DOWNTIME REDUCTION
A PROFITABLE ROAD TO SUCCESS

- PART 3 -
ANALYSING THE DOWNTIME DATA
AND
TAKING CORRECTIVE ACTIONS

Jeroen Kleef, Marcel Rooij

In part 1 – The financial impact of downtime reduction – we presented the basic economics to visualize the enormous effect of uptime improvement on profit. Herefore we used the parameters of a small solid board mill as anexample. The figures showed a remarkble profit increase of over € 400.000,-- yearly for every percent point less downtime. In part 2 and 3 we present how to realize this kind kind of improvement.

In part 2 - The downtime reduction philosophy and how to gain the necessary data – we showed that downtime reduction is a company wide process with lots of people involved. Gathering root-causes of downtime is a demanding process using the best possible sensors available: "The human sensor."

In this part (3) we will show priority determining information that will lead to controlled and focussed improvements.

5 Analysing registered downtime data

As presented in the flowchart of the downtime reduction process (part 2), analysing registered downtime data is the next step. The goal of analysing downtime data is to give quickly a clear and reliable insight in the downtime situation of the production process during an arbitrary period of time. This step can (and should) be automated as much as possible to be able to quickly and continuously monitor the actual downtime situation and trends. Eventually these results can be examined in more detail by performing a custom analysis.
These results are required to define the priorities in the approach to the actual downtime reduction and to find the root cause of identified problems within that approach.

5.1 Automatic analysis

The analysis of downtime data should have meaning for both the employees and the company. From quality management tools can be learned that a pareto analysis (80/20-rule) combined with trending and eventually an indicative linear prognosis are very useful tools in defining priorities. This is exactly why within the S&S MIS is chosen for these types of graphs. Figures 7 till 9 give a representation of a pareto, trend and prognosis analysis of the worlds most modern malting installation (imaginary data).

These graphs on the level of the overall process and of the main process steps are useful for everybody involved in the production process. Therefore it is very effective to publish actual graphs regularly e.g. on the company intranet or have them available on-demand.

Preferably the creation and publication of these pre definable graphs should be performed *automatically* and regularly (or on-demand) to ensure that everybody uses most up to date and reliable information. This also prevents that the availability of the analysis becomes dependent on the presence and priorities of a single person. Besides, from experience is known that companies only scarcely invest in people that can focus independently of any department on this type of work.

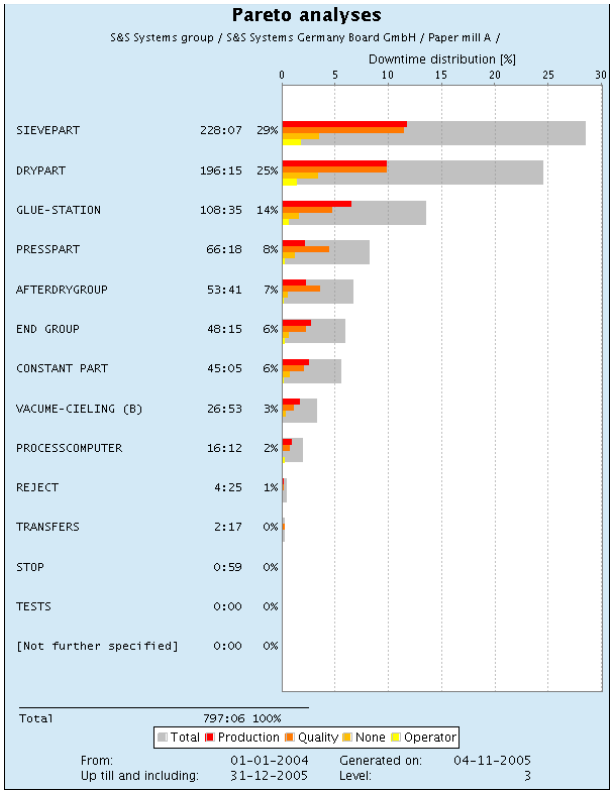

Figure 7: Pareto

5.2 Custom analysis

The analysis software tool should make it possible for the management to make custom analysis to investigate problems in more detail by zooming in one or more levels in the functional structure of the installation. This enables them to:

- find root causes and sources of errors.
- carefully define priorities. Some problems on the main process level for example may have a common cause. One cause may be of more importance than could be expected at first sight.
- check the correctness of certain registered data (this requires that a log can be created from all the registrations on a certain process part or machine item).
- make an analysis over another period in time.
- make an analysis over machine items like bearings in stead of certain process steps (if this functionality is offered by the analysis tool).
- inform top management, improvement teams and employees on request with more detailed information.

