© 2018 IJSRSET | Volume 4 | Issue 9 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology

Appraisal of Production Index of Flourescent Fitting in Nigeria: Case Study

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ABSTRACT

Underutilization of equipment capacity appears as limitation in production process as it contributes to reduce production performance. Therefore, this research aims to estimate capacity utilization of production machinery aimed at evaluating its impact on production efficiency. Nigerian Engineering Works Limited Port Harcourt was used as a case study to analyse the production index of the firm. From the findings, the average value of Capacity Utilization of production line for the manufacture of the 4ft fluorescent fitting components is given as 75% of the overall line capacity. Thus, the study concluded that there was substantial underutilisation of capacity in the manufacturing industry, which have made production output growth low and increase in industrial wastage.

Keywords : Capacity Utilization, Manufacturing Process, Production Efficiency, Industrial Production Line

I. INTRODUCTION

Generally, in a production process, the stages involved include procurement, fabrication, assembly, testing, packaging and distribution [1]. The basic aim of a production system/process is to transform raw material into finished products or components [2]. This is achieved on production line which is said to be a set of sequential process established on an industrial shop floor. To this end, improvement of capacity is therefore vital for the improvement of production systems [2].

In addition, productivity is an important economic concept used to measure the economic performance and competitiveness of a production unit, such as a firm or an industry. Productivity measures how much of a good or service can be produced from a given set of inputs [3,4]. Therefore, capacity utilisation rate plays a crucial role in evaluating economic performance of manufacturing industries. Capacity utilisation does not only explain the relationship between actual output and potential output, but also shows the level of market demand [5]. Over or under utilisation of plant capacity can reduce plant competitiveness by increasing operating costs [6]. In theory, capacity utilisation is measured in 100% efficiency level. However, in practical sense, capacity utilisation may not exceed 90% maximum level. This applies especially in developing economies due to some setbacks in the production process such as lack of proper labour monitoring and supervision, wastages in the process and machine breakdown [4]. The rate of capacity utilisation remains important, though often neglected, in the production process in Nigeria where under utilisation of some productive equipment have become rampant in almost all manufacturing establishments [5].

In Nigeria, most manufacturing industries have been faced with capacity under utilisation and this had constituted a threat to productivity and production

growth, and served as an impediment to economic growth and development of the country. Capacity of a plant or Industrial capacity is seen as the maximum measure of outputs that can be produced in a fixed period of time with given production resources. Hence, capacity utilisation refers to the ratio of actual output to the maximum or potential capacity output from a given fixed inputs of the plant [7,8]. Capacity utilisation measures how much potential of a plant is being used at a given point of the production cycle. In addition, it is used to explain some important factor of manufacturing such as productivity, profit, assessing growth, future investment and employment generation [9,10]

The aim of this paper is to estimate capacity utilization of production machinery of manufacturing industry in order to evaluate its impact on production efficiency. In this work, analysis of capacity utilization of a production line of a manufacturing industry (Nigerian Engineering Works Limited) was undertaken to ascertain the production behavior and making appropriate submissions for general industrial improvement.

II. METHODOLOGY

The following procedures are implemented in the work for measuring impact of capacity utilization on production efficiency. These processes involve the development of variables; models for estimating production efficiency through capacity utilization equation; data collection from industry; model testing; data analysis and model validation. The dependent variable of this study is the Capacity Utilization (CU) of production machineries directly involved in production; and independent variables are the input and output data of machineries. The Capacity Utilization measurement model for production machinery is as expressed in equation (1):

$$CU = \frac{Q_A}{Q_P},\ CU \geq 0 \qquad (1)$$

where Q_A is Actual output and is defined as the average output of machinery; and Q_P is potential output and represents a peak output of machinery.

The required data from the machine shop and assembly line (under study) for the production of the test product (4ft Fluorescent fitting) were obtained and recorded. In addition to this are the actual quantities produced and actual time worked. On this assembly line are two subassembly lines producing two component parts which are the bottom brackets and the top panels. Production data on these components production are collected and recorded for the Capacity Utilization analysis

III. RESULTS AND DISCUSSION

The production data utilized for the analysis were sourced from Nigerian Engineering Works Limited, Port Harcourt. In achieving a clear data presentation, the time study sheet for the job cycle of the given product are presented in tabular form as shown in Table 1

Table 1 : Production data for Bottom bracket subassembly

S/N	PERIOD OF OPERATION (Hrs/dy)	EXPECTED PRODUCTION AT 100% EFFICIENCY (Q_P)	ACTUAL PRODUCTION (Q_A)	EFFICIENCY (%)
1	8	824	580	70.38
2	8	824	650	79
3	8	824	655	79.49
4	8	824	800	97
5	8	824	512	52.13

6	8	824	736	89.32
7	8	824	673	81.67
8	8	824	704	85.44
9	8	824	563	68.33
10	8	824	615	74.64
TOTAL		**8240**	**6488**	

From Table 1, Capacity Utilization/Productivity = $\frac{\sum Q_A}{\sum Q_P} = \frac{6488}{8240} = 0.79$

Table 1 shows machine line of the production of the Bottom bracket subassembly. The cycle time is obtained as 0.58 minutes which gives an hourly production of 103 units and 824 units per shift. However, the maximum actual production of this component is 800 units per shift and minimum actual production is 512 units per shift. The average efficiency obtained was 79% which gives a Capacity Utilization/Productivity of 0.79.

Table 2 : Production data for Top panel subassembly

S/N	PERIOD OF OPERATION (Hrs/dy)	EXPECTED PRODUCTION AT 100% EFFICIENCY(Q_P)	ACTUAL PRODUCTION (Q_A)	EFFICIENCY (%)
1	8	1504	1225	81.45
2	8	1504	1150	76.51
3	8	1504	950	63.20
4	8	1504	1350	89.82
5	8	1504	850	56.55
6	8	1504	920	61.17
7	8	1504	862	57.31
8	8	1504	1301	86.50
9	8	1504	1086	72.21
10	8	1504	986	65.56
TOTAL		**15040**	**10680**	

From Table 2, Capacity Utilization/Productivity = $\frac{\sum Q_A}{\sum Q_P} = \frac{10680}{15040} = 0.71$

In addition, the cycle time for the manufacture of top panel component of the fluorescent fitting is 0.32 minutes. This gives a standard hourly production of 188 units and 1504 units per shift. The maximum actual production recorded was 1350 units while 850 units was obtained as the minimum number of units produced per shift. The average production efficiency of 71% was obtained, giving Capacity Utilization/ Productivity of 0.71. Therefore, the total average Capacity Utilization/Productivity for the manufacture of 4ft fluorescent fitting components in the machine shop is given thus:

$$\frac{0.79 + 0.71}{2} = 0.75$$

The estimated value of Capacity Utilization of production line for the manufacture of 4ft fluorescent fitting components is given as 75% of the overall line capacity.

IV. CONCLUSION

The purpose of any manufacturing firm is to be in business by maximizing the control of the factors that determine its efficiency and productivity. Therefore, the output of production system is relative to the efficiency of the system and it is also an indicator of production performance. Thus, if capacity utilization of production equipment increase, it implies high level output and vice versa. Hence, output of production system is dependent on the utilization rate of system. From the work undertaken, the average value of Capacity Utilization of production line for the manufacture of 4ft fluorescent fitting components is given as 75% of the overall line capacity. This therefore informs of the need for increase in capacity utilisation, and its positive effects will translate to increase in production with increased income for the firm.

V. REFERENCES

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