CHICKEN PARTS GRADING PROCESS EVALUATION USING MEDIAN METHOD

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Abstract: Several production lines in this company are using manual process. Work measurement is conducted in order to improve the productivity of grading. The work measurement data will be used to evaluate the lead time for the current grading process, to evaluate optimum time of grading process and to compare the productivity of the grading process at previous production plant and current production plant so that the performance of each graders can be obtained, the lead time and time taken for the whole grading process also can be obtained.

Keywords: *Cutting machine, work measurement, productivity*

1. Introduction

Work measurement is the approach of coming up with the time that a task would take when the operator working on completing it at a rate of performance (IMS, 2019). The work measurement for each operator can be recorded easily by carrying out stopwatch time study (Rio and Siti, 2018). Discussing with them also helps to get to know if there is anything slowing them down while they are working. Each operator has their own capability in working (O'Hara, 2017). Some factors affecting their performance are gender, age, weight, temperature of surrounding and etc. (Julie, 2009). In this study, the section is completing a few process, from unload birds, cutting, grading, weighing, vacuum thigh, packing, registering & tagging, sort in crate & sort in pallet. The processes involved both manpower & machines to complete those tasks & produce quality products. Each process has no time standard because manpower processes influenced by a few factors. Without time standard, process completed earlier, some completed later which causes overtime but some of the processes cannot be completed even by working overtime. The processes involved manpower and machine at the section are determined & studied through this time motion study while determining an average time needed to complete each process at the department in order to improve productivity and reduce rejection rate. As shown in Figure 1 below, the whole birds are cut into parts manually by operators. Those parts are graded manually by operators where they check for reject parts which are separated according underweight, overweight, and rejected parts. Rejected parts consist of bile stain, broken and bruises. When graders mistakenly graded the parts, quality control officers will detect them when they carry out inspection every hour. The inspection includes measuring temperature, weighing each part and rejected parts. Reject parts contain bruises, bile stain and broken. Before carrying out the inspection, they make sure the weighing machine and thermometer are calibrated. Metal detector also will be inspected by placing the

metal sample on the packaging and sending them under the metal detector. The metal detector will automatically reject the packaging, stop the conveyor and show red light signal. Each of the sample tested three times to ensure the metal detector working properly.

Figure 1. The Process Flow including Grading Process

Figure 1 above shows the process flow which the chicken parts go through before and after grading process including grading process.

2. Methodology

2.1. Stopwatch Time Study

Time study using stopwatch is one of the methods used to calculate work measurement. It is a process of measuring time taken using a stopwatch for a particular operator to complete a process at a section of the department. Since the stopwatch is used for time study purpose, it must be very accurate in measurement to the precision 0.01 minute (Shivam, 2020). Measuring the time for a few times is optional to obtain effective result in order to calculate the average time taken to complete the particular work (Jain, 2019).

2.2. Data Sheet

Date : ①
Order of the day: ②

③ Time	④ Job Task/ Activity (per person)	⑤ Quantity (birds/ pcs) (5 minutes)	⑥ Time taken (per min)					⑦ Avarage for 1 min	⑧ Number of Manpower	⑨ Remarks
			1min	1min	1min	1min	1min			

Figure 2. Data Sheet Used to Record Data

Figure 2 above shows the data sheet used to record the work measurement data manually while using stopwatch.

