ESTABLISHING MANPOWER COMBINATIONS FOR MANUAL INSPECTION AND SORTING IN A POULTRY PROCESSING INDUSTRY USING WORK MEASUREMENT

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Abstract: This project is to establish manpower combinations for manual inspection and sorting of giblets and feet of broiler chicken at a poultry processing industry. As this particular industry is intended to increase the current production rate from 80,000 products/per day to 300,000 products/per day, it is essential to identify the workers with optimum capability in doing the job task. In this selection process, it is necessary to consider the worker's productivity, generally the productivity rate of employees is one of the key factors for the increment of the production and profitability of an industry. As a result of the new combinations, the organization could benefit in the terms of reducing manpower used for manual inspection and utilize those opted out workers for other job tasks. The method of the study is a combination of work measurement and manpower planning. The data necessary for the method are the productivity level of each worker and the total output of the workers in inspection and sorting tasks of the products. The data is observed and recorded for every 30 minutes. The outcome of the project is the manpower combinations for inspection and sorting work.

Keywords: *Manpower planning; Work measurement; Labour Productivity.*

1. Introduction

Nowadays, industries start to focus on optimizing the productivity of the organization with minimal changes. Yet, it is hard to achieve as there are few underneath constraints. Most commonly is the costs associated with the replacement of manpower with new technology (machinery) or recruitment of new skilled/ unskilled workers for these optimization processes to be successful. The productivity level of an organization can be optimized by arranging and allocating the available manpower wisely.

Productivity of workers has a strong relationship with the optimization of production in an organization. Many scholars have found that productivity is the ratio of outcome and the time it takes to fulfill. So, a system is considered as more productive, when it consumes less time to achieve the desired result. Optimized manpower utilization can be an added advantage to the increment of the productivity of an organization (Salehi et al., 2013).

Next, wise allocation of workforce or manpower planning is a crucial factor in satisfying the productivity target. Manpower planning is a process of ensuring that there is a constant and sufficient supply of workers within an organization at all times. The main idea of these

process is to assure the availability of the workforce with right skills, in the right number, at the right place and also at the right time (Adekunle and Lucent-Iwhiwhu, 2014). In case of increasing production rate, manpower planning plays a vital role as the right amount of workers with adequate skills will be helpful to an organization in improving its productivity. Thus, it is a must to plan and allocate enough workers based on their capabilities to do any job in a firm. This project highlights on the possible manpower combinations in doing group based jobs and their combined output.

1.1. Problem Statement

Company X is a poultry processing factory. This company is intended to increase their current production rate from 80,000 products/per day to 300,000 products/per day. At the same time, the company is minimizing the workforce and replacing it with new high calibrated machinery. But certain tasks need to be done manually, such as inspection and sorting of giblets (liver with heart and feet). For these work, it is necessary to identify the worker with high capability and ability to achieve the targeted productivity which was set by the firm beforehand. So, the company is facing difficulty in selecting the worker who could cope up with the speed required by the management in order to achieve the production target. As currently, the process of inspection and sorting is being done by both male & female operators, but, once the new machines are started to run, management made the decision to use only female operators for that activity. Next, the manpower selection will not fully contribute to the increment in the production rate. Thus, the selected workers have to be grouped up according to their ability in doing the work. The poor manpower arrangement is also another problem faced by the production team of Company X. It is due to the poor understanding of workers capability. Hence, the production team ends up in allocating the workers with works which is not their forte.

1.2. Objectives

- To study the productivity and efficiency of workers in doing inspection and sorting works
- To identify and allocate the selected workers with high efficiency in doing inspection and sorting works.
- To reduce manpower utilized for manual inspection and sorting.

1.3. Scope

The scope of these study are:

- Focused on inspection and sorting works in preliminary department in a poultry processing company
- The product selected for the research is liver & heart and feet, both products will be inspected and sorted according to its grade.
- The productivity of each workers doing the inspection and sorting works is observed.
- Both the work will be done in groups, thus, the overall productivity will be calculated in order to form group of workers.

1.4. Outcome

At the end of the study, it is expected to obtain, identify and form the best combinations of workers with optimum productivity in doing manual inspection and sorting works. It is also expected to reduce the number of workers used for manual inspection and utilize the filtered out workers for other job areas.

