CONSTRUCTION OF INFORMATION SYSTEM INVENTORY MANAGEMENT OF RAW MATERIALS ON PT. INDOALUMINIUM INTIKARSA INDUSTRI

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ABSTRACT

PT. Indoaluminium Intikarsa Industries is a company engaged in the manufacture of aluminum products that generate foill. There are five raw materials needed to make aluminum, including ingot 99.7%, ingot refinery, scrap, alsi 30% and altab 80%. To do a production aluminum foill PT. Indoaluminium Intikarsa Industry has not been able to determine the amount of raw materials will be prepared each month, so that sometimes the company is experiencing a shortage of raw materials or experience a buildup of materials that could result in the production process is hampered.

Based on these problems gave rise to the idea to design and implement a strategy of management information system (SIM) Inventory of raw materials using forecasting SES (single exponential smoothing) with the determination of the amount of raw materials used safety stock method, which can assist companies in determining the provision of raw materials every month so that it becomes more effective.

After a testing phase black box and UAT (User Acceptance Test), This management information systems can overcome the problems occurred. PT. Indoaluminium Intikarsa the industry can find out how many raw materials that must be provided on each month to meet the needs of production.

Keywords : *Management information systems Inventory, PDCA, SES, Safety Stock.*

INTRODUCTION

PT. Indoaluminium Intikarsa industry or often also called PT 3i is a manufacturing company that is engaged in the manufacture of aluminum foil. PT. Indoaluminium Intikarsa raw raw material processing Industry into a product that is ready to be distributed to customers. As for the raw materials used include *Ingot99,7% ,Ingot Refinery, scrap, Altab80% and Alsi30%*. The raw materials supplied by supplier, by way of the company's book in advance party to the supplier within a period of times.

Based on interviews with Mr. Saeful as head of warehouse, PT. Indoaluminium has three suppliers of raw materials. Sedangkang ordering raw materials is done by involving the three parts namely head of warehouse, purchasing department and Department of PPIC. The process of provision of raw materials is carried out for one month with the arrival of a raw material range one week from the order process. Raw materials in the message do not experience a decline in quality in the long period, except for raw materials the alsi 30% only survive for a period of three months. In addition on some raw materials inventory sometimes experience a shortage and excess stock of raw materials. For example in January ingot 99,7% experiencing a shortage of stock as much as 49.999 kg and in June, ingot 99,7% experience the advantages of the stock as much as 413.176 kg. This is certainly cause circulation out of the incoming raw materials become irregular. As for raw materials often have a deficiency of IE ignot 99.7%, ingot refinery and scrap. It also results in the production of terhambatnya and cause customers reduce product orders. Of course this can lead to declining corporate profits.

In addition, PT. Indoaluminium Intikarsa Industry sehinmgga customers booking does not limit sometimes stock raw materials in warehouses suffered a shortage or a buildup of stockpiles of raw materials. Based on production data, the company produced an average 773 box/box/26 months or days, while in may 2016 production surged reach 891 box or box up to 30 a day or 30 roll aluminium foil, a surge in orders at a time when it was made part of the warehouse must prepare capacity raw materials more, but at the time the raw materials often suffered deprivation due to the existence of monitoring and controlling yet on raw materials. As is the case in January raw materials ingots that are experiencing shortages of raw materials while the booking process is done once a month with the arrival of the period of time a week after booking. These problems led to delays in the production process.

Based on these problems, we need a system of Information Management (SIM) Inventory of raw materials that can determine the availability of raw materials and when the raw materials that must be

booked in back, as well as be able to monitor the supplies of raw materials in order to be part of the warehouse is easier to determine the supply of raw materials.

1. CONTENT of the STUDY

2.1 Management Information Systems

Management information system (SIM) can be defined as a set of interrelated subsystems, gather together and form a unity, mutual interaction and cooperation among one another with certain ways to do data processing functions, receive input (input) in the form of data, then offer it (processing), and produces outputs (output) in the form of information as the basis for a useful decision makers and have a real value that can be felt as a result of either at that time or in the future , support their operations, managerial, strategic and organization, by making use of the various resources that exist and are available for these functions in order to achieve the objectives [1].

