

Data-Driven Improvement

How to Excel in Process

Manufacturing



Content

1. Introduction	4
2. Sporadic development projects do not constitute genuine continual improvement	6
3. Continual improvement requires combining the strength of data with human knowledge	8
3.1. Reliable data allows people to base conversations on facts and reality	8
3.2. The weak spots of traditional improvement methods cost you money	10
3.3. Employees' tacit knowledge is too valuable to ignore	12
3.4. Complex data is useless for people unless it is simplified	14
4. This is what continual improvement looks like in leading industrial companies in 2019	15
5. Champion's next steps in continual improvement	17

What's the difference between Continuous and Continual Improvement?

Continuous and Continual Improvement are often used interchangeably. In many contexts, Continuous Improvement seems to be the more popular choice. However, they do differ in meaning.

- Continuous means never-ending and uninterrupted – as in an ever-streaming flow.
- Continual means recurring in rapid succession, leaving time for a reflection period needed in the improvement process.

1. Introduction

As the person responsible for the product quality or the whole manufacturing process, you are fully aware of how successful continual improvement and minimization of variation can reduce waste, increase customer satisfaction, and enhance your competitive edge. That is why you make a constant effort to work on continual improvement of your processes.

Even though you might have all the basics of data-driven continual improvement in place, chances are your current methods are not getting the best out of your data or the capabilities of your people. Numerous companies in processing industries are struggling with the same issues day in and day out:

- Data is searched and collected only after an anomaly has occurred.
- People waste time on manually digging out data for analysis from manual records or disconnected systems.
- Areas for improvement are chosen based on gut feeling, consensus, or best guess.
- The work focuses more on putting out fires than on proactive projects that are correctly targeted for continual improvement.
- The success of an improvement project is unclear because effectiveness is measured sporadically.
- The operators' tacit knowledge cannot be automatically integrated into process data.

At worst, this might lead to a situation where the issue of decreasing profitability is being solved from the wrong end. The company panics and goes into termination negotiations, while the root cause of the profitability issue might be limited to the quality of a certain product on a certain production line.

With the right data tools, you can combine production data and valuable human knowledge in a way that allows you to gain maximum benefit from both as the basis for successful continual improvement.

We put together this guide as a source of information and encouragement for people like you who are ready to take continual improvement to the next level and seek to:

- 1 abandon sporadic development projects and embrace a coherent, continual spiral of improvement
- 2 reduce variation, minimize waste, and increase profitability even more effectively than before
- 3 focus improvement efforts on areas that have the most effect on your profitability
- 4 use information systems wisely to free human resources for more valuable tasks
- 5 monitor the effectiveness of improvement procedures in real time and apply corrective measures immediately
- 6 make continual improvement faster, easier, more automatic, and more proactively.

The experts who share their views in this guide:



Emil Ackerman
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+ other processing industry experts



2. Sporadic development projects do not constitute genuine continual improvement

“The foundation for productivity and profitability is the fact that a satisfied customer is willing to pay a premium to purchase the product from you instead of your competitors. This premium derives from the fact that you have a controlled process, reliable deliveries, flexibility, ability to react swiftly, and product quality that matches customer expectations. You can only fill these requirements if you are constantly on top of continual improvement and able to develop a better process.”

– Tom Anderzén

What is the starting point for continual improvement in your organization?

These things indicate that you have a strong basis for continual improvement:



You collect data on processes and quality. Great, you clearly understand the value of data!



You engage the entire organization in continual improvement. Excellent, that means that your quality culture is a joint effort.



You have the methods of continual improvement in place. Brilliant, having a framework for improvement makes the development efforts systematic.



You strive to harness your operators' tacit knowledge for more efficient operations. Good for you, this is where your greatest strength lies.

Even when an organization has established the right methods and culture for continual improvement, the day-to-day work and results might fall short of expectations.



Improvement projects occur in short cycles that are separate from day-to-day operations. They require a lot of manual work and resources, yet there is no immediate access to information about their effectiveness.