This project focuses on manpower allocation and group combination for inspection and sorting work. In order to increase the production rate and achieve the targeted productivity, it is necessary to identify the worker with high efficiency, select them based on their ability to cope up with the speed as required by management in doing the inspection and sorting works, and establish new manpower combination for those tasks as well. The method of the study is a combination of work measurement and manpower planning for the group based task. The data necessary for the method are the productivity level of each worker and the total output of the workers in inspection and sorting tasks of the products. The outcomes of the study will be establishment of manpower combinations for inspection and sorting work. Next, reduce those unfit workers and utilize them into other job tasks. These benefits the firm and the production team in allocating the works to workers according to their capabilities and selecting the right person for the right place.

2. Literature Review

2.1 Manpower Planning

The concept of manpower planning refers to a method of having the right number of people at the right time with the right qualifications , skills and additionally experience in that particular job. Authors Agabi and Ogah identified manpower planning as a method of predicting an organization's human resource needs. It is also described as a way of establishing targets that could improve the firm's ability to achieve the needs, identifying relevant resource requirements and developing plans to achieve the defined goals of the firm (Adekunle and Lucent-Iwhiwhu, 2014).

2.2 Productivity

In general, productivity is concerned with the relationship between the output generated by the production process or a service system and the input provided to obtain this output (Singh, 2016). In scholar’s view, productivity is seen as a more efficient use of resources such as labour and machinery which, if accurately calculated, can efficiently indicate output or efficiency. Author M.Salehi et. al, explored the input and output models for the productivity measurement. The input model is classified into two which is single factor productivity and multifactor productivity. Single factor productivity is a method of calculating productivity with a set of output with single input. Multifactor productivity is calculated by a blend of some inputs and outputs. The productivity obtained based on capital and labour inputs or based on a combination of capital, labour, resources, material, and services is among the most popular types of productivity in this method. Basically, labour productivity is an example of single factor productivity. The ratio of output per person is labour productivity. Apparently, a worker's output is measured by labor productivity. There are different ways of determining labour input: working time (man hour), paying labour costs, amount of workers, and amount of direct labour (Salehi et al., 2013).

2.3 Work Measurement

Work measurement is a tool which consists of several techniques can be applied in order to determine the time needed to accomplish a task and set the time for a skilled worker to perform the job at a specified performance rate. The purpose of work measurement is for manpower planning, production planning and scheduling, cost reduction and control, comparing alternative methods, and workers performance appraisal. By applying work measurement an organization could acquire the basic information required for all the activities of organizing and managing the business of the particular firm where the time element is vital (Kanawaty, 1992).

2.4 Work Measurement Techniques

Authors Mehta.A.D and Desai.D.A have classified the work measurement techniques into three generations. The first generation is an estimation method where the standard time is obtained and the productivity is analyzed by using SWAG and historical data techniques. The second generation is measuring the work through direct observation and measurement by stopwatch study or sampling techniques. The third generation is a method where intervention of IT is utilized and this generation is known as a predetermined time system. There are three techniques used in this approach which are MODAPTS, MOST, and MTM. Among those types of work measurement techniques, the time study also known as the stopwatch study has been the most common technique used by many industries and researchers to measure the work time as it is a cost efficient method (Mehta and Desai, 2014).

