



How Shopfloor-Online Supports Quality

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Ask any company how important quality is and they'll all give you the same answer – very! Having said that, some companies face more of a challenge managing quality than others. Examples are:

- Where the quality control plan is complex. It could be that there are many features to control; the process could be spread out in space and time; or many people are involved and so on. An example would be an automotive parts manufacturer making complex parts like cylinder heads, where there are thousands of features to be controlled with specifications in microns.
- Where it is known that quality issues can get through to the final product and the consequences of such issues is high. An example would be a packing manufacturer supplying product through a “hole-in-the-wall” operation to the filler. Within a very short space of time the product is filled, shipped and on the supermarket shelf. Quality issues here could result in a very expensive claim.

In these circumstances you find companies pay special attention to the quality control process, and the demands on a software solution are extremely high. It is in these environments Shopfloor-Online has excelled. Indeed in most of the areas where Shopfloor-Online has been deployed with a quality focus, it is to replace 2nd or 3rd generation systems.

Shopfloor-Online is Lighthouse's integrated factory information system working across production, job tracking, quality, spoilage, downtime, etc. It can be implemented incrementally function by function; this paper outlines the functionality of Shopfloor-Online to support the Quality function.

Scope of Quality Support

The diagram below identifies the various quality related processes that are typically performed. The diagram shows the typical processes and where they might occur within the organisation. Shopfloor-Online adds value in all these areas, saving time collecting data, collating data, and analysing data; and organising information in a way that makes it accessible and pertinent.

We start by making the people responsible for the process more effective at finding problems, diagnosing problems and resolving problems. Do this and you achieve the first step towards a major improvement in quality.

After that, by supporting the quality related activities in management and engineering, we start to build an organisation that has more time to look at, analyse and use the data, rather than one that spends all its time chasing it.



Those responsible for the quality checks

Follow the control plan

It is the norm today that operators are responsible for the process. They own the requirement to do the bulk of the routine quality checks; these may be supplemented with checks carried out by inspectors or in a lab. Operators may be responsible for

more than one line, typically involving multiple machines. There may be many different checks that need to be done with different frequencies: ranging from every 30 minutes, to hourly, shiftly, even weekly. Manufacturing lines can make different products i.e. different specifications, some products require special checks. All of this makes the process of remembering what checks should be done and what specifications to use more complex.

Shopfloor-Online helps in a number of ways:

- It knows what product is being made on the line; it always knows and uses the correct set of specifications.
- It always presents and uses the current control plan, so when a check is done the operator can be confident he is using the right version.
- It knows that checks vary from product to product and always prompts the right checks to be done.
- In situations where the check is carried out remote from the line, perhaps in a lab, the results are immediately available at the line.

Record the measurements – faster!

If the checks are carried out manually, a screen is presented detailing the samples to take and the measurements required. More complex checks may have measurements that have to be carried out in a strict sequence, this can all be defined, and Shopfloor-Online guides the operator through the measurement steps. Once complete the measurements are saved in the database.



Often the measurement data is collected from devices like dial indicators, balances, etc. These can be connected directly to the PC and data transferred electronically which saves considerable time and eliminates transcription errors.



Automated measurement collection

In various industries there are numerous specialised measuring systems ranging from dimensional measurement (e.g. bespoke gauging, CMMs...), vision systems, colour measurement, all the way to mass spectroscopy. Such systems typically output measurement files in bespoke formats.



Shopfloor-Online has the UDI (universal data interface) which has the capability to import these outputs. In this way these measuring systems can have their data automatically imported into Shopfloor-Online.

Attribute data collection

Generally, variable data is much preferred to attribute data (e.g. dimensional measurement versus go/no go gauging) because you have information before generating defects. Having said that there are several areas where attributes are invaluable:

- After dimensional control is maintained, often things like visual defects are where the majority of customer complaints arise. Capturing and analysing this data is invaluable – although in low defect rate environments it can be problematic (Shopfloor-Online has techniques to deal with this).

