Affects of Maintenance on the Control of Manufacturing Processes.

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Reaching positive conclusions about the benefits of a maintenance effort is of major importance for those driving the effort. However the implications of good maintenance practices in a manufacturing environment, are often not clear or of enough relevance to reach any conclusion by the top management. Without considering the entire manufacturing process and establishing baselines and benchmarks, the effectiveness of a maintenance program can only be considered in terms of equipment availability and cost. Many maintenance managers go to great extents to prove the savings or ROI of a particular maintenance program only to force themselves into uncomfortable positions. In some instances, one could compare manufacturing maintenance with automobile maintenance where there is little incentive for the auto mechanic to satisfy the car owner.

Implementation of **new and proven** maintenance philosophies in organizations that largely depend on process control for product quality and throughput is difficult. Some of the difficulties are around the fact that changes in process parameters are likely to be required even when the condition of the equipment is changing for the better.
The difficulty of implementation increases, as the level of automation and complexity of parameter dependency are less understood. The generally poorly documented integration of manufacturing systems is, in my opinion, the number one contributor for the "resistance to change" often encountered during implementation of maintenance programs.

The process parameters that kept the manufacturing system in check prior to the program implementation may not be valid once one upgrades the performance of individual components. It may be that Key Indicators such as MTBF show improvement but unless one analyze and validate the manufacturing system, it is not wise to claim control of the process. As an example, with reduced MTBF, calibration is often not an issue. With greater MTBF, one most likely will encounter new problems with product quality, process bottlenecks, etc that are not covered by SOPs.

There are two main constraints that often contribute to the lack of confidence by the management and unwillingness of participation by the operations personnel:

1. *Availability of drop-in spare parts or subassemblies for proper repair.*

As the equipment ages, some of the components become obsolete therefore the need to integrate replacement components. Also new developments in technology continuously provide better-improved components.
Without integration of these, the performance of the equipment is substantially reduced. However integration of these new and improved components needs to follow proper procedures in terms of design and documentation. Unfortunately these are areas that often

are not taken seriously or companies don't have the resources to sustain such in-house capabilities.
Without understanding of the implications of unplanned efforts to deal with obsolete components and product required add-ins the factory floor is exposed to a multitude of changes, all made in good faith and to the best intentions of the maintenance workforce, but lacking the basic requisites for maintainability. Over the years the systems reach a state where troubleshooting and repair has little to do with maintenance crafts. Control of the manufacturing system becomes an art mastered by those that for whatever reason understand the interaction of the various shortcomings and has patience to deal with the situations as they occur.
We all been in places were the location of pillow blocks are clearly marked with a permanent marker or a piece of tape reflects the correct position of a control damper. Once the factory reaches such fragile process control, any change which outcome is not clearly foreseen will not be welcome by either the management or workforce. The motives are very different but the indication is basically the same… "do not touch".

2. *Non-technical factors outside the environment of manufacturing systems.*

Issues like cash flow, availability of the components during a specific maintenance project, the need to satisfy the customer, etc imply that the implementation of a specific maintenance task isn't only dependent of the capability of the maintenance workforce. However ultimately, maintenance workforce is responsible or has to deal with all outcomes resulting from underperformance of the equipment. If little or no change is required, the system gives the appearance of been reliable and maintenance personnel feel confident, because the become familiar with the outcomes and are able to answer to management. If one mandates change, the new rules are seen as a deviation from the process and therefore need to be validated.

One of the non-technical factors in a manufacturing environment that affects the maintenance effort is personnel turnover. If the turnover is substantial, not only is difficult to maintain the process control knowledge and experience but also the personal relations between operations and maintenance.

We often talk about Japanese Manufacturing Systems and their level of excellence. I personally think that the current status that Japan enjoys in the manufacturing industry is a direct result of a vast effort in production engineering and research and development focused on a philosophy that integrated manufacturing systems and manufacturing automation are the basis for production efficiency and quality. If one is not very dependent on the education and training of people to decide on matters of process control, it is easy to see that one encounters less resistance while implementing changes. Even than I suspect that such high status is only applicable to certain segments of the manufacturing sector and not across the full spectrum.

The manufacturing sector in an industrial country is the main source of wages. The average level of education of the workforce determines the level of sophistication that one is able to implement in the factory without major efforts in training. It is true that automation will improve the situation but it also contributes to unemployment of those less educated and in time has social economic implications. The idea is that technology

should be a tool and workers should add wisdom to the machines. This of course only works if the workers can add the wisdom.

For those of us not blessed with highly educated workforce, limited budget for factory automation, and the increasing pressure for high productivity and quality, we must take a much different approach to the implementation maintenance systems. Technology is only a tool, the maintenance objective is to maximize the tool usefulness in ways for servitude to the factory workforce.

How many of these manufacturing companies exist?
In my opinion, large numbers of companies in the food preparation and packaging, aggregate products, metal fabrication, metal finishing, plastics manufacturing, textiles, converting, industrial cleaning and many more can be included in this category.