Management information system is described as a pyramid that can be seen in Figure 1.

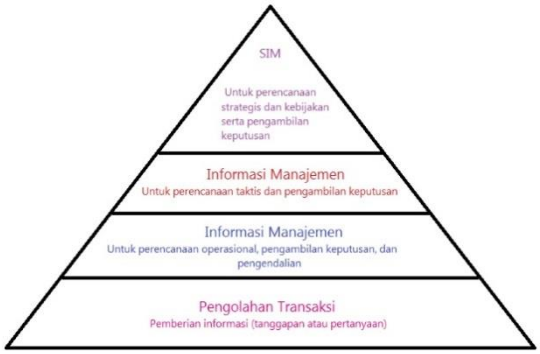


Figure 1. Pyramid Management Information System

Where is the layer essentially consisting of information for processing the transaction, a description of the status, the next layer is composed of information resources in support of day-to-day operations management, the third layer consists of system resource information to assist decision making and tactical planning for management control, and layer the peak consists of data source information to support planning and policy formulation by top level management.

1.2 The PDCA Approach

PDCA cycle is a systematic method for continuous process improvement is based on the principle that we need to understand a situation or process before fix.

The main proceedings, the actual results from an action compared to target or goal early, then do the steps of improvement if the distance difference is too big. The nature of the recurrent and continuous improvement are characteristic of PDCA cycle (Plan, Do, Check, Act), it is referred to as the Deming Circle, named by W. E. Deming. Another variation of the PDSA is PDCA (Plan, Do, Study, Act) [2]. The following is an explanation of each of the activities of the PDCA cycle:

a. *Plan*
   Is a stage to set targets or goals to be achieved in the process improvement or problem solved, then want to determine the method to be used to achieve a target or targets have been defined.
b. *Do*
   Is the application or implement all stages, which were planned in phase plan includes running processes, as well as conducting data collection (data collection) which then will be used for phase check and act.
c. *Check*
   It is the stage of examination and review as well as the study of the application of hasilhasil on stage do. Do a comparison between the actual results that have been achieved with the targets set and also the precision of the specified schedule.
d. *Action*
   Are to take action as needed against the results of this stage of the check.

1.3 *Single Eksponensial Smoothing(SES) Method*

In leveling these historical values, random errors in Align-Align to produce a forecast of "smooth" that seem to work well in certain circumstances. The simplest case of a Single Exponential Smoothing can be developed from equation (2.1) or more specifically from a variation on the equation that is as follows:

$$F_{t-1} = F_t + (\frac{x_t}{N} - \frac{x_{t-N}}{N}) \quad (2.1)$$

Mislkan a long observation is not available so it should be replaced with a value approach (approximations). One of the possible replacements are forecast previous period ft. by doing the substitution the equation (2.1) into equation (2.2) so that it can be written as (2.3).

$$F_{t-1} = F_t + (\frac{x_t}{N} + \frac{F_t}{N}) \quad (2.2)$$

$$F_{t-1} = \left(\frac{1}{N}\right) X_t + (1 - \frac{1}{N})F_t \quad (2.3)$$

Of the equation it can be seen that the forecasted value at time t + 1 depending on the weighting value of observation time t, i.e. on the weighting value of forecast time t is 1-1/N value between 0 and 1. By replacing the 1/N = a. Equation (2.3) into equation (2.4).

$$F_{t-1} = aX_t + (1 - a)F_t$$
(2.4)

Description:
F _ (t – 1) = Results forecast for period t + 1

a = Constant pemulusan
X_t = deman actual Data for the period t
X_t = Forecast period t F _ (t = n)

Exponential smoothing method in the value of α can be determined freely, meaning that there is not a way that's sure to get the optimal value α.
Then α value selection done by trial and error. The magnitude of α is located
between 0 to 1.