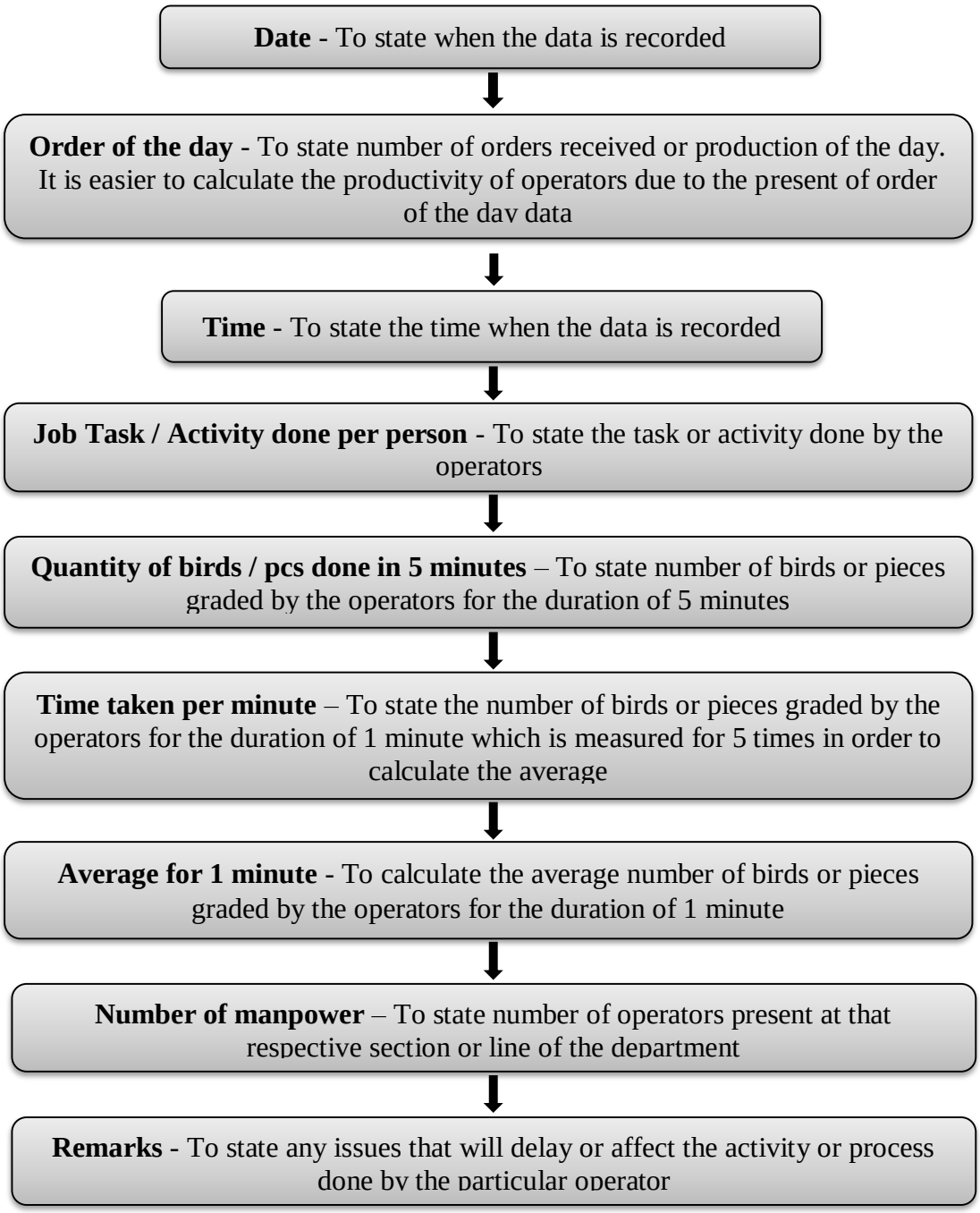

Figure 3. Flow chart of the time measurements work

Quality inspection also carry out randomly during the grading process as charted in Figure 3. Sometimes operators mistakenly cut the whole birds which is called wrong cut. When wrong cut takes place, the parts conveyed towards graders and graders will do visual inspection on the parts and reject them according to overweight parts, underweight parts and reject parts. Graders will do grading after the cutting process takes place and the parts conveyed towards them on the conveyor. They pick up those parts from conveyor, inspect them visually and put it into the top container above the conveyor for packing. If there are reject parts, they are separated according underweight, overweight, and rejected parts. Rejected parts consist of bile