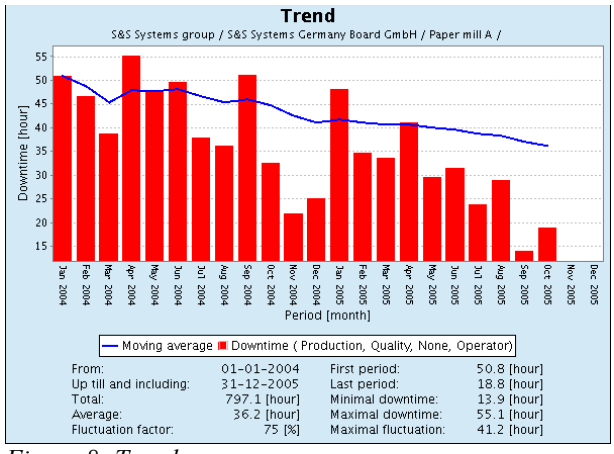

Figure 8: Trend

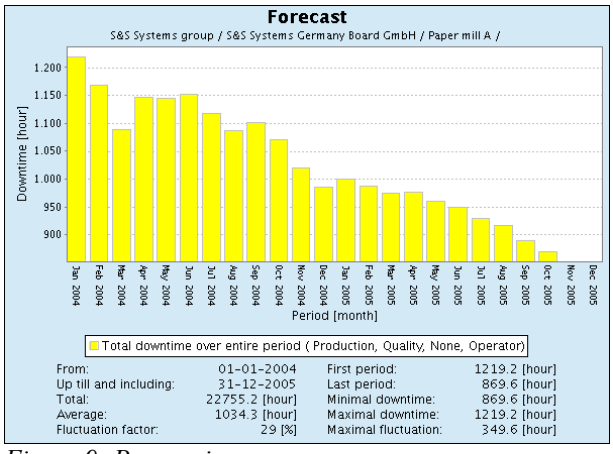

Figure 9: Prognosis

5.3 The necessity to use advanced software

Figure 10 shows a graphical representation of a relatively small S&S MIS database with the root-cause tracing paths. This representation 'only' involves 19.683 possibilities to failure.(Don't worry, you can start with as less paths as you like and expand the system in time.) Currently systems with up to and over 40.000 possibilities are being used. (Several solid board machines in a single production plant.)

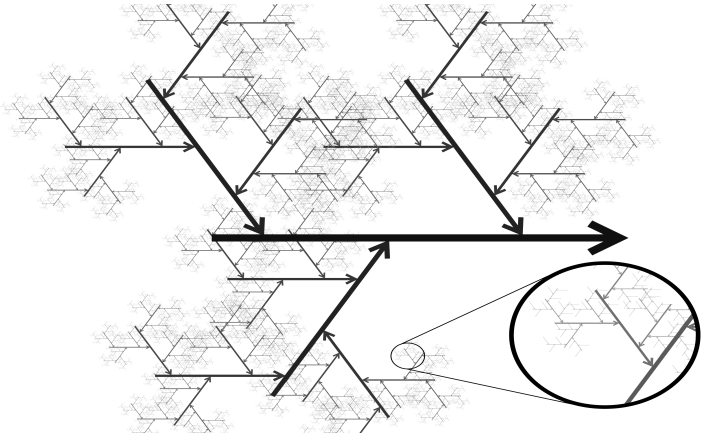

Figure 10: Rafter diagram for small S&S MIS root-cause database

Although the main structure and course of the process are visible, people can not form a clear picture of all influences that can lead to process failure. Let alone pick the single correct root-cause most responsible for downtime. Managing corrective actions following personal impressions and opinions will lead to failure of your downtime reduction process. Sadly we do encounter this almost on a daily basis as a result from human relations and power politics within the management. Hence a company should use this kind of software to be able to set priorities and manage the corrective actions.