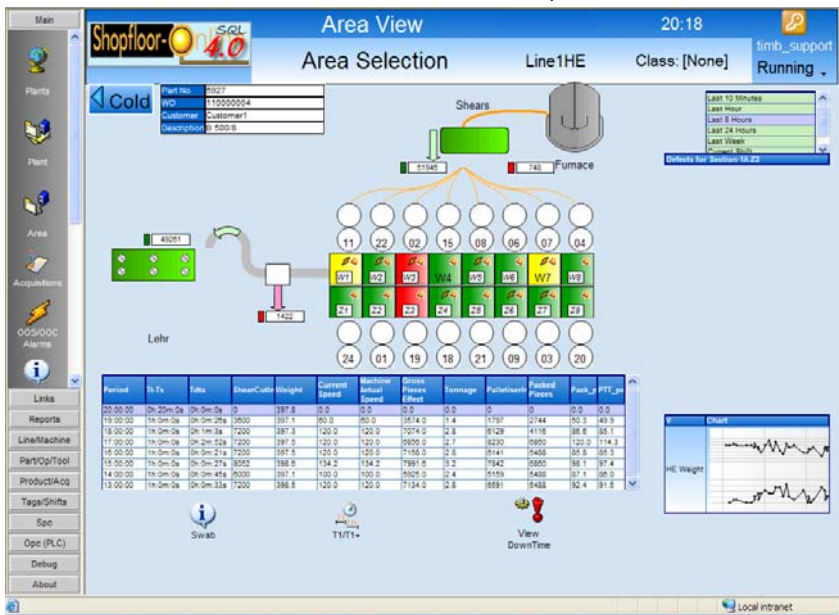
- Attributes can be configured as check lists: especially good as records of procedures like start-up, change-over, clean down or basic maintenance checks.
- Many automated systems like vision systems output defect data which can be imported automatically.

There are various options for manual attribute data entry ranging from pick-lists, to picking from images of defects. It is possible to create a defect library and make that available during data collection.

Raise alarms to exceptions

As measurements are recorded the data is automatically analysed. There are options to test against specifications and SPC rules or critical defects. So, if a measurement is out-of-spec it raises an alarm, likewise if it is out-of-control (this could be a control limit or an SPC trend rule). Alarms are a record of process problems and become

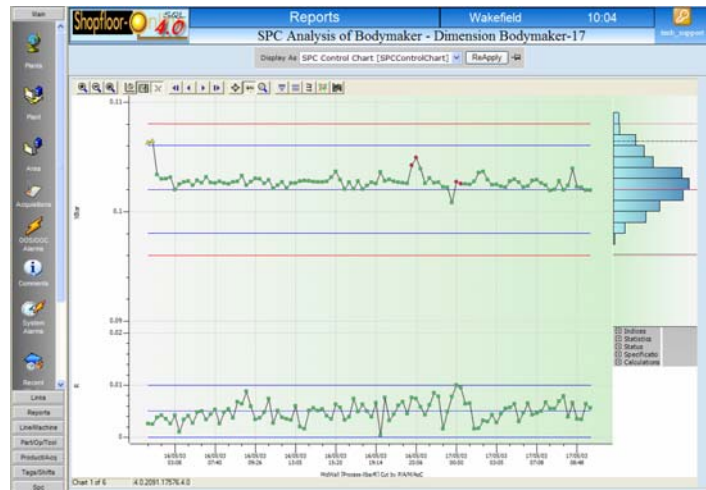
visible in many places, for example in process layout screens, quickly directing attention to where the problems lie.



React to and record exceptions

When alarms are raised the best response is to look at the history, "Is this a one off, or part of a trend?", "Should it be expected?" Built in SPC charts are available at the click of a button. A problem shows up, the user can drill in and see the chart.

What happens next is often down to experience; however some companies are very organised in this area. They have identified best practice response to a range of potential problems. The responses could be documented in "best practice knowledge base" e.g. documentation that could be linked into Shopfloor-Online. Alternatively, and more advanced, standard corrective action plans can be defined, and operators can invoke such plans in response to the alarms raised.



However organised the support, the responsibility to address the problem remains with those running the process. They have the opportunity to record what action (if any) was taken and close the alarms.