3. Methodology

3.1. Flow of the study

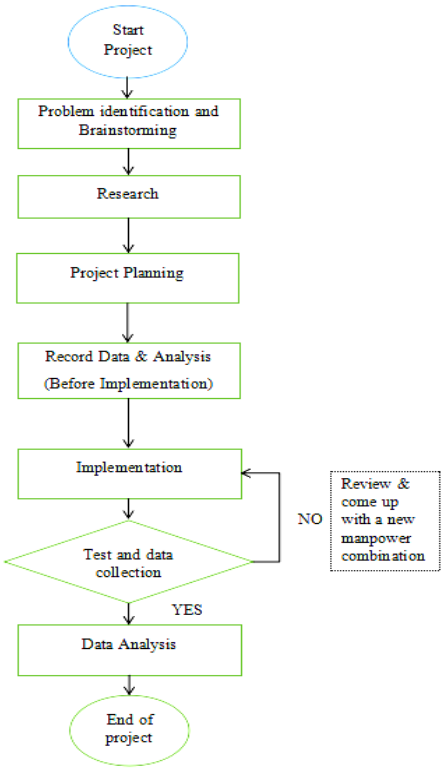

Figure 1. Process flow of the study

Firstly, the research problem which is poor manpower arrangement for manual inspection and sorting of feet & liver with heart of poultry broilers at Company X was identified. The root cause of the problems were analyzed in a discussion with the production supervisors. Later, the research on the literature of study background was conducted. This was done in order to gain knowledge on the method of planning and collecting data for the project. Selected 10 employees randomly, those who are familiar with the job task and permanent staff of the firm not a foreigner (contract worker). Each operator is identified as operators A, B, C, D, E, F, G, H, I and J. Next, a productivity test was conducted by using work measurement technique. The data obtained were recorded in a data sheet. The data collected was the output rate of those selected workers in doing inspection and sorting of both products in 30 minutes. The products are weighed once 30 minutes are over and the weight of the product is recorded as the output of each worker. The data collection was conducted for 1 month and at 3 times per week in order to obtain the average output of each worker. Then, the output data were analyzed by using Labour productivity measures. The average productivity of each worker is also obtained to know whether each worker is able to achieve the targeted productivity. Establish manpower combinations based on the analysis.

3.2. Targeted Productivity

Company X has fixed the productivity rate for inspection and sorting of both products. Thus, the worker's productivity is compared to the target.

- The targeted productivity of Liver + Heart = 68 kg/ per man hour
- The targeted productivity of Feet = 140 kg/ per man hour

3.3. Data Analysis Tool

3.3.1. Bar Charts

The bar charts were developed in order to investigate the performance level of each operator. The level of output is compared to the targeted productivity to identify the poorly performing operators who are unable to meet the target or not even producing nearly to the target. This is helpful in terms of selection of operators for combination establishment.

3.3.2. Formulas

The productivity of each operator is calculated by the Labour productivity measures. As in labour productivity, the productivity is estimated by a collection of outputs and a single input. In this study, the productivity is measured by using the sum of output for each set of data collected (output) for 30 minutes and the number of operators (input) as refer to Equation 1 and Equation 2 (Salehi et al., 2013).

$$\text{Labour Productivity} = \frac{\text{Output}}{\text{Labour Input}} \quad (1)$$

$$\begin{aligned}\text{Labour Input} &= \text{No.of operator} \times \text{time taken to acquire those output} \\ &= \text{No.of operator} \times 0.5\end{aligned} \quad (2)$$

Next, average productivity is the sum of productivity of a week divided by the number of sets of data collected. As the output is recorded 3 times per week, it is necessary to identify the average productivity of each operator as refer to Equation 3.

$$Average\,Productivity = \frac{\sum Productivity\ of\ each\ Reading}{3} \tag{3}$$

3 is the sets of data collected

The average output is the sum of output of an operator divided by the number of sets of data collected each operator as refer to Equation 4.

$$Average\,Output = \frac{\sum Output\ of\ each\ operator}{3} \tag{4}$$

The amount of difference of actual output with the target. The amount of difference in output with the target is identified in order to know the amount of output required to meet the target, for those whose output is beyond the target it is used to know how much does that person have produced beyond the target. In short, it is calculated in order to identify how much the average labour output differs with the targeted output each operator as refer to Equation 5 and Equation 6.

$$Percentage\ of\ output = \frac{Average\,Output}{Targeted\,Output} \times 100\% \tag{5}$$

$$\text{Amount of Difference} = 100\% - \text{Percentage of output} \tag{6}$$

The percentage of change in average productivity before and after implementation. This is to identify the amount of productivity increment after implementation as refer to Equation 7.

