INCREASING PRODUCTIVITY OF PT. XYZ THROUGH THE UTILIZATION OF STANDARD TIME AND THE TWO HANDED PROCESS FOR PANEL BOX PRODUCTION

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ABSTRACT

PT. XYZ is a manufacturing company renowned for its product, the Panel Box. Previously, the company's productivity level was relatively low hence it was difficult for PT. XYZ to achieve their production target. Productivity level was previously measured using the objective matrix method (OMAX); as such, the productivity index result which started at 0 in January and later followed with a 0.56% increase in February, a 1.06% increase in March, a decrease of 1.19% in April, a 1.60% decrease in May as well as a drop of 1.97% in June. One of the factors causing the downward trajectory is related to the workers in which the operator has not maximized their working hours – this is due to the workers not being able to calculate or determine the standard time required to produce 1 product therefore causing the operator to remain unwary when conducting his duties. The suggestion for PT. XYZ was to determine a standard time for the production of 1 product through the use of the two handed process. In doing so, the company was able to experience an 11.40% growth in productivity levels in July.
Keywords: Productivity, Objective Matrix (OMAX), Work Sampling, Two Handed Process

1. INTRODUCTION

1.1. Background

The main product that is produced as well as used for research purposes from PT. XYZ is the Panel Box. Based on research results, the company's productivity level was relatively low hence creating challenges in achieving the production target. A significant portion of this is because the operator were not yet been able to maximize their working hours. With no standard time determined, operators can often be found working at a leisurely pace. In an effort to fulfill the company's production target, PT. XYZ turned to necessitating overtime from its workers therefore causing excessive financial spending. Results from the Objective Matrix (OMAX) indicates that wasted time during working hours are directly linked to the operator's ability to carry out the production process.

1.2 Scope of Issue

PT. XYZ's challenge is in its inability to meet the production target given its operators' inability to fully take advantage of their working hours. To fulfill said demands, the company had to provide incentives for overtime hours thus resulting in extra spending. One of the measures to boost productivity levels is to decrease input and increase output because efficiency in utilizing the company's resources is vital to bolster profit. Resources hereby include manpower, number of total working hours, and the available hours.

1.3 Research Purposes

The purpose of this research is to provide suggestions regarding increasing productivity which among them includes:

1. Creating a strategy to increase productivity by deciding on a standard time required to manufacture 1 product by using a operating system overhaul such as Two Hand Process.
2. Conduct a review of productivity levels in Panel Box product manufacturing before utilizing the Objective Matrix (OMAX) method.

1.4 Research Limitations

The following are limitations to the research:

1. The research is carried out at PT. XYZ which is situated at Jalan Ledug No. 100 Tangerang – Banten.
2. The research is carried out only at the panel box product manufacturing level which had previously been measured.
3. Productivity measurement is valid for partial productivity in order to have an overview of the results from improving upon the operating method.
4. Data output includes product output, acceptable product data, imperfect product data, overtime hours, regular hours, and undetermined hours.
5. Inputted data consists of normal working hours, the number of workforce, and the amount of energy used.

2. THEORETICAL BACKGROUND

2.1 Productivity

Sunyoto (2012) stated that work productivity is a measurement that showcases the balance between output and input of a company within a pre-determined time period. Thus workers productivity is the output from employees that is measured by the amount of time that is utilized in maximizing the available resources. Sumanth, 1985 introduced the formal concept of productivity cycle as a means to be used for sustainable productivity. Mauli (1978) stated that productivity is not the same as production; instead production, quality performance, and results make-up the components of productivity attempts. Therefore productivity is a combination of effectiveness and efficiency which is measured as:

$$\text{Productivity} = \frac{output\ results}{used\ input} = \frac{mission}{utilized\ resources}$$

$$\text{Productivity} = \frac{effectiveness\ in\ carrying\ out\ tasks}{efficiency\ in\ utilizing\ resources} = \frac{effectiveness}{efficiency}$$