1.4 *Mean Square Error (MSE)*

The mean Squared Error (MSE), namely the average of the squared forecasting errors and can be seen in the Parallels (2.5).

$$MSE = \frac{\sum(|X_t - F_t|)^2}{n} \quad (2.5)$$

Description :
MSE = mean value of squeres errors
X_t = the actual Data in the period t
F_t = Data Forecast from models used
in the period t
n = a lot of data results forecast

1.5 *Safety Stock*

Ordering an item until the item it comes necessary period of time varies from a few hours to months. The time difference between the time of order until the item came is known by the term Grace time (Lead Time). Grace time is influenced by the availability of ordered goods and the distance between the location of the customer and suppliers. The uncertain lag time resulted in a shortage of goods for example due to the use of goods that are greater than previously expected, thus it takes a persediaaan safety (safety stock). Here's the formula in determining the Safety stock can be seen in the Parallels (2.6).

$$SS = Pemakaian\ rata - rata\ periode\ sebelumnya\ x\ LT \quad (2.6)$$

Description :
SS = Safety Stock
LT = Lead Time

1.6 Monitoring

Monitoring is the collection of information in a continuous and regular basis that will help answer questions about the project or activity. Monitoring helps remind when there was something wrong and help so that the work remains on track.

Monitoring aims at mengingkatkan the effectiveness and efficiency of a project or organization and is based on a target and rencanakegiatan are already determined. Monitoring enables us to determine whether we have sufficient resources and have been well used and become a useful basis for the evaluation and find out the capacity we have decent and pretty.

1.7 Discussion

Development of management information systems inventory done by PDCA approach (*Plan, Do, Check, Action*) [2].

1.7.1 Analysis Of PDCA

Analysis of PDCA (Plan, Do, Check, Act) is a follow-up of the analysis of a system that is running. This section will be analyzed how a raw material procurement procedures will be implemented in the management information system Inventory of raw materials on the PT. Indoaluminium Intikarsa Industrial built. Analysis of PDCA include booking process raw materials, receipt of raw material, raw material expenses, monitoring of raw materials and the selection of suppliers of raw materials.

In this study required monitoring inventory of raw materials on the previous period, which will be used as a raw material for birthday reservations and how much raw materials must be ordered back by the company. Here is the raw material inventory monitoring data based on the data in 2016 which contained data of incoming raw materials and raw materials out, can be seen in the above monitoring data.

1.7.2 Raw Materials Analysis

Analysis of the management will be made to process the raw material inventory management for production by conducting analysis of PDCA (Plan, Do, Check, and Act) and conduct forecasting method using Single Exponential Smothing (SES). Where this method is used for forecasting the coming period raw materials, using the raw materials of history for 11 months in the year 2016. Forecasting raw material that will be foretold as follows:

1. Plan Of Ordering Raw Materials

At this stage of problem identification is done i.e. how forecasting the amount of raw materials that must be booked in the coming period. Forecasting is done document history based on raw-material reservations for 11 months, to do forecasting raw material containing phases in Single Exponential Smoothing method.

The company manages the data ordering raw materials are ordered by kadiv purchasing and forecasting for the next diperiode raw materials from the raw material of pemesanann data 11 the previous period. The data that will be used as an example of the kind of raw data, namely ingots 99.7% from January till November 2016 2016. While ordering raw materials and analysis of PDCA raw Ingot Refinery, Scrap, Alsi and Altab can be seen in Appendix [E-2].

Data ordering raw ingot 99.7% which will be used to plan ordering raw materials can be seen in table 2.1.

Table 2.1 *Plan* of Ordering Raw Materials Period 2016

No.	PERIOD YEAR 2016	Ingot99.7 (Kg)
1.	January	300.000
2.	February	537.000
3.	March	580.000
4.	April	800.000
5.	May	600.974
6.	June	776.071
7.	July	200.000
8.	Agust	362.001
9.	September	400.000
10.	October	400.000
11.	November	300.000

2. *Do*

At this stage there is a process that will be conducted, among others, the calculation of the value of the constant is 0.1 to foresee the next period of reservation:

a. Raw Material Forecasting Calculation.

