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Study of Process and Proposing a Transportation Model for Hand Woven Clothes from Weaving Mill : A Case Study

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Abstract: **In this article we describe and analyse the process flow and transportation optimisation of a weaving mill and distribution network. Cplex coding is done for proposing the transportation model. Use of control chart is plotting for the quality measure. It analyse the current distribution pattern and proposes a suggestion.**

Keywords– IBM Cplex, Control charts, Excel solver.

I. INTRODUCTION

The goal of this article is to present a model of what are all the process happening in a weaving mill and their duration and scheduling, A transportation model is being proposed for the optimisation of total cost associated with it. Process flow is shown below, it is done with the help of MS Visio software. For transportation analysis IBM CPLEX coding can be use. This paper studies about all the process that is happening in weaving mill especially a hand weaving mill where all the process are semi-automated or say manual process are more than automated. The scope of automation in such industry will be very less compared to other weaving industry of same kind.

TASK	DURATION
processing stage 1	5 days
processing stage 2	7 days
colouring	2 days
Additives	3 days
Machine setting	1 days
Weaving	2hrs
Cutting	15 min
Quality check	15 min

Fig-2: Activity durations

Activity duration is as above, here processing stage from raw cotton to thread takes large time duration compare to weaving time.

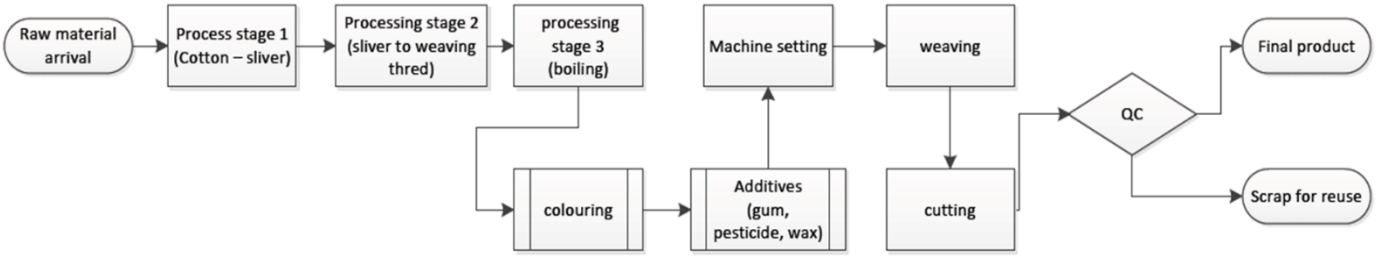

Fig-1 Process Flow

II. PROCESS FLOW :

a simple pictorial representation of the total flow the process associated with weaving from raw material entry to final product. This block layout is drawn using Microsoft visio. Raw material is pure cotton is undergone various processing stages that takes more than 2 weeks to get as a thread for weave. Cotton is undergone boiling process and converted to sliver (2 mm thick thread) and then sliver to particular diameter thread. Colouring and strengthening is done by two subgroups as shown in picture. Machine setting time is crucial and time consuming activity, then weaving then QC. Quality rejected items are moves into scrap section that may reuse.

For quality checking as per the flow process shown above, they are concerned with following
There may be a chance of occurring following defects
1. Thread braking
2. No. of thread sets (“ooda ”) are more or less 19 – 20 .
3. Improper sides.
4. Length variation

In this article we measure the process capability by various metrices using Minitab and plotting the X bar – R chart to see the variations.

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	Length (cm)	MEAN1
1	190	187.4
2	188	
3	189	
4	188	
5	190	
6	186	
7	187	
8	189	
9	185	
10	186	
11	190	
12	189	
13	188	
14	190	
15	189	
16	186	
17	185	
18	186	
19	185	
20	186	
21	189	
22	186	
23	188	
24	188	
25	189	

Table 1 length measured

A sample consist of 5 units and such type of 20 samples taken for observation. Control charts (using X bar and R chart) using Minitab gives following results.

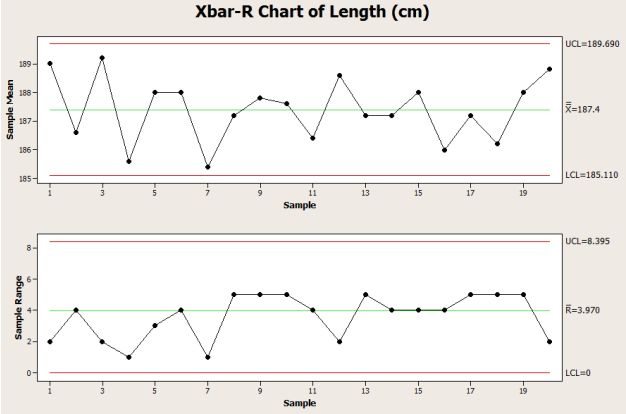

Fig .2 Control chart (Xbar and R)

Standard deviation $= \frac{\bar{R}}{d_2} = \frac{3.970}{2.326} = 1.7067$

Process Capability Ratio $= \frac{USL - LSL}{6\sigma} = \frac{190 - 185}{6 * 1.17067}$

$= 0.488$

implies natural tolerance limits in the process are not inside the 6 sigma limits.

