



Management system of paper recycling industry (“Super” Paper Industry)

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ABSTRACT

The purpose of this paper is to apply principles of management system to the paper recycling industry, Namely “Super”. The forecasted sale value for August in 2019 is firstly determined from the given specifications. By using least square method, the standard error of the estimated value is small and the forecasted sales are approximately to actual sale values. Forecasted sales for August in 2019 is 8559 packages. This calculation can help to fix responsibility for production rate. By calculating the depreciation for industry, the industry value at the end of 2019 is 115.236 million MMK and the depreciation is 170.396 million MMK. The expected cost of preventive maintenance is 163,383 MMK in every three months. The managerial accounting can help to identify the underlying cause and this will allow the management to get ahead of the problem. For a better management system, a sorting machine is needed to replace for sorting process. It can also increase customer service and quality. According to the latest current affairs in our country, one trade route to Shan States has been blocked. There was about 60% of products fall in export to Shan States. The information presented to support to the company allows it to make strategic management decisions.

Keywords: Forecasting, depreciation, maintenance and sorting machine.

1. INTRODUCTION

Management is a vital aspect of the economic life of man, which is an organized group activity. The productive resources – material, labour, capital etc. are entrusted to the organizing skill, administrative ability and enterprising initiative of the management. Under competitive economy and ever-changing environment the quality and performance of managers determine both the survival as well as success of any business enterprise. [1]

Social scientists study management as an academic discipline, investigating areas such as social organizations and organizational leadership. Some people study management at colleges or universities. Engineering management is a career that brings together the technological problem-solving ability of engineering and the organizational, administrative and planning abilities of management in order to oversee the operational performance of complex engineering driven enterprises. [2] The primary raw material for the paper production is pulps fibres

obtaining by a complicated chemical process from natural materials, mainly from wood. This fibres production is very energy demanding and at the manufacturing process there are used many of the chemical matters which are very problematic from view point of the environment protection. The alternative is obtaining of the pulp fibres from already made paper. This process is far less demanding on energy and chemicals utilization.

The paper recycling, simplified, means the repeated defibring, grinding and drying, when there are altered the mechanical properties of the secondary stock, the chemical properties of fibres, the polymerization degree of pulp polysaccharidic components, mainly of cellulose, their supramolecular structure, the morphological structure of fibres, range and level of interfibres bonds. At the repeat use of the secondary fibres, it need deliberate the paper properties alter due to the fiber deterioration during the recycling, when many alteration are irreversible. The alteration depth depends on the cycle’s number and way to the fibres use. [3]

Recycling paper is one of the best ways to save the trees and protect the environment. Nearly 80% of the paper we used can be recycled. Advantages of management system for paper recycling industry are more efficient and more profitable business particles, effective utilization of resources, increase customer service and quality, save time, effort and money, provides stability of business organization, improve the progress and service in finance, marketing and human resource. There are many paper recycling industries in Myanmar. However, they do not consider the management system. So, in this paper, the author emphasized the management system for “Super Paper Industry” from Mandalay Industrial Zone (2).

2. PAPER RECYCLING PROCESS

Paper recycling is the process by which waste paper is turned into new paper products. The process of waste paper recycling most often involves mixing used/ old paper with water and chemicals to break it down. It is then chopped up and heated, which breaks it down into strands of cellulose, a type of organic plant material, this resulting mixture is called pulp or slurry. It is strained through screens, which remove any glue or plastic (especially from plastic-coated paper) that may still be in the mixture then cleaned, de-inked, bleached, and mixed with water. Then it can be made into new recycled paper. Paper recycling process is shown in Chart-1. [3]

$$S_y = \sqrt{\frac{\sum (Y - Y_F)^2}{N - 2}} \quad (4)$$



Chart-1 Paper Recycling Process

The collection of used paper and board is the first step in the recycling process. Then the following steps are as follow; Sorting; Pulping; Screening; Cleaning; De-inking; Washing; Bleaching; Rolling; Cutting; Pulp and Paper Manufacturing Process is shown in Chart-2.



Chart-2 Pulp and Paper Manufacturing Process

Finally, the recycled paper are packed into 500 sheets per package and transported to warehouses for storage. During all these processes, it is required to consider management principles (or) inventory management system, especially controlling process, such as depreciation, forecasting and technique, maintenance and accounting. Controlling is one of the important functions of management. The main object of control is to bring to light the variations between the standards set and performance and then to take necessary steps to prevent the occurrence of such variations in future.

