The Effect of Winding Yarn (Just In Time) on Winding Machine Productivity

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ABSTRACT

An appropriate production system (just in time) is a concept that supports cost management to anticipate changes that occur in the industrial environment due to advances in technology and automation. In the just-in-time concept, production is carried out through a certain amount of inventory (inventory equals 0). This elimination of inventory amounts automatically eliminates carrying and other costs, leading to a decrease in tolerance levels for product errors.

The aim of this research is to find out and examine the influencing factors of input and output, just in time simultaneously which have a significant influence on production machines effectively and efficiently at PT. Asindo, and to find out and research the dominant influencing factors of just in time on production machines effectively and efficiently at PT. Asindo.

The results of the analysis show that the first hypothesis proposed in this research is that just-in-time production factors simultaneously have a significant influence on effective and efficient production machines at PT Asindo. This is supported by the results of the t-test, where the results show thatof (19.75) > t table of (2.03693). By looking at the value of R square = R=0.96135, meaning that the up-down variation of variable Y (effective and efficient production machines at PT. Asindo) is 92.419%, influenced by the independent variables in the model and the remaining 7.581% is due to other factors not included in this analysis. This means that the contribution of machine productivity in this model is good because it is more than 50%.

From a series of design activities to achieve high production volumes with minimum inventory or minimum defective products for production and finished products, where the winding machine in production only produces output according to demand requirements.

1. INTRODUCTION

In the era of globalization, companies throughout the world are inevitably faced with increasingly sharp competition. To be able to continue to survive in business, companies are required to increase their comparative advantage which can be achieved by using time, price and quality as competitive weapons (Goetsch & Davis, 1994; Ross & Goodhue, 1995). So far, most companies have focused more on reducing costs in the hope of setting low selling prices (Eric A. Hanushek & Wößmann, 2007; Gaspersz, 2008; Goetsch & Davis, 1994). However, with current developments, consumers do not only look at price, so a cheap price alone will not be enough to win the competition, but must be supported by good product quality (Vikaliana et al., 2021). This research was conducted at PT. ASINDO, a yarn producing company with the largest share in Indonesia (reaching around 50%). Multinational company headquartered in England.

The basic principle of just in time is the continuous improvement of the company's ability to respond to change by minimizing waste (Kusmayadi & Vikaliana, 2021; Leksic et al., 2020; Singh, n.d.). Companies to increase potential profits. Companies that use just-in-time purchasing usually emphasize the hidden costs associated with holding high inventory levels . These hidden costs include a larger

amount of storage space and a significant amount of damage, the aim is to increase productivity and reduce waste (Eka, 2012; Goetsch & Davis, 1994). Just in time is based on the concept of continuous production flow and requires each part of the production process to work together with other components (Aprilianti & Hidayat, 2019).

Based on the identification of the problems exposed above, a very broad picture of the problem is obtained, but realizing that there are limitations of time and ability, the author considers it necessary to define the problem in a clear and focused manner.regarding the impact of implementationwinding thread (just in time) is what is applied to PT. ASINDO by comparing the products produced according to consumer (buyer) demand and the productivity of the winding machine in processing it into finished products, because there is no analysis of the production winding machine.

Based on the previous description, the problem in this research can be formulated as follows:

1. Does winding thread (just in time) have a significant effect on the productivity of production winding machines at PT ASINDO?
2. How much influence does winding thread (just in time) have on the productivity of winding machines at PT. ASINDO?

Based on the background of the problem and the problem formulation above, the objectives of this research are:

1. To determine the significant effect of winding thread (just in time) on the productivity of production winding machines at PT. ASINDO
2. To increase productivity and improve production of production winding machines at PT. ASINDO

This test is to find out whether the winding thread variable (just in time) (X) has an effect on the winding machine productivity variable (Y).

