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DESIGN AND MEASUREMENT OF COMPANY PERFORMANCE BY USING BALANCED SCORECARD METHOD AT PT. ABC

Iphov Kumala Sriwana[1], Derajat Amperajaya[2], Inne Winny Runfeka[3]

[1,2,3]Industrial Engineering Department, Industrial Technology Faculty,
Esa Unggul University, Jakarta, Indonesia
iphov.kumala@esaunggul.ac.id[1], derajat.amperajaya@esaunggul.ac.id[2], Innewinny2008@gmail.com[3]

ABSTRACT

Measurement of company performance is an important thing for manager especially for planning new strategies for the future. There were various methods for measuring performance that were different between one industry and the others, but it was difficult tc say that this method could estimate succeeded of company exactly. That was why, appeared one new concept about Balanced Scorecard method. PT.ABC is one of companies runs in producing plastics and printing. But, there are still found bad performance conditions at PT.ABC. These criteria appear because company only measures performance from financial perspective, without considering non-financial perspectives (customer perspective, internal business process perspective, learning and growth perspective). By using 4 perspectives in Balanced Scorecard can help PT.ABC to design, measure, and analyze performance of company more optimally. Based on the calculation and analysis, performance of company has been good if it is observed from customer perspective (93.90%), internal business process (86.25%), and learning and growth perspective (95.36%). The average measurement from them is about 91.835%. Even though, from financial perspective, performance conditions are still not good. They can be seen from the values of performance measurement are still under the values that have been company's target or they decrease continuously, such as ROI, ROE, ROA, and profit margin. Thus, the final conclusion is PT.ABC must perceive and improve its financial perspective to reach the better result of performance.

Key words: Balanced Scorecard, financial perspective, internal business process perspective, learning and growth perspective.

1. INTRODUCTION

PT.ABC is one of companies runs in producing plastic and printing. Its office and factory starts to work and produce on Monday until Saturday (on 08.00 a.m. until 07.00 pm for office, but for factory, it must produce during a day with 3 shifts). PT. ABC is located at Kenaiban, Sumur Pacing-Tangerang.

PT.ABC is known as a growing company which has special quality product. But, implementation of strategy at PT.ABC has not progress fast. Besides that, there are still not good performance conditions, and cause values of return on equity and asset that is resulted on the end of year is not according to production volume which is constant or rises continuously. They can be happened because employees do not understand mission and strategy of PT.ABC well. Besides that, PT.ABC also measure company performance only from traditional performance, which is only perceived from financial perspective.

That is why, the aim of this research is helping PT.ABC to communicate and translate its vision, mission, and strategy for all employees through aims, measures, targets, and initiatives from each of the Balanced Scorecard perspective by using primer and secondary datas of company. So, the title of this research is "Design and Measurement Company Performance by using Balanced Scorecard Method at PT.ABC."

2. THEORITICAL BACKGROUND

The definition of Balanced Scorecard is "a measurement and management that views a business unit performance from

company and increasing the welfare of its employees. In addition, PT.ABC seeks for using assets in a productive way, holding cash is owned by both as one of company's assets, in order to compensate the existing obligations of both the short and long term ones and can result high return values.

2. Customer Perspective:

PT.ABC seeks for becoming a leading company and the main choice for the customer in terms of products quality, services provided, and finding the trust of customers

3. Internal business process Perspective:

PT.ABC trying to run business processes, especially production processes effectively and efficientiy, so that it can produce a plastic products quality with competitive and affordable price, providing the best service for customers, so the distribution of plastic to customers can be timely

4. Learning and Growth Perspective:

PT.ABC seeks for providing competent human resources and have high motivation to achieve the corporate vision and mission

2. Determination of Corporate Strategy

2.1. SWOT Analysis (Strength, Weakness, Opportunity, and Threats)

SWOT Matrix begins with making IFAS and EFAS Matrix. IFAS matrix of PT.ABC can be divided into two major components, Strengths and Weaknesses, and EFAS Matrix can be divided into two major components, Opportunities and Threats. The Matrix IFAS and EFAS of PT.ABC as shown on *Table 1.* and *Table 2.*

Table 1. IFAS Matrix

Internal Strategic Factors	Weight of Rating	Rating	Weight of Rating X Rating
Strengths:			
1. Popularity and Experience	0.15	4	0.6
2. Maintaining good plastics quality	0.1	4	0.4
3. Plastic products can be used safely	0.1	3	0.3
4. Using pure ingredients to produce plastics	0.1	3	0.3
5. Timely Delivery of finished products	0.1	4	0.4
6. Competitive Pricing	0.1	3	0.3
7. Strategic Location	0.05	3	0.15
Weaknesses:			
1. Operational of company during 24 hours causes faulty works	0.15	2	0.3
2. There are no rewards for employees who have best performance	0.15	1	0.15
TOTAL	1		2.9

Source: Interview with Plant Manager PT.ABC

Description:

Value is determined by Weights of Ratings and Ratings of company

Weights of ratings x ratings on table 4.1 above, namely:

1 = minor weaknesses
2 = major weaknesses
3 = minor strengths
4 = major strengths

Analysis *Table 1.* is the average total rating x weight of rating (based on the ranking weight of rating x rating) = (1+2+3+4)/4 = 2.5. If the total of the result below 2.5 describes the organization's internal position is still weak, but if the total of the result above 2.5 illustrates the position already expressed a strong internal organization. Based on the results obtained from *Table 1.*, PT.ABC has a total of 2.9 so that it can be said that the internal position of PT.ABC has already strength.

Table 2. EFAS MATRIX

Strategic External Factors	Weight of Rating	Rating	Weight of Rating x Rating
Opportunities			
1. Necessaries of plastics rise continuously	0.3	4	1.2
2. Plastic products become more varied, especially of the size and quality of materials (not easily torn) so it can compete	0.2	3	0.6
3. The distribution of plastic products to outside of Jabodetabek, such as: Lamoung, Bangka, etc	0.2	2	0.4
Threats:			
1. The price of plastic bags are continuously competing	0.11	2	0.22
2. Rapid technological change	0.08	2	0.16
3. The existence of other companies that sell similar products	0.04	2	0.08
4. The prices of Plastic resins are not stable	0.07	2	0.14
TOTAL	1		2.8

Source: Results of Data Processing

Description:
Value is determined by Weights of Ratings and Ratings of company. Ratings of how effectively the company's current information to respond to economic, social, cultural, political, government, law, technology and competition are as follows:
1 = bad corporate responses
2 = corporate responses are average
3 = corporate responses are above average
4 = superior corporate responses
Analysis *Table* 2. is total rating x weight of rating=2.8, which means PT.ABC has an average response to deal with external factors that exist.
Description:
<2 = bad corporate responses
2 ≤ results <3 = corporate responses are average
3 ≤ results <4 = corporate responses are above average
4 = superior corporate responses
(Source: Interview with Plant Manager PT.ABC)

Next step is making the SWOT Matrix as shown on Table 3. Referring to *Table 3*, it is established some strategic objectives of each perspective as shown on *Table 4*.

Table 4. Strategic Objectives

Perspectives	Strategic Objectives
Financial	1. Leverage Ratio 2. Liquidity Ratio 3. Efficiency Ratio 4. Profitability Ratio
Customer	- Customer satisfaction - Loyalty and trust of customer
Internal Business Process	- Motivation and Innovation of Employees - The level of plastics Quality - The level of after sales service - Providing the adequate facilities
Learning and Growth (L and G)	- Employee Satisfaction - Training for employees - Use of technology - Skills of employees

Source: Results of Data Processing

With the Balanced Scorecard method, the goal of company can be seen through each of perspective aligned with the vision and mission of PT.ABC, in order to obtain the strategic goals to clarify the objectives of the company. There are some strategic goals according to the Balanced Scorecard as listed on Table 5.:

Table 5. Strategic Goals

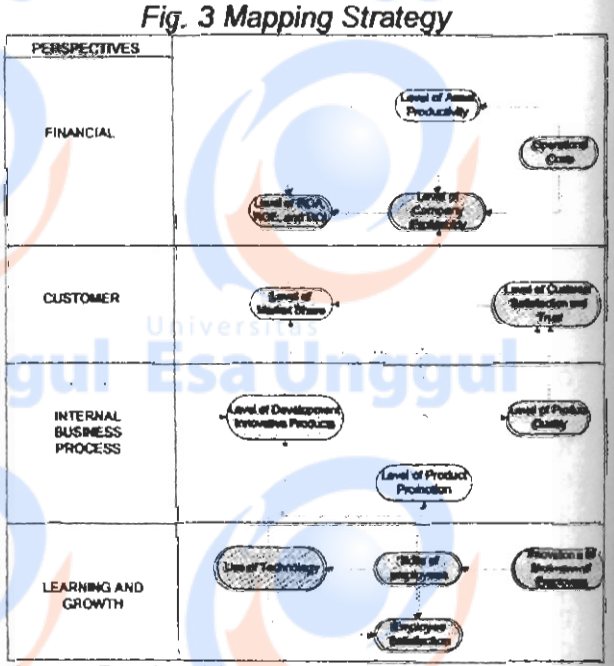
Perspectives	Strategic Goals
Financial	Shareholder Value
Customer	Firm Equity
Internal Business Process	Organizational Capital (implementing an effective processes and costs, and resulting an affordable prices
Learning and Growth	Human Capital

Source: Results of Data Processing

The next step is determining the key performance measures include:
Financial Perspective:
Increasing ROI, ROA, ROE, Profit Margin
Customer Perspective:
Improving customer satisfaction and trust
Internal Business Process Perspective:
Developing innovative products quality which are produced
Learning and Growth Perspective:
Improving skills, customer satisfaction, motivation and innovation of employees, and reliability of the use of technology, especially the production machine

Mapping Strategy
The Balanced Scorecard provides a framework to develop strategic goals that have a coherent relationship. They are established by creating a causal link between strategic goals with one and others. This illustration can be seen in *Figure 3*.

Fig. 3 Mapping Strategy



Source: Results of Data Processing

perspectives: financial, customer, internal business process, and learning and growth." (Atkitson, A.A., Kaplan, R.S., Banker, R.J., Young, M.S., 2004). 4 perspectives of Balanced Scorecard is shown in *Figure 1.*

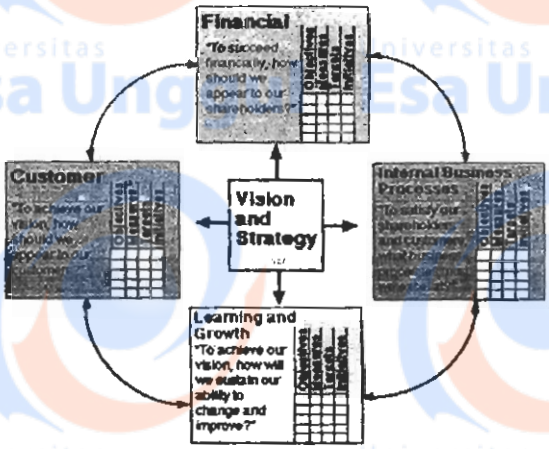


Fig 1. 4 Perspectives in Balanced Scorecard and The Relationship of That Perspectives

3. RESEARCH METHOD

Illustration of Research Method as shown in *Figure 2.*

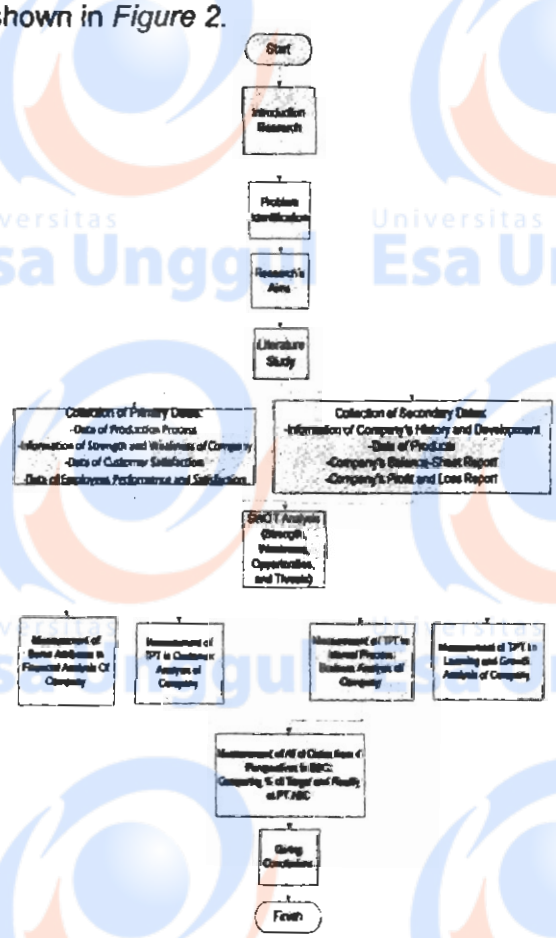


Fig 2. Research Method
Source: Result of Data Processing

4. RESULT AND ANALYZE

Based on observations made in PT.ABC, there are some performance conditions are still unfavorable, as follows:

1. Division of tasks for each worker is still unclear
2. SOP of company is not yet clear
3. Lack of skill and knowledge of employees in operating machinery and improving product varieties
4. Lack of supervisor's attention to Work Safety (K2) for employees in production
5. There are still complaints from customers about the quality and distribution of plastics
6. Handling of problems in factory are less quickly, especially in the production process
7. There is rework in production

From some of these performance condition, the next step is designing the Balanced Scorecard to improve and make performance measurement more optimally.

Steps of Designing Balanced Scorecard

1. Translating Vision and Mission into 4 Perspectives of Balanced Scorecard

Vision of PT. ABC is Being one of the biggest and best company in the field of HD-PE-PP & Bag Manufacturing and Printing in Indonesia.

Mission of PT.ABC are:

1. Satisfying customers by providing safe and products quality at affordable prices
2. Creating a conducive work environment supported by positive attitudes and actions to achieve its Corporate Vision
3. Increasing profit of company continuously
4. Become the center of making products quality through continuous improvement in quality
5. Become the center of the deveiopment of Human Resources quality
6. Being a company that gives attention to employees, customers, and society

Pouring into the 4 perspectives of Balanced Scorecard in accordance with the Vision and Mission PT.ABC as follows:

1. Financial perspective:

PT.ABC seeks for obtaining high net profit with one of his efforts is decreasing operational costs that are not needed to develop the company's business in order to translate the vision and mission of the

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Table 3. SWOT MATRIX

IFAS / EFAS	Strength (S)	Weakness (W)
	1. Popularity and Experience 2. Maintaining Good Plastics Quality 3. Plastic Products can be used safely 4. Using pure ingredients to produce plastics 5. Timely Delivery of finished products 6. Competitive Pricing 7. Strategic Location	1. Operational of company during 24 hours causes faulty works 2. There are no rewards for employees who have best performance
OPPORTUNITIES (O) 1. Necessaries of plastics rise continuously 2. Plastic products become more varied, especially of the size and quality of materials (not easily torn) so it can compete 3. The distribution of plastic products to outside of Jabodetabek, such as: Lampung, Bangka, etc	**Strategies of SO** 1. Improving the quality of plastic products with competitive price 2. Increasing the production of plastics by considering the size and design development of new plastic 3. Expanding the distribution area	**Strategies of WO** 1. Improving the structure of work for employees (the division of work shift more regularly) 2. Giving awards to employees with the best performance, for example by the addition of salary or incentive (bonus)
THREATS (T) 1. The price of plastic bags are continuously competing 2. Rapid technological change 3. The existence of other companies that sell similar products 4. The prices of Plastic resins are not stable	**Strategies of ST** 1. Making innovations in productions continuously 2. Providing optimum service for external sides of company, especially for customers and also internal sides 3. Providing certainty of products quality for sale	**Strategies of WT** 1. Enhance innovation and skills of workers through additional training 2. Improving employee's morale with increasing conditions of works and giving bonuses to employees who have best performance 3. Improving the division of task system to employees 4. Increasing products quality with competitive prices

IFAS = *Internal Strategic Factor Analysis Summary* (strengths and weaknesses)

EFAS = *External Strategic Factor Analysis Summary* (opportunities and threats)

Source: Results of Data Processing

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Strategic Measures Determination

The next step is the establishment of strategic measures as key indicators from each of perspective. Determination of these strategic measure based on strategic goals, strategic objectives, and key performance measures of perspectives. The strategic measures as shown on *Table 6.* to *Table 9.*

Table 6. Strategic Measures of Financial Perspective

No.	Strategic Objectives	Strategic Measures
1	*Leverage Ratio*	
	Showing how heavily the company is in debt and how EBIT of company has ability to pay interest on the debt and	Long term debt ratio
		The debt Ratio
		Times interest earned
		Cash Coverage Ratio
2	Liquidity Ratio:	
	Measuring how easily the firm can lay its hands on cash.	Net Working Capital to Total Asset Ratio
		Current Ratio and Quick Ratio
		Cash Ratio
3	Efficiency Ratio:	
	Measuring how productively the firm is using its assets.	Asset Turnover Ratio
		Average Collection Period
		Inventory Turnover Ratio
		Day's Sales in Inventory
4	Profitability Ratio:	
	Measuring the firm's return on its investments.	Net Profit Margin
		Operating Profit Margin
		ROA
		ROE
		ROI

Source: Results of Data Processing

Table 7. Strategic Measures of Customer Perspective

Strategic Objectives	Strategic Measures
Loyalty and trust of Customer	Customer Satisfaction of Company's services
Customer Satisfaction	Time needed by PT.ABC to solve customer's complaints
	Customer's view to PT.ABC

Source: Results of Data Processing

Table 8. Strategic Measures of Internal Business Process Perspective

No.	Strategic Objectives	Strategic Measures
1.	Motivation and Innovation of Employees	Level of Motivation and Innovation of Employees
2.	Level of Products Quality	Level of customer's complaints in according to product usage
3.	The level of after sales service	Level of purchasing plastics that has done by customers
4.	Providing the adequate facilities	% Computer used
		% Telephone Lines Used

Source: Results of Data Processing

Table 9. Strategic Measures of Learning and Growth Perspective

No.	Strategic Objectives	Strategic Measures
1	Employee Satisfaction	Level of Employee Satisfaction towards the company's facilities provided
		Level of Employee Satisfaction towards the working environment
		Level of Employee Satisfaction towards the Job Promotion
2	Training for employees	Total of employee's trainings in 1 month
		% Employees who are motivated, after attending training
3	Use of technology	Using technology easily and reliability of technology
4	Skills of Employees	% employees who are responding to customer complaints
		Level of Motivation and Innovation of the employees

Source: Results of Data Processing

Measurement and Data Analysis

a. Financial Perspective

Data Requirement

1. Data from Balance-Sheet Report
2. Data from Profit and Loss Report

The measurements of these data are shown on *Table 10.*:

Table 10. Results of Attributes from Financial Perspective Measurements on 2007-2009

Financial Attributes Perspective	Years		
	2007	2008	2009
ROI (%)	3.3	3.16	2.81
ROE (%)	14.11	17.34	15.64
ROA (%)	3.3875	3.74	3.214
Profit Margin (%)	2.3	2.519	2.98
Total debt ratio (%)	75.12	80	80.4
Net Working Capital to Total Asset Ratio	23.872%	19.98%	Valued -
Current Ratio	1.313	1.25	0.72
Quick Ratio	0.0924	0.168	0.063
Cash Ratio	0.0165	0.02258	0.0494
Asset Turnover Ratio	1.419	1.4848	1.035
Average Collection Period (days)	14	22	20
Inventory Turnover	Twice in 1 production period	Twice in 1 production period	Twice in 1 production period
Day's Sales in Inventory	251 days	231 days	264 days

Source: Results of Data Processing

Total debt ratio = $\frac{\text{total liabilities}}{\text{total assets}}$ .....(1)

NWC to asset = $\frac{NWC}{\text{total assets}}$ .....(2)

Current Ratio = $\frac{\text{Current Assets}}{\text{Current Liabilities}}$ .....(3)

Quick Ratio = $\frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$ .....(4)

Cash Ratio = $\frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$ .....(5)

Asset Turnover Ratio = $\frac{Sales}{\text{Average Total assets}}$ .....(6)

Average Collection Period = $\frac{\text{Average receivables}}{\text{Average daily sales}}$ .....(7)

Inventory Turnover Ratio = $\frac{\text{Cost of Goods sold}}{\text{Average Inventory}}$ .....(8)

Days'sales in inventory = $\frac{\text{Average Inventory}}{\text{Cost of goods sold}/365}$ .....(9)

Profit margin Ratio = $\frac{\text{Net Income}}{\text{sales}}$ .....(10)

ROA = $\frac{\text{Net Income} + \text{Interest}}{\text{Average Total Assets}}$ .....(11)

ROE = $\frac{\text{Net Income}}{\text{Average Equity}}$ .....(12)

ROI = $\frac{\text{Net Income}}{\text{Average Assets}}$ .....(13)

(Source : *Brealey, Myers,* and *Marcus,* 2007)

b. Customer Perspective
Data Requirement for analysis is obtained by using questionnaire. The measurements of strategic measures of these, can be seen on *Table 11.*:

Table 11. Results of Attributes from Customer Perspective Measurements on 2007-2009

Customer Perspective						
Strategic Objectives	Strategic Measures (SM)	Weight of SM (%)	Target (%)	Reality (%)	TPT (%)	E
Loyality and Trust of Customer	Customer Satisfaction of Company's services	50	90	80	88.89	44.45%
Customer Satisfaction	1.Time needed by IPT ABC to solve customer's complaints	50	90	98.75	98.61	49.445%
	2. Customer's view to IPT ABC		90	99.25	99.17	
		50	Rate of TPT (%)		98.89	93.895%

Source: Results of Data Processing

c. Internal Business Process Perspective
Data Requirement for analysis is obtained by using questionnaire. The measurements of strategic measures of these, can be seen on *Table 12.*:

Table 12. Results of Attributes from Internal Business Process Perspective Measurements on 2007-2009

Internal Business Process Perspective						
Strategic Objectives	Strategic Measures (SM)	Weight of SM (%)	Target (%)	Reality (%)	TPT (%)	E
Motivation and Innovation of Employees	Level of Motivation and Innovation of Employees	15	90%	90%	100	15%
Level of Products Quality	Level of customer's complaints in accorcing to product usage	35	100%	90%	100	35%
The level of after sales service	Level of purchasing plastics that has done by customers	25	100%	92%	100	25%
Providing the adequate facilities	1 % Computer Used	25	10 units	5 units	50	11.25%
	2 % Telephone Lines used		5 lines	2 lines	40	
		25	Rate of TPT (%)		45	
Total Results of Performance Measurement (E)						86.25%

Source: Results of Data Processing

d. Learning and Growth (L and G) Perspective
Data Requirement for analysis is obtained by using questionnaire. The measurements of strategic measures of these, can be seen on *Table 13.*:

Table 13. Results of Attributes from L and G Perspective Measurements on 2007-2009

Learning and Growth (L and G) Perspective						
Strategic Objectives	Strategic Measures (SM)	Weight of SM (%)	Target	Reality	TPT (%)	E
Employee Satisfaction	1. Level of Employee Satisfaction towards the company's facilities provided	25	80%	64.8%	81	22.50%
	2. Level of Employee Satisfaction towards the working environment		85%	77.8%	91.47	
	3. Level of Employee Satisfaction towards the Job Promotion		80%	78%	97.5	
		25	Rate of TPT (%)		89.99	
Training for employees	1. Total of employee's trainings in 1 month	25	100%	92%	92	23.79%
	2. % Employees who are motivated, after attending training		75%	73.75%	98.33	
		25	Rate of TPT (%)		95.17	
Use of technology	Using technology easily and reliability of technology	25	90%	90%	100	25%
Skills of Employees	% Employees who are responding to customer complaints	25	97%	90.50%	93.53	24.07%
	Level of Motivation and Innovation of the employees	25	90%	90%	100	
		25	Rate of TPT (%)		96.265	
Total Results of Performance Measurement (%)						95.56%

Source: Results of Data Processing

Average results of Total Achievement from Each of Perspective and Analysis of Data

Table 14. Average Results of Total Achievement of Perspective

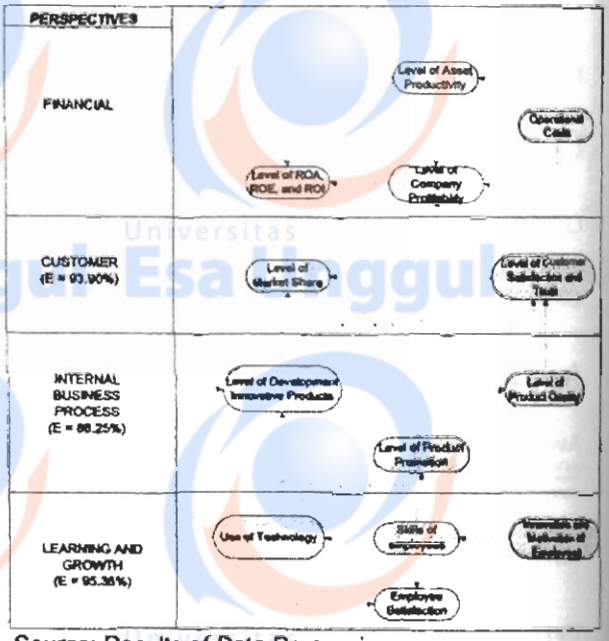
Perspectives	Total Achievement of Perspectives (%)
Customer	93.895
Internal Business Process	86.25
Learning and Growth (L and G)	95.36
Average Results of Total Achievement of Perspectives (%)	**91.835**

Source: Results of Data Processing

From the results on Table 14., it can be said that if it is seen from financial perspective, PT.ABC has not yet performed its financial well. But, from customer, internal business process, and learning and growth perspectives, PT.ABC has had good performances, because the value of measurement from one perspective has been well-balanced with the others.

