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Process Optimization and Simulation of Production Industry

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Abstract—In present scenario with increasing of global economic competition, small scale industries have known as an economic growth engine and a tool for employment so they have important role in growth and development of countries. Simulation is a very helpful and valuable work tool in manufacturing. It can be used in industrial field allowing the system`s behavior to be learnt and tested. Simulation provides a low cost, secure and fast analysis tool. It also provides benefits, which can be reached with many different system configurations. In my paper, a generalized model is developed for process optimization of small-scale industries for competitive production within the acceptable quality level of production. It is observed that most small-scale industries do not lend themselves to flexible production processes, therefore making it difficult for them to optimize production.

Keywords— small-scale industries, process optimization, manufacturing, modelling, simulation.

I. INTRODUCTION

Small industrial units are industries with limited scale of manufacturing operations, producing a product or few products with limited levels of employment and investment and are many in number than large scale industries. In many developing countries, the roles of these industries are crucial as they provide employment to a large number of people. Breaking the size barrier (limited levels of employment and investment) is a measure of success of the small-scale industries. Small-scale industries are dependent for their equipment and process technology on a limited number of resources that start with:

(a) The entrepreneurs' own technical expertise probably gained during earlier stages of paid employment.
(b) Large firms that provide the technology as a component within a sub-contracting arrangement.
(c) Government institutions desirous to support a measure of indigenous Technology.

The demand for the products of small-scale industries is crucial to their growth. Therefore this work focuses on process re-engineering of a small-scale industry for economical and competitive production.

For this purpose modelling of complex systems such as manufacturing systems is an arduous task. Simulation has gained importance in the past few years and allows designers imagine new systems and enabling them to both quantify and observe behaviour. Whether the system is a production line, an operating room or an emergency response system, simulation can be used to study and compare alternative designs or to troubleshoot existing systems. With simulation models, how an existing system might perform if altered could explored, or how a new system might behave before the prototype is even completed, thus saving on costs and lead times.

For these investigation and simulation I have chosen the corrugated box manufacturing industry. Because cardboard packaging is one of the most widely used form of packaging.

And also corrugated cardboard is stiff, strong and light in weight material made up of layers of brown craft paper. These brown craft paper rolls are transported to a corrugation machine where this paper gets crimped and glued to from corrugated cardboard called as single face corrugated board and then this single face corrugated board is cut according required dimension on the cutting machine. According to requirement by adding another corrugating medium and a third flat liner creates a double wall corrugated board or triple wall corrugated boards on gluing or bonding machine.

Then these card boards are transferred to creasing and cutting machine where extra material is removed and creasing operation is performed(i.e., from where the box get folded).

The next operation is slotting operation and finally with stitching operation corrugated box is manufactured.

II. OBJECTIVES

- To find out an optimal production line process.
- To minimize the process time.
- To formulate the optimize model for different variables.
- To formulate the input and output model of system

III. LITERATURE SURVEY

[1] A generalized model was developed for process optimization of small-scale industries for competitive production within the acceptable quality level of production. It was observed that most small-scale industries do not lend themselves

to flexible production processes, therefore making it difficult for them to optimize production when there are fluctuations in prices of production inputs.

[2] Simulation is a very helpful and valuable work tool in manufacturing. It can be used in industrial field allowing the system`s behaviour to be learnt and tested. Simulation provides a low cost, secure and fast analysis tool. It also provides benefits, which can be reached with many different system configurations. Topics to be discussed include: Applications, Modelling, Validating, Software and benefits of simulation. This paper provides a comprehensive literature review on research efforts in simulation.

[3] Based on a field investigation of 399 small - scale industries in three Indian states, i.e. West Bengal, Haryana and Maharashtra, collected during April - June 2000, the present paper analyses the pattern of awareness, acquisition and adoption of technological changes in small - scale industries. It also examines possible constraints of non - adoption of improved technologies. The pattern of use of various components of Information Technology (IT) by small entrepreneurs is also discussed. Following a broader definition of technological changes, the paper identifies major causes that are inhibiting the adoption of improved technologies and examines the role of existing policies and programmes in overcoming them; it also analyses the present procedure for availability of finance to SSI units for upgrading and modernizing their technologies and suggest measures for facilitating such services to small - scale entrepreneurs; further it evaluates the requirements of improvements in skills, education and training both of entrepreneurs and workers among the SSI units to absorb and implement technologies in their diverse manifestations. Rural urban contrasts are brought out markedly while discussing these issues.