H0 = β= 0, Means there is no influence between the winding thread (*just in time)*on the productivity of winding machines

H0 = β ≠ 0, This means there is influencewinding thread (*just in time)*on the productivity of winding machines

2. METHOD

1. Research type: Quantitative
2. Required data: Primary and secondary data
3. Time and place of research: PT ASINDO
4. Population and sample: All SSM Machines and SSP Catagories (5000m)
5. Data collection techniques: Observation, literature study and variable operationalization
6. Analysis Tools (Nurhasanah & Vikaliana, 2021):
   1) Classic assumptions test : Residual Normality, Heteroscedasticity and Autocorrelation
   2) Simple regression

      $Y = a + b$

   3) Simple correlation

      $r = n\Sigma xy - (\Sigma x)(\Sigma y) \,.\, \sqrt{\{n\Sigma x^2 - (\Sigma x)^2\}\ \{n\Sigma y2 - (\Sigma y)2\}}$

   4) Coefficient of Determination

      $Kd = r^2 \times 100\%$

   5) T-Test

      $r = n\Sigma xy - (\Sigma x)(\Sigma y) \,.\, \sqrt{\{n\Sigma x^2 - (\Sigma x)^2\}\ \{n\Sigma y2 - (\Sigma y)2\}}$

      $t\ count = \frac{b - \beta}{Sb}$

3. RESULT AND DISCUSSION

a. Overview of Research Objects

PT. ASINDO has two factories, namely one in Bogor (West Java) and another located in Pasuruan (East Java). PT.ASINDO is part of a yarn company based in England and is one of the largest yarn suppliers in the world. Currently PT. ASINDO operates in 68 countries and 250 distributors worldwide with approximately 40,000 employees. The company has grown over two decades through the merger and consolidation of various yarn companies in the UK. As a holding company engaged in the thread business, producing and marketing sewing thread is the main business.

PT ASINDO has been in Indonesia since 1940 when the factory in Pasuruan (East Java) was established, while the factory located in Bogor (West Java) has been established since 1973. The business carried out by PT ASINDO Indonesia is the dyeing and rolling process. The threads produced are from polyester fiber and other fibers for household needs, the garment industry, the shoe industry, embroidery and the automotive industry and are marketed domestically and abroad (export). Garment and shoe exports have a large portion of Indonesia's non-oil and gas exports, so PT. ASINDO has made a significant contribution to the country's economy.

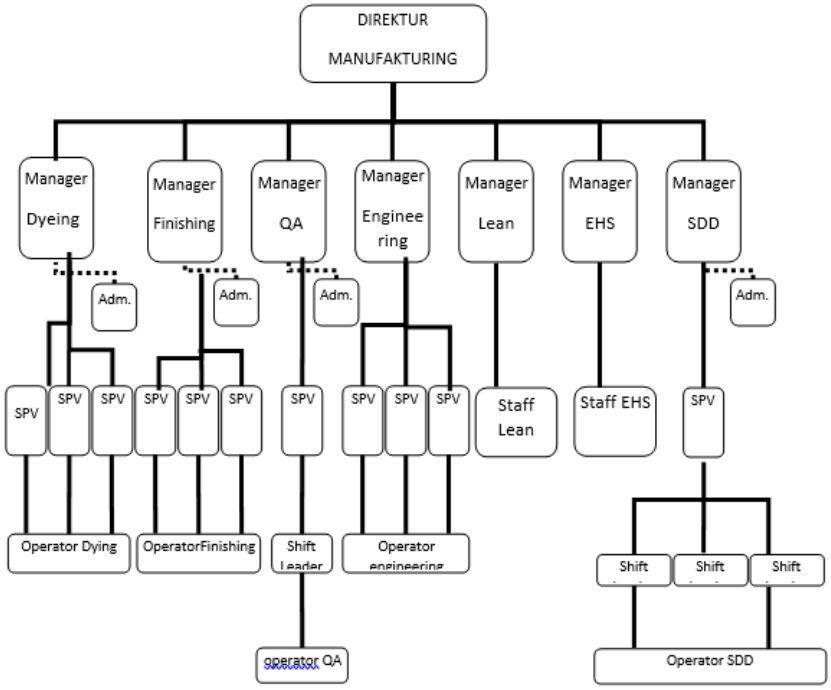

Fig 1. Production Organization Structure

b. Product Overview

The products produced by PT ASINDO are sewing threads for household needs, the garment industry, shoes, embroidery and automotive. To produce high quality products, PT ASINDO uses the latest technology by bringing in imported machines for the dyeing and color adjustment processes.