2.2 Measuring Productivity Using The Objective Matrix Model (OMAX)

The Objective Matrix Model (OMAX) is a system used to measure partial productivity that was later developed to also monitor productivity in every division within a company under the condition that the productivity criteria is in accordance to its objective. This model was first developed by Dr James L Riggs (Department of Industrial Engineering at Oregon State University). OMAX was first introduced in the United States during the 1980s.This measurement model has a unique characteristic in that the performance criteria of a working group is included within the matrix. Every performance criteria has a goal which is a special pathway to improvement as well as containing the necessary requirements with the importance of increasing productivity kept in mind. The purpose of the OMAX are as follows:

1. As a tool to measure productivity levels
2. As a tool to solve issues related to productivity
3. As a tool to monitor productivity growth

2.3 Improving Productivity according to Deming

Deming (1986) stated that implementing quality within an organization requires a change in philosophy namely for the management. According to Deming, the concept of quality within an organization or a company requires repeated change or improvement. From 14 points related to the improvement of productivity according to Deming, the following are related to workers:

a. Training workers in order to sharpen the skills needed to carry out the task
b. Improve the quality of line supervisors
c. Workers are required to conduct quality work
d. Train staff members to understand statistical methods
e. Train staff members to hone in on new skills as a requirement

2.4 Two Handed Process (PTKTK)

The Two Handed Process is a tool from the study of movement to determine efficient

measures that are necessary to complete a task. This process provides an overview of movements of the left and right hand during useas well as during idle time – this also shows the comparison of tasks carried out by the left and right hand.

Use of Two Handed Process

a. Equalize the movement of both hands and reduce fatigue
b. Remove or reduce movements that are inefficient and unproductive therefore shortening the production hours
c. As a tool to analyze the mapping of working stations
d. As a tool to be utilized for carrying out training related to new tasks

3. RESEARCH METHOD

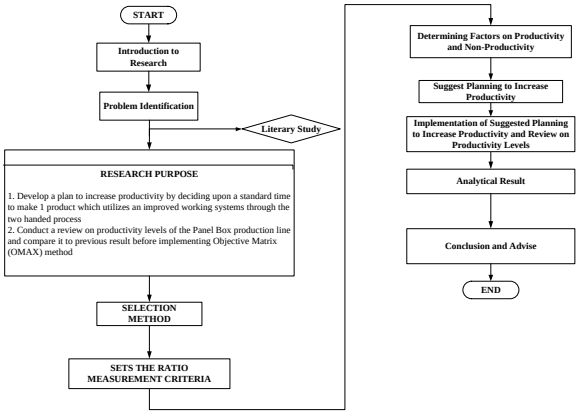

Image 1 Methodological Research Flowchart

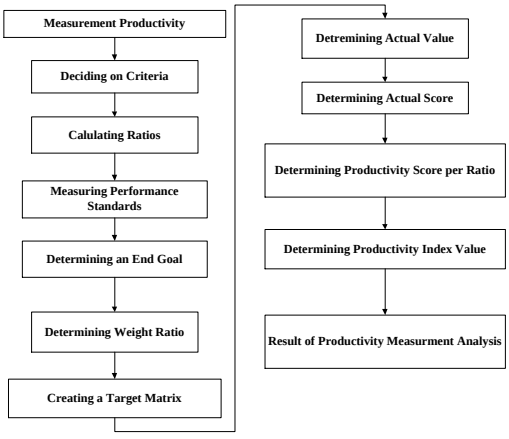

Image 2 Objective Matrix (OMAX)

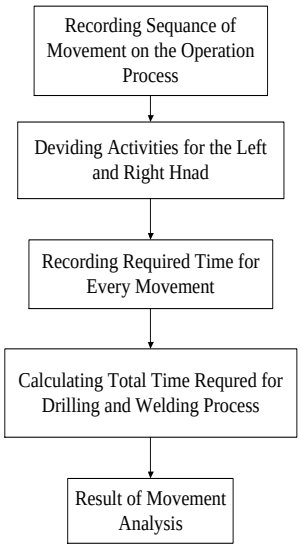

Image 3 Two Handed Measurement Method Flowchart Process Flowchart

4. RESULT AND DISCUSSION

According to previous research, it was determined that the productivity of a company often decreases. The following is the result of the previous research