5. CONCLUSION

From the results of the analysis and discussion, it can be concluded that PT.ABC has already had a good performance when viewed from three main perspectives contained in the Balanced Scorecard (customer perspective, internal business process, and L and G perspective), although from internal business process perspective is still needed attention, especially providing the adequate facilities. But, when viewed from financial perspective, the company performance is still not good, because there are some values of attributes from this that fluctuate and finally decreased on 2009 and have values below the target of company. The illustration of 4 perspectives and the relationships of them, can be seen in Figure 4:



Source: Results of Data Processing

Fig 4. Achievement of Each of Perspective and The Relationships of Strategic Measures

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APPLIED DYNAMIC SYSTEM APPROACH IN CAPACITY PLANNING AT PT. SCC

Nofi Erni, M. Derajat Amperajaya, and Binsar Peter Pakpahan

Industrial Engineering Department, Universitas Esa Unggul, Jakarta, Indonesia
nofi.erni@esaunggul.ac.id

ABSTRACT

This paper presents a system dynamic analysis to calculate capacity required of the power cord production plans in PT. SCC. This research motivated by the problems faced in production floor where there is a shortage of available capacity to respond consumer demand. The purpose of this study was to calculate the capacity production plans and to find out the ratio between the available capacity with the required capacity. The simulation in this study using a model of dynamic systems with Powersim applications. In order to make a comparison of the result are used the RCCP method. The research shown result of capacity calculation, using system dynamics ts are not much different from the RCCP method, where the available capacity is always less than the required capacity. Based on Master Production Scheduling, shown that it has shortage of capacity at almost all stations work the production floor. The best approach is calculation using Resource Profile, which is total required capacity for October 2009 - Maret 2010 as 8.442 hours and the capacity shortage as 1.340 hours or equal 15,8%. Through increasing working time to be 3 shift work hour per day at each work station, the available capacity is enough to met customer order.

Keywords: Capacity Planning, RCCP, Dynamic System, Powersim

1. INTRODUCTION

A dynamic system approach is considered quite appropriate in representing the real problem. Some advantages of dynamic system are the availability of a work frame for causal loops, the ability to create a structural model for the managerial inputs and to simulate these through a quantitive computer procedure (Sterman, 2004). System dynamics introduced by Forrester (1961) indicates that some systems may be modeled by level and rate variables. Forrester stated the system dynamics as the study of information feedback characteristics of the industrial activities to show how the organization structure, amplification (in policies), and time delay intervals influence an enterprise (Chang et al. 2006).

Capacity is the amount of work that can be done in a specified time period. Capacity is defined as the capability of a worker, machine, work center, plant, or organization to produce output per period of time (Sheikh, 2002). The intent of RCCP is to convert MPS into resourcess needed to carry out the plans. The capacity requirement of MPS can be estimated using Capacity Planning using Overall Factors, Bill of Labor and Resources Profile (Forgarty, 2005)

PT. SCC is a company engaged in the cable industry. This company produces various types of cables such as electrical cables, telephone cables, wire armature and other products. The main costumer is PT. PLN which is a state enterprise responsible for electricity will need by all the people of Indonesia. The increasing demand for electricity by the public would directly impact to the needs of the power cord, this relates directly to this power cable company which is one of the major suppliers of electrical cable for PT. PLN.

In order to accordance the wire cords that produced, must consider the planning of the production capacity of each incoming orders. In the capacity planning process should consider how many products must be produced and how many the maximum products that company can produce. Capacity planning seeks to integrate the

factors of production to minimize costs of production facilities, to control the production of which is to see whether production operations are in accordance with established plans. and taking into account economic

Main problems faced by the company is not unbalance the need for capacity with the availability of capacity on the production floor. Therefore, often there is a shortage or excess production capacity. This is because the number of planned production does not match the available capacity. Therefore it is necessary for the MPS validation test to determine whether the available capacity on the company can meet the required capacity, and therefore needs to be calculated with RCCP method to find out more details about the problem.

The purpose of this study are to analize production process, calculate available capacity and required capacity by using RCCP and System Dynamic Approach.The scope of research are are capacity production conducted on production plans to produce NYFGbY and NYY cable for October 2009 - March 2010.

2. RESEARCH METHOD

Steps in doing research can be seen in the following figure:

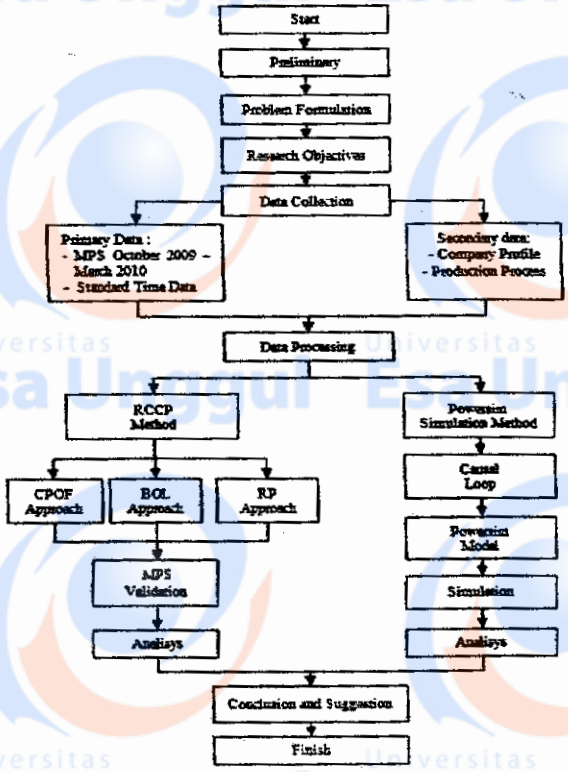

Figure 1. Research Methodology

3. RESULT AND DISCUSSION

Production process of cable NYY and NYFGbY through several step, there are stranding, insulation, cabling, inner sheating, armouring, outer sheat, testing and packaging. Each of process are the works station to calculate the capacity.Availability capacity as calculated capacity is sum of total clock hours available. It is determined by utilization and efficiency factors are used. Total available capacity to produce cable in PT SCC as 13.417 hours for October 2009 – March 2010.

3.1. RCCP method

The availability capacity are base to verify Master Production Scheduling. Based on Rough-Cut Capacity Planning (RCCP) as a medium range planning, the capacity requirements of a particular MPS can be estimated. The result of capacity required and capacity available calculation using RCCP as follow.

a. Capacity Planning using Overall Factors (CPOF)

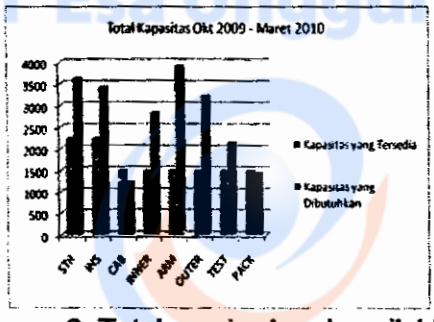

Figure 2. Total required and available capacity using CPOF

CPOF use historical proportion to calculate required capacity, for October 2009 to March 2010 the total capacity required 21.805 hours and the shortage capacity as 8.387 hours (38%). It can be concluded that in general the available capacity is smaller than the required capacity. The excess capacity are only in cabling and packing workstations. It is necessary to increase the number of machines in stranding, armouring and outer sheat work

stations, where the production process at those work stations does require quite a lot of time related to the complexity of the process to be performed, thus requiring accuracy and speed accurate machine.

b. Bill Of Labor Approach (BOL) Analysis

Not vary much different with the CPOF, the available capacity is smaller than the required capacity. BOL using standar time to produce as basic calculation capacity. The excess capacity only in cabling and packing workstations.

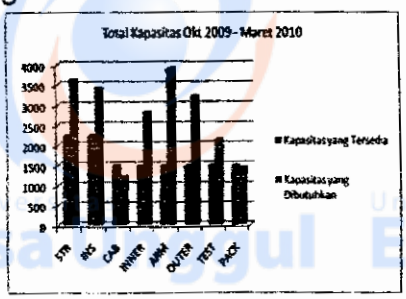

Figure 3. Total required and available capacity using BOL

With the application of the maximum amount of shift is 3 shifts, some work stations are experiencing shortages of capacity is expected to be fulfilled because the comparison is not too high. As in the work station testing, if the addition of shift applied, the required capacity can be met.

c. Resources Profile (RP) Analysis

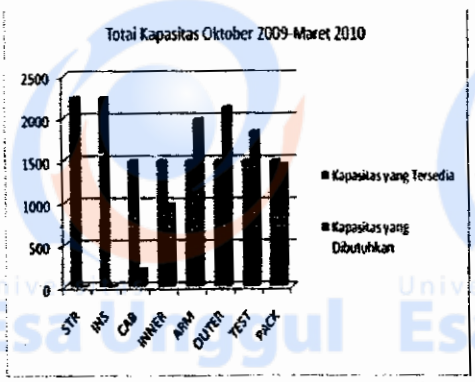

Figure 4. Total required and available capacity of using RP

Calculation of total capacity required as 8.442 hours and the shortage capacity as1.340 hours (15,8%).The result shown, the RP is the best method to calculate and verified the MPS. Working machine time have been operate for 21 hours in 3 shifts / day, and at cabling and packaging work stations operate for 14 hours in 2 shifts / day, where in one shift time is 7 hours and 1 hour is used to break and the hour break the machine is not operating. For the utilization and efficiency are made flat rate every month. In order to meet the total capacity required, the company can increase the number of shifts in cabling and packaging. With the application of the maximum amount of shift is 3 shifts, some work stations are experiencing shortages of capacity is expected to be fulfilled because the comparison is not too high. As in the work station testing, if the addition of shift applied, the required capacity can be met. Further action is to increase the number of machines. The addition of the number of machines is not necessary at all stations. From the data obtained, the work station which requires the addition of machines are Stranding, Armouring and Outer Sheat work stations, where the production process at those work stations does require quite a lot of time related to the complexity of the process to be performed, thus requiring accuracy and speed accurate machine. Meanwhile, work stations which have excess capacity can be maintained because of the estimates obtained, the available capacity could cover the required capacity.
much greater capacity than the capacity available so that the MPS is planned by the company are not eligible.

3.2. Simulation with System Dynamic

System dynamic espoused and settled for the influence diagrams or the so-called signed directed graphs of relationships between variables, with effect that the influence diagrams couldbe drawn at several levels of detail in more aggregated forms, and it came to be known as the causal loop diagrams. With the graphical implification of the influence diagrams, formal techniques could be developed for formulations sales structure (figure 5).

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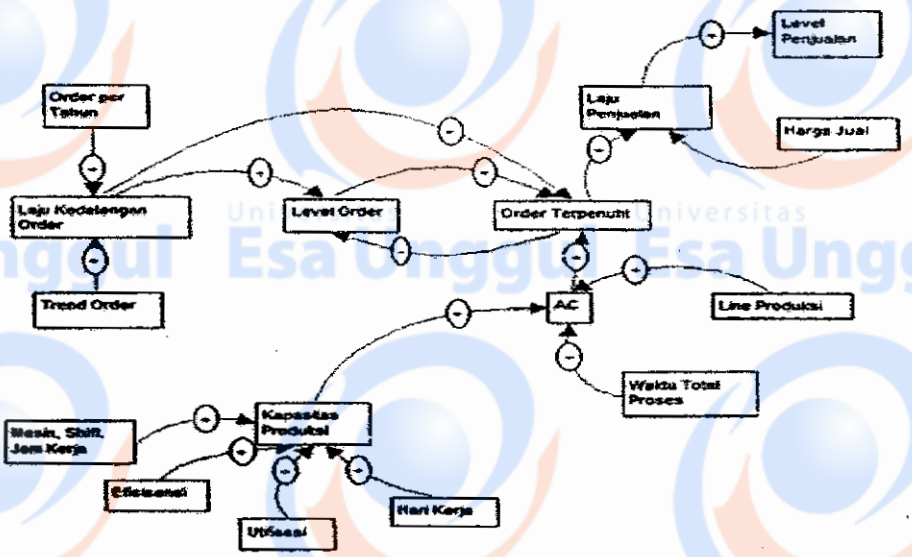

Figure 5. Causal loop diagrams Production Sales Structure

Causal loop Relations:
Incoming Order Rate is affected by Order Per Year and Trend Order, whereas Incoming Order Rate affecting Order Level and Fulfilled Order. Order Level affecting Fulfilled Order which if Order Level that come become greater, then the Order that flow into fulfilled Order will be equal with Order Level, and Fulfilled Order affected by Available Capacity because Fulfilled Order will be fullfilled if the same as Available Capacity. If Fulfilled Order reduced then Level Order will be reduced as well. Mean while Available Capacity affected by production capacity, production line, dan total time production. Production capacity affected by number of machine, Shift, work hour, efficiency, utility, and work day. While fullfiled Order will be affecting sales rate, which sales rate affected by price which will be affecting rate sale.

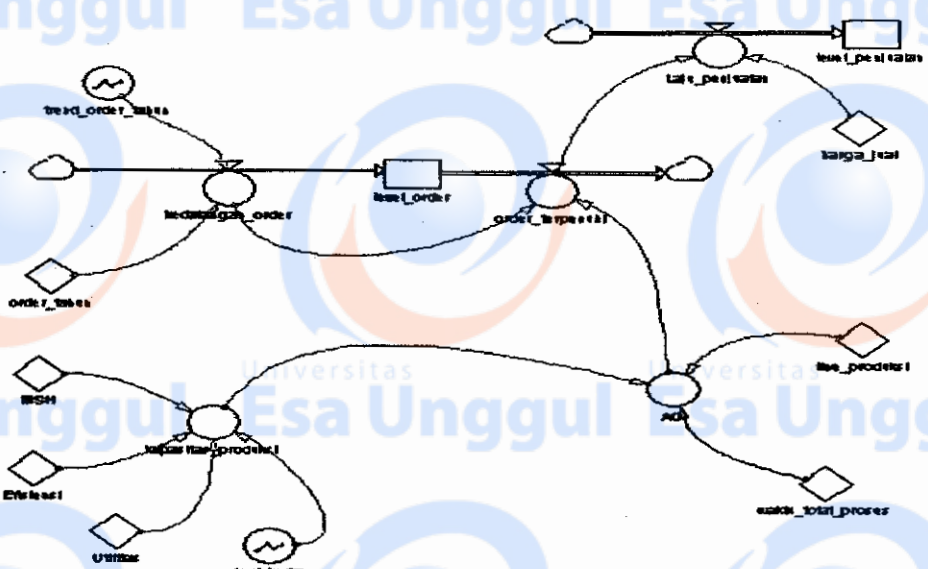

Figure 6. Production Capacity Flow Chart

Relationship between arrival and order fulfilled for 6 months can be seen that the fulfilled order always smaller than the value of the arrival order (Figure 7).

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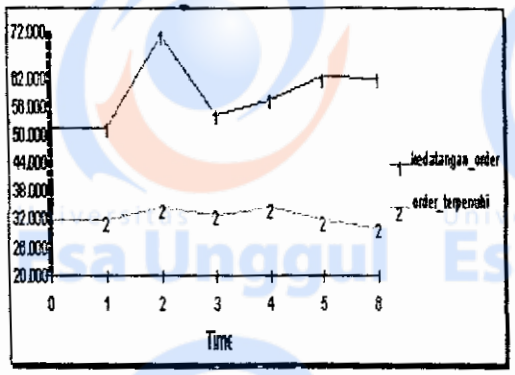

Figure 7. Relationship between the arrival with Order Fulfilled

The simulation results using Powersim as shown in Table 1. Order arrival is always greater than the fulfilled Order (available capacity). This shows that the company can not meet the required capacity in the production process. From Order terpenuhi will flow to the company's sales results for each month. These results are obtained by multiplying the number of Fulfilled Orders by selling price per meter cable.

Table 1. Comparison of Arrival with Fulfilled Order, and Sales Rate

Time	kedatangan_order	order_terpenuhi	AC	Laju_penjualan
0	51.609,66	31.842,09	31.842,09	477.631.292,29
1	51.609,66	31.842,09	31.842,09	477.631.292,29
2	71.512,13	34.736,82	34.736,82	521.052.318,86
3	54.596,83	33.289,45	33.289,45	499.341.805,58
4	57.512,02	34.736,82	34.736,82	521.052.318,86
5	62.514,63	31.842,09	31.842,09	477.631.292,29
6	62.190,72	30.394,72	30.394,72	455.920.779,01

Unit :Order (meters), sales (IDR)

From the simulation results obtained that the available capacity is always smaller than the orders came. The available capacity can not cover the needs of capacity. Also seen that the orders are fulfilled with available capacity. In November 2009 the difference is high where the orders that come are the highest order in the analyzed range of six months. That enough factors affecting this capacity shortage that is imposed by the company's shift of only 2 shifts. In addition, the working day also affects the availability of capacity. Thus, PT. SCC can anticipate the causes of these problems and to take steps in anticipation for the rate of sales for the coming months to increase.

The simulation results, it can be seen the available capacity is smaller than the required capacity. Such as the results obtained by using the Simulation System for stranding and insulation workstations have the same value with the results obtained by using the CPOF method. The results showed that the available capacity is always less than the required capacity.

Table 2. Available Capacity versus Capacity Needed In Stranding

Time	Kap_yg_tersedia	Kap_yg_dibutuhka
0	361,75	520,93
1	361,75	520,93
2	394,63	721,82
3	378,19	551,08
4	394,63	580,51
5	361,75	631,00
6	345,30	627,73

Table 3. Available Capacity versus Capacity Needed in Insulation

Time	Kap_yg_tersedia	Kap_yg_dibutuhkan
0	361,75	490,29
1	361,75	490,29
2	394,63	679,37
3	378,19	518,67
4	394,63	546,36
5	361,75	593,89
6	345,30	590,81

From the results, it can be seen that the simulation results obtained show that the available capacity is smaller than the required capacity. Thus the results obtained by using the simulation system for Insulation work station is not much different from the results obtained by using BOL. The results showed that the available capacity is always less than the required capacity is almost the same value between the simulation system using BOL.

Table 3. Available Capacity vs. Capacity Needed in Packing

Time	Kap_yg_tersedia	Kap_yg_dibutuhkan
0	361,75	206,44
1	361,75	206,44
2	394,63	286,05
3	378,19	218,39
4	394,63	230,05
5	361,75	250,06
6	345,30	248,76

Results obtained that using this simulation method, conclude that is not much different from the results obtained by using the results obtained by using the RP method for workstations Packing. The results showed that the same values obtained using both methods both RP and methods of dynamical systems methods.

From the results of the comparison between the three methods of CPOF; RCCP, BOL, and RP with the calculation results using the system simulation method with Powersim applications above obtained the results that are not much different. The value obtained is almost the same in each calculation. Thus both methods can be used to calculate production capacity at the plant.

4. CONCLUSIONS

The conclusion drawn from the overall analysis carried out on planning a production capacity of PT. SCC are as follows:

1. The Master Production Scheduling to produce NYFGbY and NYY cable for October 2009 to March 2010, is not feasible, because the required capacity smaller than available capacity.
2. Based on RCCP the Resources Profile is the best approach to calculate available and required capacity. Using RP approach and system dynamic with Powersim shown the as 8.442 hours and the capacity shortage as 1.340 hours or equal 15,8%. The shortage capacity at stranding and insulation work stations available capacity can not meet the necessary capacity to carry out the production process on time.
3. Powersim simulation results are not much different from the RCCP method, where the available capacity is always less than the required capacity. The result shown at all work stations for each period showed similar results. This shows that the RCCP method or Dynamic System Simulation methods using Powersim can be used to calculate production capacity.

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EXPERT SYSTEM HANDLING WASTE PRODUCTION INCANDESCENT LAMPS

I. Joko Dewanto and Ari Pambudi

Esa Unggul University, Jakarta, INDONESIA
djoko.dewanto@esaunggul.ac.id, djoko.dewanto@gmail.ac.id, ari.pambudi@esaunggul.ac.id

ABSTRACT

Incandescent lamps that function as the lighting is needed at all the various layers of society to be able for activity at night or in the room is less light. The process of making the light bulb through multiple stages and often there are problems in the manufacturing process that could result in wastage of raw material (waste). In this observation of an expert system to solve specific problems in the production of incandescent lamps that require particular expertise. Solving the problem here is intended to minimize the wastage of goods (waste) in the production of incandescent lamps.

In the process of handling problems, suggestions and knowledge of experts is needed for handling the problem can be easily and quickly find a solution. This expert system was created to preserve the fatherly knowledge experts in handling the problem and rules base wirh forward chaining. In the construction of expert systems, knowledge acquired from experts directly by way of interviews with experts who are experts in dealing with problems in the process of making a lamp. In this expert system is directed on how to detect waste arising from the manufacturing process and finding the roots of problems lights to be repaired so that the type of waste which had been able to disappear quickly and without prejudice to the need for an expert, because the expert system is based on expert knowledge , then applied into an expert system application program.

*Keywords: Incandescent lamps,waste production,*forward chaining,*expert system application, lamp handling problems*

1. INTRODUCTION

1.1. Background

Expert system is a system that implements the knowledge of experts in a particular field in the form software. Development of an expert system is to be solve specific problems that require specific skills such as diagnosing illness, prescription settings, scheduling, and process to detect problems. To build an expert system, the expert knowledge are implemented into the system which is then stored into the knowledge base. Development of expert system is expected to alleviate and solve existing problems and preserving the knowledge of the expert. When about to make a decision or solve complex problems, we often ask for advice or consult with an expert or experts. An expert is someone who has the knowledge and specific experience in a field, for example computer experts, nondestructive testing experts, political experts and others. The more unstructured the situation, more and specializes (and expensive) consultation is required.