For the critical analysis of existing system method study is best tool. In which various charts such as Man/Material charts, Man and Machine charts are prepared which are available in standard format in Introduction to Work Study by International Labour Office, Geneva. The success of the whole procedure depends on the accuracy with which facts are recorded, because they will provide the basis of both the critical examination and the development of the improved method.

IV. PROBLEM IDENTIFICATION

It is observed that most small-scale industries do not lend themselves to flexible production processes as well as due to inefficient utilization of floor space the sequencing of machines are not in proper order and these results in greater process time.

V. EXPERIMENTATION

The first step to minimize this problem is the critical analysis of the system. For the critical analysis Method Study is the best tool. In the method study various charts such as man charts and man and machine charts are prepared for all the workstations.

Chart No.	Sheet No.	Of	Summary			
Subject Charted:			Activity	Present	Proposed	Saving
			Operation ○	10		
			Transport ⇨	3		
Activity: Corrugation formation machine			Delay D	1		
			Inspection □			
			Storage ▽			
Method: Present			Distance(m)			
Location: M/S Shell Packagers			Time(man-h)			
Operatives(S):	Clock No.		Cost	Labour		
Charted By: A. R. Narkhede	Date:			Material		
Approved By:	Date:		Total			

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
From workstation to storage area	2	6	54sec	○ ⇨ D □ ▽	
Raw material from storage transported to workstation		6	4min 54sec		
Unload the shaft			1		
Roll of kraft paper load on shaft (Plain paper)			3min 33sec		
With the use of brush			1		
Loading roll with shaft on machine			1min 45sec		
Delay			2		
Unload the shaft			1		
Roll of kraft paper load on shaft(for corrugation)			3min 23sec		
With the use of brush			1		
Loading roll with shaft on machine			2min 10sec		
Feed the two papers on machine			30sec		
Machine start					
Corrugared sheet transferred to sheet cutter	1	0.5	2sec		

Flow Process Chart			Man Type			
Chart No.	Sheet No.	Of	Summary			
Subject Charted:			Activity	Present	Proposed	Saving
			Operation ○	3		
			Transport ⇨	3		
Activity: Sheet cutter			Delay D			
			Inspection □			
			Storage ▽	1		
Method: Present			Distance(m)			
Location: M/S Shell Packagers			Time(man-h)			
Operatives(S):	Clock No.		Cost	Labour		
Charted By: A. R. Narkhede	Date:			Material		
Approved By:	Date:		Total			

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
Setting the required dimension	1		1min 20sec	○ ⇨ D □ ▽	
Sheet from corrugation machine		0.5	2sec		
Cutting operation			1sec		
Collecting sheets at other end					
Storing			4		
Transportation of sheets to stoarge area		1	1min 45sec		
Return to workstation		1	15sec		

Flow Process Chart			Man Type				
Chart No.	Sheet No.	Of	Summary				
Subject Charted:			Activity		Present	Proposed	Saving
			Operation ○		5		
			Transport ⇨		5		
Activity: Paper cutting and printing			Delay D				
			Inspection □				
			Storage ▽				
Method: Present			Distance(m)				
Location: M/S Shell Packagers			Time(man-h)				
Operatives(S):	Clock No.		Cost	Labour			
Charted By: A. R. Narkhede	Date:			Material			
Approved By:	Date:		Total				

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
From workstation to storage area	1	3.5	20sec		
Raw material from storage transported to workstation		3.5	1min 25sec		
Raw material loading on machine	2		2		
Setting machine for cutting according to required dimension			1min 34sec		
Machine starts					
After cutting collected at other end			2min 48sec		
Transported to printing machine	1	0.2	35sec		
paper load on printing machine			20sec		
printed paper collected at other end			3min 55sec		
Printed paper transported to storing area		0.5	1		

Flow Process Chart			Man Type				
Chart No.	Sheet No.	Of	Summary				
Subject Charted:			Activity		Present	Proposed	Saving
			Operation ○		3		
			Transport ⇨		2		
Activity: Press machine			Delay D				
			Inspection □		1		
			Storage ▽				
Method: Present			Distance(m)				
Location: M/S Shell Packagers			Time(man-h)				
Operatives(S):	Clock No.		Cost	Labour			
Charted By: A. R. Narkhede	Date:			Material			
Approved By:	Date:		Total				

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
Transported from pasting machine	1	1.5	1		
Loading on machine	1		2		
Machine starts					
Removing			2		
Inspecting the sheets			45sec		
Transported to creasing machine		1.5	2		