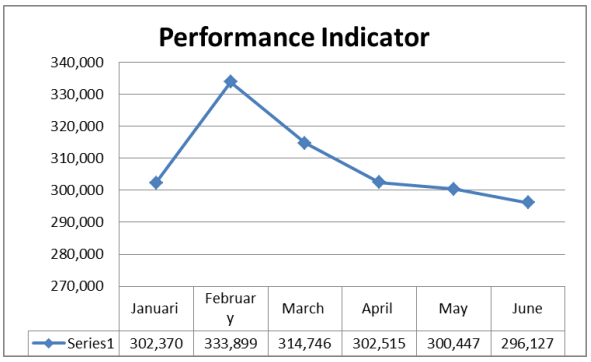

Image 4 Graph of 6-month Performance Indicator

The performance indicator illustrates the level of success in meeting targets of a company. Image 4 shows that the performance indicator of the company decreased for 4 continuous months.

Image 5 Graph of 6-month Productivity Index

The productivity index is used to determine if there is an increase or decrease in productivity in comparison to the base period. Image 5 illustrates that a company's productivity decreased for 4 continuous months as evident in the negative score index

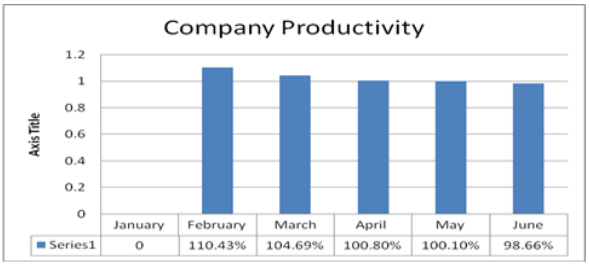

Image 6 Bar Graph 6-month Productivity Performance

Good productivity is always above 100%. Image 6 illustrates the current productivity rate of the company in which productivity from the previous month was below 100%. The increase and decrease in productivity is caused by input and output that are interrelated.

Cause and Effect Diagram

The cause and effect diagram is used to determine factors that causes a company to not fulfill its target.

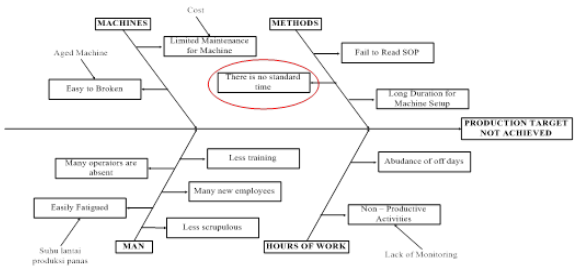

Image 7 Cause and Effect Diagram Resulting from Unmet Production Target

4.1 Increasing Productivity Planning

Increasing productivity planning is highly important for a company in order to remain competitive and stay ahead.

Flowchart (Panel Box Production Process)

Previously, the amount of time required to produce 1 product unit was 2,070 seconds or 34.7 minutes. The following is a flowchart of the production process:

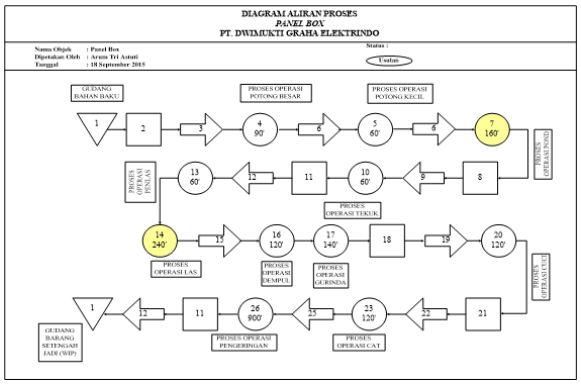

Image 8 Flowchart of Production Process

Object Name, Created by, Date, Status

The flowchart of the production process indicates that the necessary time to setup a pond system and conduct welding takes the longest duration compared to other procedures. As such, the plan is to create a two handed process for the pond system and welding process.