$$Percentage\ of\ change = \frac{V_2 - V_1}{V_1} \times 100\% \tag{7}$$

V_2 = Average productivity After Implementation

V_1 = Average productivity Before Implementation

4. Result

4.1. Before Implementation

The sum of productivity of 10 operators is calculated for each set of data. Based on figure 2 and 3, the average productivity of each week is below than the targeted productivity. The target is not achieved. According to table 1, for Liver + Heart Inspection and Sorting the average productivity is below the target around 3% to 6%. And based on table 2, it is evident that the average productivity is below the target 4% to 5%. Even though there are 10 operators who were doing the inspection yet the target remained unfulfilled. This is due to operator C and I's productivity is less than the target. Productivity of operator C is behind the

targeted productivity at 43% to 45% in Feet inspection, meanwhile for Liver + Heart the operator is below the targeted productivity around 41% to 47%. The amount of difference in productivity of operator I to the targeted productivity in Feet inspection is 40% to 43% and in Liver + Heart the difference is 36% to 47%.
Comparatively, operator C and I are producing less than other 8 operators. Thus, these 2 operators are filtered out from the list and the combinations were formed by utilizing the rest of the 8 operators.

Table 1. Average Productivity for Inspection and Sorting of Liver + Heart in December 2019

Week	Productivity (kg/per man hour)				Target (kg/per man hour)	Amount of difference
	1st Reading	2nd Reading	3rd Reading	Average		
1	64.04	63.90	63.32	63.75	68	6%
2	64.36	65.37	66.21	65.31	68	4%
3	64.86	64.19	65.85	64.97	68	4%
4	65.55	66.30	66.96	66.27	68	3%

Table 2. Average Productivity for Inspection and Sorting of Feet in December 2019

Week	Productivity (kg/per man hour)			Average Productivity	Target (kg/per man hour)	Amount of difference
	1st Reading	2nd Reading	3rd Reading			
1	134.01	132.32	133.39	133.24	140	5%
2	133.98	136.54	133.76	134.76	140	4%
3	133.04	135.07	134.26	134.12	140	4%
4	133.94	134.13	136.48	134.85	140	4%

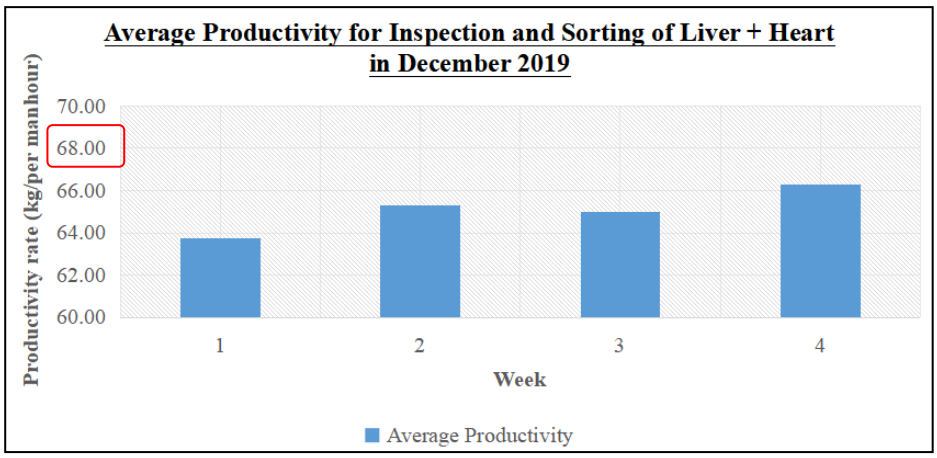

Figure 2. Average Productivity of each week in December 2019 for Liver + Heart Inspection and Sorting

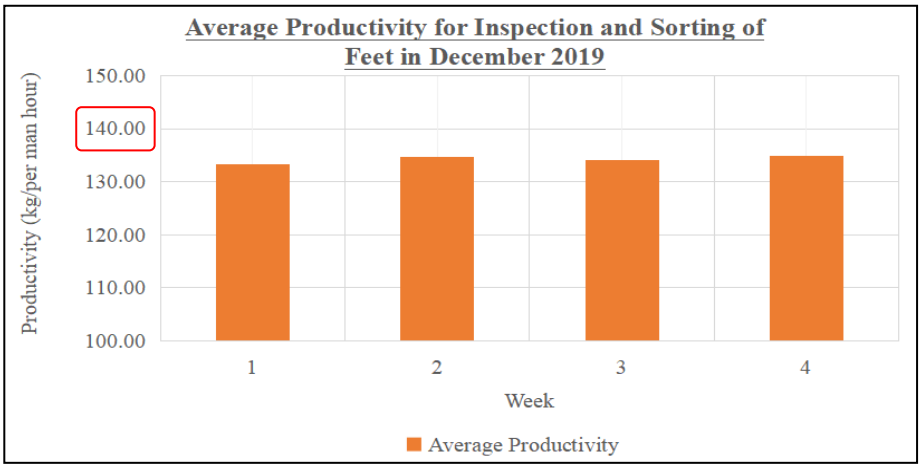

Figure 3. Average Productivity of each week in December 2019 for Feet Inspection and Sorting