stain, broken and bruises. When graders mistakenly graded the parts, quality control officers will detect them when they carry out inspection every hour.
Three crates of products are chose randomly and inspected. The inspection includes measuring temperature, weighing each part and rejected parts. Reject parts contain bruises, bile stain and broken. Before carrying out the inspection, they make sure the weighing machine and thermometer are calibrated. If they are not calibrated, they will send it to lab for calibration. Metal detector also will be inspected by placing the metal sample on the packaging and sending them under the metal detector. They metal detector will automatically reject the packaging, stop the conveyor and show red light signal. Each of the sample tested three times to ensure the metal detector working properly because it is included as one of the critical control point. This test is done to make sure the metal detector, the sensor gate which rejects packaging, the signal light and conveyor works properly.

3. Results and Discussions

There are two processes that will be explain at this section. The first process is the birds slaughtering process and the second process is the grading process. The slaughtering process using automation system increases the minimum processed bird from 7 birds per minute to 60 birds per minute

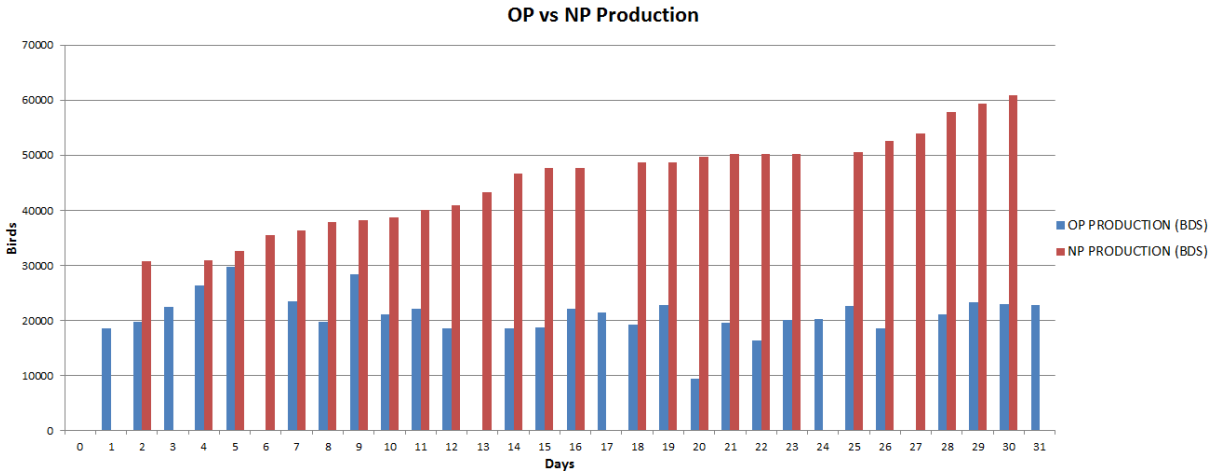

Figure 4. Old Plant versus New Plant Production Data

Figure 4 above shows the production data for M line at old plant and new plant daily. While, Figure 5 and Figure 6 shows the birds for M line at old plant and new plant by minutes and hourly. The data recorded at old plant are affected by factors such as weight of whole birds, weight of parts, wrong cut by cutters, number of operators working each day, defects on whole birds and parts such as torn skin, bruises, broken bones, broken wings, and etc. The factors related to machines won't affect the data recorded at old plant because every process done manually here. The data recorded at new plant are affected by factors such as weight of the whole birds, weight of whole bird parts, defects of cutting by machines, defects on whole birds and parts such as torn skin, bruises, broken bones, broken wings, and etc. Moreover, the data recorded at new plant was during testing while gradually increasing the number of birds processed each day because it was newly opened and some adjustments were taking place in order to make sure production runs smoothly and better than the old plant. The engineers and operators were working together while undergoing training and learning about the new

technology, system, maintenance and machines. Half of the process took place at old plant at beginning of November because of the machine cutting adjustment and weight of the parts can't be full fulfilled according to customers' demands.