3. METHODS OF INVENTORY MANAGEMENT SYSTEM

3.1. Forecasting Process and Techniques

Forecasting is the estimation of future on the basis of the past. Chart 3 shows the forecasting process.

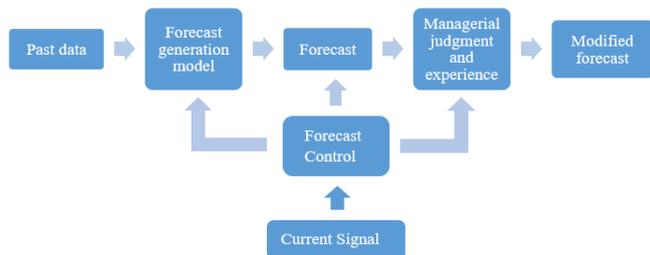


Chart-3 Forecasting Process

There are many forecasting methods in inventory management system. In this paper, the least square method is used for forecasting.

$$\sum Y = Na + b \sum X \quad (1)$$

$$\sum XY = a \sum X + b \sum X^2 \quad (2)$$

$$Y_F = a + bX \quad (3)$$

3.2. Depreciation

It is an accounting procedure to periodically reduce the value of an asset.

Causes of depreciation

1. Physical depreciation
2. Functional depreciation
3. Technological depreciation
4. Depletion
5. Monetary depreciation

The equation of sum-of-years digits (SYD) method is used to determine the depreciation.

Annual depreciation charge =

$$\frac{n - N + 1}{S.Y.D} (C - S) \quad (5)$$

Where

$$S.Y.D = \frac{n(n+1)}{2} \quad (6)$$

3.3. Maintenance System

The purpose of maintenance system is to secure reliable performance from the production system. Reliability is normally measured by the probability of satisfactory operation for a certain length of time under specified conditions. The maintenance system and its operation follows the usual format in terms of decision variables, outputs and inputs, constraints, and measures of performance. [4]

To calculate the cost of maintenance, equations (7) to (11) are used.

$$L_{avg} = \sum i(P_i) \quad (7)$$

$$B_{avg} = \frac{N}{L_{avg}} \quad (8)$$

$$TC_b = C_b \times N \quad (9)$$

$$TC_p = C_p \times N \quad (10)$$

$$B_n = N (P_1 + P_2 + \dots + P_n) + B_{n-1}P_1 + \dots + B_1P_{n-1} \quad (11)$$

Moreover, it is needed to calculate cost of the industry, production time and net income of the industry.

4. ECONOMIC EVALUATION AND FINANCIAL ANALYSIS OF PROPOSED PAPER RECYCLING INDUSTRY

4.1. Forecasting the Monthly Sales for August

The monthly sales of 2019 for 'Super' Industry are collected as shown in Table 1. In this Table, the data are for January to July in 2019 which are actual sale values. Therefore, the forecast sale of August can be calculated by using Equation (1), (2) and (3).

Table 1: Table Of Monthly Sales (2019 January to July)

Month	Sales (in packages)
Jan	6720
Feb	6240
Mar	6960
Apr	6000
May	9280
Jun	9040
Jul	8700

$$a = 6077.857$$

$$b = 495$$

$$F_{Aug} = 9542 \text{ packages}$$

$$S_y = \sqrt{\frac{4832227.658}{7-5}} = 983.0796$$

Forecasted sales for August 2019 = Forecast for August – Standard error value = $F_{Aug} - S_y$
 = $9542.875 - 983.0796$
 = $8559.7954 \sim 8559$ packages
 Actual August sales for 2019 = 8550 packages

The forecasted value based on the annual monthly sales is more accurate than the monthly forecasted value of sales within a year. The following data are obtained by calculating the mean values of both forecast sales with least square line fit.

Table 2: Table of Comparison of Actual Sales and Forecast Sales

Month	Actual Sales	Forecast Sales	Error
Jan	6720	6716	+4
Feb	6240	6240	0
Mar	6960	6968	-8
Apr	6000	6013	-13
May	9280	9264	+16
Jun	9040	9035	+5
Jul	8700	8700	0
Aug	8550	8559	-9

4.2. Depreciation for Industry

The input parameters to calculate depreciation of the industry are as follows;
 Sum-of-years digits (SYD) method
 C = Total industry cost – 686.5×10^6 MMK
 n = Economic life – 10 yrs
 S = Salvage (resale) value – 285.632×10^6 MMK
 By using equations (5) and (6),
 Industry value at the end of 2019 = 115.236 million MMK.