Chart No.	Sheet No.	Of	Summary				
Subject Charted:			Activity		Present	Proposed	Saving
			Operation ○		1		
			Transport ⇨		3		
Activity: Stiching machine			Delay D				
			Inspection □		1		
			Storage ▽		1		
Method: Present			Distance(m)				
Location: M/S Shell Packagers			Time(man-h)				
Operatives(S):	Clock No.		Cost	Labour			
Charted By: A. R. Narkhede	Date:			Material			
Approved By:	Date:		Total				

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
Transported from Slotting machine	1	1.5	1		
Loading sheets manually one by one			2sec		
Stiching operation is performed					
Storing the corrugated box			4min 10sec		
Inspecting the corrugated box			40sec		
Transported to outside of plant for sunlight	1	6	3min 23sec		

Flow Process Chart			Man Type				
Chart No.	Sheet No.	Of	Summary				
Subject Charted:			Activity		Present	Proposed	Saving
			Operation ○		3		
			Transport ⇨		3		
Activity: Pasting machine (Pasting basic 2 ply sheet to make 3-ply, 5-ply or 7-ply according to requirement)			Delay D				
			Inspection □				
			Storage ▽		1		
Method: Present			Distance(m)				
Location: M/S Shell Packagers			Time(man-h)				
Operatives(S):	Clock No.		Cost	Labour			
Charted By: A. R. Narkhede	Date:			Material			
Approved By:	Date:		Total				

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
Printed sheet transported to glueing machine	1	2	1min 10sec		
Basic 2-Ply sheet tranported to glueing machine	1	1	1		
Machine starts					
2-ply sheets load on machine manually one by one	1		2sec		
Collected at other end glued to printed paper	2		2sec		
Storing			4		
Transported to press machine		1.5	1		

Chart No.	Sheet No.	Of	Summary				
Subject Charted:			Activity		Present	Proposed	Saving
			Operation ○		3		
			Transport ⇨		2		
Activity: Creasing machine and removing extra material			Delay D				
			Inspection □				
			Storage ▽				
Method: Present			Distance(m)				
Location: M/S Shell Packagers			Time(man-h)				
Operatives(S):	Clock No.		Cost	Labour			
Charted By: A. R. Narkhede	Date:			Material			
Approved By:	Date:		Total				

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
Transported from press machine	1	1.5	2		
Loading sheets manually one by one			1sec		
Removing extra material &creasing operation simultaneously					
Collected at other end	1		3min 34sec		
Transported to slotting machine		1.5	1min 20sec		

Flow Process Chart			Material Type				
Chart No.	Sheet No.	Of	Summary				
Subject Charted:			Activity		Present	Proposed	Saving
			Operation ○		2		
			Transport ⇨		2		
Activity: Slotting machine			Delay D				
			Inspection □				
			Storage ▽		1		
Method: Present			Distance(m)				
Location: M/S Shell Packagers			Time(man-h)				
Operatives(S):	Clock No.		Cost	Labour			
Charted By: A. R. Narkhede	Date:			Material			
Approved By:	Date:		Total				

Description	Qty	Distance (m)	Time (min)	Symbol	Remarks
Transported from creasing machine	1	1.5	1		
Loading sheets manually one by one			2sec		
Collected at other end	1				
Storing			4		
Tranported to stiching machine		1.5	1		

VI. CONCLUSIONS

For the problem identification the method study conclude insufficient utilization of floor space the sequencing of machine are analysed using critical analysis method and from the man chart, decrease process time using proper sequencing of machine.

REFERENCES

[1] A. K. Ogunkoya, M.Eng.1* and A. A. Aderoba, (2010),"A Model for Process Optimization of Small-Scale Industry for Competitive Production, Pacific Journal of Science and Technology, Volume 11. Number 2".
[2] F. Hosseinpour, and H. Hajihosseini,(2009)," Importance of Simulation in Manufacturing", World Academy of Science, Engineering and Technology.
[3] Sahu P. P,(2006),"Adoption of Improved Technology in India's Small-scale Industries".
[4] D.A. van Beek , A. van den Ham, J.E. Rooda,"Modeling and control of process industry batch production system", Eindhoven University of Technology, Dept. of Mechanical Engineering, Netherlands.
[5] www.packaging-simulation.com
[6] www.dcmsme.gov.in

Books:
[1] Introduction to Work Study by International Labour Office, Geneva.
[2] Motion and Time Study Design and Measurement of Work by Ralph M. Barnes.