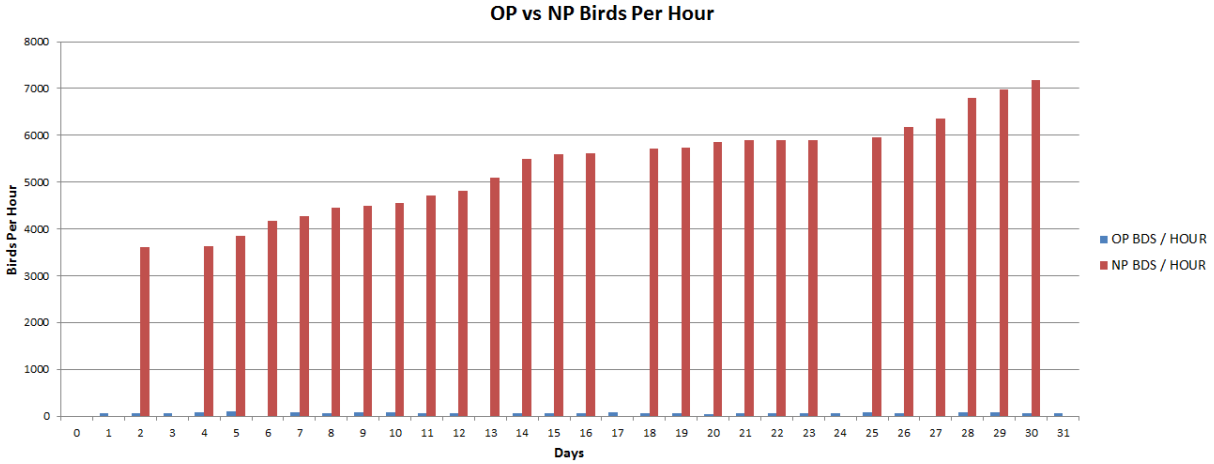

Figure 5. Old Plant versus New Plant Birds per Hour Data

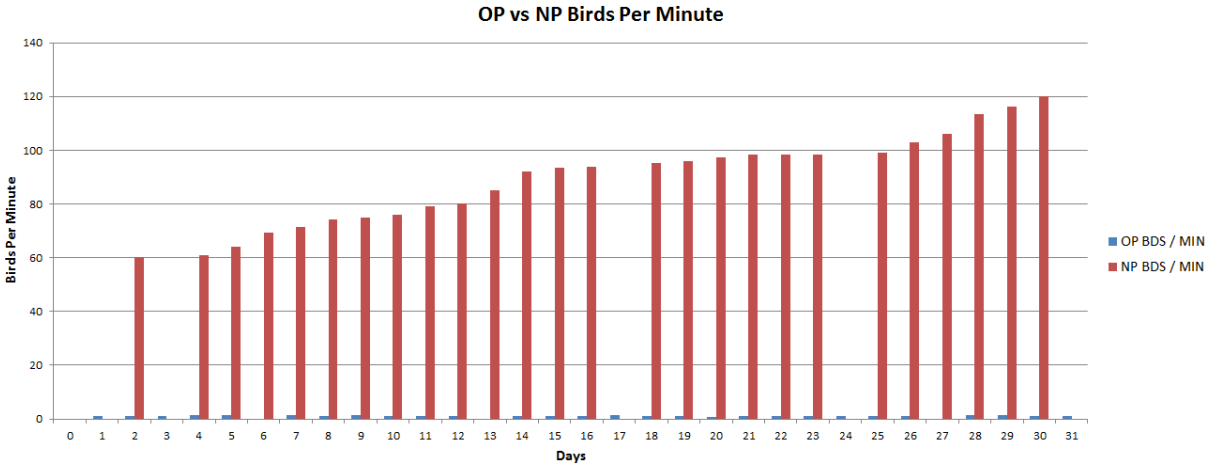

Figure 6. Old Plant versus New Plant Birds per Minute Data

However for grading process, two parts of chicken has been compared that is chicken thigh and drumstick. Figure 7 and Figure 8 show the grading comparison for M line at old plant and new plant for chicken thigh and drumstick for the month of October 2019 and January 2020. Old plant grading done manually while new plant grading done manually by operators then the graded parts put onto conveyors with sensor gates which will grade according to each weight of the parts set by supervisor of the line. The parts will be separated according to its weight range whether acceptable or reject. If the parts is too near the sensors will miss counting some of the parts which will bypass all the sensor gates and enter the crate placed at the end of the conveyors. These parts will be put onto conveyors again by the operators so that the sensor gates detect them. At old plant, grading process is slower because the whole process done manually compared to new plant which is done within 46 hours of the whole month.