Expert System goal is to transfer expertise from one expert to the computer, then to other people (who are not experts). This process included in engineering knowledge (knowledge engineering) that will be discussed later.

In this case the author wants to discuss the detection problem in the production of incandescent lamps, incandescent lamps in the process of making required several stages starting from the beginning to the end until the goods are so ready to be packed. In dealing with the proper analysis required for the desired lamps to avoid the mistakes that can lead to waste in the manufacturing process.

1.2. Formulation of problem

A problem to be solved in this observation is how to handle a problem in the manufacture of incandescent lamps by using an expert system. Handling problems

that do are limited to only 5-watt incandescent lamps.

1.3. Objectives and benefits

In the general objective to be achieved is to design an expert system that can help experts and technicians to handle the problems in the production of incandescent lamps with a fast and efficient, while also in order to help provide ways of handling problems in the production of incandescent lamps to new tech so companies do not need to pay for training that takes a long time. The specific objectives to be achieved include:

1. Learn the application of expert system for handling the problem.
2. Building an expert system to handle problems that occur from the process of making incandescent lamp.

2. DESCRIPTION THEORY

2.1 Expert systems

An expert system according to Jackson, Peter. (*Introduction to Expert Systems*, 1999) is a computer program that has a base of knowledge from one or several experts and reasoning to solve a problem or to give advice. Knowledge bases in expert system derived from knowledge and experience possessed by the expert, which is then used to solve a problem, either to make decisions or to give advice.

2.1.1 Knowledge Engineering

Engineering knowledge is a process to obtain specific domain knowledge and build it into a knowledge base. Knowledge engineering process includes five activities, namely:

1. Acquisition of knowledge
   The process of getting knowledge from human experts and literature.
2. Knowledge representation
   Encoding human knowledge into computer representation.
3. Knowledge Validation
   Process to ensure the knowledge gained can be acceptable.
4. Inference
   Involves Inference the activities of software design that is able to reason on the basis of knowledge and can provide advice and suggestions for solutions to specific requests.
5. Explanation and Justification
   Facilities that allow the expert system provides an explanation of why and how a given conclusion.

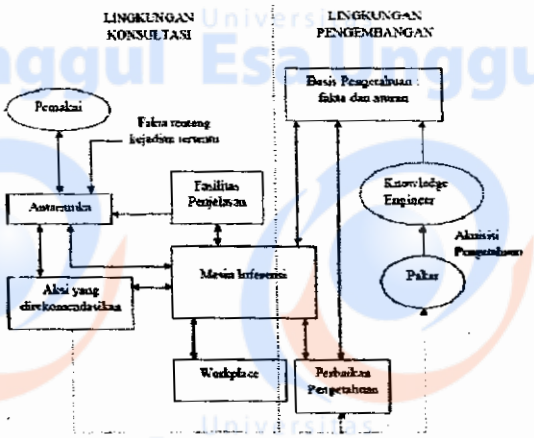

Figure II-1. Arsitektur Sistem Pakar
Source : learning resources esa unggul

2.2. Forward Chaining

Forward chaining starts with data available and uses the inference rules to conclude more data until desire goal is reached.

3. ANALYSIS AND DESIGN

3.1 Problem Analysis

Incandescent lamps is one type of lighting from several types of lights available today and is still used in the homes. The process of making the lamp takes skill and knowledge of the technicians because the making process this bulb through several stages from initial engine start and then the next machine until the end of the machine. That requires a routine for checking if there is waste in the production of each machine can be minimized. To handle the problems that arise in production that resulted in the emergence of a strong waste analysis is required, and it can be resolved by senior technicians who have extensive experience in finding problems that occur in the production process, while for junior technician who recently worked or are still just need guidance of senior engineers, and even then take a long time because to be able to handle problems and find solutions required a long time for the technicians. But sometimes the senior technician was not immune from mistakes

because of their conditions of fatigue or because they forget when they never see the same thing but it all is the human factor is the main cause because of their experience was not written or recorded for any time there lived a similar problem see just where the problem and how to solution.

3.2. Strategy problem solving

It is expected that this expert system, the junior engineers, and technicians are also candidates to understand and know the problems that are common in the production of lamps, especially incandescent lamps without having to meet immediately with the expert. In addition, this expert system can also be used by senior technicians or other experts to document all his knowledge into the system, such as adding new data detection problem they know.

3.3 System Design

The Goal of an expert system that will be made in this final task is to handle problems that occur in the production of incandescent lamps, which will provide a conclusion where the origin of the causes of problems that occur along the repair solution based on the features that have been incorporated into the system. The program will provide conclusions error process or mechanical process that occurs in accordance with the existing problems, but before the user must answer a series of questions posed to the users get the conclusion. The conclusion contains a type error process or mechanical process, and solutions. So that the user's role is important, because to obtain the correct conclusion, the user must also answer questions displayed on the system correctly.

Users also must provide input and support on the system, which will then be processed by the expert (experts) to generate a new conclusion about the damage.

3.4 Knowledge Base

At this stage the created base knowledge matrix. The resulting data into the knowledge base or knowledge base is a form of science or pengelaman experts and the data obtained through direct observation plus the theories from books.

3.5 Inference Engine

One component of an expert system that is important is the inference engine (inference engine). Inference engine is a process or operation on the basis of knowledge or information obtained from an expert. An information can be utilized with maximum if the information is converted first into the rules (rule), so that in solving the problem much easier to do tracking or tracing to get the conclusion of the production process errors. In the inference engine are the mechanisms of thinking and analyzing a specific problem to find the answer.

3.6. Design Structure Database

3.6.1 Table tblUser

Usefulness of tblUser table is to store data from the administrator that consists of user names, passwords.

Table 3.6.1 : Table user

Field	Type	Width	Explaination
nama	Text	10	Nama user
passwd	Text	8	Password user

3.6.2. Table tblJenis

Usefulness of the table is to store data tblJenis questions about the type of error process, either the combustion process and mechanical process, which consists of NoJenis, Types.

Table 3.6.2 : Tabel jenis

Field	Tipe	Widt	Explanation
No_jenis	Char	4	Primary key
Jenis	text	75	

3.6.3 Table tblCiri

Usefulness of tblCiri table is to store data from identification error production, the data consist of NoCiri, Characteristics, Diagnosis.

Table 3.6.3 : Table tblCiri

Field	Type	Width	Explanation
NoCiri	text	4	Primary key
Ciri	text	75	

Diagnosa	memo		

3.6.4 Table tblMacam
Usefulness of the table is to store data tblMacam table is save kinds of damage in one section. The data table consists of NoMacam, and Macam.

Table 3.6.4 : Table tblMacam

Field	Type	Width	Explanation
NoMacam	Text	4	Primary key
Macam	Text	75	

3.6.5 Table tblRelasi1
Usefulness of tblRelasi1 table is to store data from a table tblMacam NoMacam who will liaise with NoJenis from tblJenis table. The data table consists of NoMacam tblRelasi1, and NoJenis.

Table 3.6.5 : Table relasi1

Field	Tipe	Panjang	Explanation
NoMacam	Text	4	
NoJenis	Text	4	

3.6.6 Table tblRelasi2
Usefulness of tblRelasi2 table is to store data from a table tblJenis NoJenis who will liaise with NoCiri from tblCiri table. The data table consists of NoJenis tblRelasi2, and NoCiri.

Tabel 3.6.6 : Table relasi2

Field	Type	Width	Explaination
NoJenis	Text	4	
NoCiri	text	4	

3.7 Flowchart
Flowchart or data flow diagram, is a chart depicting the logic flow of data to be processed on a course from beginning to end. Flow chart is very useful for programmers to prepare programs that complicated. Flowchart consists of symbols representing the functions of the program steps and the flow line or flowlines shows a sequence of symbols that do.

3.7.1 Flowchart Home Users
On the main menu the user of this expert system there are several menu options. Users are allowed to choose one from the menu that has been available. If you already selected it will appear selanjunya process. Figure flowchart "Home Users" can be seen in Figure III-1.

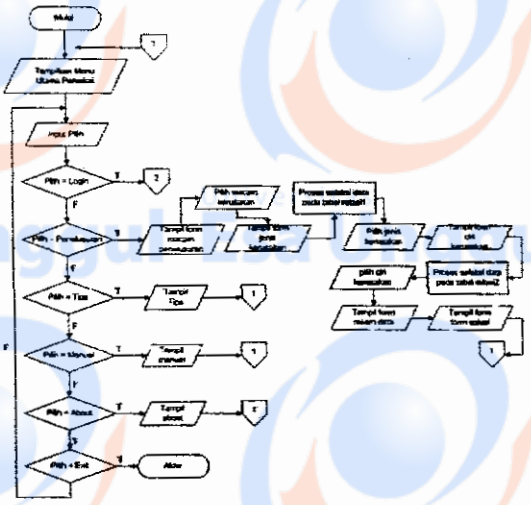

Figure III-1. Flowchart Main menu

3.7.2 Flowchart Login Menu
On the login menu describes the process of an administrator or expert must login and enter the admin menu. Figure flowchart "Login" can be seen in Figure III-2.

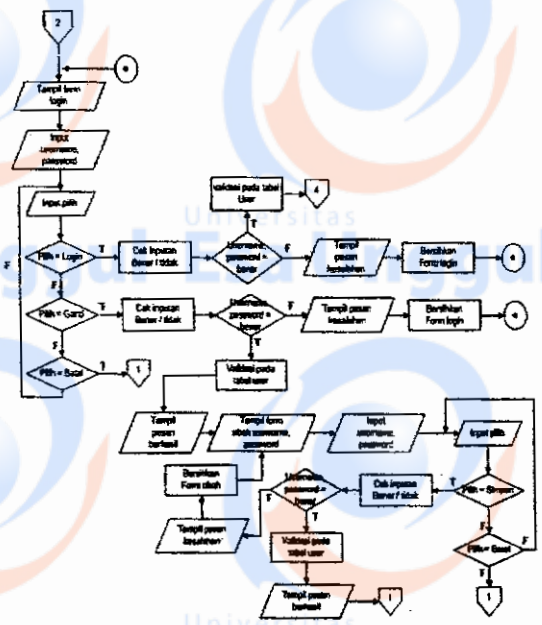

Figure III-2. Flowchart login menu

3.7.3 Flowchart Expert Menu
Flowchart expert menu explain the process of an administrator or a specialist to change the data in an expert system to deal with this incandescent lamp. Figure flowchart "Expert Menu " can be seen in Figure III-3.

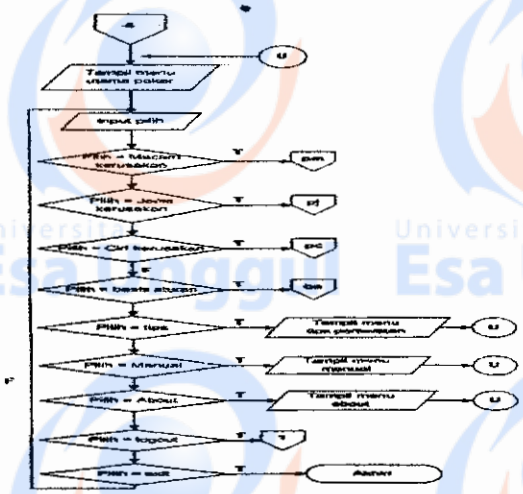

Figure III-3. Flowchart Expert Menu

Damage Types Menu 3.7.4 Flowchart kind of damage menu to explain the process of an administrator or a specialist to modify the data on the data types of damage in this expert system. Figure flowchart "kind of damage" can be seen in Figure III-4.

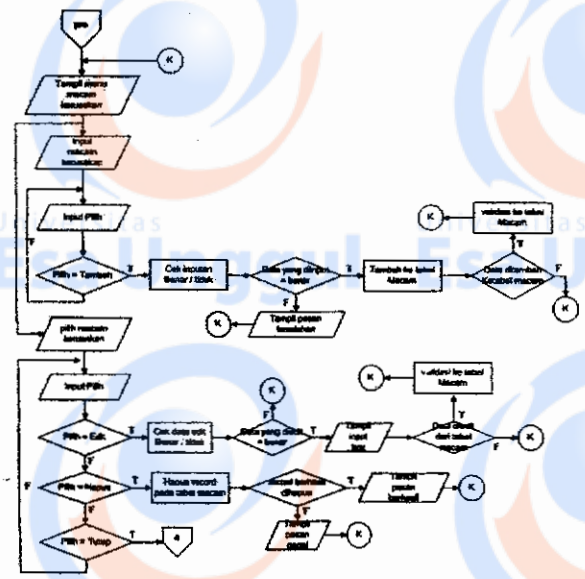

Figure III-4. Flowchart Kind of Damage Menu

3.7.5 Flowchart Type of Damage Menu Flowchart menu describes the type of damage to an administrator or a specialist to modify the data on the data type of damage in this expert system. Figure flowchart "type of damage" can be seen in Figure III-5.

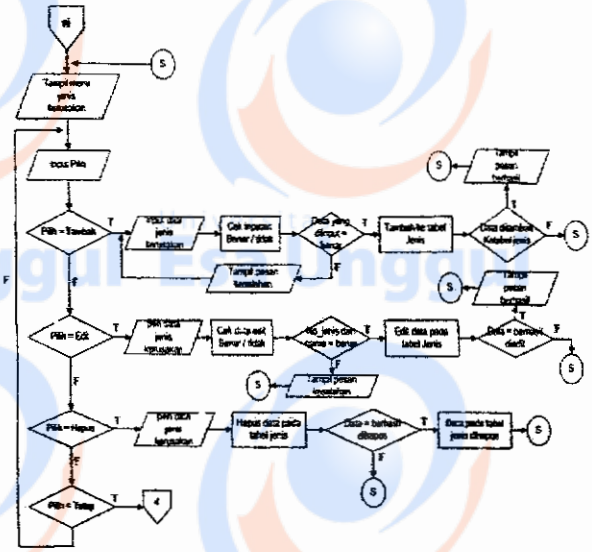

Figure III-5. Flowchart Type of damage Menu

3.7.6 Flowchart Feature of Damage Menu describes the characteristics of damage to an administrator or a specialist process to change data on the damage characteristics of data in this expert system. Figure flowchart "characteristic damage" can be seen in Figure III-6.

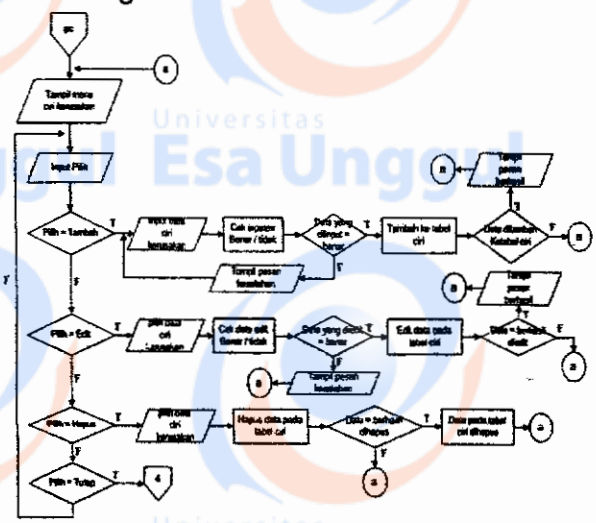

Figure III-6. Flowchart features of damage menu

3.7.7 Flowchart Rule Base Menu Flowchart menu added to this rule explains the process of an administrator or a specialist to modify the data on the data added in this expert system rules. Figure flowchart "add rule" can be seen in Figure III-7.

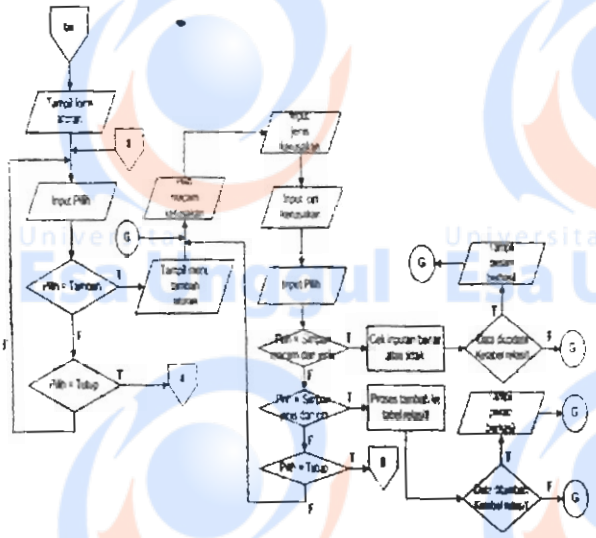

Figure III-7. Flowchart user menu

3.8 Software Requirements Analysis

3.8.1 General description of software
To achieve the goal of this developed a software. software is named "Story Problem Solving." Naming this indicates that the software can look for solutions to the problems that occur in the production process incandescent lamps. The function of this software are:

1. Assist junior engineers and technicians new to be able to easily find solutions to problems that are happening, so that the junior engineers and technicians just do not need a long time to be menanganimasalah that occurred in the production of incandescent lamps.

2. Assist training department in terms of cost, because to be a technician training required considerable time and cost is not small.

3.9 Software development

3.9.1 Design Interface Main Menu
Expert system is designed to have a simple interface. The design of this screen is useful to facilitate the user in using this expert system program to be able to find solutions to problems that occur in the production of incandescent lamps. By using the program Visual Basic 6.0, the interface is designed expert system has only one main interface and some additional interfaces as a facility to change the facts and other knowledge. The main interface can be seen in Figure III-8 below.

Figure III-8. Design Interface

3.9.2 The design of login menu interface

Experts login menu is used for or admin to login or go to the menu for admin or expert can manipulate the data. This form uses several components such as command buttons, labels, frames, and also the textbox.

Figure III-9. The design screen display menu login

Rule 3.9.3 The Design Rules of Display From
The Design Rules of Display Form aim to see or show the existing rules, this form can only be accessed by the admin or expert, not for the user.

Figure III-10. The design rules of display form

3.9.4 The design Rule of display form Add
Rule form add is intended to supplement the existing rules, then store them in the knowledge base. This form uses several components such as labels, combo box, list box, and also a command button.

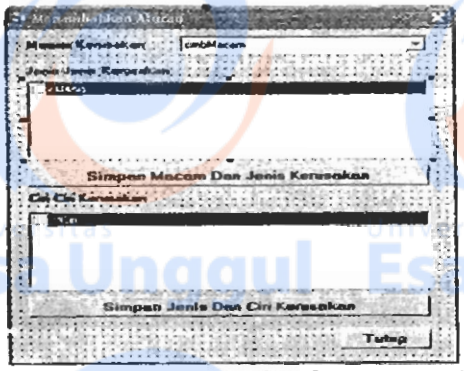

Figure III-11. The design form add rule

3.9.5 The design characteristic of display form Damage

The design characteristic of display form damage is designed to display and simultaneously to change the data such as adding damage characteristics, damage editing features, and also remove the characteristic damage to the base of knowledge. If the data that has been added, edited or deleted and then stored into the knowledge base. This form uses some components like label, textbox, msflexgrid, and a command button. And also data to connect to the database.

Figure III-12. The design of display form characteristic damage

3.9.6 Draft form looks like the type of damage

As in draft form looks like the damage characteristics, form the type of damage also to display and modify data such as delete, add, edit data. In this form there are several command buttons that function to process the edit, add, delete, save, close, and also to see the record data. Other components of the labels, text boxes, data, and msflexgrid.

Figure III-13. The design form the type of damage

3.9.7 Draft form looks like kind of damage

In this form there are several kinds of components like label, textbox, listbox and command button. This form serves to see all kinds of damage, add the fact if there are new facts that would like added to the knowledge base, or any facts you want to delete and who wish to update. III-14 As the picture below.

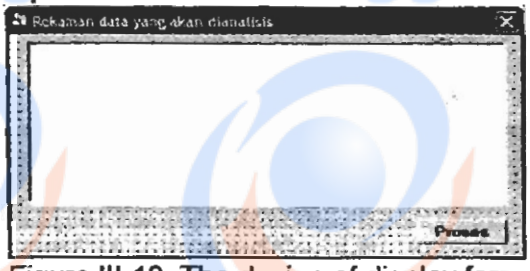

Figure III-19. The design of display form solution

4. IMPLEMENTATION AND TESTING

Implementation and testing expert system program. The program will be tested and implemented, with the hope of easy use easy and max for the users (junior engineers and technicians) that wish to study in finding a solution to the problems that occur processed manufacture of incandescent lamps. In this expert system program testing using several examples of cases in order to know the performance of the system as well as analysis of program results.

4.1 Implementation

Implementation is one of the stages in the manufacture of an expert system. Expert system created using Visual Basic 6.0 programming language, and database applications based Micrososoft Access 2003 stand alone. The result of the implementation of the programming

language Visual Basic 6.0 is as follows:

4.1.1 Main Menu Screen Display User
When the program first run of the first shown is the main menu screen, main menu is used only for the user. On the main menu screen the user there are buttons to link to another view. For users, there are buttons available search button and engine maintenance tips. Views from the Main Menu screen user program can be seen in Figure IV-1 below.

Figure IV-1. Display main menu user interface

4.1.2 Login Screen Display Menu
If experts wanted to enter the main menu of experts, first go through the menu to login. Login screen display menu program can be seen in Figure IV-2 below.

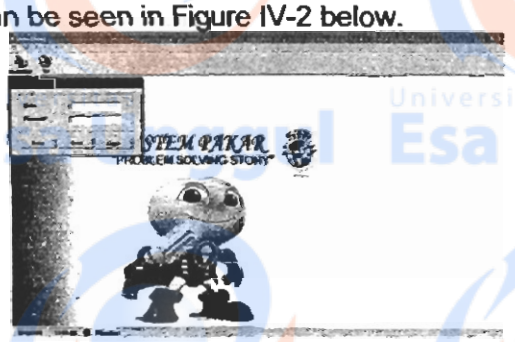

Figure IV-2. Display the login menu expert system

4.1.3 Main Menu Screen Display Specialists
Display the main menu is almost the same experts view the user main menu, only the difference is only in the key of knowledge. On the main menu the user, this button is not visible because only the main menu experts are there. This knowledge to the button menus like kind of damage that serves to see the data from the kinds of damage and also to change or add data, the type of damage that function to see data on the type of damage and also to change or add data, characteristics damage function to view the data from the characteristic damage and also to change or add data, and rules that serve to add rules. On the main menu also contains the user tips the same as the user's main menu. Display the main menu screen program experts can be seen in Figure IV-3.

4.1.4 Display Screen Menu Damage Types
In this menu an expert can add new facts such kinds of damage or change the kind of damage and remove the kind of damage that already exists, then the system will store data (nomacam, kind) if the experts choose the save button, to change or delete data experts to stay selecting from this menu. Display menu kind of damage can be seen in Figure IV-4 below.

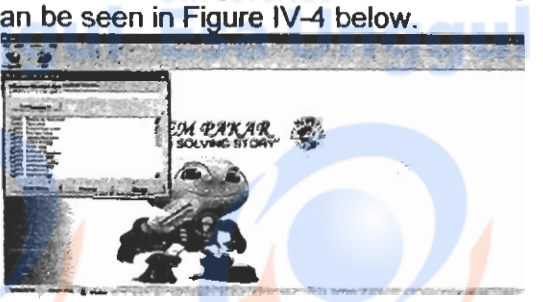

Figure IV-4. Display Screen Menu Kind of Damage

4.1.5 Display Menu Type of Damage
Menu type of damage is to display records from a table type, an expert on this menu can also add a new damage type, edit the type of damage, and remove the type of damage that already exists and then save it direcord no type, and type in the table type. Menu display this type of damage can be seen in Figure IV-5 below.