The value of forecasting can be searched by using the equation (2.3) which has been described previously in Chapter 2 as for the alpha (α) that will be used is the value range between zero to one i.e. alpha = 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9 for comparison.

The first thing that was done to calculate the Single Exponential Smoothing forecasting method that is determining the value of the constant alpha = 0.1 and predicted demand for november [E-2]. As for value – the value for forecasting data taken from the request of raw ingot baha in table 3.2, and then distribute the value – the value to formula (2.3) will be obtained by calculation is as below :

Calculation example of forecasting to α = 0.1:

Based on sales data on the table 2.1, compute forecasting bookings for February 2016.

It is known that :

Bookings in the months of January (Xt) = 300000kg and forecasting results of January (Ft) = 300000kg, obtained by calculation example as below:

$F_{February}$ = (0.1 * 300000) + (1 - 0.1)* 300000
= 300000 Kg

For the calculation of the month of March, note that:

Booking in February (Xt) = 537000 and yield forecasting in February (Ft) = 300000, so that the obtained sample calculation as below:

F_{March} = (0.1 * 537000) + (1 - 0.1)*300000
= 323700 Kg

The calculation for the month of April and next month is done in the same manner in accordance with the calculation of sales in February and March.

Calculation example of forecasting for α = 0.2:

Bookings in the months of January (Xt) = 300000 and forecasting results of January (Ft) = 300000, so that the obtained sample calculation as below:

$F_{February}$ = (0.2 * 300000) + (1 - 0.2)*300000
= 300000 Kg

For the calculation of the month of March, note that:

Booking in February (Xt) = 537000 and yield forecasting in February (Ft) = 300000, so that the obtained sample calculation as below:

F_{March}= (0.2 * 537000) + (1 – 0.2)*300000
= 347400 kg

Calculation for alpha = 0.2 from April and next month is done the same way with the calculation of booking in February and March. Do sales in the same way as above until alpha = 0.9.

After the whole calculation of sales from February to July, obtained as a result of the calculation for alpha = 0.1 up to alpha = 0.9 and can be seen in table 2.2

b. Mean Square Error (MSE) Analysis

After the whole calculation of sales from February to July, obtained as a result of the calculation for alpha = 0.1 up to alpha = 0.9 and can be seen in table 3.2.

MSE = $(X_{Februari} – F_{Februari})^2$
= $(537000 – 300000)^2$
= 56169000000

Doing the same calculation as an example up to 6th period. After calculating the MSE until the 11th, the MSE total the next step from the 2nd to the 11th period divided the number of periods. From the results of the forecasting and MSE packed obtained results such as the one in table 2.3.

Table 3.2 The results of Calculations of forecasting and MSE

Period	Preliminary data	Forecasting Results								
		α = 0.1	α = 0.2	α = 0.3	α = 0.4	α = 0.5	α = 0.6	α = 0.7	α = 0.8	α = 0.9
Januar y	300.000	-	-	-	-	-	-	-	-	-
Febru ary	537.000	300000	300000	300000	300000	300000	300000	300000	300000	300000
Macht	580.000	323700	347400	371100	394800	418500	442200	465900	489600	513300
April	800.000	349330	393920	433770	468880	499250	524880	545770	561920	573330
May	600.974	394397,0	475136	543639	601328	649625	689952	723731	752384	777333
June	776.071	415054,7	500303,6	560839,5	601188,4	625299,5	636565,2	637801,1	631256	618609,9
July	200.000	451156,3	555457,08	625409,0	671140,24	700685,3	720268,68	734590,0	747108	760324,9
Agust	362.001	426040,7	484365,664	497786,3	482684,144	450342,6	408107,472	360377,0	309421,6	256032,5
Septe mber	400.000	419636,7	459892,7312	457050,7	434410,8864	406171,8	380448,3588	361513,8	351485,12	351404,1
Octob er	400.000	417673,1	447914,185	439935,5	420646,5318	403085,9	392177,4355	388454,1	390297,024	395140,4
Nope mber	300.000	415905,7	438331,348	427954,8	412387,9191	401543,0	396870,9742	396536,2	398059,4048	399514,0
Forecasting Results		404315,2	410665,0784	389568,4	367432,7516	350771,5	338748,3897	328960,9	319611,881	309951,4
MSE		526619663800	484906276788	500010247879	437702020697	424226659277	418964313314	422483115482	435522603534	459431998397