4.2. Manpower Combinations

There is 3 combinations established for each product. For Feet, operators D, G and J are those fixed operators as the productivity rate of these 3 operators is averagely at the same level. Based on their productivity, it is clear that they possess the ability to reach the target for feet inspection and sorting easily with their output. For Liver + Heart, operator A and F are selected as the fixed operators. As these two operators achieve the target with their constant output rate. Operators B, E, and H who are manageable both product's inspection & sorting are shuffled act as substitutes in each group.

Table 3. Combinations or groups of Feet Inspection and Sorting

Product	Group	Operator
Feet	1FT	E
		H
		D
		G
		J
	2FT	E
		B
		D
		G
		J
	3FT	H
		B
		D
		G
		J

Table 4. Combinations or groups of Liver + Heart Inspection and Sorting

Product	Group	Operator
Liver + Heart	1LH	A
		B
		F
	2LH	A
		H
		F
	3LH	A
		E
		F

4.3. After Implementation

Table 5. The changes in average productivity of Feet inspection & sorting after implementation

Week	Avg.Productivity Before implementation (kg/per man hour)	Group	Avg.Productivity After implementation (kg/per man hour)	Percentage of Change
1	133.24	1 FT	148.57	12%
		2 FT	142.36	7%
		3 FT	143.92	8%
2	134.76	1 FT	151.61	13%
		2 FT	145.35	8%
		3 FT	145.75	8%
3	134.12	1 FT	153.06	14%
		2 FT	143.76	7%
		3 FT	144.02	7%
4	134.85	1 FT	152.16	13%
		2 FT	145.74	8%
		3 FT	145.37	8%

Table 6. The changes in average productivity of Liver + Heart inspection & sorting after implementation

Week	Avg.Productivity Before implementation (kg/per man hour)	Group	Avg.Productivity After implementation (kg/per man hour)	Percentage of Change
1	63.75	1LH	70.64	11%
		2LH	71.67	12%
		3LH	73.14	15%
2	65.31	1LH	73.14	12%
		2LH	74.72	14%
		3LH	73.96	13%
3	64.97	1LH	73.52	13%
		2LH	75.83	17%
		3LH	73.76	14%
4	66.27	1LH	72.94	10%
		2LH	74.09	12%
		3LH	74.23	12%

5. Discussion

The data obtained after implementation is shown in table 5 and 6, each group achieved the targeted productivity. In feet inspection & sorting activity, the average productivity after implementation increased by 7% to 14%, while in Liver + Heart inspection & sorting activity the percentage increased from 10% to 17%. Thus, the combinations helped the firm in terms of achieving the targeted productivity with minimal workforce. The established combinations effectiveness is proven. As per the theory of manpower planning, when right number of people is placed at right place by considering each one's ability in achieving the target.[2]
The number of workers for inspection and sorting jobs is reduced. The 2 filtered out operators are utilized for other areas within the same department.

6. Conclusion

To conclude, all 3 objectives of the study are achieved. The productivity level of each worker is measured based on their output by using labour productivity measures and the output is recorded by applying work measurement technique. Then, the data obtained were compared to the targeted productivity and analyzed on operators ability to meet the targeted productivity. As the result of analysis, 2 operators are identified as poorly performing and unfit for the job task. Next, few combinations were established neglecting those 2 operators. The total number of operators required for Inspection and Sorting job tasks is reduced from 10 to 8. Those 2 operators are utilized for other areas which requires workers such as veterinary trimming or final bird inspection. As these two segments do not require experts or skilled workers. For future research in this topic it suggested to study on the ways to handle absenteeism and ensure that it does not affect the targeted productivity or the effectiveness of the combinations that have been established.

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