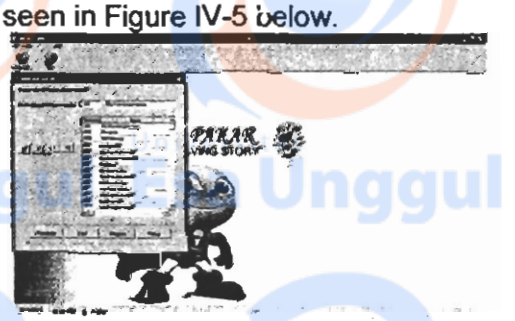

Figure IV-5. Display menu type of damage

4.1.6 Display Menu Characteristic of Damage
Display the menu is the same as the menu kind of damage, and damage type menu,

this menu can display records from the table features, expert on this menu can also add, edit, and remove and store the knowledge base. Display menu features this damage can be seen in Figure IV-6 below.

Figure IV-6. Display Menu Characteristic Damage

4.1.7 Display Menu Screen of Rule Base
Menu rule base is used by experts to add rules in the knowledge base. In this menu only displays the records from the table sorts, table type, and characteristics tables, each of which is connected by a table and table relasi1 relasi2. Display menu rule base can be seen in Figure IV-7.

Figure IV-7. Display menu rule base

4.1.8 Menu Display Rules of Add
In this rule add the menu will display the record kind of damage, record the type of damage, and record characteristics of the damage. Rules that will be added by experts selected on the basis of the kinds of damage, and experts add the type of damage and damage characteristics and store them in the knowledge base. This rule adds menu display can be seen in Figure IV-8.

Figure IV-8. Display menu add rule

4.2 Test Cases

4.2.1 Hardware and software specifications
This program has been tested on a laptop with hardware specs as follows:
Processor: Intel Pentium Dual Core T4300 @ 2.1 Ghz
Memory: 2 GB DDR3
VGA: NVidia GeForce G210M
Harddisk: 320 GB
Software used in trials of hardware above have the following specifications:
Operating system: Windows XP Professional SP3
Application program: Microsoft Visual Basic 6.0
Database Applications: Microsoft Access 2003

4.2.2 How to Run programs Expert System Search
The test program was conducted to determine whether the program created is in conformity with the purposes of this expert system. Here is an example of operation of the program will search an expert system to guide users in the use of this expert system program. The test cases for expert system program that used this rule is the rule to 99. where this rule has been attached in chapter IV

1. The first step
In the first step appears choices kinds of damage, because the authors wanted to examine the case of the rule to a 9 then the choice is M017 "Filament off" (see Figure IV-9).

Figure IV-9. Display screen search menu variety

2. The second step
If the selected range of damage from the rule to 99 (M0017 "Filament off") then nomacam same field in the table relation 1 nojenis field so that the process continues when the user pressed the continue button on the next search is the search type will appear as the following picture (figure IV-10).

Figure IV-10. Display screen type search menu

3. The third step
In accordance with the rule to 99, then the selected nojenis J031 ("Filament off to the right"), then the same field with the field nojenis nocin relations on the table so that the process continues when the user pressed the continue button on the next search is the search feature will display the image as follows (image IV-11).

Figure IV-11. Display screen search menu features

4. The fourth step
In the fourth step is chosen nociri C099 ("the right of the suction needle too off") then the field in the table nociri characteristic has been chosen so that the process continues when the user pressed the continue button on the next search recorded data will appear like the following picture (figure IV-12 .)

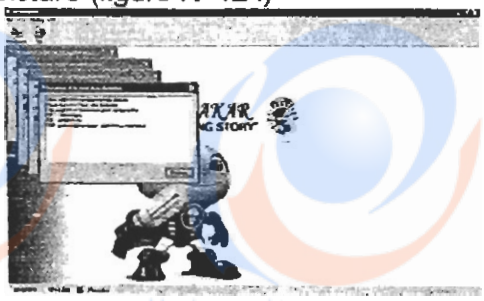

Figure IV-12. Display screen data records

5. The fifth step
Because the selected nociri namely C099 ("the right of the suction needle too off") then the diagnosis will be known as field diagnostics and field nociri is a table that is characteristic table. Suggestions or solutions can be known if the field has been selected nociri, such as images that appear below (figure IV-13).

Figure IV-13. Display screen solution

4.3 Advantages And Disadvantages Expert System Program

4.3.1 Excess program
The advantage of this expert system programs, among others:
1. This expert system has a simple interface, so users can easily use this program without having to do training first.
2. With the existence of this expert system, it will be easier to detect problems and find solutions to problems that occur in the production of incandescent lamps.
3. This expert system can be a

documentation and knowledge base for an expert in the field of manufacturing incandescent lamps.

4.3.2 Lack of programs

Lack of programs owned by this expert system, among others:

1. Due to time constraints and capabilities, expert systems have not been able to display images and video data to users more clearly understand the problems that exist in production and is easier to handle.
2. Because the database used Microsoft Access 2003, then the expert system program is only a stand alone course, the database can not be stored on the server to be shared to the client computer.

5. CONCLUSION & SUGGESTIONS

5.1.Conclusion

The result of an expert system to solve the problem of raw materials wasted in incandescent lamps, has a knowledge base that represents the system knowledge and the willingness of experts in the manufacture of light with both a user interface as well as experts, easily changed through the user interface expert, forward method chaining.

5.2 Suggestions

In a further development, will be the interface to display images and video so that the user is more easily understood for solving problems in the production of incandescent lamps, design interface expert system more user friendly by improving visualization, can be updated (update) periodically, so that existing data be always in accordance with the development of light manufacturing. And User interface should be revised to make it look more attractive and provided additional menus.

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ANALYSIS OF THE APPLICATION KNOWLEDGE MANAGEMENT SYSTEM IN HIGHER EDUCATION (THE CASE OF ESA UNGGUL OF UNIVERSITY)

Riya Widayanti

Esa Unggul University, Jakarta, INDONESIA
riya.widayanti@esaunggul.ac.id

ABSTRACT

In an era where knowledge is increasingly seen as an organization's most valuable asset, many firms have implemented knowledge-management systems (KMS) in an effort to capture, store, and disseminate knowledge across the firm. Concerns have been raised, however, about the potential dependency of users on KMS and the related potential for decreases in knowledge acquisition and expertise development (Cole 1998; Alavi and Leidner 2001b; O'Leary 2002a). The purpose of this study, which is exploratory in providing information about knowledge management, providing information about the stages of development of knowledge-management system, along with such tools, as well as provide input to higher education will be the role of knowledge to improve individual and organizational values.

Keywords : knowledge management

1. INTRODUCTION

Knowldege management into areas that are important in the learning process of an organization. Knowledge possessed by the organization must be able to provide progress for the organization itself. In order for organizations to survive, it is required for every person who is in knowledge sharing organization. That requires strong management for knowledge is rooted in every individual in the organization and do not go away with the support infrastructure for the dissemination of information within the organization.

Development at present to encourage the increasingly rapid changes in all spheres of life, consequently accelerating effects of globalization and information technology development is very fast. This condition is clearly caused by the need for new ways in dealing with all that happened to survive. Emphasis will be increasingly important quality of human resources (HR) is one vague response in addressing these changes, and this of course requires efforts to enhance and develop human resources.

Accordingly, the role of science became more prominent, because only with knowledge of all the changes that occur can be addressed appropriately. This means that education plays an important role in preparing qualified human resources and competitive. Tight global competition, particularly in the economic field has made the business organizations to rethink their business management strategies, and quality human resources with the mastery of knowledge become an important choice that must be done within that context.

In recent years, organizations have increasingly realized that one of their most valuable assets is the knowledge that is developed internally and possessed by individuals within the organization. Cameron (2000, 3) similarly noted, "Knowledge is power, but without the adequate management of that knowledge, the consequences for [organizations] could be devastating." Not surprisingly, technology is viewed as the key enabler to effective knowledge management. Early technological strategies focused on the use of inteligent systems, but these strategies have not been terribly effective (Duchessi and O'Keefe 1992). More recently, corporate efforts are focusing on a class of technologies referred to as knowledge-management systems (KMS) (Leech and Sutton 2002).

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1.1 The Purpose of the study

Provide an overview of knowledge management, providing information about the stages of development of knowledge-management system, along with such tools, as well as provide input to higher education will be the role of knowledge to improve individual and organizational values.

1.2 Scope of Study

In this study only discusses the role of knowledge management within the organization, describes the stages to develop knowledge management system, and provides a description of the application of knowledge management systems within an organization.

2. THEORETICAL BACKGROUND

Knowledge management becomes one of the necessary tools for modern day organizations. Universities also have to pay intensive attention to knowledge management projects in order to accomplish their objectives and continue the ongoing learning process. The time period is very important and should be organized and developed for upgradable standards. In universities where research and development studies play an important role, knowledge management has a very critical position in the process (Mikulecka & Mikulecky, 2000). Knowledge is the main asset of universities; accordingly, universities play the main character to spread and manipulate knowledge for the society and are the key factor for implementing strategies. In order to reach their missions and social functions, universities should have ef ective use of knowledge management (Conceicao Heitor, & Oliveira, 1998; Oosterlinck, 2002). The new ideas and suggestions are important in order to develop the knowledge management tools; however, there are not enough studies on this important issue (Agrawal, 2004; Kidwell, Linde, & Johnson, 2000; Rowley, 2000).

According to strategic management literature, it has been discussed that resource based implementation has been more ef icient and unique for the success of organizations and that organizations should focus on this strategic and valuable technique (Connor, 2002; Prahalad, & Hamel, 1990; Zack, 1999). Knowledge, today, is the most important and strategic resource in our environment (Kogut, & Zander, 1996; Nonaka, & Takeuchi, 1995; Wijetunge, 2002). "Knowledge" can be defined as "purposeful knowledge" (Davenport, & Laurence, 1998; Yahya, & Goh, 2002). Organizations should expand their resources to organize data in useful format. However, knowledge can only be reached if and only if organizations expend additional resources to discover patterns, rules, and contexts where the knowledge works. Knowledge can also be identified as the role of converting data to knowledge within the context of environment and experience. Knowledge has more critical function in decision making process, more than resource and data. Knowledge can be defined as accurate and non-accurate knowledge. Accurate knowledge can be described as formal-systematic knowledge where it can be easily explained and message transferred to the recipient. Whereas non-accurate knowledge is where the message is difficult to explain, transfer, and identify. It can be described in different ways such as talents, senses, meanings, values, etc. The new organizational identity can be formed when the individuals' accurate and non-accurate knowledge combine each other in organizations (Nonaka, & Takeuchi, 1995; Nonaka, Toyama, & Konno, 2000;Yim, Kim, Kim, & Kwahk, 2004). Knowledge is the most decisive organizational resource in the organizational structure of institutions which should be used and organized systematically in order to be efficient and effective. In order to manage knowledge, effective planning and programming is needed. The management of knowledge is the combination of important topics such as explaining, obtaining, developing the knowledge, the use of knowledge in an ef ective way and spread of knowledge in the organization. Knowledge management is the time period where organizations share common situations they have to adapt themselves in highly competitive and changing environment (Beijerse, 1999; Demarest, 1997; Perez, & Pablos, 2003).

Knowledge management can be defined as the organizational "efforts designed to (1) capture knowledge; (2) convert personal knowledge to group-available knowledge; (3) connect people to people, people to knowledge, knowledge to people, and knowledge to knowledge; and (4) measure that knowledge to facilitate management of resources and help understand its evolution" (O'Leary 2002a, 273). Knowledge-management systems (KMS) focus on bringing together the explicit knowledge that exists in organizations, the know-what that can be easily documented and shared (Sambamurthy and Subramani 2005), such as basic definitional information (e.g., technical terminology), procedures for performing tasks (e.g., audit checklists), guidelines for interpretation (e.g., GAAP guidance), and previous problem resolution examples (e.g., client memos outlining solutions to issues raised)—information often referred to as "three-ring binder" knowledge (Dilnutt 2002). As noted by Alavi and Leidner (2001b), KMS initially contain these types of explicit knowledge and are later expanded upon with a body of tacit knowledge that continues to grow as users add their interpretations of the explicit knowledge to the system's knowledge base. Tacit knowledge is the know-how that is difficult to document and emerges from experiences (Sambamurthy and Subramani 2005). Alavi and Leidner (2001b) further note that access and/or assimilation of the explicit knowledge in such systems is a necessary precursor to effective use of the accumulated tacit knowledge in the system. This is consistent with recent findings in the knowledge-based system (KBS) literature showing that novice users gravitate toward explicit knowledge support while experienced decision makers gravitate toward available tacit knowledge support (Arnold et al. 2006). The use of KMS to support an organization's professionals in their decision making through organizational knowledge creation is a double-edged sword.

The process of changing data into information according to Daven and ports in the book of Paul L. Tobias done in several stages: Contextualized: understanding the data coliected, Categorized: understand the unit of analysis or a key component of data, Calculated: mathematically analyze the data statistically, Coreccted: eliminate errors from data Condensed: summarize data in a more concise and clear.

Knowledge can be classified along four key dimensions: (1)type, (2) focus, (3) complexity and (4) perishabililty over time, as shown in figure ..

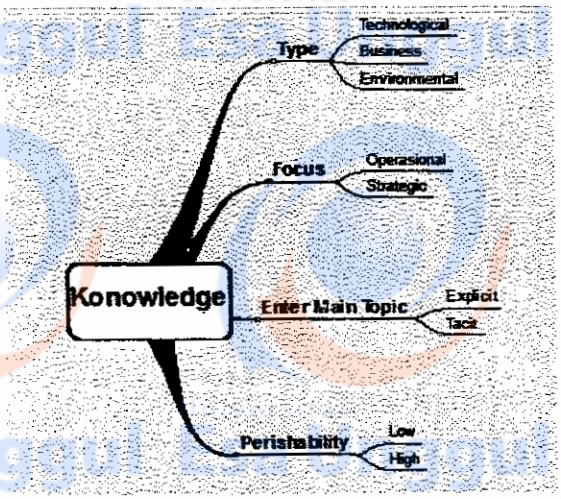

Figure 1. A map of some key facets of knowledge

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Table 1 Comparing Tacit and Explicit Knowledge

Charasteristic	Tacit	Explicit
Nature	Personal, context-specific	Can be Codefied and Explicated
Formalization	Difficult to formalize, record, encode, or articulated	Can be codified and transmitted in systematic and formal language
Development	Developed through aprocess of trial and erroe encounterd in practice	Developed through explication of tacit understanding and interpretation of information
Location	Store in head of people	Stored in documents, databases, web pages, email, chart, etc.
Conversion processes	Converted to explicit through externalization that is often driven by metaphor and analogy	Well supported by existing IT
IT Support	Hard to manage, share, or support, with IT	Well supported by existing IT
Medium Needed	Needs a rich communication medium	Can be transferred through conventional channels

The basic process of knowledge management, are:

1. Knowledge acquisition
   The process of development and creation of insight, skills and relationship.
2. Knowledge Sharing
   Disseminating and making available what is alredy known.
3. Knowledge Utilization
   Learning is integrated into the organization.

Knowledge management is a complex activity that cannot deliver business impact without a concreat plan(Tiwana, 2008). The 10-step KM road map that will guide you through strategizing, desining, developing, and implementing a KM-initiative-with a company in mind. Table ... describes how each of these steps is logically arranged.

Table 2 The 10-step KM Roadmap

Part	Step
Phase 1:	**Infrastructural Evaluation**
I	Step1. Anayzing existing infrastructure
	Step 2. Aligning KM and business strategy
Phase 2:	**KM System Analysis, Design, and Development**
II	Step 3. Designing the Km Archetecture and integrating existing infrastructure
	Step 4. Auditing and analyzing existing knowledge
	Step 5. Designing the KM team
	Step 6. Creating the KM blueprint
	Step 7. Developing the KM system
Phase 3:	**Development**
III	Step 8. Deploying with result-driven incrementalism(RDI) methodoly
	Step 9. Leadership issue
Phase 4:	**Metric for Performance Evaluation**
IV	Step 10. Real-option analysis of return and performance

3. RESEARCH METHOD

This study uses literature to present the data either through text books, journals and internet. Descriptive research is a method of research that attempt to describe and interpret the objects in accordance with what the. This research is also often called non experimental , because in this research study does not control and manipulate variables. Descriptive research is generally done with the main objective, namely to systematically describe the facts and characteristics of the studied object and subject as appropriate.

4. RESULT AND DISCUSSION

Esa Unggul University was founded in 1998, ranging from economics and engineering faculties until now into 8 faculties with 23 departments. The more the organization is then required to compete in the digital age. One of the major in business education is to maintain the quality of teaching, research and community service, all of this has become a milestone in every good work program's strategic plan as well as tactical and operational plans. Fortunately compete then in 2006 the university was building a massive infrastructure, classrooms equipped with computers and LCD projectors, on the other hand it is to upgrade the computer in all units, with a joint venture with one computer vendor, with the added value could enjoy the warranty for 3 years.

Summary of knowledge management systems that have been run and used in Esa Unggul contained in the following table:

Table 3. List of knowledge management applications at the University Esa Unggul

Aplication Name	Technology	Database	Unit Manager	Active	Status
Hybrid Learning	moodle	MS SQL	Learning Support Dept	2007	Active
Digital Library	Web – PHP	MySQL	Library	2009	Active
Blog Civitas Esa Unggul	Web – PHP	MS SQL	Public Relation Dept	2010	Active
E-Paper	Web – PHP	MS SQL	Public Relation Dept	2010	Active
Fasilkom Learning Center	Web	MS SQL	Computer Science Faculty	2009	Active

Hybrid Learning
Applications Hybrid Learning is an application to support teaching and learning process ata the Universitas Esa Unggul. Diterapkan pada tahun 2007, kebijakan awal dilaksanakannya dengan membentuk tim penilaian modul perkuliahan, dimana bertugas

Digital Library
Is an application that supporta the library unit in order to manage the books of the university library collections.

Blog Civitas Esa unggul
Captures information and aspirations of staff and lecturers, as well as a forum for sharing information from all fields

E-Paper
Presenting the report on faculty and student research

Fasilkom Learning Center
Applications developed solely by students Faculty of Computer Science with the aim to facilitate the task of storage either individual or group, easy access to good software is related to the lecture or not, in order to enrich scholarly in the field of information technology.

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Although he has developed several knowledge management applications within the university, but there are some activities that have not been well documented, but benefit from these activities is to support business processes and even to contribute to all business units.
The activities are as follows:
1. Coordination Meeting

Meetings are conducted once every month, where the participants are the Dean of the Faculty, which discussed matters related to academic, administrative and student affairs. Report of activities of faculty and faculty development became the main topic.

2. Coffee Morning
Held every Tuesday, followed by the entire faculty, where the purpose of this activity is to share the latest information. Brainstorming session becomes an arena for every department to be able to share information.

Analysis
Application of knowledge management was conducted in a different time with different KM team, the following summary of the implementation of knowledge management applications.

In the implementation of KM applications have a variety of approaches:
Tool used in determining KM platform is document management system. Document management systems make vast ampunt of document, such as product literatur, electronic form, specifications, and correspondence, easily accessible and adaptable throug the web. The systems often include workflow functionality that allows documents to be intelligently routed to select, relevant employees.

In addition, this knowledge management applications need to be made of elements to search, indexing and retrieving, as can be accessed according to the desired topic. Currently, the application of knowledge management systems are still at the stage of collecting and distributed immediately, not stored in a database. Have not done the scientific grouping, these applications still stand alone, not integrated.
Selection of team knowledge management, because stand-alone application and have a working unit different then the KM team structure is also different. Hybrid learning focus on the management of instructional materials and manage teaching activities. Blogs and e-paper applications that are different but managed by a unit of the PR Department, its use was different, the blog to accommodate the aspirations of staff, while e-paper to accommodate the research of faculty and students.

In a further development of KM can be started from the KM strategy plan which is aligned with business strategy, grouping the topics of science and knowledge. Development of KM team, including expertise, the administrator who controls the KM tools and establishing policies for the implementation of KM.

Lack of socialization and communication both within the university, became one of the causes of KM application is not going well. The application of complex systems knowledge management will be useless if not used by the community. Because it needs the right strategy to motivate community members to use the system.

The transformation of this knowledge depend on the mentality and culture for each individual so that the actualization of the activity in the organization will be based on new confidence as a collective agreement (member organizations work with the new spirit.) Based on mental model of a mutually agreed upon organization they then transform this knowledge into strategies, programs, systems / new document as a guide to work all members.

The scheme proposed the application of knowledge management systems:

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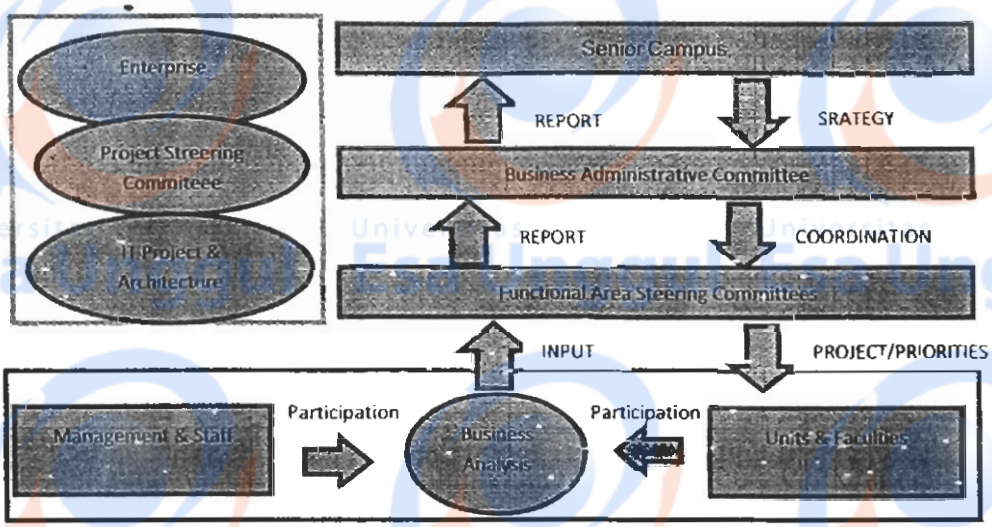

Figure 2. The scheme proposed the application of knowledge management systems

Contribution of units and faculty are as follows:

1. Identiy unit issue & opportunies
2. Subject matter expertise to support analysis
3. Participate in focus groups and projects
4. Support ongoing business processes

Contribusion of management and staff:

1. Identify opportunities to maintain/ improve systems
2. Provide technical expertise to analysis of request
3. Parcipate in project team
4. Support Solution on ongoing basis

Funcional Area steering commitees capable of:

1. Analyze, coordinate, prioritize and apporve request from units stakeholders
2. Understran, communicate, manage impact of various initiatives to functional customers

Business Administrative Committee capable of:

1. Define Strategis administrative priorities
2. Develop/promote broader outlook to ensure strategic alignment and customer group focus
3. Understans and help realize synergies for initiatives with cross-unit impacts

Senior campus committee capable of:

1. Provide strategic campus priorities and major funding allocations
2. Make appropriate decisions as required consistent with their accountability

It is essential in knowledge management is the creation of a conducive learning environment, so that the workers be motivated to continue learning, taking advantage of information or knowledge provided by the business, and develop individual knowledge and ultimately willing to share the new knowledge gained to become knowledge organization, or in other words, knowledge management focus for productive human being in it separately develop the knowledge and willing to share the knowledge he had.

5. CONCLUSION

Organizations business and educational must focus on creating and developing knowledge workers that can succeed and excel in a competitive, global environment. Business organizations must identify the knowledge dimensions necessary to create and sustain a competitive advantage, as educational institutions must identify the corresponding knowledge dimensions necessary to provide qulity instructional program that develop students into knowledge worker. Additionally, organizations needs pepople commited to lifelong learning in order to sustain and improve their knowledge base.