Based on the results of the comparison of α in the calculation of Forecast error using MSE, it can be inferred that the forecasting error ingot 99.7%, α with a value of 0.6 produces very small error. From table 3.3 MSE values of α = 0.6 i.e. 41896431331.4. 0.6, then the PT. Indoaluminium Intikarsa the industry in november recommended procurement of raw ingot in December with a total of 338,748 Kg.
After forecasting conducted monitoring in raw materials ingots 99.7%. can be seen in table 3.3.

Table 3.2 Monitoring

Period Year 2016	Ingot 99.7%				
	Sign In	Sign Out	Circulation of Expenditure	Remains	Status
January	300.000	349.999	-49.999	-	Kurang
February	537.000	539.656	-2.656	-	Kurang
March	580.000	566.597	13.403	13.403	Lebih
April	800.000	622.462	177.538	190.841	Lebih
May	600.974	449.608	151.371	342.212	Lebih
June	776.071	362.895	413.176	755.388	Lebih
July	200.000	175.527	24.473	779.961	Lebih
Agust	362.001	508.328	-146.327	633.634	Lebih
September	400.000	542.455	-142.455	491.179	Lebih
October	400.000	571.332	-171.332	319.847	Lebih
November	300.000	425.000	-125.000	194.847	Lebih
Total	5.256.046	5.113.859		142.187	

Didapatlah monitoring of the table the rest of raw materials in november as much as 142,187 Kg.

3. *Check*

The checking is done by using a Safety Stock as for the calculations as follows:
It is known that:
The number of forecasting in December = 338,748
The number of days in the month of December = 30 days
Lead Time on procurement to supplier = 7 days
The completion of the :

Safety Stock = (338.748 * 7) / 30 = 79.041 Kg.

Safety stock calculation based on the above, then the PT Indoaluminium Intikarsa the industry must provide a Safety stock of raw Ingot 99.7% as much as 79,041 Kg, so that at the time the raw material was less than the amount of safety stock then the system will tell you that there is a raw material that has a stock of unsafe.

4. *Action*

This stage is the stage of determining the action to be performed based on forecasting and the amount of safety stock is to make improvements in the ordering of materials to supplier.

This stage is the stage of determining the action to be performed based on forecasting and the amount of safety stock is to make improvements in the ordering of materials to supplier:
Amount = (forecasting bookings + safety stock) – the remaining stock.

The number of reservations = (338.748 + 79.041)-142.187 = 275.602 Kg.

Then the number of messages that must be for the month of December, namely 275,602 Kg.

1.7.3 Analisys of PDCA Acceptence

The reception of raw materials after the raw materials in a message with the appropriate amount of material bakus forecasting is done. As for the PDCA process conducted as follows:

1. *Plan* the reception of raw materials

The reception of raw materials is carried out in accordance with the booking of raw materials between March 25 to 30 each month, with a reception that is 1 to 2 weeks. Here is an example of the plan's acceptance of raw ingot 99.7% in table 3.3.

Table 3.3 Plan Acceptance of raw materials

No	Name Of Raw Material	*Supplier Name*	Order Date	Total Booking (Kg)	Receipt Date
1.	Ingot99.7%	PT.Indonesian Asahan Aluminium	26-Des-2015	300.000	05 s/d 12-Jan-2016

2. *Do* The Reception Of Raw Materials

At this stage Do i.e. do what was done in the Plan. Can be seen in table 3.4.