Table 2 Table of Operating Time before Reparation

Process	Time (Second)	Frequency	F*T	Time (Minute)
Large Cut	15	6	90	1,5
Small Cut	15	4	60	1
Drilled	40	4	160	2,67
Bent	15	4	60	1
Penlas	15	4	60	1
Welding	60	4	240	4
Sizing	30	4	120	2
Stone Grinding	35	4	140	2,33
Washing	120	1	120	2
Coating	120	1	120	2
Drying	900	1	900	15
Total	1365	37	2070	34,5

Two Handed Process Diagram before Reparation
Pond System Process (Holes)

MAP OF THE LEFT HAND AND RIGHT HAND

Task : Proses Lubang
DEPARTEMENT : Produksi
MAPPING NUMBER : 01
NOW : √ | SUGGESTION : -
MAPPED BY : ARUM
DATE of MAPPING PROCESS : 18 -10 - 2015

Left Hand	Time (sec)	Symbol		Time (sec)	Right Hand
Idle	2	De	Re	2	The materials will reach in the process
Idle	2	De	G	2	Hold the material to be in the process of
Idle	2	De	D	2	The materials will be raised in the process from the desk
Idle	4	De	M	4	Bring materials that will be in the process of the table towards the drill machine
Idle	2	De	RI	2	Unleash the raw materials on the table
Taking the Raw Material for Drilling 1	3	M	G	3	Hold the drill machine
Taking the Raw Material for Drilling 1	10	G	P	10	Redirect raw material for perforated 1
Taking the Raw Material for Drilling 1	20	G	U	20	Use the drill machine
Releasing material on the table for the process of hole 2	3	M	G	3	Hold the drill machine
Taking the Raw Material for Drilling 2	10	G	P	10	Redirect raw material for perforated 2
Taking the Raw Material for Drilling 2	20	G	U	20	Use the drill machine
Releasing material on the table for the process of hole 3	3	M	G	3	Hold the drill machine
Taking the Raw Material for Drilling 3	10	G	P	10	Redirect raw material for perforated 3
Taking the Raw Material for Drilling 3	20	G	U	20	Use the drill machine
Releasing material on the table to process the hole 4	3	M	G	3	Hold the drill machine
Taking the Raw Material for Drilling 4	10	G	P	10	Redirect raw material for perforated 4
Taking the Raw Material for Drilling 4	20	G	U	20	Use the drill machine
Releasing material on the table to process the hole 4	3	RI	G	3	Hold the drill machine
Idle	5	De	RI	5	Release drill
Taking the raw materials for drilling in basket	8	G	De	8	Unemployed
Total	160			160	

Image 9 Two Handed Process for Pond System (Holes)

Welding Process

MAP OF THE LEFT HAND AND RIGHT HAND

TASK : Proses Las
DEPARTEMENT : Produksi
MAPPING NUMBER : 01
NOW : √ | SUGGESTIONS : -
MAPPED BY : ARUM
DATE of MAPPING PROCESS : 18 -10 - 2015

Left Hand	Time (sec)	Symbol		Time (sec)	Right Hand
Idle	2	De	Re	2	Reach for materials for processing
Idle	2	De	G	2	Hold materials for processing
Idle	2	De	D	2	Lift materials for processing
Hold raw materials welding on top right corner	2	M	G	2	Hold welding machine
Hold raw materials for welding on the top corner	10	G	P	10	Position raw materials for welding by top right corner
Hold raw materials for welding on the top corner	44	G	U	44	Utilise welding machine
Place raw materials on the top of table to begin welding on top left corner	2	RI	G	2	Hold welding machine
Place raw materials on the top of table to begin welding on top left corner	10	G	P	10	Position raw materials for welding by top left corner
Place raw materials on the top of table to begin welding on top left corner	44	G	U	44	Utilise welding machine
Place raw materials on top of table to begin welding on bottom right corner	2	RI	G	2	Hold welding machine
Place raw materials on top of table to begin welding on bottom right corner	10	G	P	10	Position raw materials for welding by bottom right
Place raw materials on top of table to begin welding on bottom right corner	44	G	U	44	Utilise welding machine
Place raw materials on top of table to begin welding on bottom left corner	2	RI	G	2	Hold drilling machine
Place raw materials on top of table to begin welding on bottom left corner	10	G	P	10	Position raw materials for welding by bottom left corner
Place raw materials on top of table to begin welding on bottom left corner	44	G	U	44	Utilise drilling machine
Place raw materials on top of table to begin welding on bottom left corner	2	RI	G	2	Hold drilling machine
Idle	3	De	RI	3	Release drilling machine
Take the drilled raw material in a basket	5	G	De	5	Idle
Total	240			240	

