6173	930

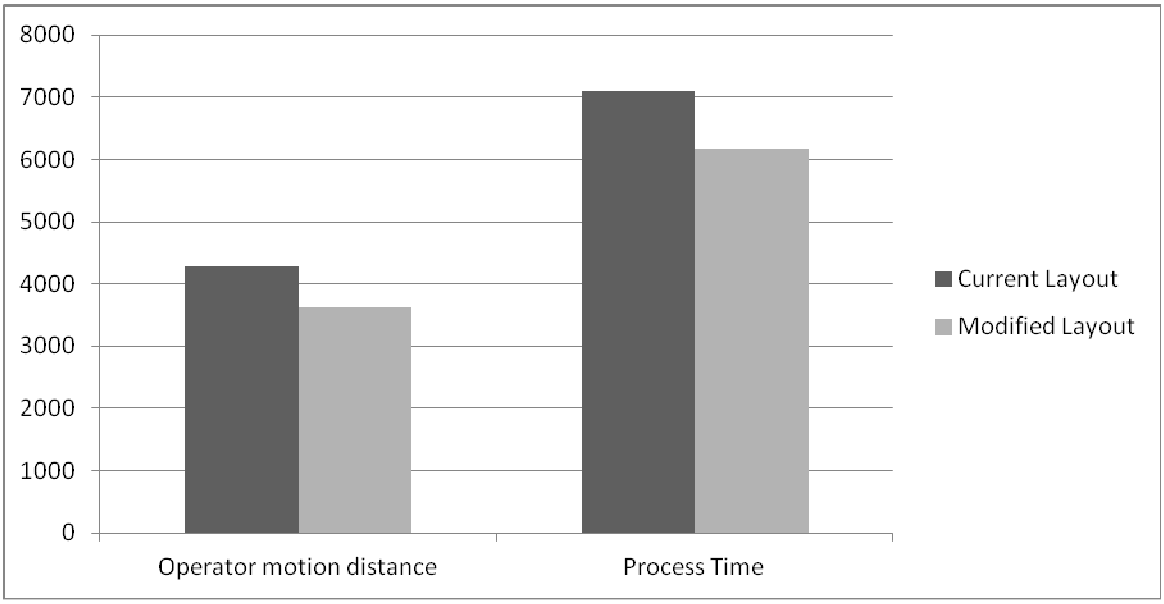


Figure 8: Comparison of Layouts

3.2 Alternative energy source

As stated earlier, the power (energy) need of the factory is currently provided by highly inconsistent national grid. The factory falls back to fossil driven generators each time the electric power authorities ceases light. The cost of running these generators is so expensive that the factory finds it very difficult to continue the bread baking business. This makes the introduction of a lean informed power source inevitable. Interestingly, some homes in Nsukka metropolis are fast embracing power sources alternative to the mentioned ones. Hence, a cost benefit analysis of a solar energy system was conducted and recommended for the campus bread industry.

3.3 Solar energy systems

These are systems which derive their driving energy from the sun. The energy is utilized either as light energy (photo systems) or as heat energy (thermal systems). Some examples of such systems are photovoltaic power generating systems. The basic principle is the use of light as a direct energy source. When photon particles strike electrons in semiconductor materials, electrons are freed from their bound positions liberating them to move. The electrons move only in one direction and if a circuitry is established, current flows and electric power becomes available.

3.4 Sizing and costing of the solar energy system

This design is for an Off Grid stand alone solar power generation.

3.4.1 Location Description of Bread Factory

Nsukka is located at 6 52'N and 7 23' E and receives at least six hours of solar insulation daily.

3.4.2 Sizing of a Photovoltaic (Solar) System

Parameters of Materials Used:

1. Lumetta LLP solar panel = 420Wp
2. Trojan battery of 6V 820Ah
3. Tristar 60A MPPT Charge Controller
4. 7.5KVA ION Luminius Inverter
5. The solar panel has an efficiency of 90%
6. Battery discharge factor = 0.9

3.4.3 Assumptions

All the machines run over an average of 12hrs per day.
30 workers charge their phones at the same time for 12hrs.
CFL bulbs are replaced with LED bulbs for better efficiency.
This is design is for the worst case scenario of the production site, machine and man energy requirement.

Table 4.3 Energy need of the Factory

S/N	Equipment	No.	Individual capacity(W)	Total Capacity(W)	Duration	Watt-hour
1.	Milling/mixing machine	1	500	500	12hrs	6000
2.	Mixing machine	2	550	1100	12hrs	13200
3.	Chilling machine	1	2540	2540	12hrs	30480
4.	Slicing machine	6	180	1080	12hrs	12960
5.	Moulding machine	2	750	1500	12hrs	18000
6.	Electric bulbs (CFL)	13	25	325	12hrs	2340
7.	Phone charger	30	5	150	12hrs	1800
	Total			7065		84, 780

For this design, a 7.5KVA ION Luminous Inverter is chosen because it will withstand a load of 7065W comfortably.

3.4.4 Sizing of Battery

$$Number\ of\ batteries = \frac{Total\ Load\ in\ watthour}{battery\ capacity} \quad (2)$$

Total Load in watt-hour = 84780watt-hour
Battery capacity in watt = 6V × 820Ah = 4920watt
Number of batteries = 17.23
Hence , 18 batteries will be required.