Tabel 3.4 *Do* The Reception Of Raw Materials

No	Name Of Raw Material	*Supplier Name*	Order Date	Total Booking (Kg)	Receipt Date	Total Receipts (Kg)
1.	Ingot99.7%	PT.Indonesian Asahan Aluminium	26-Des-2015	300.000	8-Jan-2016	300.000

3. *Check* The Reception Of Raw Materials

At this stage is the stage of checking of reservations, would have been appropriate or not. Can be seen in table 3.5.

Tabel 3.5 Check The Reception Of Raw Materials

No	Name Of Raw Material	*Supplier Name*	Order Date	Total Booking (Kg)	Receipt Date	Total Receipts (Kg)	*Check*
1.	Ingot99.7%	PT.Indonesian Asahan Aluminium	26-Des-2015	300.000	8-Jan-2016	300.000	Match

4. *Action* The Reception Of Raw Materials

This stage is the stage of the action performed after doing the check stage. Here is the act to be performed.

- If bookings do not correspond to the number of ordered then contact supplier warehouse section that booking is not appropriate or less to do less raw material delivery.
- If booking a match then the parts warehouse do direct storage of raw material received from supplier.

1.7.4 Analisys PDCA Pengeluaran Bahan Bak spending on raw materials

Analysis of PDCA process raw material expenses on management information systems Inventory of raw materials on the PT. Indoaluminium Intikarsa Industry. Expenditure analysis stages of raw materials analysis using PDCA as follows:

1. Raw Material Expenses Plan Planning

Planning Plan done by using data on expenditure of raw materials during the months of January to November (11 months) and production data from January-november (11 months) in the previous period, can be seen in table 3.6 below:

Table 3.6 Raw ingot 99.7% period 2016

No.	Name Of Material	Total Of Material (kg)
1.	Ingot99.7%	5.256.046

While the amount of raw materials used for production can be seen in table 3.7.

Table 3.7 expenditure amount of raw material for the production of the period 2016

No	Period Year 2016	Raw Material Expenditure (kg)	Produck Demain(roll)
1	January	349.999	1390
2	February	539.656	1348
3	March	566.597	1584
4	April	622.462	1508
5	May	449.608	1782
6	June	362.895	1688
7	July	175.527	1272
8	Agust	508.328	1698
9	September	542.455	1696
10	October	571.332	1552
11	Nopember	425.000	1494
Total		5.113.859	17012

2. *Do* Spending On Raw Materials

Based on the stage of the plan is to do this step of the process from the stages of the plan. As for example the calculations as follows

a. Calculation of production per day
   = Number of production/long day * month
   = 17012/30 * 11
   = 52 roll/day
b. Calculation of spending 99.7% ingots per day
   = total expenditure/lama day * month
   = 5.113.859/30 * 11
   = 15,497 kg
c. Calculation of raw ingot 99.7% for one roll of aluminum foil
   = number of raw ingot 99.7%/52
   = 15.497/52
   = 298 kg

3. *Check* Phase Check Dispensing raw materials

This stage is the stage of the examination of whether the results are already fit in apply according to what in the Plan phase plan.

a. Calculation of expenses on raw materials raw ingot 99.7%

January = demand * average raw material per roll
= 1390 * 298
= 414,220

February = demand * average raw material per roll
= 1348 * 298
= 401,704

Further calculations are performed in the same way. After all get the results done the sums the number of results from January through november, so get the results out of a total expenditure of raw material that is as much as 5,113,859 kg

4. *Action* Spending on raw materials

Based on the stage of the check. By calculating the jumblah the availability of raw materials in the period January to December 2016 is reduced by the amount of usage of raw materials during the period January through november 2016, so as to get the rest of the stock of raw materials in november. Can be seen in table 3.8.

Table 3.8 Details spending on raw materials

Name Of Raw Material	Raw Material Ingot 99.7%
Amount Of Raw Material Usage	5.113.859
Total Stock Raw Materia	5.256.046
Remaining Stock Of November	142.187

From the table above, it was concluded that at this stage the availability of raw materials on the period of 11 remaining raw materials as much as 142,187 kg. This is demonstrating that the average availability of enough raw materials to meet the needs of production.

