Effective process and quality control in pulp and paper industry

HARICHANDAN, A. K.,* MAJUMDAR, S. C.,* MISRA, S. K.,* GUPTA, B. B.,* BIHANI, B. L.*

SUMMARY

Process and quality control in Indian Paper Industry has not been given due attention. Considering the present market needs and trends it is felt that a serious thought is given in this direction Process and qual ty control programme in the paper industry can work effectively with support from the Management and sincere efforts by all concerned. Prospectives of process and quality control and its combination have been discussed in this paper bes des how effectively it can be launched The role of the Management function of quality control people, process control measures as wel as quality control and Statistics have also been discussed. It has been stressed that a long term benefit as the outcome of such a programme is preferable to the short term advantages for the growth of the industry.

Paper making is a complex process involving the use of various types of fibrous raw-materials, chemicals, fillers, dyes etc. In the recent years, the growth of paper industry has been quite significant, yet we may not be able to meet immediately our future demand and thus make the quantity factor rather predominant for both the manufacturers as well as for the consumers. Besides, the industry is severely hit by shortage of raw-materials and power, increasing cost of inputs and various other unforeseen factors. The outcome of all these constraints has severely effected the aspects of process and quality control. The future of the industry looks rather bleak though in fact it should have been otherwise, considering the wide gap between the demand and supply. If survival is the problem, stepping up of R & D activities with stringent process and quality control, shall be the solution for the future.

PROCESS CONTROL vis a vis QUALITY CONTROL

Where there is a process, there has to be some sort of control without which it is likely to behave in an unwarrented manner and the resultant product may not be of desired quality. The aim of process control is to control the process accurately and precisely at the pre-determined conditions with the help of tools available. Quality on the other hand is the measure to ensure good quality products at the optimum cost. This is aided by sampling and testing to check and monitor the process as well as the product and to segregate the faulty output to ensure quality to the market.

The conditions for process control is provided by the quality control measures. For example, if consistency of the stock, percentage of loading, stock valve opening etc. are the process control devices, then the substance ash and other characteristics of paper like strength etc. are the quality control measures.

Process control helps to build up the desired quality in a product by maintaining a balanced state in the process by measuring conditions representing the balance and providing an automatic counter action to any change in the conditions. The balance of variables in the process may be balance of any form of energy like heat, pressure or inputs such as pulp, chemicals, fillers etc. It is the function of the quality control to provide the conditions, to measure the quality standards of products, byproducts etc. and monitor the process, if desired specifications are not met. The process control is oblivious of the quality

*JK Paper Mill, JAYKAYPUR, Orissa

one is going to make, whereas the quality control has to be aware of the conditions within which the process is to operate. Without quality control, process control has got no advantage and without process control quality control cannot be effective and economical though it can work but shall be limited to inspection and segregation only and under the circumstances a strict adherance to quality standards cannot be feasible and quality assurance is bound to diminish to a great extent. However, a combination of both shall result in better quality output at the minimum input and to the fullest satisfactian of the consumers.

CONSTRAINTS

Process and quality control in Paper industry is quite a different proposition altogether and cannot be in the same line as that of automobile or electronics industries where cent percent inspection of the components is possible. Various factors which effect successful working of the system are as follows :—

a) Variables affecting the paper quality are too many, starting from raw-materials, chemicals and dyes to machine components and human factor. Further, the interaction between the variables affect more than one quality aspects at a time. It is practically difficult to ensure a consistent performance of all the variables in spite of the best approch.

b) Certain quality parameters like shade, formation, rattle etc. cannot be measured and thus have to depend on individual judgement which is bound to vary. Besides, no automatic control measures can be provided for this, except human judgement and observation.

c) In the Indian context, there is no fixed end use for a particular variety of paper. A certain quality meant for a specific end use is often utilised for various other purposes where it may not be found suitable.

d) Sampling and inspection procedure always leaves a gap for error as'cent percent sampling is not feasible.

e) Concept of quality varies inrespective of its end use and cost. The consumers expect the best irrespective of the requirement and it often changes with a better product he comes across though it is meant for different end use. Besides, an inferior quality with lower cost is rather preferable to many a consumers. Similarly, the production man judges quality by the quantum of rejection and the sales man by his sales value. It is an established fact that quality parameters change with the market situation and prevailing cost. This upsets the process and quality control measures and at times makes it difficult to adopt.

f) Quality achievement of a product is a collective effort where everyone concerned has some contribution or the other. Lack in effort at one stage is bound to reflect on the ultimate product. This awareness is lacking in Indian Paper industry where the major workforce is not adequately knowledgeable and trained to consider themselves as a part of the community sharing the fruits of the effort.