3.4.5 Sizing of Solar Panels

$$\text{Number of solar panels} = \frac{Total\ Load\ in\ watthour}{panel\ efficiency \times Wp \times DD \times battery\ discharge\ factor} \quad (3)$$

= 41.53
This implies that 42 panels will be required.

3.5 Cost Analysis of Installation

1. Cost of Charge Controller N101,649.39
2. Cost of Battery N436,626
3. Cost of solar panels N3,687,768
4. Cost of Inverter N270, 000

Total cost N4, 496, 043.39

Maximum Total cost (Total cost + Miscellaneous expenses) N5, 000, 000.
Solar power generation has zero or little maintenance because of absence of moving parts, minimum warranty of 25years. It is also modular.

3.6 Sources of funds for investment in the proposed energy source

Several bodies are currently providing grants for small and medium scale industries in Nigeria. One of such available grants is the YOUWIN programme of the federal government which provides grant to the tune of ten million naira (N10, 000,000.00) to SMEs. Also a solar energy company called Cleanergy Nigeria Limited provides counterpart funds for SMEs and residential homes as part of corporate social responsibility. The company provides 50% of the initial installation of solar energy system to her customers. The management of the case study factory were happy to know of these opportunities and immediately indicated interest in them, following the realities of the work.

4. Comparison of the two energy system sources and discussion

Cost of existing power system for a year is over seven million naira (N7, 800, 000) while that of the proposed power source is five million naira (N5, 000, 000).

A percentage reduction of 35.99% is easily noticed. It is reasonable to say that the cost of retaining the existing system may look profitable since it is on a cumulative note. Yet, switching over to the new improved alternative will increase the productivity of the factory in the near future. This work therefore advice that the factory should source funds from any available means to install the solar power system. Considering the negligible maintenance cost and other characteristics of solar power systems, the cost reduction gained in this work will keep rising in subsequent years resulting in continuous improvement in productivity. Overall, the initial installation cost of the solar power system seems prohibitive but profitable at the long run.

CONCLUSION

Improvement of the productivity of SMEs using lean concept has been completed. The steps taken to achieving the objectives of the work was clearly stated and applied to a specific example namely; Campus bread industry Nsukka, Enugu State Nigeria. The existing processing methods were studied and its problems identified. Modifications in the problem areas were then made from a lean concept perspective. The operator motion distance was reduced by 15.62% which can translate to optimal operator utilisation and fatigue reduction. There is equally a reduction in process time by 13.09%. An alternative power generating system capable of reducing power cost by 35.99% is proposed for the factory. This result shows that the lean concept is a good method of improving the productivity of small and medium scale enterprises.

References

Bhasin S. (2012), Performance of Lean in Large Organisations. Journal of Manufacturing Systems, 31, 349-357.

Hemanand, K., Amutbuselvan, D., Raja, C. S., and Sundaraja, G. (2011), Improving Productivity of Manufacturing Division Using Lean Concepts and Development of Material Gravity Feeder- A Case Study". International journal of Lean Thinking Volume, 3(2); 117-134

Heymanns B. Lean Manufacturing and the Food Industry, flowmakers, continuos system improvement CSI [online] Available: http://www.flowmakers.com/articles/Articlefoodindustryandkaizen.pdf, (4th June, 2014)

Jones, D. and Mitchell, A. Lean Thinking for the NHS London: NHS confederation [online] Available: http://www.nlm.nih.gov>journallist>int (7th July, 2014).

Micietova, M. (2011), Lean production, lean vs. Mass production, TPM As a tool of lean production, Perner's Contact, 5, 6, 210-216

Okolie, P. C, Ezechi, D. J., Ebieladoh, S. J. and Iwenofu, C.O, (2013), Optimization of Processing Data Time for Stephens Bread Industries Owerri, Imo State, Nigeria International journal of multidisciplinary sciences and engineering, 4, 11. 26-39

Rother M, Shook J. (1998), Learning to See: Value Stream Mapping to add value and eliminate Muda. Brookline: The Lean Enterprise Institute.

Shah R. and Ward.T. P. (2003), Lean Manufacturing Context, Practice Bundles and Performance, Journal of Operations Management, 21 (2), 129-142

Taho,Y., Yiyo, K., Chao-Ton, S and Chia-Lin, H. (2015), Lean Production System Design for Fishing Net Manufacturing using Lean Principles and Simulation Optimization. Journal of Manufacturing Systems, 34, 66-73.

Vendan, S. P. and Sakthidhasan. K, (2010), Reduction of Wastages in Motor Manufacturing Industry, Jordan Journal of Mechanical and Industrial Engineering, 4; 5; 579-590

Vieira, L. F. S., (2010) Application of Lean Manufacturing Methodologies to Improve Productivity: Fedima Tyres Case Study. [Online] Available: https://fenix.tecnico.ulisboa.pt/.../ResumoAlargado_LeanManufacturing (30th June, 2014)

Waston R., Power D. and Samson D. (2011), Lean-How Much Is Enough? The University of Melbourne Victoria 3010 Australia, Poms 22nd Annual Conference Renon Nevada, U.S.A., 020-0422 Apr 29-May 2

Weigel, A. L. (2000), A book Review: Lean Thinking Assignment for ESD.83 Research Seminar in Engineering Systems [online] Available: http://web.mit.edu/esd.83/www/notebook/**WomackJones**.PDF (9th June, 2015)

Womack, J. P. and Daniel, T. J., (2003), Lean Thinking: Banish Waste and Create Wealth in Your Cooperation, Simon and Schuster: Inc. New York 2nd ED