Sigma level $= \frac{USL - Mean}{\sigma} = \frac{190 - 187.4}{1.7067}$

$= 1.52$

Ie the process follows 1.52 sigma level

Fraction of non-conforming item

P $= P(x<185) + (x>190)$

$= \Phi(\frac{185 - 187.4}{1.7067}) + \Phi(\frac{190 - 187.4}{1.7067})$

$= 0.000101599$

ie 101 parts per million

III. DISTRIBUTION

Under the Central weaving board there having mainly 3 weaving centre at

1. Payyannur
2. Munnad
3. Periye

Finished products from all these centres moves to central office stock room at Payyannur.

There are 12 outlets in Kasaragod district, in that 4 are main.

1.Kundamkuzhy
2.Kasaragod
3.Neeleswaram
4.Kanhangad

Source capacity and destination demand details are a follows.

A factor is being multiplied with the real value to comprehend with the company policy.

	sources	Capacity	60%
1	Munnad	650	390
2	Payyannur	900	570
3	Periye	650	390

	Outlet	demand
1	Kundamkuzhy	300
2	Kasaragod	400
3	Neeleswar	300
4	Kanhangad	350

Some assumptions we are taking as follows

- Taken only main destinations
- Lion's share of the capacity consumes by these 4 outlets
- Assume 60% of capacity

	Payyannur	capacity	60%
Munnad	78	650	390
Periye	64	650	390
stock demand	780		

Total Cost = (390*78) + (390*64)

= 55380 Rs

	Kky	Ksd	Nlswr	Khd	Capacity
Payyannur	73	87	30	41	1350
Demand	300	400	300	350	

Total Cost = (73*300) + (87*400) + (30*300) + (41*350)

= 80050 Rs

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*trans model.mod *trans model.dat *trans model.ops

```
/*********************************************
 * OPL 12.5 Model
 * Author: Shyam
 * Creation Date: 21-Sep-2016 at 6:19:20 PM
 *********************************************/
{string} Source=...;
{string} Destination=...;
int Supply[Source]=...;
int Demand[Destination]=...;
int Cost[Source][Destination]=...;
dvar int Trans[Source][Destination];
minimize
sum( c in Source , w in Destination )
Cost[c][w] * Trans[c][w];
subject to {
forall( c in Source, w in Destination)
Trans[c][w]>=0;
forall( c in Source , w in Destination )
ctSupply:
sum( w in Destination )
Trans[c][w] == Supply[c];
forall( c in Source , w in Destination )
ctDemand:
sum( c in Source )
Trans[c][w] == Demand[w];
}
execute DISPLAY {
writeln("trans = ",Trans);
}
```

Fig.3 Transportation model Cplex Code

We makes a suggestion that a transportation arrangement by making Cost matrix. The fig.3 shows a Cplex code for transportation model with constraints as demand and supply.

*trans model.mod *trans model.dat *trans model.ops

```
/*********************************************
 * OPL 12.5 Data
 * Author: Shyam
 * Creation Date: 21-Sep-2016 at 6:19:20 PM
 *********************************************/
Source = { "Munnad","Payyannur","Periye" };
Destination = { "Kundamkuzhy","Kasaragod","Neeleswaram","Kanhangad" };
Supply=[390,570,390];
Demand=[300,400,350,300];
Cost=[[5,25,39,28][73,87,30,41][9,21,32,12]];
```

Fig. 4 Cost matrix data

	Kky	Ksd	Nlswr	Khd	Capacity
Munnad	5	25	39	28	390
Payyannur	73	87	30	41	570
Periye	9	21	32	12	390
Demand	300	400	350	300	

Here constrains are the demands of each outlets and capacity of each weaving centre. And the assignment for each outlet and centre found by using excel solver.

	Kky	Ksd	Nlswr	Khd	Capacity
Munnad	300	90	0	0	390
Payyannur	0	0	350	220	570
Periye	0	310	0	80	390
Demand	300	400	350	300	

This will be the final basic feasible solution

Total Cost = (300*5) + (90*25) + (350*30) + (270*41) + (310*21) + (80*12)

= 30740 Rs

From the observation its clear that current practice they are doing holds more capital expense for transportation.

IV. RESULT

From the transportation results it is clear that it is spend much more capital expense in terms of transportation of finished goods. So here is the proposal for transportation leads overall profit in capital

V. CONCLUSION

With those assumptions we made earlier proposed transportation model will give an optimised result. Since the factor which we taken for comprehend the company policy we cannot tell exact or percentage of the savings that we can made. The result shows that the proposed model can save a reasonable amount of capital that the company may invest on it. The process is being studied and since it is a manual operations all over there is no scope of automation or any sort of improvement in that area. But there is a scope for improving in inventory and productivity improvement side by applying various lean tools in future.

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