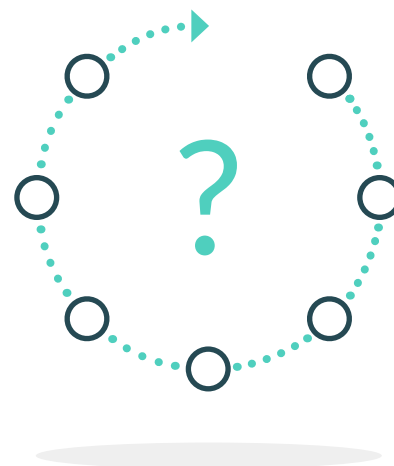
Areas for improvement and the causes of waste are often mapped based on incomplete or random human observations or, at its worst, mere assumption.



Data about the assumed bottlenecks in production and quality is only collected after the incident. This extra time put into the measuring period postpones the actual improvement procedures, and either more waste is produced, or lost production occurs due to the delay caused by analysis.

How to move from sporadic improvement cycles into comprehensive continual improvement?

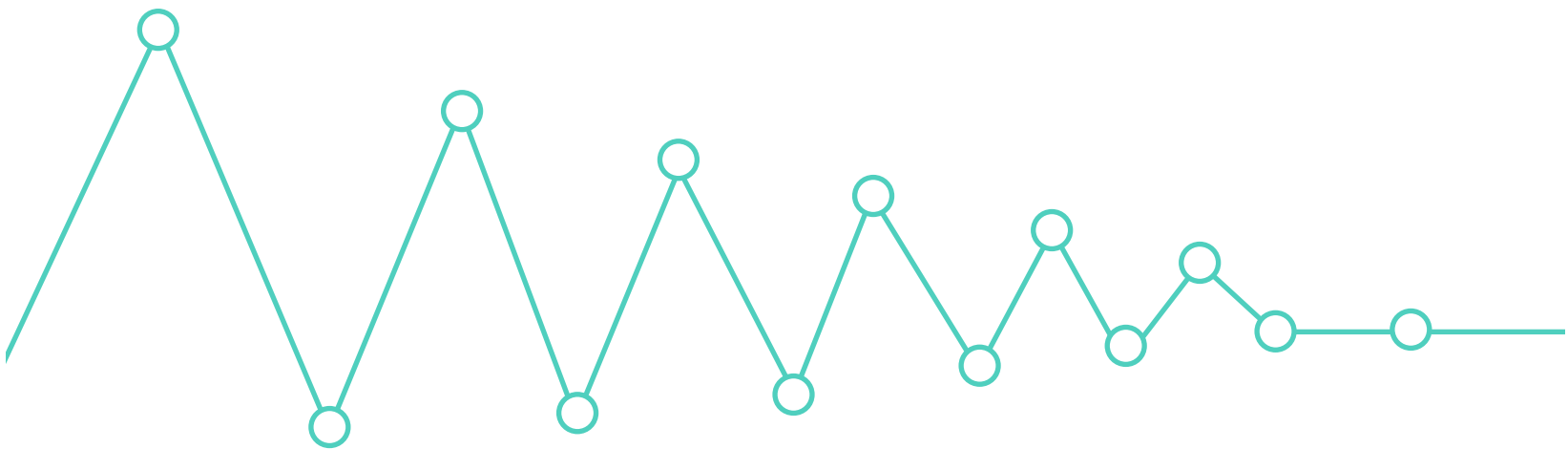
As quality culture, improvement methods, and other basics are in place, there is a strong foundation for taking continual improvement to the next level. The right data and analytics tool allows you to build your continual improvement processes on a wider information volume and to integrate tacit knowledge into the data. You have an exceptional opportunity to harness the strengths of your data as well as the human knowledge for optimal productivity.



Do you conduct sporadic development projects and call them continual improvement?

3. Continual improvement requires combining the strength of data with human knowledge

Data and information derived from that data have their strengths and weaknesses. Human knowledge has its strengths and weaknesses. The key to successful continual improvement is to harness data tools that allow you to combine your production data and human tacit knowledge in your organization in a way that minimizes the weaknesses of both while maximizing their strengths.



3.1. Reliable data allows people to base conversations on facts and reality

Continual improvement requires continuous cycles of process review and decision-making:

- What end results are you aiming to achieve?
- What area needs to be improved in order to hit that target?
- Can the issue be fixed with swift cycle of corrective and preventive action, or do you need to conduct a more extensive project to discover and eliminate the root cause?
- What sort of data will you collect? How will you analyze and diagnose that data?
- What remediation and improvement procedures do you need?
- How will you measure success and effectiveness?