Table 3 shows the annual depreciation for 10 years of economic life.

Table-3: Table of Depreciation for Economic Life (in million MMK)

Yr	Beginning book value	Annual Depreciation Charge	Accumulated Depreciation Charge	Ending book Value
1	686.50	72.89	72.89	613.62
2	613.62	65.60	138.49	548.02
3	548.02	58.31	196.79	489.71
4	489.71	51.02	247.80	438.69
5	438.69	43.73	291.54	394.96
6	394.96	36.44	327.98	358.51
7	358.52	29.15	357.13	329.36
8	329.36	21.87	379.00	307.50
9	307.50	14.58	393.58	292.92
10	292.92	7.29	400.90	285.63

4.3. Maintenance

The required data to determine maintenance are as follow:
 Breakdown cost = $C_b = 30000$ MMK
 Preventive maintenance cost = $C_p = 5000$ MMK
 numbers of machines = $N = 11$
 Total breakdown cost/month can be calculated by using equation (7),(8) and (9).
 $L_{avg} = 2.5$ months

$B_{avg} = 5.366$ /month
 $TC_b = 160980$ MMK/month
 Total preventive cost per month can be calculated by using equation (10) and (11).
 $TC_p = 55000$ MMK

Table 4: Table of Total Cost for Preventive Maintenance

I	B	B/ month	TC _b / month	TC _p / month	TC/ month
1	4.50	4.50	135000	55000	190000
2	9.93	4.96	148913	27500	176413
3	14.51	4.84	145050	18333	163383*
4	20.50	5.13	153780	13750	167530

The minimum preventive maintenance cost occurred 163383 MMK / month in every 3 months.

$PMC > BMC$

$163383 \text{ MMK} > 160980 \text{ MMK}$

Since it has a small different amount between PMC & BMC, we use preventive maintenance which is better policy for industry.

4.4. Specifications of “Super” Paper Industry

Table 5: Input uses and costs for daily

Raw material	2250 viss used (400~500 MMK for 1 viss)
Water usage (For Boiler)	16000 liters
Fuel usages (For Boiler)	3 different types can be used.
i. Rice-shell	3 tons daily (18000 MMK for 1 ton)
ii. Sawdust	2.5 tons daily (40000 MMK for 1 ton)
iii. Coal	2 tons daily (60000~80000 MMK for 1 ton)

Product
 Raw material \Rightarrow Product
 (used/ old papers) \Rightarrow (recycled paper)
 Use 2250 viss daily
 Produced 1956 viss daily
 (15% waste due to losses)

Daily product	240 packages/ day (1 package contains 500 sheets)
Selling price	(750~800 MMK for 1 viss)

4.5. Determining the Economical Use of Boiler’s Fuel

Three different types of fuel can be used for boiler.

1st fuel type – Rice-shell 1 ton – 18,000 MMK

For 3 ton/day - $3 \times 18,000 = 54,000$ MMK / day

2nd fuel type – Sawdust 1 ton – 40,000 MMK

For 2.5 ton/day – $2.5 \times 40,000 = 100,000$ MMK/day

3rd fuel type – Coal 1 ton – 60,000 MMK

For 2 ton/day - $2 \times 60,000 = 120,000$ MMK/day

$Cost_{coal} > Cost_{sawdust} > Cost_{rice-shell}$

$120,000 \text{ MMK} > 100,000 \text{ MMK} > 54,000 \text{ MMK}$

Therefore, we use rice-shell for boiler’s fuel. It is more economical and cheaper than other two fuel types.

4.6. Production Line Layout

The process of “Super” industry of the production line layout is shown in Chart 4.

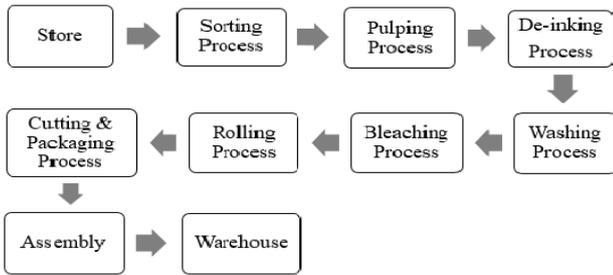


Chart-4 Production Line Layout

4.7. Activity Network diagram

An activity is represented by a line or arrow. This line or arrow connects two events. Each event is specific point in time making the beginning and or end of an activity. A dual-purpose symbol for an event is a circle topped by a cross; the circle facilitated computer computations and the cross aids manual arithmetic.