Traceability

Shopfloor-Online always automatically records the product, line, machine, shift, crew, the user (person doing the check), date and time, works order number (job reference), type of check (e.g. production, set-up, trial..) with every check done – without burdening the user. In addition it has the ability to record additional information when the checks are carried out, for example raw material batch, raw material supplier... This information is invaluable for subsequent analysis.

If other areas of Shopfloor-Online outside the quality function are already in use, like say tool tracking, or inventory consumption, then the quality checks can automatically be tagged with this information without the user having to enter it.

What about quality checks not related to the process?

So far the focus has been production based quality checks, but there are other areas where checks occur for example receiving materials, out-bound product audits, routine maintenance checks, and so on. All of these can be easily accommodated within Shopfloor-Online.

Laboratory systems

In companies where there is a laboratory running complex tests these have often been managed by LIMS systems. Good though they are they do tend to be isolated, so two possibilities exist: either transfer all the tests to Shopfloor-Online; or build an interface that brings across key information.

Quality management

Define the control plan

The control plan defines the parameters to be monitored, the sample sizes and frequencies. Having one place where all the control plans can easily be seen and managed is a significant benefit in itself. But control plans change over time and it is imperative to ensure the current control plan is being followed on the shop floor.

Shopfloor-Online allows the control plan to be defined in terms of variables to measure and defects (attributes) to record. When control plans change there is a complete revision history. You never need to worry that the latest control plan is not being followed as it is automatically used when data is collected

Audit performance against the control plan

Having established the control plan, the next step is to ensure that the control plan is being followed by those responsible for implementing it, e.g. operators, inspectors or the lab. To do this Shopfloor-Online reports checks done against checks required at the click of a button.

Seldom is life so simple: for some the process of auditing checks and frequencies is complicated by the fact that machines don't run 100% of the time. So a typical investigation might go like this, "This check is supposed to be done 8 times a shift, but it was only done 5 times on this shift – why?", to which the response might be, "Well, the machine was down for 3 hours". Up until now that was virtually impossible to validate. Shopfloor-Online however can (if connected) capture the downtime data as well, and then validation of the control plan is shown in one report: checks due, downtime, checks due after adjusting for downtime, and checks done.

Review the exceptions management process

When alarms have been raised e.g. an out-of-spec or out-of-control situation, then there should be a response taken. In this respect Quality Managers need to see that the process for responding to alarm conditions is working.

Reports are available to analyse alarms raised, responses and response time.

Review exceptions

In order to remain aware and in control Quality Management need to know the issues that are arising. Of course it is very easy for everyone to see what problems have been occurring.

Review process performance and prioritise improvements

Longer term analysis, typically process capability, identifies poor performing processes. It could be there are too many issues arising, customer complaints or lost production time. Whatever, the information is there to find the areas that improvement work should focus on.

Internal reporting and KPIs

Most quality functions have targets to aim for, whether it is process capabilities, percentage out-of-spec, achievement against control plan, customer complaints... Often collating the data for these reports can be very time-consuming.

When the data is recorded in Shopfloor-Online, these reports are available at the click of a button. For demanding applications it may be that a custom report is written to deliver the KPIs. Not only do these reports save time, they are also available in real-time so that progress towards the target can easily be monitored.

Release procedures

Quality Management are responsible for many procedures, not least how to do the check. Usually such procedures are managed within a document control system but that doesn't necessarily make them accessible. Shopfloor-Online can link to the latest documents, so when an operator is prompted to do a check, the current procedure is there available at the click of a button.

Customer investigations and traceability

How much time is spent on customer investigations? How painful is it to get hold of the data and find out what happened? With Shopfloor-Online all the reports are there to pull back the information needed:

- Checks done: when they were done, the measurement values, who did them...
- Alarms raised and responses
- Material, Tool traceability

It is possible to search by line, machine, date, works order, shift, batch number, feature, defect, part, almost any way needed.

Customer certification

Some companies are requested to supply certificates to support shipments of product. This means pulling together data from the production run and producing a report. Many times this focuses on a few key parameters and customers want statistics like process average, standard deviation, +/- 3 sigma, capability figures etc.

It can be complicated by the fact that the customer specifications might be different from the manufacturing specifications and the customer specifications need to be used in the certificate.