6 Taking the right corrective action

The goal of the next step in the flowchart of the downtime reduction process is taking the right (= most effective) corrective actions by first defining priorities mainly based on the (pareto) analysis and secondly by creating projects to ensure a solid approach.

6.1 Priorities, overall plan and budget

The pareto analysis in combination with trending and prognosis graphs indirectly give a good impression of the financial impact of certain failures in the production process. Combining this information with other operational considerations like desired uptime, economical risks and current affairs, production and technical management can define priorities in solving the problems.

Then an overall plan should be created for a structured approach to tackle all prioritized problem areas. Many of the identified problems will be solved as part of daily business. The analysis has in these cases only functioned as a trigger and will keep functioning to monitor progress. For each of the remaining prioritized problems this overall plan should exist out of roughly defined projects. For each project, important project parameters like a concrete, precise, exact and measurable goal, quality, time, and resources should be estimated to be able to give an impression of the costs of all improvement plans (budget).

With this information on assets and liabilities pay back times can easily be calculated. If required, top management can eventually be asked for budget approval.

6.2 Projects and improvement teams

Once the projects kick off, it is important that they are well organized from start to finish to make them successful. Assign an (internal) project leader for each project and demand for:

- initiation, training and coaching of an improvement team to make use of the available knowledge and experience within the company and to improve acceptance of the eventual solution. Project leader and members can for example be paper makers, technicians, administrative personnel, people from logistics and etcetera.
- solid project management (goal, time, resources, budget).
- use of downtime analysis tools to find root causes of problems.
- use of methods and (planning) tools like BPI, PDCA-cycles and Gantt charts.
- taking into consideration external assistance (e.g. knowledge, project co-ordination).
- regular and clear reports on the progress of project and interim results.

6.3 Controlling your corrective actions

In many organizations we encounter proliferation of optimization projects. All originated from good willing employees who do see opportunities to improve and take action. Since completing optimization projects often is a very complex task, involving men, machine and material interaction and consuming lots of time, gross of them bleed an ineffective death. By focussing these resources on the top 2 or 3 production consuming problems pointed out by the software, chances of success will increase enormously.

To keep focus on the few single running optimization projects one should use structured action lists completely integrated into the system. This will enable you to collect all information related to a specific problem and monitor progress by viewing the status of the defined actions. This state is represented by parameters such as:

- date of initiation
- date of expected completion
- current status
- priority
- notes
- responsible person
- executing person.

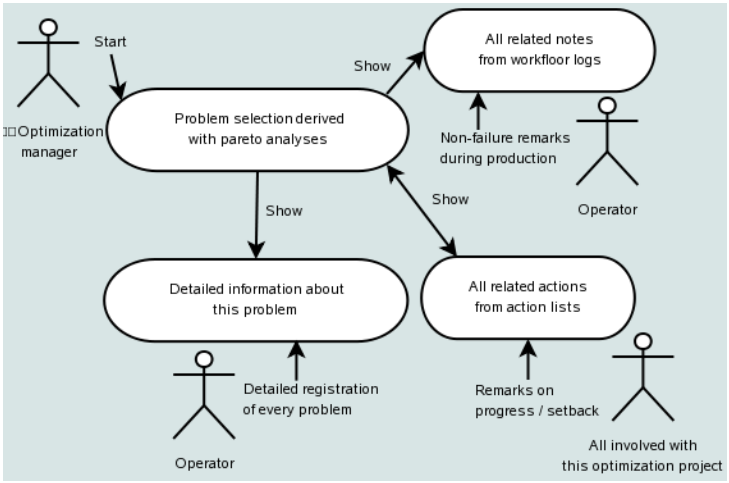

Figure 11: Collecting all information related to a single root-cause

Every progress or setback should be registered in the system. Periodical meetings have to take place in order to maintain the momentum of the project. Here a delicate balance has to be found to prevent these meetings becoming a bureaucratic hurdle. With the right information on hand this is prevented easily.