Table 6: Table of Producing for 10 packages within 1 hour

Process	Time Taken (min)
A. Sorting	10
B. Pulping	6
C. De-inking	8
D. Washing	7
E. Bleaching	10
F. Rolling	9
G. Cutting & Packing	10

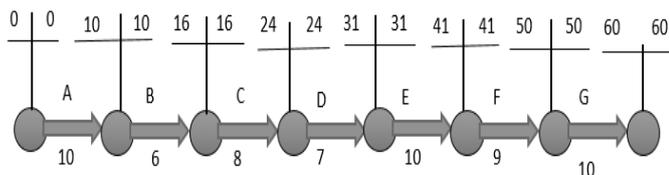


Chart-5 Activity Network Diagram

4.8. Adjusted Trial Balance of 'Super' Industry end of July

To calculate the forecast of August 2019, the net income of end of July is calculated.

Table-7: Table of Adjusted Trial Balance (July 31)

No	Details	Debit	Credit
1	Cash	569510	
2	Account Receivable	200000	
3	Accumulative Depreciation: Building		6000
4	Office Equipment	50000	
5	Accumulative depreciation: Office Equipment		4500
6	Account Payable		300000
7	Goods		814510
8	U Myint Soe, Capital		1500000
9	Wages & Salaries Expense	1500000	
10	Telephone Bill Expense	20000	
11	Electricity Expense	300000	
12	Insurance Expense	20000	
13	Insurance Interest Received		45000
14	Depreciation Expense: Building	6000	
15	Depreciation Expense: Office Equipment	4500	
		2670010	2670010

4.9. Income Statement for the month July at 31 July, 2019

Table 8: Table of Net Income (July 31)

Revenues:	MMK	MMK
	4926460	4926460
Expense : Purchases	2511950	
Salaries	1500000	
Telephone Bill	20000	
Electricity	300000	
Insurance	20000	
Depreciation	11500	4383450
Net income		543010

J. Replacing Paper Sorting Machine

If a paper sorting machine is used to replace 2 workers for a better production rate, the advantages and disadvantages are as following Table.

Cost of paper sorting machine – 1.52×10⁶ MMK

Salaries Expense – 300000 MMK (for 2 workers) per month

Table 9: Table of Comparison of Sorting Machine and Manpower

Features	Sorting Machine	Manpower
Usage	Standardized	No Standardized
Efficiency	High	Low
Number of Products	Many	Few
Time Taken	Low	High
Raw material inventory	Low	High
In-Process inventory	High	Low
Finished goods inventory	High	Low
Worker skill	-	Need
Investment cost	High	Low
Long-term cost	Low	High
Maintenance	Required	-
Space requirement	Need	-
Depreciation & salvage value	Variable	-
Salaries expense	-	Fixed
Insurance & bonus fees	-	Variable

According to the chart shown in Chart 6, it is obviously that the advantages of using sorting machine is more than those of man power. Therefore, we can use a sorting machine as a replacement for man power to achieve better economic and better management system.

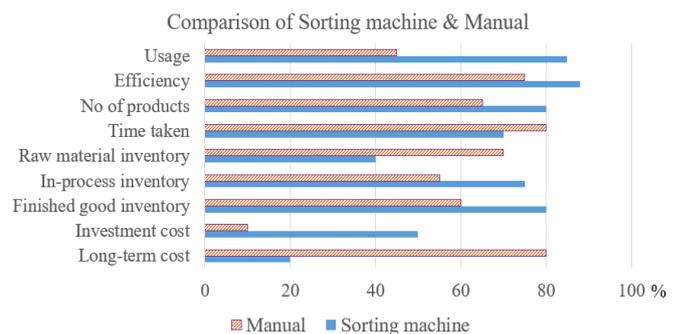


Chart-6 Comparison of Sorting Machine & Manpower

5. CONCLUSION

For economic evaluation and financial analysis, boiler's fuel, forecasting, depreciation, maintenance, accounting for management including trial balance and net income are calculated in this paper. Rice-shell is the economical use for boiler's fuel. Forecasted sales for August in 2019 is 8559 packages. By calculating the depreciation for industry, the industry value at the end of 2019 is 115.236 million MMK and the depreciation is 170.396 million MMK. The expected cost of preventive maintenance is 163,383 MMK in every three months. The adjusted trial balance on both credit and debit sides is 2670010 MMK respectively. The net income for July is 543,010 MMK. For a better management system, a sorting machine is needed to replace for sorting process.

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BIOGRAPHY

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