Shopfloor-Online allows custom reports to be built to meet this requirement. The customer reports can be set up to be different for different customers and automatically produced at the end of a production run.

Compliance reporting and audits

How much time is spent preparing for customer audits? At least with Shopfloor-Online all the data to support the audit is available:

- Use of current procedures
- Achievement against the control plan
- Response to exceptions
- Process capabilities

Supervisors and Line Management

One of the many tasks a supervisor has to do is to check how the quality control process is operating in the shift. Are we doing all the checks? What are the problems? How are we dealing with them?

All of these elements are easy to identify with reports within Shopfloor-Online.

In addition the live plant screens give a real-time view of the state of the process, problems are not going un-noticed. Supervisors are more informed and more in control.

Work smarter – exception management

Shopfloor-Online has facilities to watch for conditions like critical parameter violations, overdue checks, unacknowledged alarms beyond a threshold. It can send emails or SMS text messages to alert the management team to critical events.

Engineering

This is a broad area that interacts with quality. There are several points to bring out where Shopfloor-Online adds value.

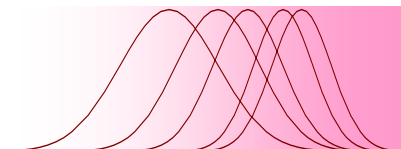
Manage specifications

Engineering own the specifications, Quality are usually responsible for ensuring the current specifications are in use when carrying out the quality checks.

Shopfloor-Online contains all the product specifications, whether this is managed by Quality or Engineering all the specifications are easily managed in one place. If specification change there is a complete revision history, previously collected data remains attached to the original specifications. Once a specification has been changed it is automatically used thereafter.

Process capability

Specifications are one thing, process capability another! Often the two don't mix in a sensible way! Having said that tracking the process capability of key parameters is a very common requirement, it is often the basis of key performance indicators.



Reports are available to give extensive analysis options for process capability. For example analysing data over different time frames, only looking at selected parameters, rolling up to an overall level, or breaking down by line, machine, indeed all the traceability tags like material supplier and tool. This provides a very powerful drill down to show where the variation occurs most.

However, with Shopfloor-Online, Engineering have ready access to the capability information. Ideally this should feed into the design process.

Engineering are able to see where the flash points are and can be involved in process improvement activities accordingly.

Manage control limits

There are companies that use SPC control charts and those that use them effectively! The biggest benefit of control charts is to give a clear and precise signal to those running the process as to when to intervene (and when not to). To achieve this several things have to happen:

- The control limits must be set properly: obviously outside the inherent process capability. To do this you must ensure you have enough data to see all sources of variation. Within Shopfloor-Online you have the history of all measurements to analyse. Not so obviously, they must be set at the point at which it is decided it is economically viable to intervene. This is the work of a multi-disciplinary process improvement team.
- Responses to out-of-control signals must be prepared. Operators are used to dealing with out-of-specification signals, but not out-of-control. If this is to work, clear guidance must be given to instruct people what to do when such an alarm is raised. Again in Shopfloor-Online this guidance can be formalised and delivered in a context sensitive way as an aid.

Trials and process improvement work

Trials for new processes, materials, tools occur frequently. The whole purpose of the trial is to collect and analyse data. Shopfloor-Online is therefore well suited to this task. The data is easy to collect and there are various analysis tools and charts to analyse the data.

Should more demanding analysis be required the data can easily be extracted from Shopfloor-Online via Excel and passed into other applications like Minitab.

Machine equipment / tool buy-off

Similar to trials is equipment buy-off and the same points apply in terms of collecting and analysing data.

In addition data can be collected over the life of the machine/tool so that deterioration can be measured. This is very useful for establishing cost effective maintenance plans and viable tool life.

Define best practice response to problems (corrective actions)

Where engineering and process improvement teams come together to define best practice in the form of corrective action plans these can be documented and made available within Shopfloor-Online.

At one level this can be as simple as links to documents or intranet sites. It can also be the compilation of detailed instructions – action plans. Action plans can be

invoked when the circumstances apply, and they list detailed actions to be carried out.

Shopfloor-Online has the ability to present the action lists and monitor their closure. All of this is to support a more systematic approach to managing the process.