7 Conditions on the presented process

Reducing downtime is not a simple process. It exists out of many links. Also, the environment in which this process takes place is very dynamic. In the previous paragraphs a few conditions to make the downtime reduction process successful have already been mentioned. As in any other complex process the communication and co-operation between the departments and persons concerned, require also some extra attention to realize the desired results:

- the whole organization, but especially top management should support the downtime reduction process, selected approach (process) and employed tools and resources;
- downtime reduction goals and everybody's tasks should be simple, clear, realistic and communicated to everybody directly or indirectly involved;
- the downtime reduction process should be seen as a continuous process.;
- required downtime (related) information should be straightforward, graphically oriented, up to date and easily accessible for everybody involved. It is important to realize that when downtime decreases the quality and the quantity of downtime information will have to increase to be able to improve.

As said, the human factor is a very important factor in this process, especially in the registration and correction phase. This is especially the case in a branch of industry where it is still impossible to completely control the process automatically. As opposed to sensors, operators cannot only notice the effects of certain failures, but sometimes even the malfunctioning of a machine prior to the failure and most of the time they can interpret findings in such a way that it will lead to the probable cause of these failures (problems).

Therefore it is important to keep the operators motivated to participate in the downtime reduction process from their noticing and registration task to their role in improvement teams. Management can achieve this by giving them positive impulses regularly (see flowchart of the downtime reduction process). Figure 12 gives an indication of how the downtime reduction process probably will progress in the course of time when the co-operation functions well.

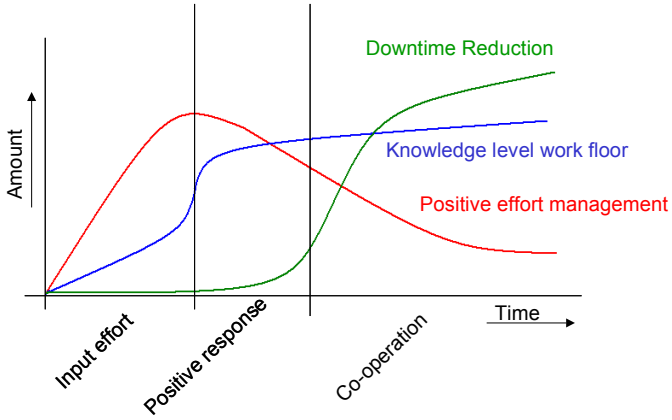

Figure 12: Downtime reductions progress as a function

8 Conclusions

Based on the experience of developing a MIS (Management Information System) to support the downtime reduction process and using it for several years in the paper industry, the following can be concluded:

- Dependent on the cost structure of a company and assuming a profit margin of 10%, the profit increment approximately varies between 4.7% and 8,2% for every percent point the downtime decreases (approximately € 2,- till € 4,- per tonne).
- Less downtime will lead to a more stable process. A stable process has numerous advantages for the organization.
- To succeed in increasing uptime, it is of vital importance to approach downtime reduction as a (continuous) process. Once recognized as a process, proven strategies can be applied to improve and streamline the process effectively and efficiently. For example by using the theory of Business Process Improvement (BPI).
- The human factor plays an important role in each step of the downtime reduction process, from noticing and registration failures, interpreting analysed data and defining corrective actions to participating in improvement projects. This requires a team approach. Management should give a positive impulse by providing feedback, training, coaching, rewarding, time and other means of support.
- In contrast with sensors, people often can notice multiple effects caused by a single problem. Interpretation of this information can quickly lead or point to the root cause. Solving downtime reduction by investing in sensors is therefore probably only successful in certain niches. Besides, people are available, it is part of their task anyway and they are flexible enough to adjust to the dynamic environment.
- The presented philosophy can be a useful addition to many production and maintenance concepts.

9 Acknowledgements

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