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PROCEEDING

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APPLIED DYNAMIC SYSTEM APPROACH IN CAPACITY PLANNING AT PT. SCC

Nofi Erni, M. Derajat Amperajaya, and Binsar Peter Pakpahan

Industrial Engineering Department, Universitas Esa Unggul, Jakarta, Indonesia
nofi.erni@esaunggul.ac.id

ABSTRACT

This paper presents a system dynamic analysis to calculate capacity required of the power cord production plans in PT. SCC. This research motivated by the problems faced in production floor where there is a shortage of available capacity to respond consumer demand. The purpose of this study was to calculate the capacity production plans and to find out the ratio between the available capacity with the required capacity. The simulation in this study using a model of dynamic systems with Powersim applications. In order to make a comparison of the result are used the RCCP method. The research shown result of capacity calculation, using system dynamics ts are not much different from the RCCP method, where the available capacity is always less than the required capacity. Based on Master Production Scheduling, shown that it has shortage of capacity at almost all stations work the production floor. The best approach is calculation using Resource Profile, which is total required capacity for October 2009 - Maret 2010 as 8.442 hours and the capacity shortage as 1.340 hours or equal 15,8%. Through increasing working time to be 3 shift work hour per day at each work station, the available capacity is enough to met customer order.

Keywords: Capacity Planning, RCCP, Dynamic System, Powersim

1. INTRODUCTION

A dynamic system approach is considered quite appropriate in representing the real problem. Some advantages of dynamic system are the availability of a work frame for causal loops, the ability to create a structural model for the managerial inputs and to simulate these through a quantitive computer procedure (Sterman, 2004). System dynamics introduced by Forrester (1961) indicates that some systems may be modeled by level and rate variables. Forrester stated the system dynamics as the study of information feedback characteristics of the industrial activities to show how the organization structure, amplification (in policies), and time delay intervals influence an enterprise (Chang et al. 2006).

Capacity is the amount of work that can be done in a specified time period. Capacity is defined as the capability of a worker, machine, work center, plant, or organization to produce output per period of time (Sheikh, 2002). The intent of RCCP is to convert MPS into resourcess needed to carry out the plans. The capacity requirement of MPS can be estimated using Capacity Planning using Overall Factors, Bill of Labor and Resources Profile (Forgarty, 2005)

PT. SCC is a company engaged in the cable industry. This company produces various types of cables such as electrical cables, telephone cables, wire armature and other products. The main costumer is PT. PLN which is a state enterprise responsible for electricity will need by all the people of Indonesia. The increasing demand for electricity by the public would directly impact to the needs of the power cord, this relates directly to this power cable company which is one of the major suppliers of electrical cable for PT. PLN.

In order to accordance the wire cords that produced, must consider the planning of the production capacity of each incoming orders. In the capacity planning process should consider how many products must be produced and how many the maximum products that company can produce. Capacity planning seeks to integrate the

factors of production to minimize costs of production facilities, to control the production of which is to see whether production operations are in accordance with established plans. and taking into account economic

Main problems faced by the company is not unbalance the need for capacity with the availability of capacity on the production floor. Therefore, often there is a shortage or excess production capacity. This is because the number of planned production does not match the available capacity. Therefore it is necessary for the MPS validation test to determine whether the available capacity on the company can meet the required capacity, and therefore needs to be calculated with RCCP method to find out more details about the problem.

The purpose of this study are to analize production process, calculate available capacity and required capacity by using RCCP and System Dynamic Approach.The scope of research are are capacity production conducted on production plans to produce NYFGbY and NYY cable for October 2009 - March 2010.

2. RESEARCH METHOD

Steps in doing research can be seen in the following figure:

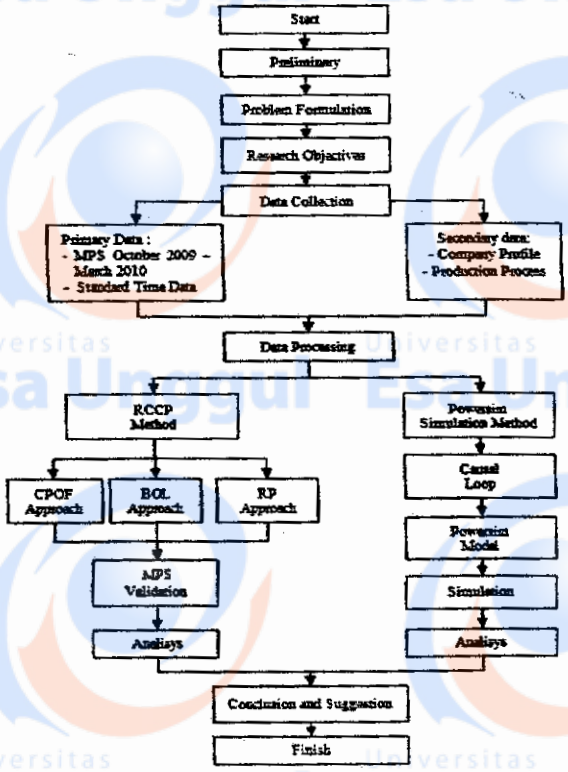

Figure 1. Research Methodology

3. RESULT AND DISCUSSION

Production process of cable NYY and NYFGbY through several step, there are stranding, insulation, cabling, inner sheating, armouring, outer sheat, testing and packaging. Each of process are the works station to calculate the capacity.Availability capacity as calculated capacity is sum of total clock hours available. It is determined by utilization and efficiency factors are used. Total available capacity to produce cable in PT SCC as 13.417 hours for October 2009 – March 2010.

3.1. RCCP method

The availability capacity are base to verify Master Production Scheduling. Based on Rough-Cut Capacity Planning (RCCP) as a medium range planning, the capacity requirements of a particular MPS can be estimated. The result of capacity required and capacity available calculation using RCCP as follow.

a. Capacity Planning using Overall Factors (CPOF)

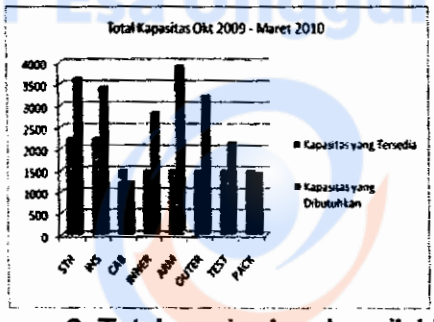

Figure 2. Total required and available capacity using CPOF

CPOF use historical proportion to calculate required capacity, for October 2009 to March 2010 the total capacity required 21.805 hours and the shortage capacity as 8.387 hours (38%). It can be concluded that in general the available capacity is smaller than the required capacity. The excess capacity are only in cabling and packing workstations. It is necessary to increase the number of machines in stranding, armouring and outer sheat work

stations, where the production process at those work stations does require quite a lot of time related to the complexity of the process to be performed, thus requiring accuracy and speed accurate machine.

b. Bill Of Labor Approach (BOL) Analysis

Not vary much different with the CPOF, the available capacity is smaller than the required capacity. BOL using standar time to produce as basic calculation capacity. The excess capacity only in cabling and packing workstations.

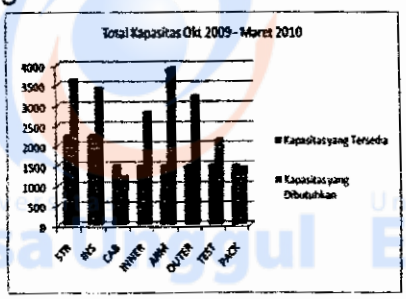

Figure 3. Total required and available capacity using BOL

With the application of the maximum amount of shift is 3 shifts, some work stations are experiencing shortages of capacity is expected to be fulfilled because the comparison is not too high. As in the work station testing, if the addition of shift applied, the required capacity can be met.

c. Resources Profile (RP) Analysis

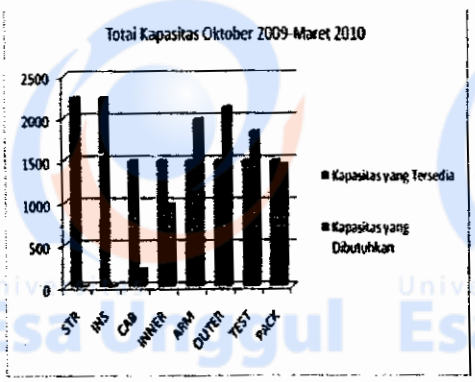

Figure 4. Total required and available capacity of using RP

Calculation of total capacity required as 8.442 hours and the shortage capacity as1.340 hours (15,8%).The result shown, the RP is the best method to calculate and verified the MPS. Working machine time have been operate for 21 hours in 3 shifts / day, and at cabling and packaging work stations operate for 14 hours in 2 shifts / day, where in one shift time is 7 hours and 1 hour is used to break and the hour break the machine is not operating. For the utilization and efficiency are made flat rate every month. In order to meet the total capacity required, the company can increase the number of shifts in cabling and packaging. With the application of the maximum amount of shift is 3 shifts, some work stations are experiencing shortages of capacity is expected to be fulfilled because the comparison is not too high. As in the work station testing, if the addition of shift applied, the required capacity can be met. Further action is to increase the number of machines. The addition of the number of machines is not necessary at all stations. From the data obtained, the work station which requires the addition of machines are Stranding, Armouring and Outer Sheat work stations, where the production process at those work stations does require quite a lot of time related to the complexity of the process to be performed, thus requiring accuracy and speed accurate machine. Meanwhile, work stations which have excess capacity can be maintained because of the estimates obtained, the available capacity could cover the required capacity.
much greater capacity than the capacity available so that the MPS is planned by the company are not eligible.

3.2. Simulation with System Dynamic

System dynamic espoused and settled for the influence diagrams or the so-called signed directed graphs of relationships between variables, with effect that the influence diagrams couldbe drawn at several levels of detail in more aggregated forms, and it came to be known as the causal loop diagrams. With the graphical implification of the influence diagrams, formal techniques could be developed for formulations sales structure (figure 5).

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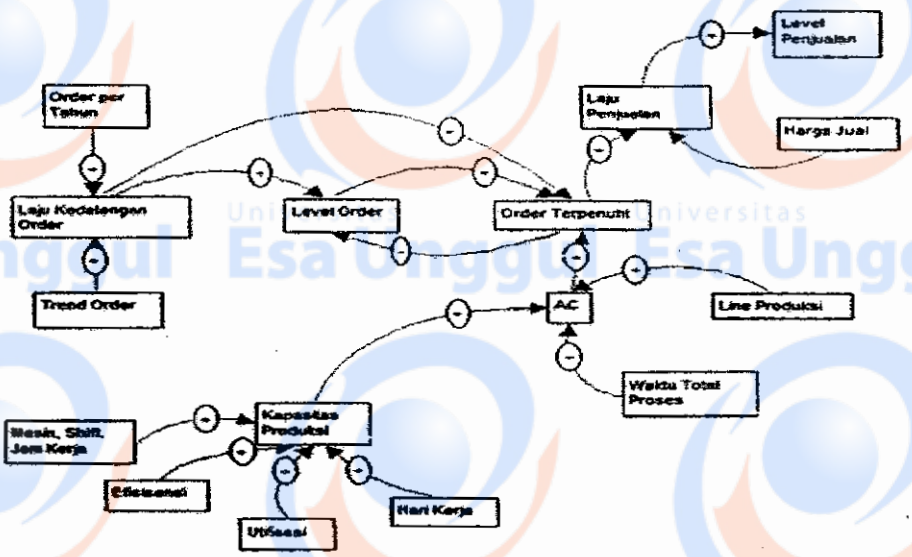

Figure 5. Causal loop diagrams Production Sales Structure

Causal loop Relations:
Incoming Order Rate is affected by Order Per Year and Trend Order, whereas Incoming Order Rate affecting Order Level and Fulfilled Order. Order Level affecting Fulfilled Order which if Order Level that come become greater, then the Order that flow into fulfilled Order will be equal with Order Level, and Fulfilled Order affected by Available Capacity because Fulfilled Order will be fullfilled if the same as Available Capacity. If Fulfilled Order reduced then Level Order will be reduced as well. Mean while Available Capacity affected by production capacity, production line, dan total time production. Production capacity affected by number of machine, Shift, work hour, efficiency, utility, and work day. While fullfiled Order will be affecting sales rate, which sales rate affected by price which will be affecting rate sale.

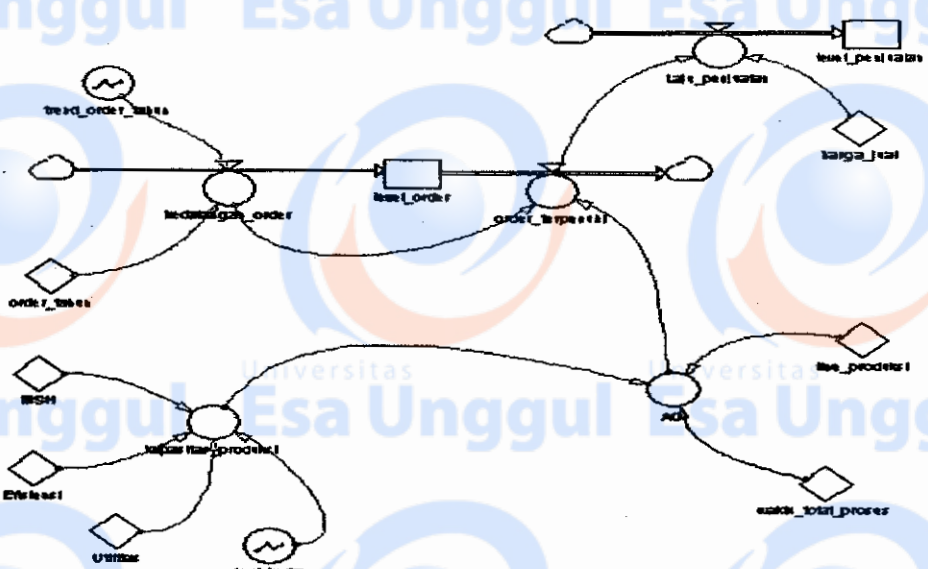

Figure 6. Production Capacity Flow Chart

Relationship between arrival and order fulfilled for 6 months can be seen that the fulfilled order always smaller than the value of the arrival order (Figure 7).

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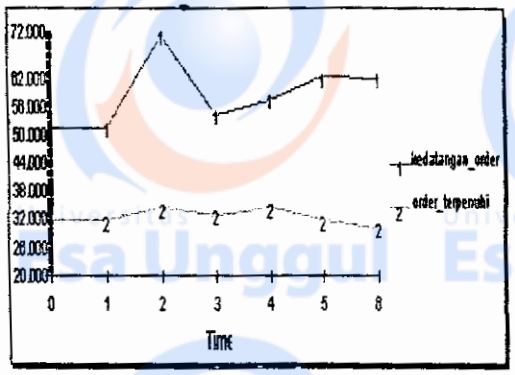

Figure 7. Relationship between the arrival with Order Fulfilled

The simulation results using Powersim as shown in Table 1. Order arrival is always greater than the fulfilled Order (available capacity). This shows that the company can not meet the required capacity in the production process. From Order terpenuhi will flow to the company's sales results for each month. These results are obtained by multiplying the number of Fulfilled Orders by selling price per meter cable.

Table 1. Comparison of Arrival with Fulfilled Order, and Sales Rate

Time	kedatangan_order	order_terpenuhi	AC	Laju_penjualan
0	51.609,66	31.842,09	31.842,09	477.631.292,29
1	51.609,66	31.842,09	31.842,09	477.631.292,29
2	71.512,13	34.736,82	34.736,82	521.052.318,86
3	54.596,83	33.289,45	33.289,45	499.341.805,58
4	57.512,02	34.736,82	34.736,82	521.052.318,86
5	62.514,63	31.842,09	31.842,09	477.631.292,29
6	62.190,72	30.394,72	30.394,72	455.920.779,01

Unit :Order (meters), sales (IDR)

From the simulation results obtained that the available capacity is always smaller than the orders came. The available capacity can not cover the needs of capacity. Also seen that the orders are fulfilled with available capacity. In November 2009 the difference is high where the orders that come are the highest order in the analyzed range of six months. That enough factors affecting this capacity shortage that is imposed by the company's shift of only 2 shifts. In addition, the working day also affects the availability of capacity. Thus, PT. SCC can anticipate the causes of these problems and to take steps in anticipation for the rate of sales for the coming months to increase.

The simulation results, it can be seen the available capacity is smaller than the required capacity. Such as the results obtained by using the Simulation System for stranding and insulation workstations have the same value with the results obtained by using the CPOF method. The results showed that the available capacity is always less than the required capacity.

Table 2. Available Capacity versus Capacity Needed In Stranding

Time	Kap_yg_tersedia	Kap_yg_dibutuhka
0	361,75	520,93
1	361,75	520,93
2	394,63	721,82
3	378,19	551,08
4	394,63	580,51
5	361,75	631,00
6	345,30	627,73

Table 3. Available Capacity versus Capacity Needed in Insulation

Time	Kap_yg_tersedia	Kap_yg_dibutuhkan
0	361,75	490,29
1	361,75	490,29
2	394,63	679,37
3	378,19	518,67
4	394,63	546,36
5	361,75	593,89
6	345,30	590,81

From the results, it can be seen that the simulation results obtained show that the available capacity is smaller than the required capacity. Thus the results obtained by using the simulation system for Insulation work station is not much different from the results obtained by using BOL. The results showed that the available capacity is always less than the required capacity is almost the same value between the simulation system using BOL.

Table 3. Available Capacity vs. Capacity Needed in Packing

Time	Kap_yg_tersedia	Kap_yg_dibutuhkan
0	361,75	206,44
1	361,75	206,44
2	394,63	286,05
3	378,19	218,39
4	394,63	230,05
5	361,75	250,06
6	345,30	248,76

Results obtained that using this simulation method, conclude that is not much different from the results obtained by using the results obtained by using the RP method for workstations Packing. The results showed that the same values obtained using both methods both RP and methods of dynamical systems methods.

From the results of the comparison between the three methods of CPOF; RCCP, BOL, and RP with the calculation results using the system simulation method with Powersim applications above obtained the results that are not much different. The value obtained is almost the same in each calculation. Thus both methods can be used to calculate production capacity at the plant.

4. CONCLUSIONS

The conclusion drawn from the overall analysis carried out on planning a production capacity of PT. SCC are as follows:

1. The Master Production Scheduling to produce NYFGbY and NYY cable for October 2009 to March 2010, is not feasible, because the required capacity smaller than available capacity.
2. Based on RCCP the Resources Profile is the best approach to calculate available and required capacity. Using RP approach and system dynamic with Powersim shown the as 8.442 hours and the capacity shortage as 1.340 hours or equal 15,8%. The shortage capacity at stranding and insulation work stations available capacity can not meet the necessary capacity to carry out the production process on time.
3. Powersim simulation results are not much different from the RCCP method, where the available capacity is always less than the required capacity. The result shown at all work stations for each period showed similar results. This shows that the RCCP method or Dynamic System Simulation methods using Powersim can be used to calculate production capacity.

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EXPERT SYSTEM HANDLING WASTE PRODUCTION INCANDESCENT LAMPS

I. Joko Dewanto and Ari Pambudi

Esa Unggul University, Jakarta, INDONESIA
djoko.dewanto@esaunggul.ac.id, djoko.dewanto@gmail.ac.id, ari.pambudi@esaunggul.ac.id

ABSTRACT

Incandescent lamps that function as the lighting is needed at all the various layers of society to be able for activity at night or in the room is less light. The process of making the light bulb through multiple stages and often there are problems in the manufacturing process that could result in wastage of raw material (waste). In this observation of an expert system to solve specific problems in the production of incandescent lamps that require particular expertise. Solving the problem here is intended to minimize the wastage of goods (waste) in the production of incandescent lamps.

In the process of handling problems, suggestions and knowledge of experts is needed for handling the problem can be easily and quickly find a solution. This expert system was created to preserve the fatherly knowledge experts in handling the problem and rules base wirh forward chaining. In the construction of expert systems, knowledge acquired from experts directly by way of interviews with experts who are experts in dealing with problems in the process of making a lamp. In this expert system is directed on how to detect waste arising from the manufacturing process and finding the roots of problems lights to be repaired so that the type of waste which had been able to disappear quickly and without prejudice to the need for an expert, because the expert system is based on expert knowledge , then applied into an expert system application program.

*Keywords: Incandescent lamps,waste production,*forward chaining,*expert system application, lamp handling problems*

1. INTRODUCTION

1.1. Background

Expert system is a system that implements the knowledge of experts in a particular field in the form software. Development of an expert system is to be solve specific problems that require specific skills such as diagnosing illness, prescription settings, scheduling, and process to detect problems. To build an expert system, the expert knowledge are implemented into the system which is then stored into the knowledge base. Development of expert system is expected to alleviate and solve existing problems and preserving the knowledge of the expert. When about to make a decision or solve complex problems, we often ask for advice or consult with an expert or experts. An expert is someone who has the knowledge and specific experience in a field, for example computer experts, nondestructive testing experts, political experts and others. The more unstructured the situation, more and specializes (and expensive) consultation is required.

Expert System goal is to transfer expertise from one expert to the computer, then to other people (who are not experts). This process included in engineering knowledge (knowledge engineering) that will be discussed later.

In this case the author wants to discuss the detection problem in the production of incandescent lamps, incandescent lamps in the process of making required several stages starting from the beginning to the end until the goods are so ready to be packed. In dealing with the proper analysis required for the desired lamps to avoid the mistakes that can lead to waste in the manufacturing process.

1.2. Formulation of problem

A problem to be solved in this observation is how to handle a problem in the manufacture of incandescent lamps by using an expert system. Handling problems

that do are limited to only 5-watt incandescent lamps.

1.3. Objectives and benefits

In the general objective to be achieved is to design an expert system that can help experts and technicians to handle the problems in the production of incandescent lamps with a fast and efficient, while also in order to help provide ways of handling problems in the production of incandescent lamps to new tech so companies do not need to pay for training that takes a long time. The specific objectives to be achieved include:

1. Learn the application of expert system for handling the problem.
2. Building an expert system to handle problems that occur from the process of making incandescent lamp.

2. DESCRIPTION THEORY

2.1 Expert systems

An expert system according to Jackson, Peter. (*Introduction to Expert Systems*, 1999) is a computer program that has a base of knowledge from one or several experts and reasoning to solve a problem or to give advice. Knowledge bases in expert system derived from knowledge and experience possessed by the expert, which is then used to solve a problem, either to make decisions or to give advice.

2.1.1 Knowledge Engineering

Engineering knowledge is a process to obtain specific domain knowledge and build it into a knowledge base. Knowledge engineering process includes five activities, namely:

1. Acquisition of knowledge
   The process of getting knowledge from human experts and literature.
2. Knowledge representation
   Encoding human knowledge into computer representation.
3. Knowledge Validation
   Process to ensure the knowledge gained can be acceptable.
4. Inference
   Involves Inference the activities of software design that is able to reason on the basis of knowledge and can provide advice and suggestions for solutions to specific requests.
5. Explanation and Justification
   Facilities that allow the expert system provides an explanation of why and how a given conclusion.

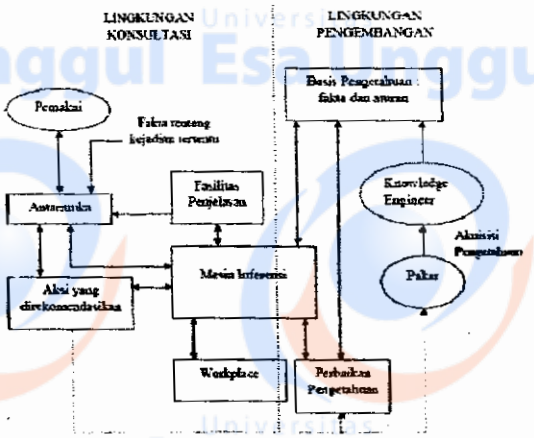

Figure II-1. Arsitektur Sistem Pakar
Source : learning resources esa unggul

2.2. Forward Chaining

Forward chaining starts with data available and uses the inference rules to conclude more data until desire goal is reached.