The company produces seven types of of yarn products, namely:

1. SSP (Staple Spun Polyester)

   Resembling cotton thread fiber, the manufacturing cost is cheaper. Strength: 1316 cN (yarn), 1290 cN (final product) Stretchability: 11 – 17 % (yarn), 14 – 16 % (final product) Application: For general sewing, widely used in the garment industry producing shirts, t-shirts, trousers and jacket.

2. PPC (Polyester Poly Corespune)

   Similar in character to cotton thread fiber, stronger than SSP because it contains continuous polyester at its core. Strength: 1385 cN (yarn), 1320 cN (final product) Stretch: 16 – 19 % (yarn), 13 – 18 % (final product) Application : Used in the garment industry where sewing results are desired which are very superior in terms of appearance, strength and durability. For example, shirts and trousers for outdoors and very soft shirts.

3. TXP (Texturized Polyester)

   Unspliced fiberStrength: 1340 cN (yarn), 1300 cN (final product) Stretch: 20 – 28% (yarn), 22–30 % (finish good) Application: Widely used in the garment industry producing underwear, gym clothes or clothes sports that are comfortable on the skin. TXP is used as overlock thread.

4. PCC (Polyester Cotton Covered)

   Polyester core fiber wrapped in cotton. Used for sewing 100% cotton materials. Strength: 1385 cN (yarn), 1310 cN (final product) Stretch: 16 – 19% (yarn), 13 – 18 % (final product) Application: Generally used for the garment industry which uses jeans or fabrics made from cotton as the basic material (cotton) too.

5. Bonded Nylon

   Very strong, the reduction in strength during the sewing process is only 5% compared to non-bonded which is up to 20%. Strength: 2275 cN (thread), 2060 cN (final product) Stretch: 14 – 22 % (thread), 14 – 22 % (product end)Application: Used for the sports shoe industry which requires thread with a high level of abrasion or friction resistance.

6. TRP (Trilobal Polyester)

   Seamless fiber with a triangular cross-sectional shape. Strength: 1420 cN (yarn), 1378 cN (final product) Stretch: 14 – 18 %(yarn), 22 – 30% (final product) Application: Widely used in the embroidery industry because it has shiny properties. TRP thread is stronger than rayon.

7. CFP (Continued Filament Polyester)

   Seamless fiber. The manufacturing process is more difficult, the strength exceeds SSP. Strength: 2280 cN (grey), 2150 cN (finish good) Stretchability: 14 – 20% (grey), 16 – 21 % (finish good) Application: Widely used in industries that require strength high threads, for example the leather shoe industry, bags, sandals, automotive leather jackets, gloves and furniture.

b. Data Analysis and Results

Analysis and discussion is an explanation of the results process and discussion of data management that has been carried out for 34 months at PT. ASINDO. And using SPSS version 22.0 software to determine the effect of winding thread (just in time) as an independent variable on the winding machine as a dependent variable (Ekonomi & Yogyakarta, 2012; Vikaliana & Irwansyah, 2019).

Table 1. Variable Tabulation

NO	BULAN	X(Pass)	Y(Testing)	X^2	Y^2	X.Y
1	JANUARI	118	226	13924	51076	26668
2	FEBRUARI	96	189	9216	35721	18144
3	MARET	267	340	71289	115600	90780
4	APRIL	284	375	80656	140625	106500
5	MEI	329	399	108241	159201	131271
6	JUNI	271	330	73441	108900	89430
7	JULI	266	360	70756	129600	95760
8	AGUSTUS	105	165	11025	27225	17325
9	SEPTEMBER	233	320	54289	102400	74560
10	OKTOBER	185	240	34225	57600	44400
11	NOVEMBER	179	240	32041	57600	42960
12	DESEMBER	162	240	26244	57600	38880