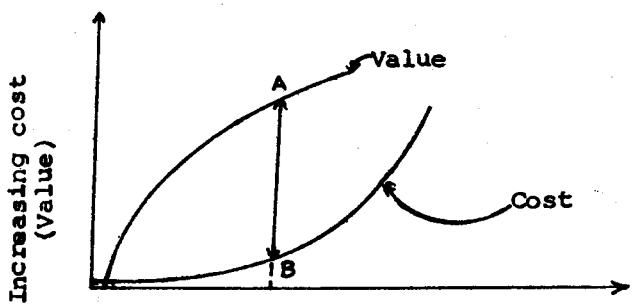
HOW TO MAKE IT WORK EFFECTIVELY

1) Roll of the Management

The Management plays the most vital role for successful working of any Quality Control programme due to following facts :

a) **Cost Consideration**

Quality control activities in any operation are effected by cost factor. To improve upon and maintain a consistent quality the cost of production apparently increases but at the same time the value of quality also increases. Therefore, it is imperative to strike a balance as to what extent the value of quality can be improved at the optimum cost.



(Cost and Value of Quality)

The figure above indicates that without increasing the technical expertise, a product shall be there but the value of the quality may be on the negative side i. e. it may not sell in the market. Similarly, the cost can be increased to a great extent but value does not go up proportionately. The points A & B strike the balance where value added is maximum at the cost 'B' which can be taken as optimum. The management must know the cost of quality by way of defective product, rejection, inspection cost, procurement of good materials, equipments etc. and must decide as to what extent the quality can be improved to compensate the cost involved.

b) **Organisational set up**

Quality control is important tool of the Management to achieve whatever objective is aimed at. To small organisations a full scale Quality control department may become a luxury and generally one man makes all kinds of decisions with an aim to sell the product at any cost. But in big organisations, manufacturing varieties of paper, where many Managers are involved in making significant decisions, the quality control should have a separate identity which shall facilitate independent funtioning and decision making. Based on our experience at JK Paper Mills where a full scale Process and Quality control system is operating quite successfully, the following organisational set up seems to work efficiently and effectively.

c) **Training**

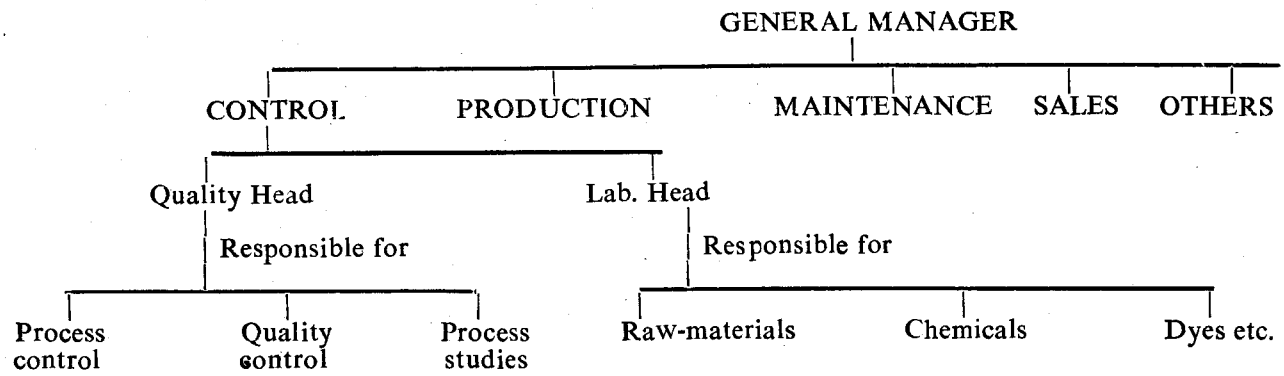
The most important aspect of launching a quality control programme in a paper mill is to all concerned. Selection of personnel by management should be judicious considering the delicate nature of the job involved. Quality conciousness at all levels has to be developed by holding lectures demonstrations, participation, discussions, seminars etc.