Image 10 Mapping of Welding Process

Two Handed Process after Reparation Pond System (Holes) Recommendations

MAP OF THE LEFT HAND AND RIGHT HAND

TASK : Proses Lubang
DEPARTEMENT : Produksi
MAPPING NUMBER : 01
NOW : - | SUGGESTIONS : √
MAPPED BY : ARUM
DATE of MAPPING PROCESS : 18 - 10 - 2015

Left Hand	Time (sec)	Symbol		Time (sec)	Right Hand
Idle	2	De	Re	2	Reach for materials for process
Idle	2	De	G	2	Hold materials for processing
Idle	2	De	M	2	Take materials for process from the table move to the drill machine
Idle	2	De	RI	2	Place raw materials on table
Taking the raw materials for drilling 1	3	M	G	3	Hold the drilling machine
Taking the raw materials for drilling 1	10	G	P	10	Posing the raw materials for drilling 1
Taking the raw materials for drilling 1	20	G	U	20	Utilise drilling machine
Taking the raw materials for drilling 2	10	G	P	10	Position raw materials for drilling 2
Taking the raw materials for drilling 2	20	G	U	20	Utilise drilling machine
Taking the raw materials for drilling 3	10	G	P	10	Position raw materials for drilling 3
Taking the raw materials for drilling 3	20	G	U	20	Utilise drilling machine
Taking the raw materials for drilling 4	10	G	P	10	Position raw materials for drilling 4
Taking the raw materials for drilling 4	20	G	U	20	Utilise drilling machine
Idle	2	De	RI	2	Release drilling machine
Place drilled raw materials in basket	3	G	De	3	Idle
Total	136			136	

Image 11 Suggestions for Two Handed Process on Pond System (Holes)

Recommendations for Welding Process

MAP OF THE LEFT HAND AND RIGHT HAND

TASK : Proses Las
DEPARTEMENT : Produksi
MAPPING NUMBER : 01
NOW : - | SUGGESTIONS : √
APPED BY : ARUM
DATE of MAPPING PROCESS : 18 - 10 - 2015

Left Hand	Time (sec)	Symbol		Time (sec)	Right Hand
Idle	2	De	Re	2	The materials will reach in the process
Idle	2	De	G	2	Hold the material to be in the process of
Hold raw materials for welding by top right corner	2	M	G	2	Holding a welding machine
Hold raw materials for welding by top right corner	6	G	P	6	Redirect raw materials to weld the top right
Hold raw materials for welding by top right corner	32	G	U	32	Use the welding machine
Hlod raw materials for welding by top left corner	6	G	P	6	Redirect raw materials to weld the top left
Hlod raw materials for welding by top left corner	32	G	U	32	Use the welding machine
Hold raw materials for welding by bottom right corner	6	G	P	6	Redirect raw material for welded the bottom right
Hold raw materials for welding by bottom right corner	32	G	U	32	Use the drill machine
Hold raw materials for welding by bottom left corner	6	G	P	6	Redirect raw material for welded the bottom left
Hold raw materials for welding by bottom left corner	32	G	U	32	Use the drill machine
Place the raw materials for welding on table by bottom left corner	2	RI	G	2	Hold the drill machine
Idle	3	De	RI	3	Hold the drill machine
Place raw materials for drilling in basket	5	G	De	5	Idle
Total	168			168	

Image 12 Suggestions of Two Handed Process for Welding Procedure

4.2 Results Of Productivity Increase Planning

After implementing the suggested two handed process, the time results was 1,324 seconds or 31.7 minutes. Hence the company should be able to produce 30 products/day without overtime. Below is the operational time table before and after reparation:

Table 3 Table of Operational Time after Reparation

Process	Time (sec)	Frequency	F*T	Time (minutes)
Large Cut	13	6	78	1.3
Small cut	13	4	52	0.87
Drilled	34	4	136	2.27
Bent	12	4	48	0.8
Perlas	12	4	48	0.8
Welding	42	4	168	2.8
Sizing	26	4	104	1.73
Stone Grinding	32	4	128	2.13
Washing	120	1	120	2
Coating	120	1	120	2
Drying	900	1	900	15
Total	1324	37	1902	31.7