13	JANUARI	280	381	78400	145161	106680
14	FEBRUARI	271	378	73441	142884	102438
15	MARET	312	398	97344	158404	124176
16	APRIL	284	370	80656	136900	105080
17	MEI	281	400	78961	160000	112400
18	JUNI	178	282	31684	79524	50196
19	JULI	213	292	45369	85264	62196
20	AGUSTUS	319	421	101761	177241	134299
21	SEPTEMBER	303	398	91809	158404	120594
22	OKTOBER	241	312	58081	97344	75192
23	NOVEMBER	274	357	75076	127449	97818
24	DESEMBER	283	378	80089	142884	106974
25	JANUARI	247	361	61009	130321	89167
26	FEBRUARI	319	400	101761	160000	127600
27	MARET	295	374	87025	139876	110330
28	APRIL	308	409	94864	167281	125972
29	MEI	283	382	80089	145924	108106
30	JUNI	375	429	140625	184041	160875
31	JULI	269	365	72361	133225	98185
32	AGUSTUS	264	402	69696	161604	106128
33	SEPTEMBER	297	379	88209	143641	112563
34	OKTOBER	277	357	76729	127449	98889
35	NOVEMBER	0		0	0	0
36	DESEMBER	0		0	0	0
	Σ	8.668	11.649	2.350.386	4.147.969	3.112.536

c. Residual Normality Test

This normality test uses the SPSS 22.0 program and uses the Kolmogrov-Smirnov test, after calculating the results you get:

Table 2. Residual Normality Test

NPar Tests

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		34
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	18,97839944
Most Extreme Differences	Absolute	,077
	Positive	,065
	Negative	-,077
Test Statistic		,077
Asymp. Sig. (2-tailed)		,200[c,d]

a. Test distribution is Normal

b. Calculated from data

This test To ensure whether the data we have follows a normal distribution, we can look at Asymp. Sig (2-tailed). If sig is more than 0.05 then the data is normally distributed, and from the output data above it can be seen that the significance value of Asymp. Sig (2-tailed) is 0.200. Because the significance value is more than 0.05, the residual value is normally distributed.

Heteroscedasticity Test

Heteroscedasticity Test Using Spearman's Rho Correlation Method

Table 3. Spearman's Rho Output

Nonparametric Correlations

Correlations

			Unstandardized Residual	JIT	PRODUKTIVITAS
Spearman's rho	Unstandardized Residual	Correlation Coefficient	1,000	-,024	,299
		Sig. (2-tailed)	.	,892	,086
		N	34	34	34
	JIT	Correlation Coefficient	-,024	1,000	,878**
		Sig. (2-tailed)	,892	.	,000
		N	34	34	34
	PRODUKTIVITAS	Correlation Coefficient	,299	,878**	1,000
		Sig. (2-tailed)	,086	,000	.
		N	34	34	34

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the results above it can be seen that the correlation between the just in time variables and productivity with the unstandardized residual has a significance value (sig 2 tailed) of more than 0.05, it can be concluded that there is no heteroscedasticity problem (Mustafa & Wijaya, 2012).

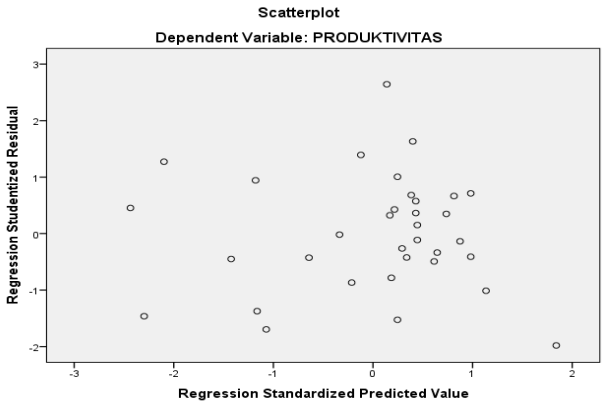

Fig 2. Scatterplot Output Graph

Based on the output it can be seen that the points do not form a clear pattern, and the points spread above and below the number 0 on the Y axis. So, it can be concluded that there is no heteroscedasticity problem in the regression model.

Autocorrelation Test

Autocorrelation is a correlation between observation items arranged according to time and place. Testing model

Table 4. Autocorrelation Test

Model Summary b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.961 a	,924	,922	19,273	1,768

a. Predictors: (Constant), JIT
b. Dependent Variable: PRODUCTIVITY

Using the Durbin Watson test (DW test).

Decision making in the Durbin Watson test is as follows:

1) DU < DW < 4-DU then Ho is accepted, meaning there is no autocorrelation
2) DW < DL or DW > 4-DL then Ho is rejected, meaning autocorrelation occurs
3) DL < DW < DU or 4-DU < DW < 4-DL, meaning there is no certainty or definite conclusion.