The chicken thigh and drumstick that can be produced in 3 months increased by 160,000 pieces compared to old plant production.

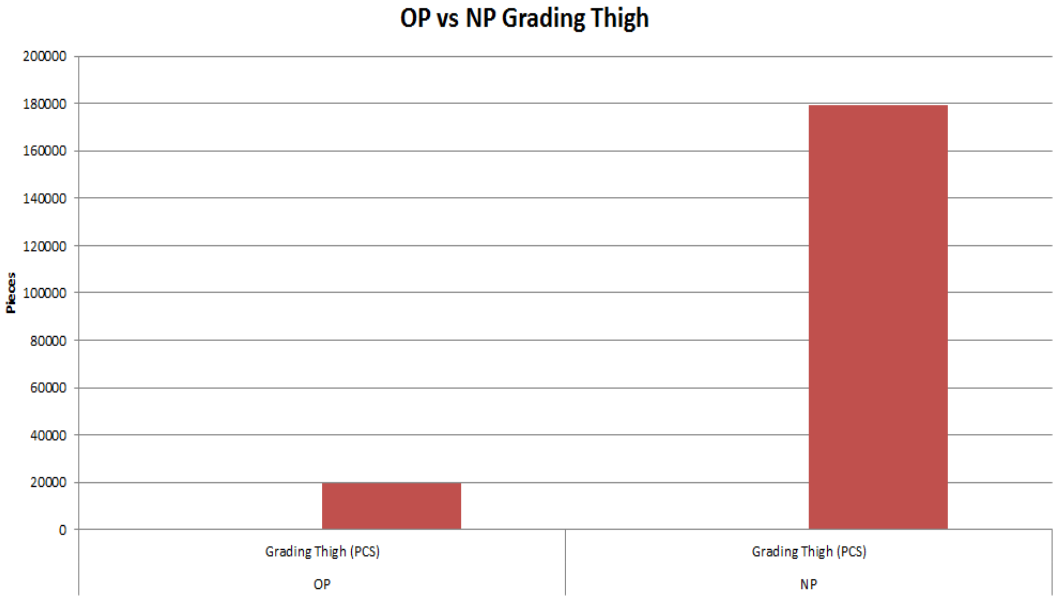

Figure 7. Old Plant versus New Plant Grading Thigh Data

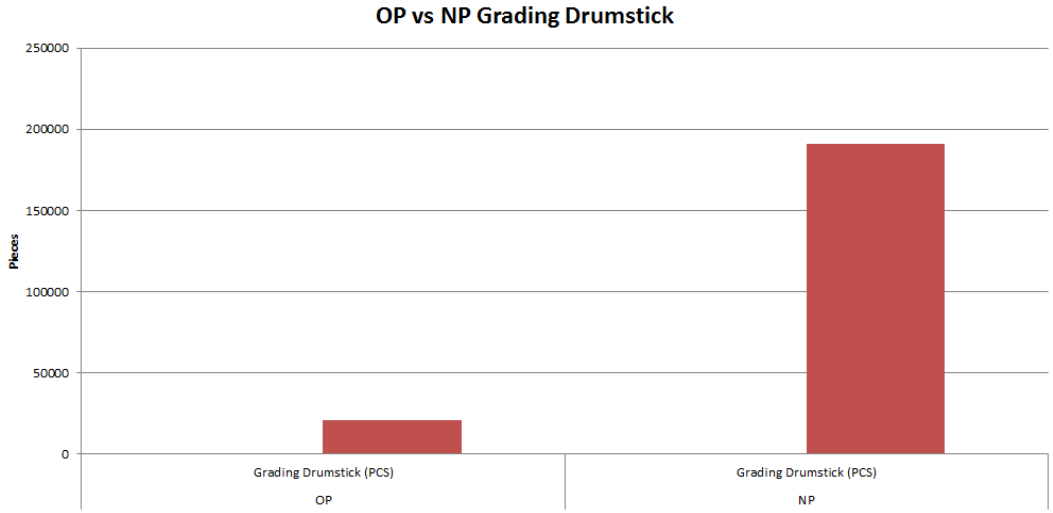

Figure 8. Old Plant versus New Plant Grading Drumstick Data

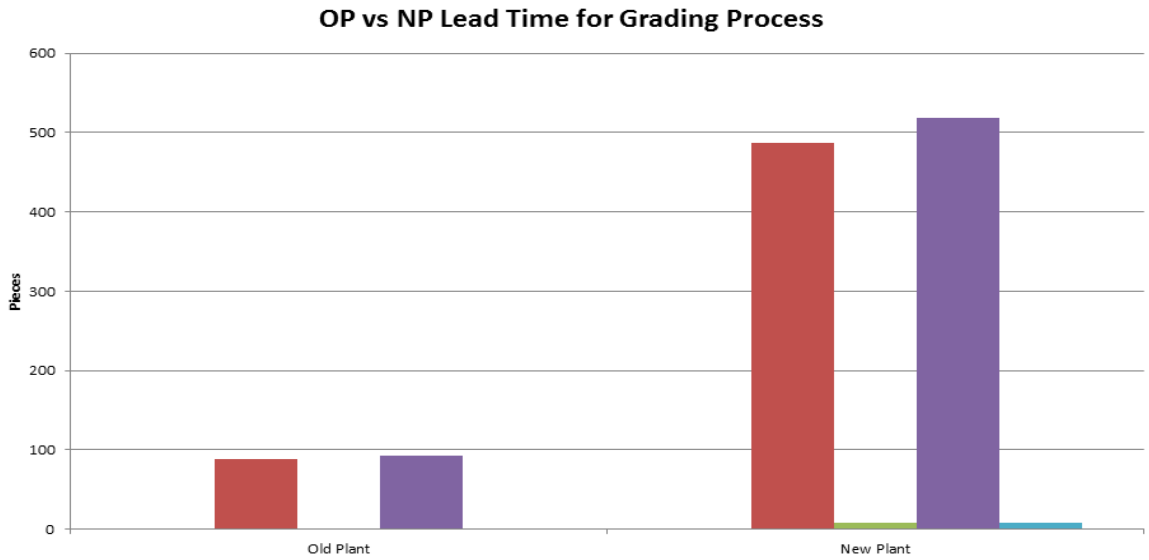

Figure 8. Old Plant versus New Plant Lead Time for Grading Process Data

Figure 8 shows the percentage of grading rate lead time for thigh parts at new plant improved by 453% compared to old plant. While the percentage of grading rate lead time for drumstick parts at new plant improved by 464% compared to old plant.

Calculation for percentage of improvement is refer to Equation 1 shown below (Rio and Siti, 2018).

$$Mean, \overline{X} = \frac{x_1 + x_2 \dots x_n}{n} \quad (1)$$

2019

Mean, $\overline{X} = \frac{19518+21095}{2} = \frac{40613}{2} = 20306.5$

2020

Mean, $\overline{X} =$

$$\frac{191028 + 179137 + 169569 + 186957 + 193043 + 235509 + 188824 + 198163 + 210222 + 236345 + 236265 + 219494}{12}$$

$= \frac{2444556}{12} = 203713$

Percentage of improvement $= \frac{203713 - 20306.5}{20306.5} = \frac{183406.5}{20306.5} = 903\%$

The calculation above shows percentage of increment of grading process productivity rate for new plant by 903%.