3. ANALYSIS AND DESIGN

3.1 Problem Analysis

Incandescent lamps is one type of lighting from several types of lights available today and is still used in the homes. The process of making the lamp takes skill and knowledge of the technicians because the making process this bulb through several stages from initial engine start and then the next machine until the end of the machine. That requires a routine for checking if there is waste in the production of each machine can be minimized. To handle the problems that arise in production that resulted in the emergence of a strong waste analysis is required, and it can be resolved by senior technicians who have extensive experience in finding problems that occur in the production process, while for junior technician who recently worked or are still just need guidance of senior engineers, and even then take a long time because to be able to handle problems and find solutions required a long time for the technicians. But sometimes the senior technician was not immune from mistakes

because of their conditions of fatigue or because they forget when they never see the same thing but it all is the human factor is the main cause because of their experience was not written or recorded for any time there lived a similar problem see just where the problem and how to solution.

3.2. Strategy problem solving

It is expected that this expert system, the junior engineers, and technicians are also candidates to understand and know the problems that are common in the production of lamps, especially incandescent lamps without having to meet immediately with the expert. In addition, this expert system can also be used by senior technicians or other experts to document all his knowledge into the system, such as adding new data detection problem they know.

3.3 System Design

The Goal of an expert system that will be made in this final task is to handle problems that occur in the production of incandescent lamps, which will provide a conclusion where the origin of the causes of problems that occur along the repair solution based on the features that have been incorporated into the system. The program will provide conclusions error process or mechanical process that occurs in accordance with the existing problems, but before the user must answer a series of questions posed to the users get the conclusion. The conclusion contains a type error process or mechanical process, and solutions. So that the user's role is important, because to obtain the correct conclusion, the user must also answer questions displayed on the system correctly.

Users also must provide input and support on the system, which will then be processed by the expert (experts) to generate a new conclusion about the damage.

3.4 Knowledge Base

At this stage the created base knowledge matrix. The resulting data into the knowledge base or knowledge base is a form of science or pengelaman experts and the data obtained through direct observation plus the theories from books.

3.5 Inference Engine

One component of an expert system that is important is the inference engine (inference engine). Inference engine is a process or operation on the basis of knowledge or information obtained from an expert. An information can be utilized with maximum if the information is converted first into the rules (rule), so that in solving the problem much easier to do tracking or tracing to get the conclusion of the production process errors. In the inference engine are the mechanisms of thinking and analyzing a specific problem to find the answer.

3.6. Design Structure Database

3.6.1 Table tblUser

Usefulness of tblUser table is to store data from the administrator that consists of user names, passwords.

Table 3.6.1 : Table user

Field	Type	Width	Explaination
nama	Text	10	Nama user
passwd	Text	8	Password user

3.6.2. Table tblJenis

Usefulness of the table is to store data tblJenis questions about the type of error process, either the combustion process and mechanical process, which consists of NoJenis, Types.

Table 3.6.2 : Tabel jenis

Field	Tipe	Widt	Explanation
No_jenis	Char	4	Primary key
Jenis	text	75	

3.6.3 Table tblCiri

Usefulness of tblCiri table is to store data from identification error production, the data consist of NoCiri, Characteristics, Diagnosis.

Table 3.6.3 : Table tblCiri

Field	Type	Width	Explanation
NoCiri	text	4	Primary key
Ciri	text	75	

Diagnosa	memo		

3.6.4 Table tblMacam
Usefulness of the table is to store data tblMacam table is save kinds of damage in one section. The data table consists of NoMacam, and Macam.

Table 3.6.4 : Table tblMacam

Field	Type	Width	Explanation
NoMacam	Text	4	Primary key
Macam	Text	75	

3.6.5 Table tblRelasi1
Usefulness of tblRelasi1 table is to store data from a table tblMacam NoMacam who will liaise with NoJenis from tblJenis table. The data table consists of NoMacam tblRelasi1, and NoJenis.

Table 3.6.5 : Table relasi1

Field	Tipe	Panjang	Explanation
NoMacam	Text	4	
NoJenis	Text	4	

3.6.6 Table tblRelasi2
Usefulness of tblRelasi2 table is to store data from a table tblJenis NoJenis who will liaise with NoCiri from tblCiri table. The data table consists of NoJenis tblRelasi2, and NoCiri.

Tabel 3.6.6 : Table relasi2

Field	Type	Width	Explaination
NoJenis	Text	4	
NoCiri	text	4	

3.7 Flowchart
Flowchart or data flow diagram, is a chart depicting the logic flow of data to be processed on a course from beginning to end. Flow chart is very useful for programmers to prepare programs that complicated. Flowchart consists of symbols representing the functions of the program steps and the flow line or flowlines shows a sequence of symbols that do.

3.7.1 Flowchart Home Users
On the main menu the user of this expert system there are several menu options. Users are allowed to choose one from the menu that has been available. If you already selected it will appear selanjunya process. Figure flowchart "Home Users" can be seen in Figure III-1.

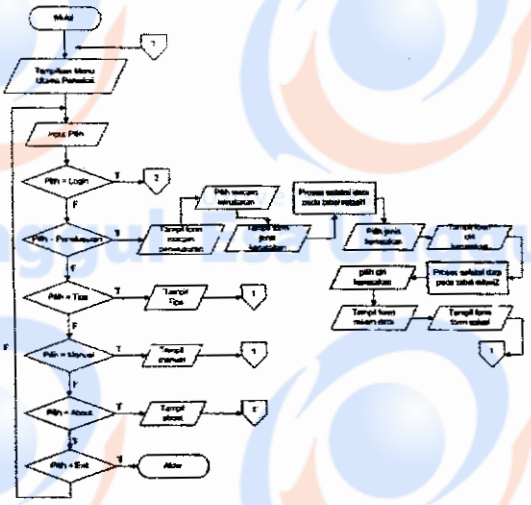

Figure III-1. Flowchart Main menu

3.7.2 Flowchart Login Menu
On the login menu describes the process of an administrator or expert must login and enter the admin menu. Figure flowchart "Login" can be seen in Figure III-2.

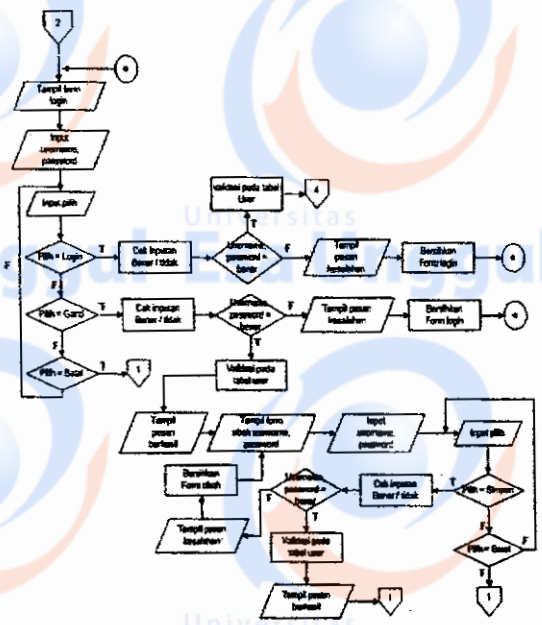

Figure III-2. Flowchart login menu

3.7.3 Flowchart Expert Menu
Flowchart expert menu explain the process of an administrator or a specialist to change the data in an expert system to deal with this incandescent lamp. Figure flowchart "Expert Menu " can be seen in Figure III-3.

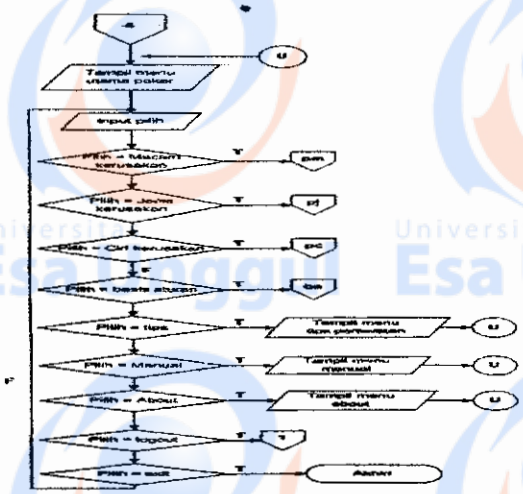

Figure III-3. Flowchart Expert Menu

Damage Types Menu 3.7.4 Flowchart kind of damage menu to explain the process of an administrator or a specialist to modify the data on the data types of damage in this expert system. Figure flowchart "kind of damage" can be seen in Figure III-4.

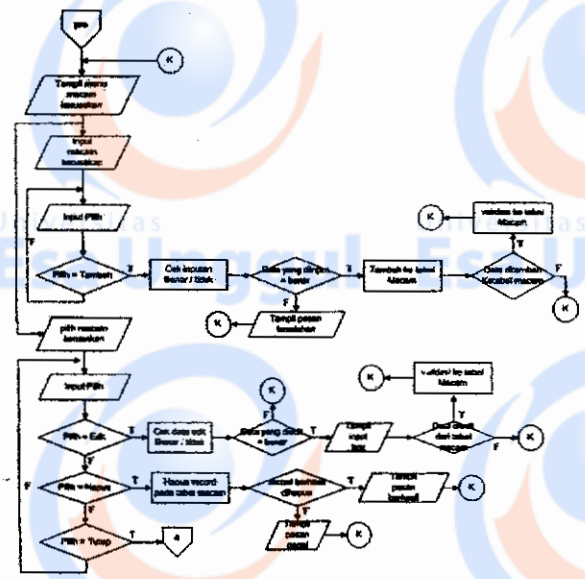

Figure III-4. Flowchart Kind of Damage Menu

3.7.5 Flowchart Type of Damage Menu Flowchart menu describes the type of damage to an administrator or a specialist to modify the data on the data type of damage in this expert system. Figure flowchart "type of damage" can be seen in Figure III-5.

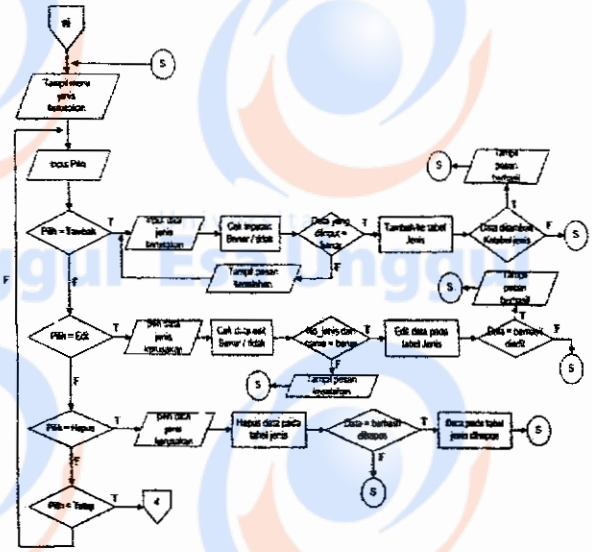

Figure III-5. Flowchart Type of damage Menu

3.7.6 Flowchart Feature of Damage Menu describes the characteristics of damage to an administrator or a specialist process to change data on the damage characteristics of data in this expert system. Figure flowchart "characteristic damage" can be seen in Figure III-6.

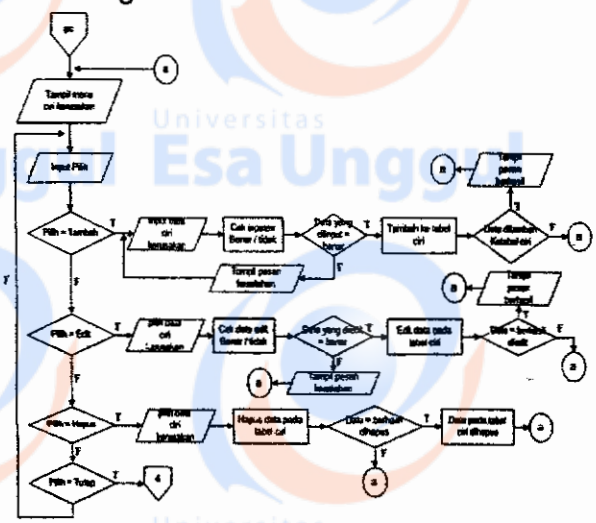

Figure III-6. Flowchart features of damage menu

3.7.7 Flowchart Rule Base Menu Flowchart menu added to this rule explains the process of an administrator or a specialist to modify the data on the data added in this expert system rules. Figure flowchart "add rule" can be seen in Figure III-7.

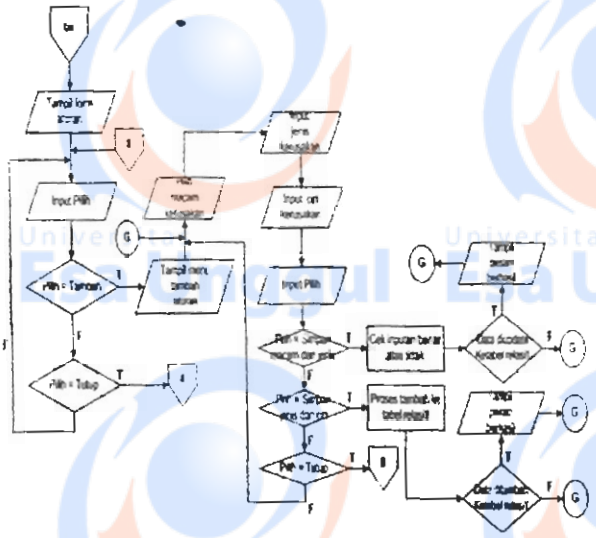

Figure III-7. Flowchart user menu

3.8 Software Requirements Analysis

3.8.1 General description of software
To achieve the goal of this developed a software. software is named "Story Problem Solving." Naming this indicates that the software can look for solutions to the problems that occur in the production process incandescent lamps. The function of this software are:

1. Assist junior engineers and technicians new to be able to easily find solutions to problems that are happening, so that the junior engineers and technicians just do not need a long time to be menanganimasalah that occurred in the production of incandescent lamps.

2. Assist training department in terms of cost, because to be a technician training required considerable time and cost is not small.

3.9 Software development

3.9.1 Design Interface Main Menu
Expert system is designed to have a simple interface. The design of this screen is useful to facilitate the user in using this expert system program to be able to find solutions to problems that occur in the production of incandescent lamps. By using the program Visual Basic 6.0, the interface is designed expert system has only one main interface and some additional interfaces as a facility to change the facts and other knowledge. The main interface can be seen in Figure III-8 below.

Figure III-8. Design Interface

3.9.2 The design of login menu interface

Experts login menu is used for or admin to login or go to the menu for admin or expert can manipulate the data. This form uses several components such as command buttons, labels, frames, and also the textbox.

Figure III-9. The design screen display menu login

Rule 3.9.3 The Design Rules of Display From
The Design Rules of Display Form aim to see or show the existing rules, this form can only be accessed by the admin or expert, not for the user.

Figure III-10. The design rules of display form

3.9.4 The design Rule of display form Add
Rule form add is intended to supplement the existing rules, then store them in the knowledge base. This form uses several components such as labels, combo box, list box, and also a command button.

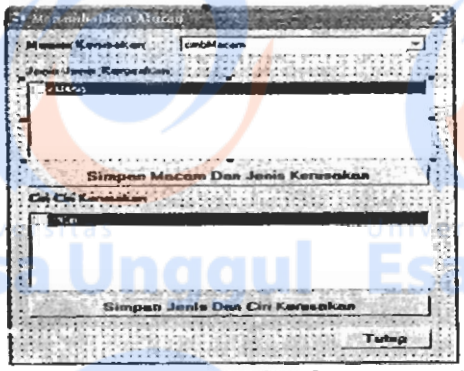

Figure III-11. The design form add rule

3.9.5 The design characteristic of display form Damage

The design characteristic of display form damage is designed to display and simultaneously to change the data such as adding damage characteristics, damage editing features, and also remove the characteristic damage to the base of knowledge. If the data that has been added, edited or deleted and then stored into the knowledge base. This form uses some components like label, textbox, msflexgrid, and a command button. And also data to connect to the database.

Figure III-12. The design of display form characteristic damage

3.9.6 Draft form looks like the type of damage

As in draft form looks like the damage characteristics, form the type of damage also to display and modify data such as delete, add, edit data. In this form there are several command buttons that function to process the edit, add, delete, save, close, and also to see the record data. Other components of the labels, text boxes, data, and msflexgrid.

Figure III-13. The design form the type of damage

3.9.7 Draft form looks like kind of damage

In this form there are several kinds of components like label, textbox, listbox and command button. This form serves to see all kinds of damage, add the fact if there are new facts that would like added to the knowledge base, or any facts you want to delete and who wish to update. III-14 As the picture below.

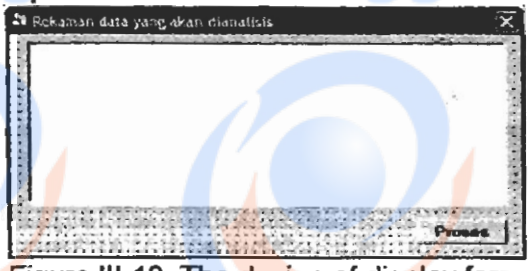

Figure III-19. The design of display form solution

4. IMPLEMENTATION AND TESTING

Implementation and testing expert system program. The program will be tested and implemented, with the hope of easy use easy and max for the users (junior engineers and technicians) that wish to study in finding a solution to the problems that occur processed manufacture of incandescent lamps. In this expert system program testing using several examples of cases in order to know the performance of the system as well as analysis of program results.

4.1 Implementation

Implementation is one of the stages in the manufacture of an expert system. Expert system created using Visual Basic 6.0 programming language, and database applications based Micrososoft Access 2003 stand alone. The result of the implementation of the programming

language Visual Basic 6.0 is as follows:

4.1.1 Main Menu Screen Display User
When the program first run of the first shown is the main menu screen, main menu is used only for the user. On the main menu screen the user there are buttons to link to another view. For users, there are buttons available search button and engine maintenance tips. Views from the Main Menu screen user program can be seen in Figure IV-1 below.

Figure IV-1. Display main menu user interface

4.1.2 Login Screen Display Menu
If experts wanted to enter the main menu of experts, first go through the menu to login. Login screen display menu program can be seen in Figure IV-2 below.

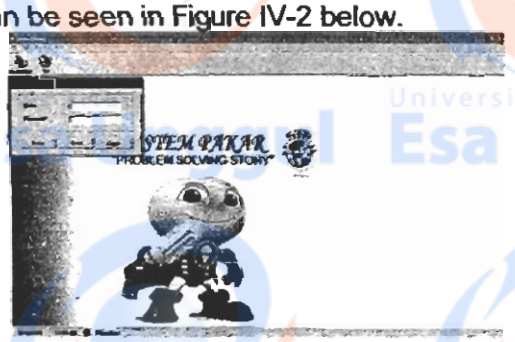

Figure IV-2. Display the login menu expert system

4.1.3 Main Menu Screen Display Specialists
Display the main menu is almost the same experts view the user main menu, only the difference is only in the key of knowledge. On the main menu the user, this button is not visible because only the main menu experts are there. This knowledge to the button menus like kind of damage that serves to see the data from the kinds of damage and also to change or add data, the type of damage that function to see data on the type of damage and also to change or add data, characteristics damage function to view the data from the characteristic damage and also to change or add data, and rules that serve to add rules. On the main menu also contains the user tips the same as the user's main menu. Display the main menu screen program experts can be seen in Figure IV-3.

4.1.4 Display Screen Menu Damage Types
In this menu an expert can add new facts such kinds of damage or change the kind of damage and remove the kind of damage that already exists, then the system will store data (nomacam, kind) if the experts choose the save button, to change or delete data experts to stay selecting from this menu. Display menu kind of damage can be seen in Figure IV-4 below.

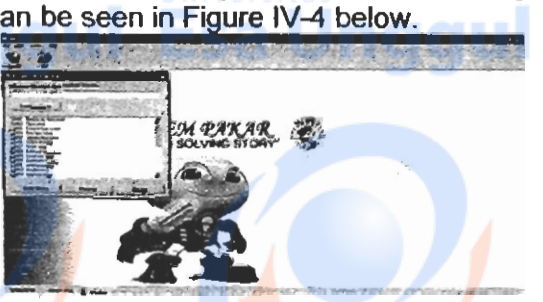

Figure IV-4. Display Screen Menu Kind of Damage

4.1.5 Display Menu Type of Damage
Menu type of damage is to display records from a table type, an expert on this menu can also add a new damage type, edit the type of damage, and remove the type of damage that already exists and then save it direcord no type, and type in the table type. Menu display this type of damage can be seen in Figure IV-5 below.

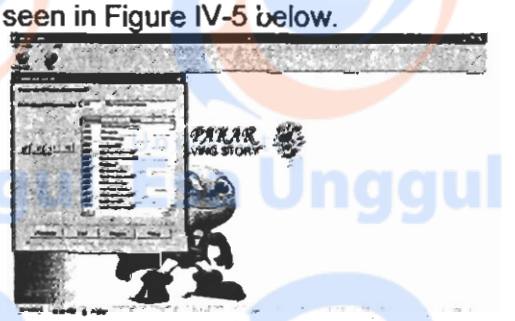

Figure IV-5. Display menu type of damage

4.1.6 Display Menu Characteristic of Damage
Display the menu is the same as the menu kind of damage, and damage type menu,

this menu can display records from the table features, expert on this menu can also add, edit, and remove and store the knowledge base. Display menu features this damage can be seen in Figure IV-6 below.

Figure IV-6. Display Menu Characteristic Damage

4.1.7 Display Menu Screen of Rule Base
Menu rule base is used by experts to add rules in the knowledge base. In this menu only displays the records from the table sorts, table type, and characteristics tables, each of which is connected by a table and table relasi1 relasi2. Display menu rule base can be seen in Figure IV-7.

Figure IV-7. Display menu rule base

4.1.8 Menu Display Rules of Add
In this rule add the menu will display the record kind of damage, record the type of damage, and record characteristics of the damage. Rules that will be added by experts selected on the basis of the kinds of damage, and experts add the type of damage and damage characteristics and store them in the knowledge base. This rule adds menu display can be seen in Figure IV-8.

Figure IV-8. Display menu add rule

4.2 Test Cases

4.2.1 Hardware and software specifications
This program has been tested on a laptop with hardware specs as follows:
Processor: Intel Pentium Dual Core T4300 @ 2.1 Ghz
Memory: 2 GB DDR3
VGA: NVidia GeForce G210M
Harddisk: 320 GB
Software used in trials of hardware above have the following specifications:
Operating system: Windows XP Professional SP3
Application program: Microsoft Visual Basic 6.0
Database Applications: Microsoft Access 2003

4.2.2 How to Run programs Expert System Search
The test program was conducted to determine whether the program created is in conformity with the purposes of this expert system. Here is an example of operation of the program will search an expert system to guide users in the use of this expert system program. The test cases for expert system program that used this rule is the rule to 99. where this rule has been attached in chapter IV

1. The first step
In the first step appears choices kinds of damage, because the authors wanted to examine the case of the rule to a 9 then the choice is M017 "Filament off" (see Figure IV-9).

Figure IV-9. Display screen search menu variety

2. The second step
If the selected range of damage from the rule to 99 (M0017 "Filament off") then nomacam same field in the table relation 1 nojenis field so that the process continues when the user pressed the continue button on the next search is the search type will appear as the following picture (figure IV-10).