No quality control programme can be successful without Managements' constant and all round support. People at all levels should operate in the same wave length as management thinks fit to achieve the common objective i. e. to manufacture a product conforming to quality standards and to the fullest satisfaction of the consumers at reasonable cost and this can only be achieved if proper training is imparted to all concerned to develop qnality awareness.

2) **Function**

a) **Quality Man**

Having set up a fullscale Quality control department, the functions and responsibilities should be streamlined and clearly defined. Human relation is of paramount importance to a quality man as he is supposed to act as a link man or via-media between various sections of the mill. Under no circumstances he should think that his job is spying in someone else's territory. For any abnormality, the product is to be blamed and not the person concerned. Strained relations are often



In the above model, Quality control has got a status at par with production, maintenance sales, es etc. and has got an equal voice in all manag-e rial decisions. It can work without interference from other sections of the mills and a strict quality contol is possible irrespective of the quantity involved.

encountered over the quantum of rejection, assessment of defective paper etc., but a little humour has been found to be an effective tool to ease up tension and normalise the situation. A quality man often gets involved in controversy arising between departments which he must sort out at any cost. He has to work hand-in hand with

process people to have a better product control and thus has got enough opportunity to educate people down under the importance of quality output and should exaplain them the severity of defects in the paper with regard to its end use. He should think as a consumer does and has to act as a Management's representative to achieve the objective. He, besides having adequate koowledge of the process, must be in a position to suggest remedial measures and should be in the firm habit of reaching conclusions.

b) **Control**:

A combination of feed forward and feedback control, in the Indian conditions, seems to work better. For regular products varieties, the set conditions are already arrived at and the process operates wihin these parameters. However. for introduction of new product, R & D should carryout the necessary experimentation in the bench scale where conditions are set for process control. Care should be taken while transferring laboratory control standard into full scale mill operation. No matter how well designed the experiment may be in the laboratory, a new set of variables will come into play. Conditions are never always ideal in the full scale mill operation. Process study helps in keeping track of these variables and should provide adequate counter action.

Before the production starts a decision is necessary as to what is to be made and what quality standards are needed. While formulating all such standards/parameters, limits etc. the process capability must be taken into consideration. No process is controllable unless it operates within its acceptable limits.

Pulp and paper industry is one of the most difficult of all industries in which to measure accurately and directly various variables within a process due to its interactions between the variables. Unless each piece of equipment is controllable and unless the entire system is controllable as a system i. e. unless the dynamics of the process are such that they can be readily tuned to perfection with persently known control tools, either the process equipment is to be re-designed to make it controllable or more sophisticated tools be made available or both. With the advent of computer control system which is actually an extension of instrumentation process control the prospective looks better. For regular process and quality control activities in an integrated paper mill, the conditions for process control and tests for quality control measures have been briefly outlined below: However, in the Indian context, the Pulping and Recovery control parameters are rarely changed. It is the paper machine alone where variable conditions are set depending on the quality of the product desired

The frequency of sampling and testing depends on the size of the mill, nature of production etc. However, statistical approach can be adopted to derive acceptance sample size and reliability.

The above mentioned QC measures coupled with analysis of chemicals, fillers, dyes and a quick feed back in case of any abnormality anywhere shall help maintain the process to produce a uniform quality.

Over and above, it is the responsibility of the Quality Control to appreciate the problems of the consumer and to deliver technical expertise to over come/minimise the same. Study of market complaints and suggestion for remedial measures are equally important. A regular dialogue between Sales and Quality control can help in this regard.