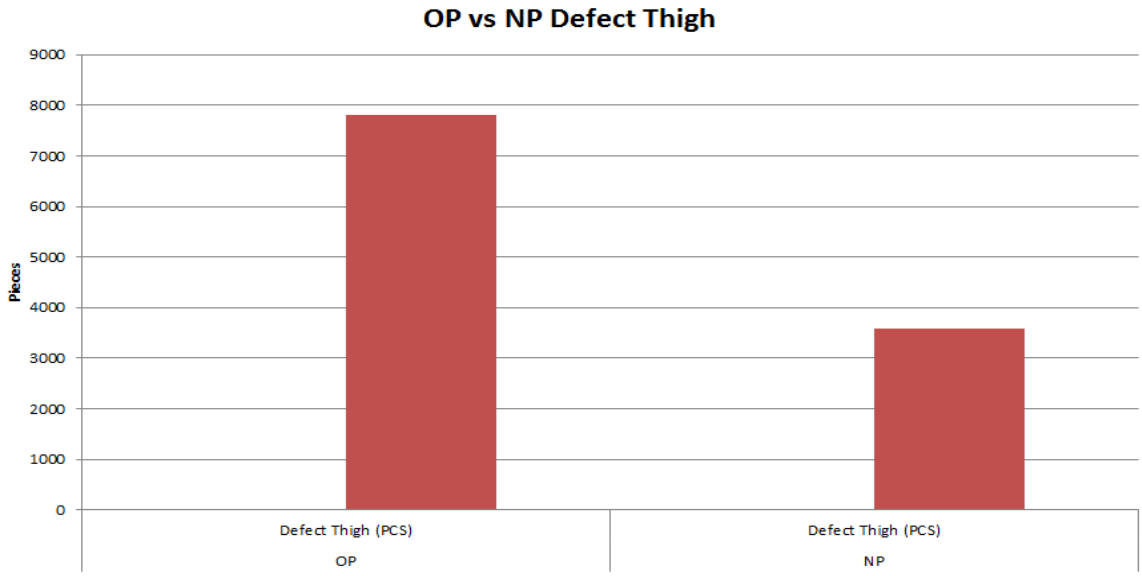

Figure 9. Old Plant versus New Plant Defect Thigh Data

Figure 9 above shows the defect thigh data for M line at old plant and new plant.