Based on the table 4 above, it can be seen that the Durbin-Watson value is 1.768. Because the DW value lies between DU and 4-DU (1.5136 < 1.768 < 2.4864), the results are no autocorrelation in the regression model.

Simple Regression Analysis

To find formulas a and b, you can use the Least Square method.

Table 5. Simple Regression

Coefficientsa

Model	Unstandardized Coefficients		Standardized Coefficients	Q	Sig.
	B	Std. Error	Beta		
1 (Constant)	83,758	13,521		6,195	,000
X	1,016	,051	,961	19,745	,000

Then pThe equation Y= a +bX is Y= 83.751 + 1.0154 X. For a simple regression graph it can be seen as below:

Y= a +b X is, which means that if there is an increase or decrease in the winding thread (just in time) variable.

Simple Correlation

The correlation coefficient (R), which shows the degree of relationship between X and Y is determined from:

Table 6. Simple Correlation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,961a	,924	,922	19.27991

Coefficientpositive correlation (R=0.96135)between machine productivity (Y) and just in time(X), bmeaning it gets bigger just in timegetting bigger toothe resulting winding machine productivity and the level of connection can be said to be strong (Ekonomi & Yogyakarta, 2012; Sarwono & Herlina, 2012).

Coefficient of Determination

r^2 x100% = 0.96135^2 = 0.92419

Coefficient determination (R2)=0.92419=92.419%, meaning that the increase or decrease in winding machine productivity (Y) by 92.419% can be explained by the linear relationship between winding thread (just in time) and winding machine productivity with the equation Y= 83.751 + 1.0154X , while the remaining 7.581% was due to other factors not included in this analysis.

T-Test Count

1. Calculated Standart Error of Estimate (Se)

$$SE = \frac{\sqrt{\sum Y^2 - a\sum Y - b\sum XY}}{n-2}$$

$$SE = \frac{\sqrt{4.147.969 - (83{,}751 \text{ X } 11.649) - (1.0154\ X\ 3.112.536)}}{34-2}$$

$$SE = 19.2715$$

2. Calculate the Standard Error of the Regression Coefficient

$$SB = \frac{\text{Se}}{\sqrt{\sum X^2 - (\sum X)^2/n}}$$

$$SB = \frac{19.27}{\sqrt{2.350.386 - (8.668)^2/34}}$$

$$SB = 0.0514$$

3. T-Test

$$T\ Count = \frac{b - \beta}{Sb}$$

$$T\ Count = \frac{1{,}0154 - 0}{0{,}0514} = 19.75$$

$$T\ Table = 2.03693$$

Calculated t is (19.75) > t table is (2.03693) = Ho is rejected, Ha is accepted. So, it can be concluded that this winding thread (just in time) does have a significant effect on the productivity of the winding machines at PT.ASINDO that in line with previous research (Aprilianti & Hidayat, 2019).

4. CONCLUSION

Based on the results of research and discussion regarding The Influence Of Winding Yarn (Just In Time) On Winding Machine Productivity At Pt.Asindo, If just in time is an operations management philosophy that seeks to eliminate waste in all aspects of the company's production activities. The main goal of just in time is to increase the productivity of the production or operations system by eliminating all kinds of activities that do not add value to a product. So the following conclusions can be drawn:

Based on a series of design activities to achieve high production volumes with minimum inventory or minimum defective products for raw materials, production work instructions and finished products, where the winding machine in production only produces output according to demand requirements, therefore just in time has a significant effect on production produced and has an impact on the amount of production and quality of the products produced.

The influence of thread winding (just in time) in this company is very large where the productivity value is 92.419% and the remaining 7.581% is caused by other factors not included in this analysis such as wrong label, wrong machine program, wrong cone and wrong count. ply. Therefore, the influence of thread winding (just in time) on the productivity of this machine is very strong, namely 0.96135, so the conclusion is that there is a significant influence after implementing just in time, because it saves excess or insufficient production where the amount of production is adjusted to demand needs, and continue to pay attention to product quality by paying attention to winding machine maintenance, either directly or periodically, to increase production productivity.

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