Table 4 Production Data on July 2015 after Reparation

Date	Product Result	Acceptable Products	Rived Product	Number of Hours for Normal Machine	Number of Hours of Broken Machine	Electricity Usage (Kwh)	Numnuber of Operators	Jam Kerja yang Tersedia (Jam)	Overtime Hours
01/07/2015	31	29	2	6,8	1,2	190,32	27	8	1
02/07/2015	31	30	1	7	1	189,77	26	8	1,5
03/07/2015	30	28	2	7	1	188,38	26	8	1
04/07/2015	HOLIDAY								
05/07/2015									
06/07/2015	32	30	2	6,8	1,2	191,76	27	8	1
07/07/2015	31	29	2	6,9	1,1	189,47	27	8	1,5
08/07/2015	31	29	2	7	1	190,01	26	8	1
09/07/2015	30	29	1	6,8	1,2	188,67	26	8	1
10/07/2015	31	29	2	7	1	190,26	27	8	1,5
11/07/2015	HOLIDAY								
12/07/2015									
13/07/2015	31	29	2	7	1	188,66	27	8	1
14/07/2015	30	29	1	6,9	1,1	190,21	26	8	1,5
15/07/2015	31	29	2	6,9	1,1	191,89	27	8	1
16/07/2015	EID MUBARAK HOLIDAY								
17/07/2015									
18/07/2015									
19/07/2015									
20/07/2015									
21/07/2015	30	29	1	6,8	1,2	191,01	27	8	1
22/07/2015	31	29	2	6,9	1,1	188,91	26	8	1,5
23/07/2015	31	30	1	7	1	186,96	27	8	1
24/07/2015	32	30	2	6,9	1,1	189,68	27	8	1
25/07/2015	31	30	1	6,8	1,2	190,54	26	8	1,5
26/07/2015	HOLIDAY								
27/07/2015									
28/07/2015	31	29	2	6,9	1,1	189,79	27	8	1,5
29/07/2015	32	31	1	6,9	1,1	190,67	27	8	1
30/07/2015	31	30	1	7	1	190,78	26	8	1
31/07/2015	30	28	2	7,2	0,8	189,86	26	8	1,5

Table 5 Value of Ratio on July 2015

Date	Ratio 1 (unit/hour)	Ratio 2 (unit/kwh)	Ratio 3 (unit/person)	Ratio 4 (%)	Ratio 5 (%)	Ratio 6 (%)	Ratio 7 (%)
01/07/2015	387,5	16,3	114,8	125	6,5	6,9	17,6
02/07/2015	387,5	16,3	119,2	188	3,2	3,3	14,3
03/07/2015	375	15,9	115,4	125	6,7	7,1	14,3
04/07/2015	HOLIDAY						
05/07/2015							
06/07/2015	400	16,7	118,5	125	6,3	6,7	17,6
07/07/2015	387,5	16,4	114,8	188	6,3	6,9	15,9
08/07/2015	387,5	16,3	119,2	125	6,5	6,9	14,3
09/07/2015	375	15,9	115,4	125	3,3	3,4	17,6
10/07/2015	387,5	16,3	114,8	188	6,5	6,9	14,3
11/07/2015	HOLIDAY						
12/07/2015							
13/07/2015	387,5	16,4	114,8	125	6,5	6,9	14,3
14/07/2015	375	15,8	115,4	188	3,3	3,4	15,9
15/07/2015	387,5	16,2	114,8	125	6,5	6,9	15,9
16/07/2015	EID MUBARAK HOLIDAY						
17/07/2015							
18/07/2015							
19/07/2015							
20/07/2015							
21/07/2015	375	15,7	111,1	125	3,3	3,4	17,6
22/07/2015	387,5	16,4	119,2	188	6,5	6,9	15,9
23/07/2015	387,5	16,6	114,8	125	3,2	3,3	14,3
24/07/2015	400	16,9	118,5	125	6,3	6,7	15,9
25/07/2015	387,5	16,3	119,2	188	3,2	3,3	17,6
26/07/2015	HOLIDAY						
27/07/2015							
28/07/2015	387,5	16,3	114,8	188	6,5	6,9	15,9
29/07/2015	400	16,8	118,5	125	3,2	3,3	15,9
30/07/2015	387,5	16,2	119,2	125	3,2	3,3	14,.3
31/07/2015	375	15,8	115,4	188	6,7	7,1	11,1