Figure IV-10. Display screen type search menu

3. The third step
In accordance with the rule to 99, then the selected nojenis J031 ("Filament off to the right"), then the same field with the field nojenis nocin relations on the table so that the process continues when the user pressed the continue button on the next search is the search feature will display the image as follows (image IV-11).

Figure IV-11. Display screen search menu features

4. The fourth step
In the fourth step is chosen nociri C099 ("the right of the suction needle too off") then the field in the table nociri characteristic has been chosen so that the process continues when the user pressed the continue button on the next search recorded data will appear like the following picture (figure IV-12 .)

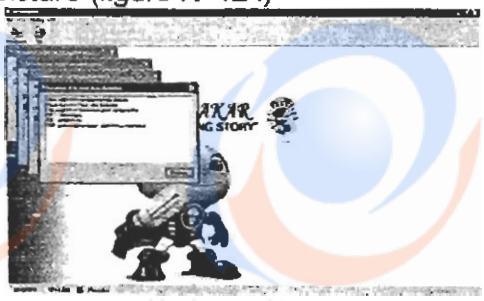

Figure IV-12. Display screen data records

5. The fifth step
Because the selected nociri namely C099 ("the right of the suction needle too off") then the diagnosis will be known as field diagnostics and field nociri is a table that is characteristic table. Suggestions or solutions can be known if the field has been selected nociri, such as images that appear below (figure IV-13).

Figure IV-13. Display screen solution

4.3 Advantages And Disadvantages Expert System Program

4.3.1 Excess program
The advantage of this expert system programs, among others:
1. This expert system has a simple interface, so users can easily use this program without having to do training first.
2. With the existence of this expert system, it will be easier to detect problems and find solutions to problems that occur in the production of incandescent lamps.
3. This expert system can be a

documentation and knowledge base for an expert in the field of manufacturing incandescent lamps.

4.3.2 Lack of programs

Lack of programs owned by this expert system, among others:

1. Due to time constraints and capabilities, expert systems have not been able to display images and video data to users more clearly understand the problems that exist in production and is easier to handle.
2. Because the database used Microsoft Access 2003, then the expert system program is only a stand alone course, the database can not be stored on the server to be shared to the client computer.

5. CONCLUSION & SUGGESTIONS

5.1.Conclusion

The result of an expert system to solve the problem of raw materials wasted in incandescent lamps, has a knowledge base that represents the system knowledge and the willingness of experts in the manufacture of light with both a user interface as well as experts, easily changed through the user interface expert, forward method chaining.

5.2 Suggestions

In a further development, will be the interface to display images and video so that the user is more easily understood for solving problems in the production of incandescent lamps, design interface expert system more user friendly by improving visualization, can be updated (update) periodically, so that existing data be always in accordance with the development of light manufacturing. And User interface should be revised to make it look more attractive and provided additional menus.

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ANALYSIS OF THE APPLICATION KNOWLEDGE MANAGEMENT SYSTEM IN HIGHER EDUCATION (THE CASE OF ESA UNGGUL OF UNIVERSITY)

Riya Widayanti

Esa Unggul University, Jakarta, INDONESIA
riya.widayanti@esaunggul.ac.id

ABSTRACT

In an era where knowledge is increasingly seen as an organization's most valuable asset, many firms have implemented knowledge-management systems (KMS) in an effort to capture, store, and disseminate knowledge across the firm. Concerns have been raised, however, about the potential dependency of users on KMS and the related potential for decreases in knowledge acquisition and expertise development (Cole 1998; Alavi and Leidner 2001b; O'Leary 2002a). The purpose of this study, which is exploratory in providing information about knowledge management, providing information about the stages of development of knowledge-management system, along with such tools, as well as provide input to higher education will be the role of knowledge to improve individual and organizational values.

Keywords : knowledge management

1. INTRODUCTION

Knowldege management into areas that are important in the learning process of an organization. Knowledge possessed by the organization must be able to provide progress for the organization itself. In order for organizations to survive, it is required for every person who is in knowledge sharing organization. That requires strong management for knowledge is rooted in every individual in the organization and do not go away with the support infrastructure for the dissemination of information within the organization.

Development at present to encourage the increasingly rapid changes in all spheres of life, consequently accelerating effects of globalization and information technology development is very fast. This condition is clearly caused by the need for new ways in dealing with all that happened to survive. Emphasis will be increasingly important quality of human resources (HR) is one vague response in addressing these changes, and this of course requires efforts to enhance and develop human resources.

Accordingly, the role of science became more prominent, because only with knowledge of all the changes that occur can be addressed appropriately. This means that education plays an important role in preparing qualified human resources and competitive. Tight global competition, particularly in the economic field has made the business organizations to rethink their business management strategies, and quality human resources with the mastery of knowledge become an important choice that must be done within that context.

In recent years, organizations have increasingly realized that one of their most valuable assets is the knowledge that is developed internally and possessed by individuals within the organization. Cameron (2000, 3) similarly noted, "Knowledge is power, but without the adequate management of that knowledge, the consequences for [organizations] could be devastating." Not surprisingly, technology is viewed as the key enabler to effective knowledge management. Early technological strategies focused on the use of inteligent systems, but these strategies have not been terribly effective (Duchessi and O'Keefe 1992). More recently, corporate efforts are focusing on a class of technologies referred to as knowledge-management systems (KMS) (Leech and Sutton 2002).

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1.1 The Purpose of the study

Provide an overview of knowledge management, providing information about the stages of development of knowledge-management system, along with such tools, as well as provide input to higher education will be the role of knowledge to improve individual and organizational values.

1.2 Scope of Study

In this study only discusses the role of knowledge management within the organization, describes the stages to develop knowledge management system, and provides a description of the application of knowledge management systems within an organization.

2. THEORETICAL BACKGROUND

Knowledge management becomes one of the necessary tools for modern day organizations. Universities also have to pay intensive attention to knowledge management projects in order to accomplish their objectives and continue the ongoing learning process. The time period is very important and should be organized and developed for upgradable standards. In universities where research and development studies play an important role, knowledge management has a very critical position in the process (Mikulecka & Mikulecky, 2000). Knowledge is the main asset of universities; accordingly, universities play the main character to spread and manipulate knowledge for the society and are the key factor for implementing strategies. In order to reach their missions and social functions, universities should have ef ective use of knowledge management (Conceicao Heitor, & Oliveira, 1998; Oosterlinck, 2002). The new ideas and suggestions are important in order to develop the knowledge management tools; however, there are not enough studies on this important issue (Agrawal, 2004; Kidwell, Linde, & Johnson, 2000; Rowley, 2000).

According to strategic management literature, it has been discussed that resource based implementation has been more ef icient and unique for the success of organizations and that organizations should focus on this strategic and valuable technique (Connor, 2002; Prahalad, & Hamel, 1990; Zack, 1999). Knowledge, today, is the most important and strategic resource in our environment (Kogut, & Zander, 1996; Nonaka, & Takeuchi, 1995; Wijetunge, 2002). "Knowledge" can be defined as "purposeful knowledge" (Davenport, & Laurence, 1998; Yahya, & Goh, 2002). Organizations should expand their resources to organize data in useful format. However, knowledge can only be reached if and only if organizations expend additional resources to discover patterns, rules, and contexts where the knowledge works. Knowledge can also be identified as the role of converting data to knowledge within the context of environment and experience. Knowledge has more critical function in decision making process, more than resource and data. Knowledge can be defined as accurate and non-accurate knowledge. Accurate knowledge can be described as formal-systematic knowledge where it can be easily explained and message transferred to the recipient. Whereas non-accurate knowledge is where the message is difficult to explain, transfer, and identify. It can be described in different ways such as talents, senses, meanings, values, etc. The new organizational identity can be formed when the individuals' accurate and non-accurate knowledge combine each other in organizations (Nonaka, & Takeuchi, 1995; Nonaka, Toyama, & Konno, 2000;Yim, Kim, Kim, & Kwahk, 2004). Knowledge is the most decisive organizational resource in the organizational structure of institutions which should be used and organized systematically in order to be efficient and effective. In order to manage knowledge, effective planning and programming is needed. The management of knowledge is the combination of important topics such as explaining, obtaining, developing the knowledge, the use of knowledge in an ef ective way and spread of knowledge in the organization. Knowledge management is the time period where organizations share common situations they have to adapt themselves in highly competitive and changing environment (Beijerse, 1999; Demarest, 1997; Perez, & Pablos, 2003).

Knowledge management can be defined as the organizational "efforts designed to (1) capture knowledge; (2) convert personal knowledge to group-available knowledge; (3) connect people to people, people to knowledge, knowledge to people, and knowledge to knowledge; and (4) measure that knowledge to facilitate management of resources and help understand its evolution" (O'Leary 2002a, 273). Knowledge-management systems (KMS) focus on bringing together the explicit knowledge that exists in organizations, the know-what that can be easily documented and shared (Sambamurthy and Subramani 2005), such as basic definitional information (e.g., technical terminology), procedures for performing tasks (e.g., audit checklists), guidelines for interpretation (e.g., GAAP guidance), and previous problem resolution examples (e.g., client memos outlining solutions to issues raised)—information often referred to as "three-ring binder" knowledge (Dilnutt 2002). As noted by Alavi and Leidner (2001b), KMS initially contain these types of explicit knowledge and are later expanded upon with a body of tacit knowledge that continues to grow as users add their interpretations of the explicit knowledge to the system's knowledge base. Tacit knowledge is the know-how that is difficult to document and emerges from experiences (Sambamurthy and Subramani 2005). Alavi and Leidner (2001b) further note that access and/or assimilation of the explicit knowledge in such systems is a necessary precursor to effective use of the accumulated tacit knowledge in the system. This is consistent with recent findings in the knowledge-based system (KBS) literature showing that novice users gravitate toward explicit knowledge support while experienced decision makers gravitate toward available tacit knowledge support (Arnold et al. 2006). The use of KMS to support an organization's professionals in their decision making through organizational knowledge creation is a double-edged sword.

The process of changing data into information according to Daven and ports in the book of Paul L. Tobias done in several stages: Contextualized: understanding the data coliected, Categorized: understand the unit of analysis or a key component of data, Calculated: mathematically analyze the data statistically, Coreccted: eliminate errors from data Condensed: summarize data in a more concise and clear.

Knowledge can be classified along four key dimensions: (1)type, (2) focus, (3) complexity and (4) perishabililty over time, as shown in figure ..

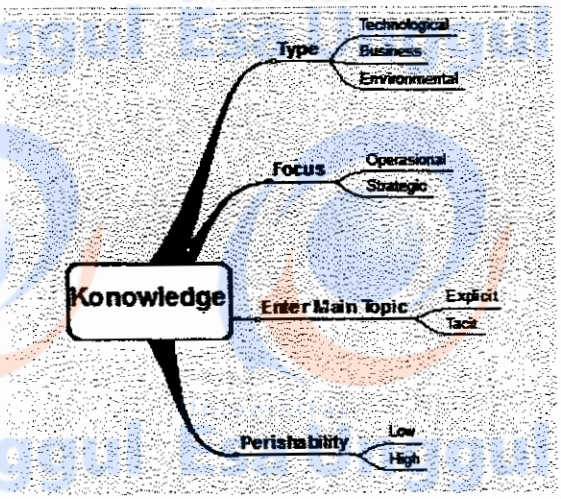

Figure 1. A map of some key facets of knowledge

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Table 1 Comparing Tacit and Explicit Knowledge

Charasteristic	Tacit	Explicit
Nature	Personal, context-specific	Can be Codefied and Explicated
Formalization	Difficult to formalize, record, encode, or articulated	Can be codified and transmitted in systematic and formal language
Development	Developed through aprocess of trial and erroe encounterd in practice	Developed through explication of tacit understanding and interpretation of information
Location	Store in head of people	Stored in documents, databases, web pages, email, chart, etc.
Conversion processes	Converted to explicit through externalization that is often driven by metaphor and analogy	Well supported by existing IT
IT Support	Hard to manage, share, or support, with IT	Well supported by existing IT
Medium Needed	Needs a rich communication medium	Can be transferred through conventional channels

The basic process of knowledge management, are:

1. Knowledge acquisition
   The process of development and creation of insight, skills and relationship.
2. Knowledge Sharing
   Disseminating and making available what is alredy known.
3. Knowledge Utilization
   Learning is integrated into the organization.

Knowledge management is a complex activity that cannot deliver business impact without a concreat plan(Tiwana, 2008). The 10-step KM road map that will guide you through strategizing, desining, developing, and implementing a KM-initiative-with a company in mind. Table ... describes how each of these steps is logically arranged.

Table 2 The 10-step KM Roadmap

Part	Step
Phase 1:	**Infrastructural Evaluation**
I	Step1. Anayzing existing infrastructure
	Step 2. Aligning KM and business strategy
Phase 2:	**KM System Analysis, Design, and Development**
II	Step 3. Designing the Km Archetecture and integrating existing infrastructure
	Step 4. Auditing and analyzing existing knowledge
	Step 5. Designing the KM team
	Step 6. Creating the KM blueprint
	Step 7. Developing the KM system
Phase 3:	**Development**
III	Step 8. Deploying with result-driven incrementalism(RDI) methodoly
	Step 9. Leadership issue
Phase 4:	**Metric for Performance Evaluation**
IV	Step 10. Real-option analysis of return and performance

3. RESEARCH METHOD

This study uses literature to present the data either through text books, journals and internet. Descriptive research is a method of research that attempt to describe and interpret the objects in accordance with what the. This research is also often called non experimental , because in this research study does not control and manipulate variables. Descriptive research is generally done with the main objective, namely to systematically describe the facts and characteristics of the studied object and subject as appropriate.

4. RESULT AND DISCUSSION

Esa Unggul University was founded in 1998, ranging from economics and engineering faculties until now into 8 faculties with 23 departments. The more the organization is then required to compete in the digital age. One of the major in business education is to maintain the quality of teaching, research and community service, all of this has become a milestone in every good work program's strategic plan as well as tactical and operational plans. Fortunately compete then in 2006 the university was building a massive infrastructure, classrooms equipped with computers and LCD projectors, on the other hand it is to upgrade the computer in all units, with a joint venture with one computer vendor, with the added value could enjoy the warranty for 3 years.

Summary of knowledge management systems that have been run and used in Esa Unggul contained in the following table:

Table 3. List of knowledge management applications at the University Esa Unggul

Aplication Name	Technology	Database	Unit Manager	Active	Status
Hybrid Learning	moodle	MS SQL	Learning Support Dept	2007	Active
Digital Library	Web – PHP	MySQL	Library	2009	Active
Blog Civitas Esa Unggul	Web – PHP	MS SQL	Public Relation Dept	2010	Active
E-Paper	Web – PHP	MS SQL	Public Relation Dept	2010	Active
Fasilkom Learning Center	Web	MS SQL	Computer Science Faculty	2009	Active

Hybrid Learning
Applications Hybrid Learning is an application to support teaching and learning process ata the Universitas Esa Unggul. Diterapkan pada tahun 2007, kebijakan awal dilaksanakannya dengan membentuk tim penilaian modul perkuliahan, dimana bertugas

Digital Library
Is an application that supporta the library unit in order to manage the books of the university library collections.

Blog Civitas Esa unggul
Captures information and aspirations of staff and lecturers, as well as a forum for sharing information from all fields

E-Paper
Presenting the report on faculty and student research

Fasilkom Learning Center
Applications developed solely by students Faculty of Computer Science with the aim to facilitate the task of storage either individual or group, easy access to good software is related to the lecture or not, in order to enrich scholarly in the field of information technology.

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Although he has developed several knowledge management applications within the university, but there are some activities that have not been well documented, but benefit from these activities is to support business processes and even to contribute to all business units.
The activities are as follows:
1. Coordination Meeting

Meetings are conducted once every month, where the participants are the Dean of the Faculty, which discussed matters related to academic, administrative and student affairs. Report of activities of faculty and faculty development became the main topic.

2. Coffee Morning
Held every Tuesday, followed by the entire faculty, where the purpose of this activity is to share the latest information. Brainstorming session becomes an arena for every department to be able to share information.

Analysis
Application of knowledge management was conducted in a different time with different KM team, the following summary of the implementation of knowledge management applications.

In the implementation of KM applications have a variety of approaches:
Tool used in determining KM platform is document management system. Document management systems make vast ampunt of document, such as product literatur, electronic form, specifications, and correspondence, easily accessible and adaptable throug the web. The systems often include workflow functionality that allows documents to be intelligently routed to select, relevant employees.

In addition, this knowledge management applications need to be made of elements to search, indexing and retrieving, as can be accessed according to the desired topic. Currently, the application of knowledge management systems are still at the stage of collecting and distributed immediately, not stored in a database. Have not done the scientific grouping, these applications still stand alone, not integrated.
Selection of team knowledge management, because stand-alone application and have a working unit different then the KM team structure is also different. Hybrid learning focus on the management of instructional materials and manage teaching activities. Blogs and e-paper applications that are different but managed by a unit of the PR Department, its use was different, the blog to accommodate the aspirations of staff, while e-paper to accommodate the research of faculty and students.

In a further development of KM can be started from the KM strategy plan which is aligned with business strategy, grouping the topics of science and knowledge. Development of KM team, including expertise, the administrator who controls the KM tools and establishing policies for the implementation of KM.

Lack of socialization and communication both within the university, became one of the causes of KM application is not going well. The application of complex systems knowledge management will be useless if not used by the community. Because it needs the right strategy to motivate community members to use the system.

The transformation of this knowledge depend on the mentality and culture for each individual so that the actualization of the activity in the organization will be based on new confidence as a collective agreement (member organizations work with the new spirit.) Based on mental model of a mutually agreed upon organization they then transform this knowledge into strategies, programs, systems / new document as a guide to work all members.

The scheme proposed the application of knowledge management systems:

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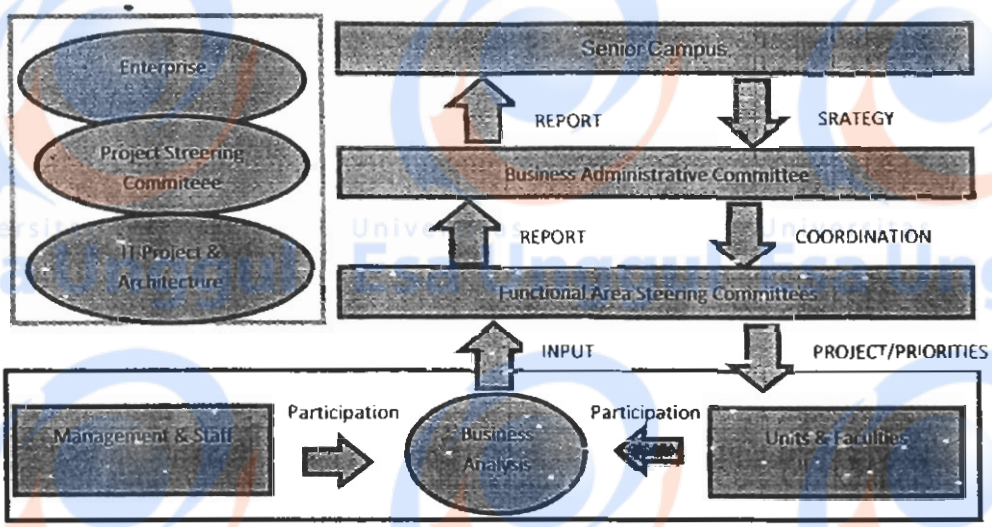

Figure 2. The scheme proposed the application of knowledge management systems

Contribution of units and faculty are as follows:

1. Identiy unit issue & opportunies
2. Subject matter expertise to support analysis
3. Participate in focus groups and projects
4. Support ongoing business processes

Contribusion of management and staff:

1. Identify opportunities to maintain/ improve systems
2. Provide technical expertise to analysis of request
3. Parcipate in project team
4. Support Solution on ongoing basis

Funcional Area steering commitees capable of:

1. Analyze, coordinate, prioritize and apporve request from units stakeholders
2. Understran, communicate, manage impact of various initiatives to functional customers

Business Administrative Committee capable of:

1. Define Strategis administrative priorities
2. Develop/promote broader outlook to ensure strategic alignment and customer group focus
3. Understans and help realize synergies for initiatives with cross-unit impacts

Senior campus committee capable of:

1. Provide strategic campus priorities and major funding allocations
2. Make appropriate decisions as required consistent with their accountability

It is essential in knowledge management is the creation of a conducive learning environment, so that the workers be motivated to continue learning, taking advantage of information or knowledge provided by the business, and develop individual knowledge and ultimately willing to share the new knowledge gained to become knowledge organization, or in other words, knowledge management focus for productive human being in it separately develop the knowledge and willing to share the knowledge he had.

5. CONCLUSION

Organizations business and educational must focus on creating and developing knowledge workers that can succeed and excel in a competitive, global environment. Business organizations must identify the knowledge dimensions necessary to create and sustain a competitive advantage, as educational institutions must identify the corresponding knowledge dimensions necessary to provide qulity instructional program that develop students into knowledge worker. Additionally, organizations needs pepople commited to lifelong learning in order to sustain and improve their knowledge base.

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DESIGN AND MEASUREMENT OF COMPANY PERFORMANCE BY USING BALANCED SCORECARD METHOD AT PT. ABC

Iphov Kumala Sriwana[1], Derajat Amperajaya[2], Inne Winny Runfeka[3]

[1,2,3]Industrial Engineering Department, Industrial Technology Faculty,
Esa Unggul University, Jakarta, Indonesia
iphov.kumala@esaunggul.ac.id[1], derajat.amperajaya@esaunggul.ac.id[2], Innewinny2008@gmail.com[3]

ABSTRACT

Measurement of company performance is an important thing for manager especially for planning new strategies for the future. There were various methods for measuring performance that were different between one industry and the others, but it was difficult tc say that this method could estimate succeeded of company exactly. That was why, appeared one new concept about Balanced Scorecard method. PT.ABC is one of companies runs in producing plastics and printing. But, there are still found bad performance conditions at PT.ABC. These criteria appear because company only measures performance from financial perspective, without considering non-financial perspectives (customer perspective, internal business process perspective, learning and growth perspective). By using 4 perspectives in Balanced Scorecard can help PT.ABC to design, measure, and analyze performance of company more optimally. Based on the calculation and analysis, performance of company has been good if it is observed from customer perspective (93.90%), internal business process (86.25%), and learning and growth perspective (95.36%). The average measurement from them is about 91.835%. Even though, from financial perspective, performance conditions are still not good. They can be seen from the values of performance measurement are still under the values that have been company's target or they decrease continuously, such as ROI, ROE, ROA, and profit margin. Thus, the final conclusion is PT.ABC must perceive and improve its financial perspective to reach the better result of performance.

Key words: Balanced Scorecard, financial perspective, internal business process perspective, learning and growth perspective.

1. INTRODUCTION

PT.ABC is one of companies runs in producing plastic and printing. Its office and factory starts to work and produce on Monday until Saturday (on 08.00 a.m. until 07.00 pm for office, but for factory, it must produce during a day with 3 shifts). PT. ABC is located at Kenaiban, Sumur Pacing-Tangerang.

PT.ABC is known as a growing company which has special quality product. But, implementation of strategy at PT.ABC has not progress fast. Besides that, there are still not good performance conditions, and cause values of return on equity and asset that is resulted on the end of year is not according to production volume which is constant or rises continuously. They can be happened because employees do not understand mission and strategy of PT.ABC well. Besides that, PT.ABC also measure company performance only from traditional performance, which is only perceived from financial perspective.

That is why, the aim of this research is helping PT.ABC to communicate and translate its vision, mission, and strategy for all employees through aims, measures, targets, and initiatives from each of the Balanced Scorecard perspective by using primer and secondary datas of company. So, the title of this research is "Design and Measurement Company Performance by using Balanced Scorecard Method at PT.ABC."