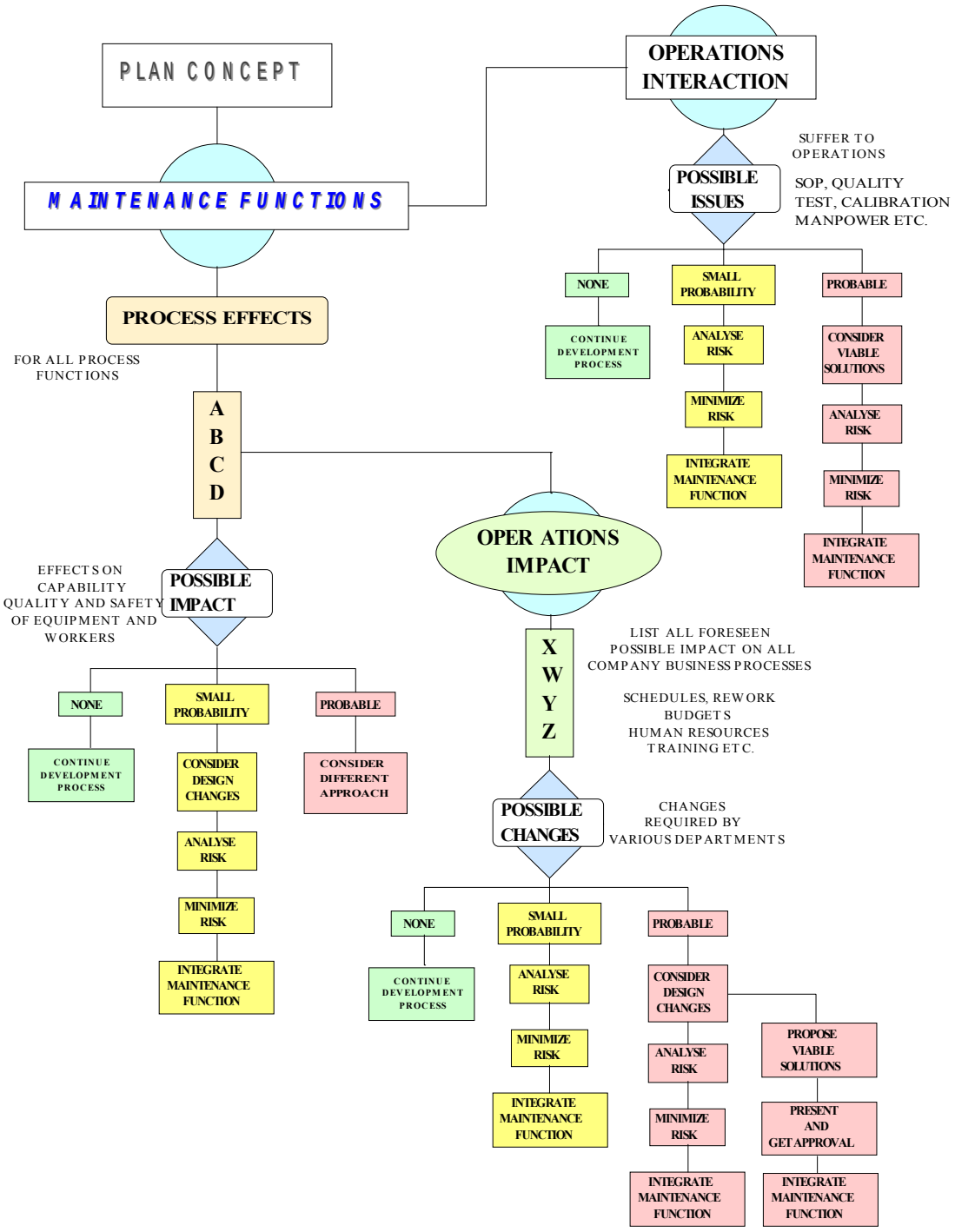
What to do? How to implement maintenance systems in a food manufacturing plant where 60% of the workforce is from a temporary agency? One certainly can't take the approach that each worker will police its own work and strive for the best possible quality and zero defects. Most of the production workforce does not understand what acceptable quality is.

There are several topics to consider that are the basis for implementing a maintenance program without creating problems to operations:

1. The maintenance workforce needs to be considered of primary importance and the company management needs to develop a retention plan that minimizes turnover within the organization. Turnover must be a key indicator not only for the maintenance organization but also for the entire company.
2. The maintenance workforce needs to gain full knowledge of the process control and quality requirements. This do not necessarily mean that maintenance can act as quality control but maintenance personnel should be able to operate the equipment in production mode and be able to make product that meets "finished goods" requirements.
3. The maintenance workforce needs to be focused in augmenting the operations capability and reducing the suffering of production departments. A work order system is only a communication tool to record a maintenance event. It should not be used to define responsibilities. An inspection should be an event that positively updates the state of the equipment and not a mere recording of conditions.
4. The maintenance workforce is usually the most educated in the plant relating to equipment issues. Their input in matters of process capability and quality is essential to planning and scheduling.
5. Planned maintenance must be scheduled with input from those that do the work. At least a review response from the worker related to required tools and time.
6. When things don't go according to plans, take the opportunity to make an improvement on the program instead of back step. The original program did not work well. Remember that you decided to try the new program because the old one was not adequate.

Realizing that any action by maintenance workers will have an affect on the manufacturing process and that unpredicted changes affects confidence is an important step towards development of a successful maintenance program.

MAINTENANCE PROGRAM DEVELOPMENT



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