It should feed necessary information as regard to procurement of materials of right quality and cost. Process study faction of the quality control should be deeply involved in reducing the cost by minimising waste, improve upon existing quality and performance, regular study of process parameters, product development etc. It should keep abreast with the latest technology and should try out various new additives, chemicals, processes, raw-materials etc. to improve the productivity. Daily, weekly, monthly and annual statements with regard to quality, rejection, defects etc. should be prepared for comparison and analysis.

c) **Roll of statistics**

Statistics is by far the most efficient tool for successful implementation of the process and quality control programme. From time to time, the results obtained should be analysed statistically and changes should be made, if required.

d) **Communication**

It is needless to emphasize the importance of communication which is quite obvious. Without effective and timely communication, actions desired shall be delayed and the product is likely to carry sub-standard quality which is not desirable. In any feed back control system, the time lag should be as little as possible to keep the abnormality at its

Sl. No.	Sections of the mili	Conditions for process control	Testings for Quality control
1.0	**Pulping**		
1.1	Raw material	To minimise fungus, borer, termite attack on storage.	Analysis for various constituents to keep track of changes.
1.2	Chippers	Knife grinding and re-chipper	Chips classification, moisture.
1.3	Cooking	Temperature, pressure, bath ratio, time, chemicals.	Cooking chemical for TAA, K. No., black liquor for density and free alkali.
1.4	Washing	Pulp flow, dilution factor, hot water temperature.	Alkali loss.
1.5	Screening	Water pressure for screens.	Screen reject to minimise fibre losses.
1.6	Bleaching	Pulp flow, chemical dosage, temperature, dilution for pulp washing.	Bleach chemicals, strength, pH, brightness, viscosity, residual chlorine, strength evaluation.
2.0	**Recovery**		
		Temperature, pressure, sulfate addition, air-flow to furnance, nozzle size, lime addition, temperature during causticizing, filter load etc.	Black liquor for density, temp., viscosity, smelt analysis for reduction percentage and other chemicals, lime for free Cao, green and white liquor strength, sulfiidity and clarity, alkali loss through lime sludge.
3.0	**Paper machine**		
3.1	Stock Perparation	Refiner load, consistency chemical dosage.	Freeness, F.L.I., inspection for cleanliness of pulp and chemicals, chemical strength.
3.2	Paper machine	Stock v/v opening, centricleaner pressure, speed, head, slice, shake, vacuum, press load, steam to dryers, size press load, calender Temp. and load	Paper quality with respect to surface characteristics, substance, bulk, strength and other special properties as and when required.
4.0	**PF plant and Finishing House.**		
		Knife load in cutters, size combinations etc.	Maximum inspection of unfinished and finished goods.

minimum. A few tools are helpful in this regard as given below :

i. Process control charts, graphs, abnormality charts can be displayed at concerned process sections where reporting is to be made.

ii. Telephone

iii. Verbal communication in case of severe abnormality warranting immediate action.

iv. Meetings, discussions etc.

Conclusion

To conclude, if we put emphasis on QUALITY FIRST, long term profit will increase. But if we stress on short term profit, we have to lose in a long term international contest and long term benefit. If the objective of the management is 'QUALITY FIRST', consumers' trust grows gradually, the products will be in great demand and long term profit will grow and consequently stable management will become possible. Keeping an eye for the future, with an aim for long term profit, 'QUALITY FIRST' can be the only objective and it can and has to work effectively provided a systematic process and quality control programme is actively supported by the management and allround genuine and sincere effort is made.

ACKNOWLEDGEMENT

The authors are grateful to the management of M/s Straw Products Ltd., for their kind permission to present the paper at IPPTA annual seminar, 1984 and their genuine effort to achieve the objective - 'QUALITY FIRST'.

REFERENCES

1. Donald P. Eckman; Principles of Industrial Process Control.
2. Macdonald, R.G.; Pulp and Paper Manufacture-Vol II.
3. R. B. Fetter; The Quality Control System.
4. E. L. Grant- Statistical Quality Control.
5. Fred Striet: Paper Quality Control.
6. P. K. Sarkar etal: A Practicl Approach to Quality Control in Paper Mills", IPPTA, XVII (1), March, 1980.
7. S. D. Sharma etal: Quality Control in Paper Industry—A Function of Statistical Technology, IPPTA XVII (1), March, 1980.
8. K. Ishikawa: Musashi Institute of Technology, Japan. Company-wise quality control is a revolutional concept for management.