2. THEORITICAL BACKGROUND

The definition of Balanced Scorecard is "a measurement and management that views a business unit performance from

company and increasing the welfare of its employees. In addition, PT.ABC seeks for using assets in a productive way, holding cash is owned by both as one of company's assets, in order to compensate the existing obligations of both the short and long term ones and can result high return values.

2. Customer Perspective:

PT.ABC seeks for becoming a leading company and the main choice for the customer in terms of products quality, services provided, and finding the trust of customers

3. Internal business process Perspective:

PT.ABC trying to run business processes, especially production processes effectively and efficientiy, so that it can produce a plastic products quality with competitive and affordable price, providing the best service for customers, so the distribution of plastic to customers can be timely

4. Learning and Growth Perspective:

PT.ABC seeks for providing competent human resources and have high motivation to achieve the corporate vision and mission

2. Determination of Corporate Strategy

2.1. SWOT Analysis (Strength, Weakness, Opportunity, and Threats)

SWOT Matrix begins with making IFAS and EFAS Matrix. IFAS matrix of PT.ABC can be divided into two major components, Strengths and Weaknesses, and EFAS Matrix can be divided into two major components, Opportunities and Threats. The Matrix IFAS and EFAS of PT.ABC as shown on *Table 1.* and *Table 2.*

Table 1. IFAS Matrix

Internal Strategic Factors	Weight of Rating	Rating	Weight of Rating X Rating
Strengths:			
1. Popularity and Experience	0.15	4	0.6
2. Maintaining good plastics quality	0.1	4	0.4
3. Plastic products can be used safely	0.1	3	0.3
4. Using pure ingredients to produce plastics	0.1	3	0.3
5. Timely Delivery of finished products	0.1	4	0.4
6. Competitive Pricing	0.1	3	0.3
7. Strategic Location	0.05	3	0.15
Weaknesses:			
1. Operational of company during 24 hours causes faulty works	0.15	2	0.3
2. There are no rewards for employees who have best performance	0.15	1	0.15
TOTAL	1		2.9

Source: Interview with Plant Manager PT.ABC

Description:

Value is determined by Weights of Ratings and Ratings of company

Weights of ratings x ratings on table 4.1 above, namely:

1 = minor weaknesses
2 = major weaknesses
3 = minor strengths
4 = major strengths

Analysis *Table 1.* is the average total rating x weight of rating (based on the ranking weight of rating x rating) = (1+2+3+4)/4 = 2.5. If the total of the result below 2.5 describes the organization's internal position is still weak, but if the total of the result above 2.5 illustrates the position already expressed a strong internal organization. Based on the results obtained from *Table 1.*, PT.ABC has a total of 2.9 so that it can be said that the internal position of PT.ABC has already strength.

Table 2. EFAS MATRIX

Strategic External Factors	Weight of Rating	Rating	Weight of Rating x Rating
Opportunities			
1. Necessaries of plastics rise continuously	0.3	4	1.2
2. Plastic products become more varied, especially of the size and quality of materials (not easily torn) so it can compete	0.2	3	0.6
3. The distribution of plastic products to outside of Jabodetabek, such as: Lamoung, Bangka, etc	0.2	2	0.4
Threats:			
1. The price of plastic bags are continuously competing	0.11	2	0.22
2. Rapid technological change	0.08	2	0.16
3. The existence of other companies that sell similar products	0.04	2	0.08
4. The prices of Plastic resins are not stable	0.07	2	0.14
TOTAL	1		2.8

Source: Results of Data Processing

Description:
Value is determined by Weights of Ratings and Ratings of company. Ratings of how effectively the company's current information to respond to economic, social, cultural, political, government, law, technology and competition are as follows:
1 = bad corporate responses
2 = corporate responses are average
3 = corporate responses are above average
4 = superior corporate responses
Analysis *Table* 2. is total rating x weight of rating=2.8, which means PT.ABC has an average response to deal with external factors that exist.
Description:
<2 = bad corporate responses
2 ≤ results <3 = corporate responses are average
3 ≤ results <4 = corporate responses are above average
4 = superior corporate responses
(Source: Interview with Plant Manager PT.ABC)

Next step is making the SWOT Matrix as shown on Table 3. Referring to *Table 3*, it is established some strategic objectives of each perspective as shown on *Table 4*.

Table 4. Strategic Objectives

Perspectives	Strategic Objectives
Financial	1. Leverage Ratio 2. Liquidity Ratio 3. Efficiency Ratio 4. Profitability Ratio
Customer	- Customer satisfaction - Loyalty and trust of customer
Internal Business Process	- Motivation and Innovation of Employees - The level of plastics Quality - The level of after sales service - Providing the adequate facilities
Learning and Growth (L and G)	- Employee Satisfaction - Training for employees - Use of technology - Skills of employees

Source: Results of Data Processing

With the Balanced Scorecard method, the goal of company can be seen through each of perspective aligned with the vision and mission of PT.ABC, in order to obtain the strategic goals to clarify the objectives of the company. There are some strategic goals according to the Balanced Scorecard as listed on Table 5.:

Table 5. Strategic Goals

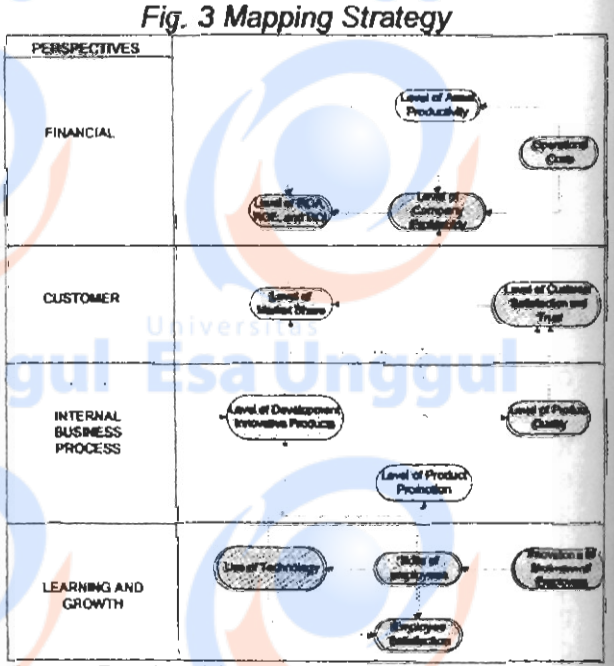
Perspectives	Strategic Goals
Financial	Shareholder Value
Customer	Firm Equity
Internal Business Process	Organizational Capital (implementing an effective processes and costs, and resulting an affordable prices
Learning and Growth	Human Capital

Source: Results of Data Processing

The next step is determining the key performance measures include:
Financial Perspective:
Increasing ROI, ROA, ROE, Profit Margin
Customer Perspective:
Improving customer satisfaction and trust
Internal Business Process Perspective:
Developing innovative products quality which are produced
Learning and Growth Perspective:
Improving skills, customer satisfaction, motivation and innovation of employees, and reliability of the use of technology, especially the production machine

Mapping Strategy
The Balanced Scorecard provides a framework to develop strategic goals that have a coherent relationship. They are established by creating a causal link between strategic goals with one and others. This illustration can be seen in *Figure 3*.

Fig. 3 Mapping Strategy



Source: Results of Data Processing

perspectives: financial, customer, internal business process, and learning and growth." (Atkitson, A.A., Kaplan, R.S., Banker, R.J., Young, M.S., 2004). 4 perspectives of Balanced Scorecard is shown in *Figure 1.*

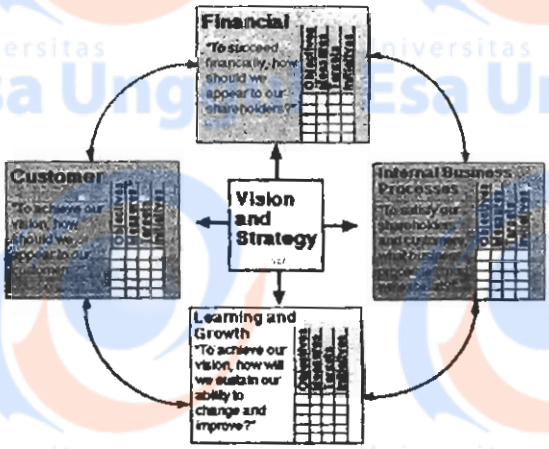


Fig 1. 4 Perspectives in Balanced Scorecard and The Relationship of That Perspectives

3. RESEARCH METHOD

Illustration of Research Method as shown in *Figure 2.*

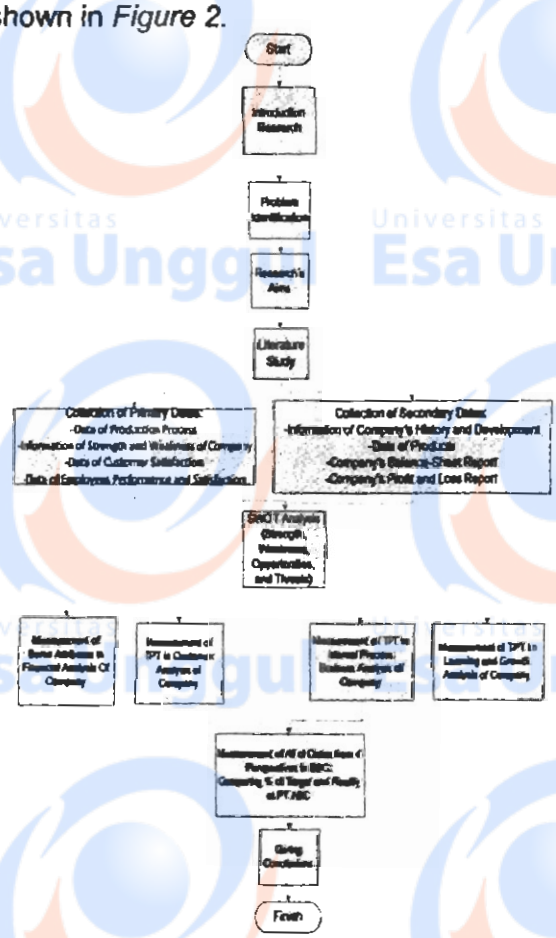


Fig 2. Research Method
Source: Result of Data Processing

4. RESULT AND ANALYZE

Based on observations made in PT.ABC, there are some performance conditions are still unfavorable, as follows:

1. Division of tasks for each worker is still unclear
2. SOP of company is not yet clear
3. Lack of skill and knowledge of employees in operating machinery and improving product varieties
4. Lack of supervisor's attention to Work Safety (K2) for employees in production
5. There are still complaints from customers about the quality and distribution of plastics
6. Handling of problems in factory are less quickly, especially in the production process
7. There is rework in production

From some of these performance condition, the next step is designing the Balanced Scorecard to improve and make performance measurement more optimally.

Steps of Designing Balanced Scorecard

1. Translating Vision and Mission into 4 Perspectives of Balanced Scorecard

Vision of PT. ABC is Being one of the biggest and best company in the field of HD-PE-PP & Bag Manufacturing and Printing in Indonesia.

Mission of PT.ABC are:

1. Satisfying customers by providing safe and products quality at affordable prices
2. Creating a conducive work environment supported by positive attitudes and actions to achieve its Corporate Vision
3. Increasing profit of company continuously
4. Become the center of making products quality through continuous improvement in quality
5. Become the center of the deveiopment of Human Resources quality
6. Being a company that gives attention to employees, customers, and society

Pouring into the 4 perspectives of Balanced Scorecard in accordance with the Vision and Mission PT.ABC as follows:

1. Financial perspective:

PT.ABC seeks for obtaining high net profit with one of his efforts is decreasing operational costs that are not needed to develop the company's business in order to translate the vision and mission of the

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Table 3. SWOT MATRIX

IFAS / EFAS	Strength (S)	Weakness (W)
	1. Popularity and Experience 2. Maintaining Good Plastics Quality 3. Plastic Products can be used safely 4. Using pure ingredients to produce plastics 5. Timely Delivery of finished products 6. Competitive Pricing 7. Strategic Location	1. Operational of company during 24 hours causes faulty works 2. There are no rewards for employees who have best performance
OPPORTUNITIES (O) 1. Necessaries of plastics rise continuously 2. Plastic products become more varied, especially of the size and quality of materials (not easily torn) so it can compete 3. The distribution of plastic products to outside of Jabodetabek, such as: Lampung, Bangka, etc	**Strategies of SO** 1. Improving the quality of plastic products with competitive price 2. Increasing the production of plastics by considering the size and design development of new plastic 3. Expanding the distribution area	**Strategies of WO** 1. Improving the structure of work for employees (the division of work shift more regularly) 2. Giving awards to employees with the best performance, for example by the addition of salary or incentive (bonus)
THREATS (T) 1. The price of plastic bags are continuously competing 2. Rapid technological change 3. The existence of other companies that sell similar products 4. The prices of Plastic resins are not stable	**Strategies of ST** 1. Making innovations in productions continuously 2. Providing optimum service for external sides of company, especially for customers and also internal sides 3. Providing certainty of products quality for sale	**Strategies of WT** 1. Enhance innovation and skills of workers through additional training 2. Improving employee's morale with increasing conditions of works and giving bonuses to employees who have best performance 3. Improving the division of task system to employees 4. Increasing products quality with competitive prices

IFAS = *Internal Strategic Factor Analysis Summary* (strengths and weaknesses)

EFAS = *External Strategic Factor Analysis Summary* (opportunities and threats)

Source: Results of Data Processing

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Strategic Measures Determination

The next step is the establishment of strategic measures as key indicators from each of perspective. Determination of these strategic measure based on strategic goals, strategic objectives, and key performance measures of perspectives. The strategic measures as shown on *Table 6.* to *Table 9.*

Table 6. Strategic Measures of Financial Perspective

No.	Strategic Objectives	Strategic Measures
1	*Leverage Ratio*	
	Showing how heavily the company is in debt and how EBIT of company has ability to pay interest on the debt and	Long term debt ratio
		The debt Ratio
		Times interest earned
		Cash Coverage Ratio
2	Liquidity Ratio:	
	Measuring how easily the firm can lay its hands on cash.	Net Working Capital to Total Asset Ratio
		Current Ratio and Quick Ratio
		Cash Ratio
3	Efficiency Ratio:	
	Measuring how productively the firm is using its assets.	Asset Turnover Ratio
		Average Collection Period
		Inventory Turnover Ratio
		Day's Sales in Inventory
4	Profitability Ratio:	
	Measuring the firm's return on its investments.	Net Profit Margin
		Operating Profit Margin
		ROA
		ROE
		ROI

Source: Results of Data Processing

Table 7. Strategic Measures of Customer Perspective

Strategic Objectives	Strategic Measures
Loyalty and trust of Customer	Customer Satisfaction of Company's services
Customer Satisfaction	Time needed by PT.ABC to solve customer's complaints
	Customer's view to PT.ABC

Source: Results of Data Processing

Table 8. Strategic Measures of Internal Business Process Perspective

No.	Strategic Objectives	Strategic Measures
1.	Motivation and Innovation of Employees	Level of Motivation and Innovation of Employees
2.	Level of Products Quality	Level of customer's complaints in according to product usage
3.	The level of after sales service	Level of purchasing plastics that has done by customers
4.	Providing the adequate facilities	% Computer used
		% Telephone Lines Used

Source: Results of Data Processing

Table 9. Strategic Measures of Learning and Growth Perspective

No.	Strategic Objectives	Strategic Measures
1	Employee Satisfaction	Level of Employee Satisfaction towards the company's facilities provided
		Level of Employee Satisfaction towards the working environment
		Level of Employee Satisfaction towards the Job Promotion
2	Training for employees	Total of employee's trainings in 1 month
		% Employees who are motivated, after attending training
3	Use of technology	Using technology easily and reliability of technology
4	Skills of Employees	% employees who are responding to customer complaints
		Level of Motivation and Innovation of the employees

Source: Results of Data Processing

Measurement and Data Analysis

a. Financial Perspective

Data Requirement

1. Data from Balance-Sheet Report
2. Data from Profit and Loss Report

The measurements of these data are shown on *Table 10.*:

Table 10. Results of Attributes from Financial Perspective Measurements on 2007-2009

Financial Attributes Perspective	Years		
	2007	2008	2009
ROI (%)	3.3	3.16	2.81
ROE (%)	14.11	17.34	15.64
ROA (%)	3.3875	3.74	3.214
Profit Margin (%)	2.3	2.519	2.98
Total debt ratio (%)	75.12	80	80.4
Net Working Capital to Total Asset Ratio	23.872%	19.98%	Valued -
Current Ratio	1.313	1.25	0.72
Quick Ratio	0.0924	0.168	0.063
Cash Ratio	0.0165	0.02258	0.0494
Asset Turnover Ratio	1.419	1.4848	1.035
Average Collection Period (days)	14	22	20
Inventory Turnover	Twice in 1 production period	Twice in 1 production period	Twice in 1 production period
Day's Sales in Inventory	251 days	231 days	264 days

Source: Results of Data Processing

Total debt ratio = $\frac{\text{total liabilities}}{\text{total assets}}$ .....(1)

NWC to asset = $\frac{NWC}{\text{total assets}}$ .....(2)

Current Ratio = $\frac{\text{Current Assets}}{\text{Current Liabilities}}$ .....(3)

Quick Ratio = $\frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$ .....(4)

Cash Ratio = $\frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$ .....(5)

Asset Turnover Ratio = $\frac{Sales}{\text{Average Total assets}}$ .....(6)

Average Collection Period = $\frac{\text{Average receivables}}{\text{Average daily sales}}$ .....(7)

Inventory Turnover Ratio = $\frac{\text{Cost of Goods sold}}{\text{Average Inventory}}$ .....(8)

Days'sales in inventory = $\frac{\text{Average Inventory}}{\text{Cost of goods sold}/365}$ .....(9)

Profit margin Ratio = $\frac{\text{Net Income}}{\text{sales}}$ .....(10)

ROA = $\frac{\text{Net Income} + \text{Interest}}{\text{Average Total Assets}}$ .....(11)

ROE = $\frac{\text{Net Income}}{\text{Average Equity}}$ .....(12)

ROI = $\frac{\text{Net Income}}{\text{Average Assets}}$ .....(13)

(Source : *Brealey, Myers,* and *Marcus,* 2007)

b. Customer Perspective
Data Requirement for analysis is obtained by using questionnaire. The measurements of strategic measures of these, can be seen on *Table 11.*:

Table 11. Results of Attributes from Customer Perspective Measurements on 2007-2009

Customer Perspective						
Strategic Objectives	Strategic Measures (SM)	Weight of SM (%)	Target (%)	Reality (%)	TPT (%)	E
Loyality and Trust of Customer	Customer Satisfaction of Company's services	50	90	80	88.89	44.45%
Customer Satisfaction	1.Time needed by IPT ABC to solve customer's complaints	50	90	98.75	98.61	49.445%
	2. Customer's view to IPT ABC		90	99.25	99.17	
		50	Rate of TPT (%)		98.89	93.895%

Source: Results of Data Processing

c. Internal Business Process Perspective
Data Requirement for analysis is obtained by using questionnaire. The measurements of strategic measures of these, can be seen on *Table 12.*:

Table 12. Results of Attributes from Internal Business Process Perspective Measurements on 2007-2009

Internal Business Process Perspective						
Strategic Objectives	Strategic Measures (SM)	Weight of SM (%)	Target (%)	Reality (%)	TPT (%)	E
Motivation and Innovation of Employees	Level of Motivation and Innovation of Employees	15	90%	90%	100	15%
Level of Products Quality	Level of customer's complaints in accorcing to product usage	35	100%	90%	100	35%
The level of after sales service	Level of purchasing plastics that has done by customers	25	100%	92%	100	25%
Providing the adequate facilities	1 % Computer Used	25	10 units	5 units	50	11.25%
	2 % Telephone Lines used		5 lines	2 lines	40	
		25	Rate of TPT (%)		45	
Total Results of Performance Measurement (E)						86.25%

Source: Results of Data Processing

d. Learning and Growth (L and G) Perspective
Data Requirement for analysis is obtained by using questionnaire. The measurements of strategic measures of these, can be seen on *Table 13.*:

Table 13. Results of Attributes from L and G Perspective Measurements on 2007-2009

Learning and Growth (L and G) Perspective						
Strategic Objectives	Strategic Measures (SM)	Weight of SM (%)	Target	Reality	TPT (%)	E
Employee Satisfaction	1. Level of Employee Satisfaction towards the company's facilities provided	25	80%	64.8%	81	22.50%
	2. Level of Employee Satisfaction towards the working environment		85%	77.8%	91.47	
	3. Level of Employee Satisfaction towards the Job Promotion		80%	78%	97.5	
		25	Rate of TPT (%)		89.99	
Training for employees	1. Total of employee's trainings in 1 month	25	100%	92%	92	23.79%
	2. % Employees who are motivated, after attending training		75%	73.75%	98.33	
		25	Rate of TPT (%)		95.17	
Use of technology	Using technology easily and reliability of technology	25	90%	90%	100	25%
Skills of Employees	% Employees who are responding to customer complaints	25	97%	90.50%	93.53	24.07%
	Level of Motivation and Innovation of the employees	25	90%	90%	100	
		25	Rate of TPT (%)		96.265	
Total Results of Performance Measurement (%)						95.56%

Source: Results of Data Processing

Average results of Total Achievement from Each of Perspective and Analysis of Data

Table 14. Average Results of Total Achievement of Perspective

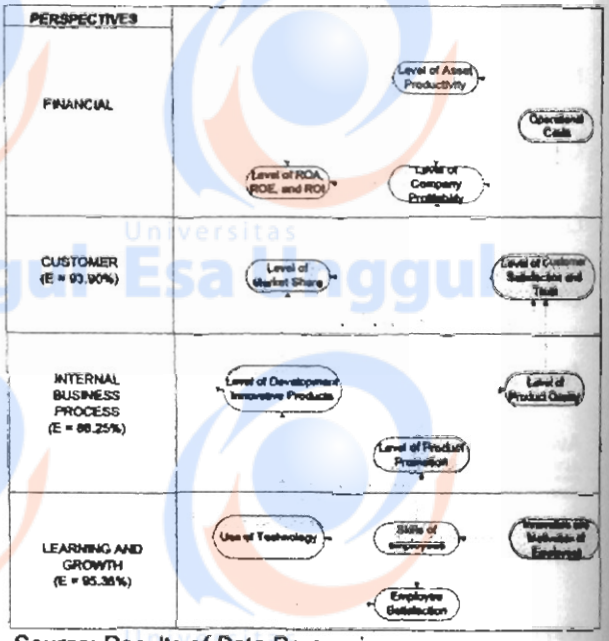
Perspectives	Total Achievement of Perspectives (%)
Customer	93.895
Internal Business Process	86.25
Learning and Growth (L and G)	95.36
Average Results of Total Achievement of Perspectives (%)	**91.835**

Source: Results of Data Processing

From the results on Table 14., it can be said that if it is seen from financial perspective, PT.ABC has not yet performed its financial well. But, from customer, internal business process, and learning and growth perspectives, PT.ABC has had good performances, because the value of measurement from one perspective has been well-balanced with the others.

5. CONCLUSION

From the results of the analysis and discussion, it can be concluded that PT.ABC has already had a good performance when viewed from three main perspectives contained in the Balanced Scorecard (customer perspective, internal business process, and L and G perspective), although from internal business process perspective is still needed attention, especially providing the adequate facilities. But, when viewed from financial perspective, the company performance is still not good, because there are some values of attributes from this that fluctuate and finally decreased on 2009 and have values below the target of company. The illustration of 4 perspectives and the relationships of them, can be seen in Figure 4:



Source: Results of Data Processing

Fig 4. Achievement of Each of Perspective and The Relationships of Strategic Measures

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