Table 6 Result of Upwards Interval and Downwards Interval

	Ratio 1 (unit/hour)	Ratio 2 (unit/kwh)	Ratio 3 (unit/person)	Ratio 4 (%)	Ratio 5 (%)	Ratio 6 (%)	Rtio 7 (%)
Above Average	385,625	16,25	116,39	150,2	5,195	5,475	15,572
Excellent	400	16,9	119,2	18,8	6,7	7,1	17,6
Bad	375	15,7	111,1	12,5	3,2	3,3	11,1
Target Score	400	17,3	118,52	12,5	3,13	3,23	6,67
Performance	387,5	16,3	115,15	15,65	4,95	5,2	14,35
Top Interval	2,054	0,15	0,311	-0,36	-0,295	-0,321	-1,272
Bottom Interval	3,542	0,183	1,763	45,9	0,665	0,725	1,491

Table 7 Result of Productivity Measurement using the Objective Matrix Method (OMAX) on July 2015

	Criteria	Ratio 1	Ratio 2	Ratio 3	Ratio 4	Ratio 5	Ratio 6	Ratio 7	Description
	Performance	387,25	16,3	115,15	15,65	4,95	5,2	14,35	
	Score								
Target	10	400	17,3	118,52	81,25	96,88	96,97	93,75	Very Good
	9	396,875	17,101	117,991	80,966	96,62	96,733	92,841	Good
	8	393,75	16,905	117,465	80,68	96,356	96,493	91,93	
	7	390,625	16,709	116,939	80,394	96,092	96,253	91,019	
	6	387,5	16,513	116,413	80,108	95,828	96,013	90,108	Is being
	5	384,375	16,513	115,887	79,822	95,564	95,773	89,197	
	4	381,25	16,121	115,361	79,536	95,3	95,533	88,286	
Standart Performance	3	378,125	15,925	114,835	79,25	95,032	95,293	87,375	Less Good
	2	372,917	15,65	112,257	77	95,388	94,712	86,583	
	1	367,709	15,375	109,679	74,75	93,744	94,131	85,791	
Least	0	362,5	15,1	107,4	72,5	93,1	93,55	8,5	Less Good
	Weight (%)	15,00%	5,10%	24,10%	5,10%	7,10%	40,90%	3,50%	
	Score	4	3,383	3,789	2,5	7,85	2,86	3,138	
	Value (%)	60,00%	17,25%	91,31%	12,75%	20,24%	117,22%	10,98%	
	Note	Less Good	Is being	Is being	Less Good	Less Good	Less Good	Less Good	

	The Basic Period	Periode saat ini
Indicators Of Performance	296,1271	329,7612

Index Productivity	11,40%
The Productivity Of The Company	106,10%

Table 7 displays the results of measuring productivity using the Objective Matrix Method after implementing the suggestions thus resulting in positive changes. Based on the productivity index value, there was an increase of 11.40%.

5. CONCLUSION

In the beginning of the research it was explained that productivity for PT. XYZ was relatively low caused by use of working hours that were not maximized by the operator. As such the company found it difficult to meet their target. To minimize the aforementioned problem, a standard time had to be determined by the operator to make one product. Setting up the standard time required improving the work system using the two handed process. It was previously mentioned that to make one product required 34.5 minutes and the diagram for the production process illustrated that the pond system and welding were the most time-consuming procedures. Prior to adopting a standard time, the construction for a pond system time required 2.67 minutes and welding required 4 minutes. After setting up a standard time, the pond process took to 2.27 minutes and welding at 2.8 minutes. Therefore after conducting reviews on productivity levels

using the objective Matrix method (OMAX) the company's productivity increased by 11.40%.

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