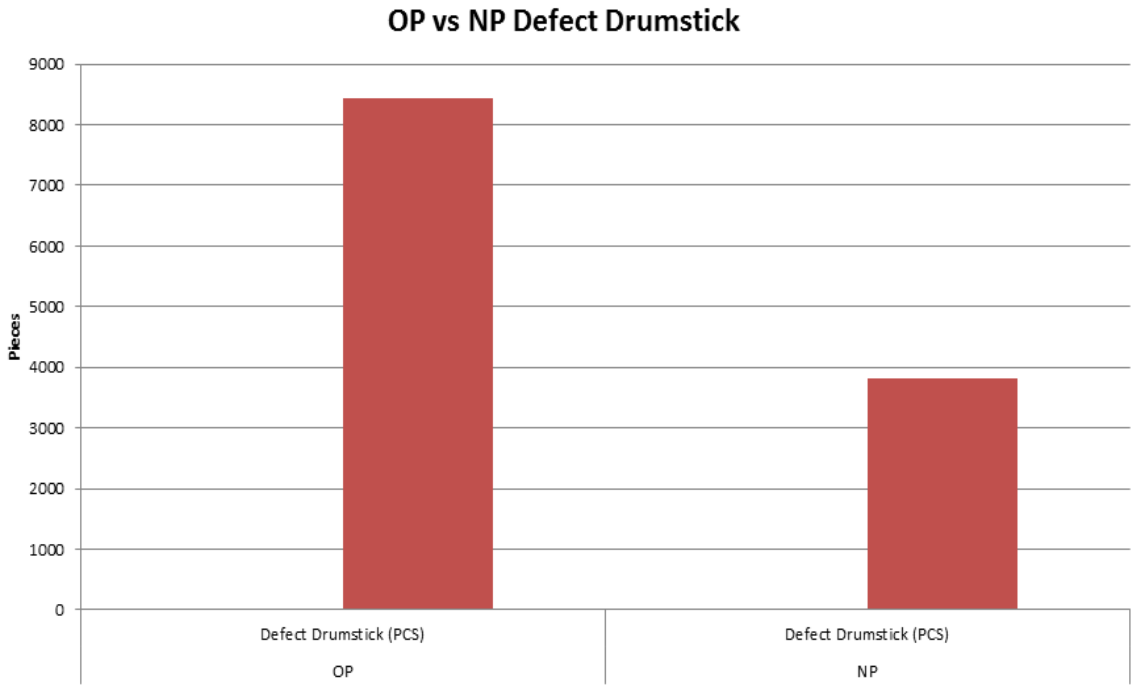

Figure 10. Old Plant versus New Plant Defect Drumstick Data

Figure 10 above shows defect of thigh and drumstick at the old and new plant. The data comparison shows that defect of new plant is almost half of the old plant according to Figure 10. This shows how improved the performance of current plant compared to the previous plant. By reducing the defect, better quality of the parts are achieved.

Calculation for percentage of improvement is shown below.

2019

Mean, $\overline{X} = \frac{7807+8438}{2} = \frac{16245}{2} = 8122.5$

2020

Mean, $\overline{X} = \frac{3582+3820}{2} = \frac{7402}{2} = 3701$

Percentage of improvement = $\frac{8122.5-3701}{8122.5} = 54.4\%$

The calculation above shows rejection rate reduced by 54.4%.

The data recorded on some days are low due to the weight of whole birds distributed to this production line. It's because of the different types of weight of whole birds received from farm. Only whole birds with certain weight range are used at this line for cutting so that weight of the parts can be achieved according to customers' demands. So, whenever the whole birds received from farm with the weight range needed at this line increase, the data recorded on that day also increase. This is the reason why the pattern of data recorded fluctuates.

4. Conclusion

Productivity rate increased by 903% from 20,306.5 to 203,713 birds processed per month at New Plant by using fully automation system (Technology from Netherland). Rejection rate reduced by 54.4% {Oct 2019|Jan 2020}. Grading process for chicken thigh improved by 2882% {Oct 2019|Jan 2020}. Grading process for chicken drumstick improved by 2956% {Oct 2019|Jan 2020}. Lead time for grading process improved by 453% for thigh parts and 464% for drumstick parts. Grading process for chicken thigh and drumstick consistency at about $313901.25 \pm 72737.75695$ and $74309.4375 \pm 249184.3261$ at the New Plant (Jan – April 2020).

References

IMS. (2019). Work measurement. Retrieved: https://www.ims-productivity.com/page.cfm/content/Work-Measurement/ on 29 November 2019.

Jain, M. (2019). Time Recording Techniques Used In Time Study. Retrieved: https://www.yourarticlelibrary.com/cost-accounting/time-study/time-recording-techniques-used-in-time-study on 29 November 2019.

Julie, K. N. (2009). Factors Affecting Poultry Meat Quality. Retrieved: https://thepoultrysite.com/articles/factors-affecting-poultry-meat-quality on 20 December 2019.

O'Hara, C. (2017). How To Get An Employee To Work Faster: Harvard Business Review. Retrieved: https://hbr.org/2017/01/how-to-get-an-employee-to-work-faster on 20 December 2019.

Rio, P. and Siti K. U. (2018). Watch time study and most: work measurement techniques. Journal of Engineering and Management in Industrial System. 5(2):87-94

Shivam, N. (2020). Economics Discussion: Stop Watch Time Study: Meaning, Procedure And Equipment. Retrieved: https://www.economicsdiscussion.net/engineering-economics/stop-watch-time-study-meaning-procedure-and-equipment/21706 on 30 November 2019.