1.8 Test Result

Based on the results of functional testing is done with beta testing, test case with interviews and testing user acceptance test. the following conclusions can be drawn:

1. *Fungsional Testing*

   Based on the results of the testing that is done then it can be concluded that the testing process is correct. Application of the perproses process in the form of the look was enough achieved.. In functional testing that is done can already displays the expected output.

2. *Beta Testing*

Based on beta testing that has been done then it can be concluded that:

1. Systems to be built could be useful for its users.
2. in the wake of the System can work.
3. The system can reduce the problem.
4. The system can perform monitoring and determining the amount of raw materials.
5. System built easy to use.
6. Menu on the system enough to suit the needs of the company.
7. The language used on the system easy to understand.
8. Display system in the wake of already good enough.

3. *User Acceptance Test* (UAT) Testing

Based on UAT testing (*User Acceptance Test*) that has been done that the system produces as expected. So, it can be concluded that the test results had already been accepted by the user

2. Conclusion

Based on the description of discussion the analysis that has been done, then the conclusion can be drawn against management information system Inventory of raw materials on Industrial Intikarsa PT. Indoaluminium as follows:

1. Management information systems Inventory of raw materials Indoaluminium Intikarsa PT. pad Industry had enough help in the warehouse section doing the presentation of information availability of raw materials and plan the amount of raw material that should be in the message for the coming period to support the production process.
2. Management information systems Inventory of raw materials on Industrial Intikarsa Indoaluminium PT can provide assistance in the management of inventory forecasting using SES, monitoring and safety stock. so that it can reduce the likelihood of the occurrence of the condition of shortage or surplus raw materials caused the disruption of the production process.

As for suggestions on the research of the management information system Inventory of raw materials on PT. Indoaluminium Intikarsa the industry can only do maintenance related raw materials. Therefore, for the development expected in the booking process the raw material more dynamic in tailoring needs raw materials such as ordering raw materials do not only one time in a month ... In addition it is hoped can also manipulate financial data to find out the profit the company owned.

BIBLIOGRAPHY

[1] Darmawan, D. & Fauzi, K. N., 2015. *Sistem Informasi Manajemen.* Bandung: PT Remaja Rosdakarya Offset.

[2] Nazir, M., 2014. *Metode Penelitian.* Bogor: Ghalia Indonesia.

[3] Yakub, 2012. *Pengantar Sistem Informasi.* Yogyakarta: Graha Ilmu.

[4] Sutanta, E., 2003. *Sistem Informasi Manajemen.* Yogyakarta: Graha Ilmu.

[5] Prasetio, A., 2012. *Buku Pintar Pemrograman Web.* Jakarta Selatan: Mediakita.

[6] Sokovic, M., Pavletic, D. & Pipan, K. K., November 2010. Quality Improvement Methodologies – PDCA Cycle, RADAR Matrix, DMAIC and DFSS. *JAMEE,* 43(1), pp. 476-482.

[7] White, S. A. & Miers, D., 2008. *BMPN Modeling and Reference Guide: Understanding and Using BPMN.* Lighthouse Point: Future Strategis Inc.

[8] Mustaqbal, M. S., Firdaus, R. F. & Rahmadi, H., 2015. Pengujian Aplikasi Menggunakan Black Box Testing Boundary Value Analysis.

Jurnal Ilmiah Teknologi Informasi Terapan, Volume I.

[9] Simarmata, J., 2010. *Rekayasa Perangkat Lunak.* Yogyakarta: ANDI OFFSET.

[10] Spyros Makridakis, Steven C. Wheelwright, Metode-Metode Peramalan Untuk Manajemen, Jakarta: Bina Rupa Aksara, 1994..

[11] A. Kadir, Dasar Perancangan dan Implementasi Database Relational, Yogyakarta: Andi Publisher, 2008.

[12] R. S. Pressman, Rekayasa Perangkat Lunak, Solo: Andi Publisher, 2012