Both data and human knowledge have distinctive features that make them useful in different ways when making decisions related to continual improvement.

This is how data brings added value to the decision-making in continual improvement:

- **Data is not a question of opinion or consensus.**

When the targets, objectives, or procedures of continual improvement are defined by human power only, decisions are often based on opinions, political consensus, or the loudest voice. Data-driven decision-making is based on the reality of the situation as observed and interpreted by knowledgeable people instead of opinions or impressions that are based on assumption or groupthink. Evidence-based decisions allow the organization to concentrate their investigations better and focus on the right things.

- **Data is unbiased and democratic.**

The old hands on the production line often run products in their own way based on their experience. It might prove challenging to get them to operate in a standard or consistent manner. Data provides you with undeniable and unbiased proof of why certain process operations for products should be run with certain parameters.

- **Data captures information undetected by human senses.**

Variation in both the process and the end product is often the sum of several small factors. Usually, single factors are impossible to detect with human senses, but data reliably captures them. From data, variation can be detected even when it stays within the specification limits.

This is how human knowledge brings added value to the decision-making in continual improvement:

- **Humans understand context.**

Humans are needed to put information derived from data into context in a way that makes that information useful in real decision-making situations. For example, data can reveal variation even when it stays within the specification limits. But only a human can assess whether a statistical anomaly detected by the data is relevant in a certain environment and whether it needs to be addressed.

- **Humans can form strategic goals.**

To succeed in continual improvement, you need to set clear and concrete targets. Also, the results of continual improvement need to be tied to the context of business operations and justified from the profit point of view. The people in the organization understand what targets best support the business's operations, strategy, and success.

- **The emotional intelligence of humans is the best soil for managing change.**

Continual improvement requires structured change management, and people cannot be managed with data alone. Data does contribute by bringing undisputed facts to the conversation and can, at best, boost successful change management. However, only humans can show leadership that takes employees' needs into account and shapes not only processes but shared culture as well.

3.2. The weak spots of traditional improvement methods cost you money

“Manual work takes up a lot of our employees’ time. We would have much better use for all those wasted resources in developing our operations.”

“We might be missing data from the part of the process that we want to develop. We have to collect data afterward, which means that the actual improvement phase won’t be completed on time.”

“The areas for improvement are elected by acclamation or over afternoon coffee, making projects a success more by accident than design.”

How long do you plan to tolerate the slowness and other downsides of the traditional methods of continual improvement? How long can you afford to stand aside and watch projects drag on while producing more and more waste every day?

Conduct a DMAIC project with more automation, speed, and accuracy

Whichever framework your company has in place for continual improvement, the challenges are usually the same. In the chart below, we broke down the benefits of the Quva® Flow data and analytics tool in DMAIC projects.

Traditional project:

Phase

With Quva® Flow:

1

Areas for improvement are often chosen based on consensus, loudest opinion, or the best-sounding idea.

Define

Areas for improvement are chosen based on undeniable information derived from data.

2

Data has been collected, but not necessarily from the period or the process that you need. The improvement measures are delayed as a sufficient set of data needs to be collected from scratch.

Measure

The complete data collection system has to be up and running before the implementation of Quva® Flow. You can be certain that you have access to the exact data you need whenever you need it.

3

There are separate statistics software available for the analysis phase, but first you have to define what part of the data is relevant in each case. It also takes a lot of manual work to move the data between the data sources and the analytics tools.

Analyze

The data is analyzed largely automatically within the system. All manual procedures that take up time and human effort are automated, so human resources are spared for more valuable tasks. The analysis is more accurate, as automation reduces the risk of human error.

4

Improvement procedures are inflicted, and their importance is difficult to communicate to operators.

Improve

With data, the importance and significance of improvement procedures can be better justified, which reduces resistance and objections among operators.

5

After the improvement project, the process is left to its own devices. It is not until later that the current situation is measured, and the effectiveness of the improvement assessed. If the improvement is not satisfactory, a new project is needed.

Control

Real-time data provides immediate and continual feedback on the current situation. Monitoring can be focused on the areas of improvement. Automated alerts inform users about any anomalies, and the causes behind them can be addressed immediately.

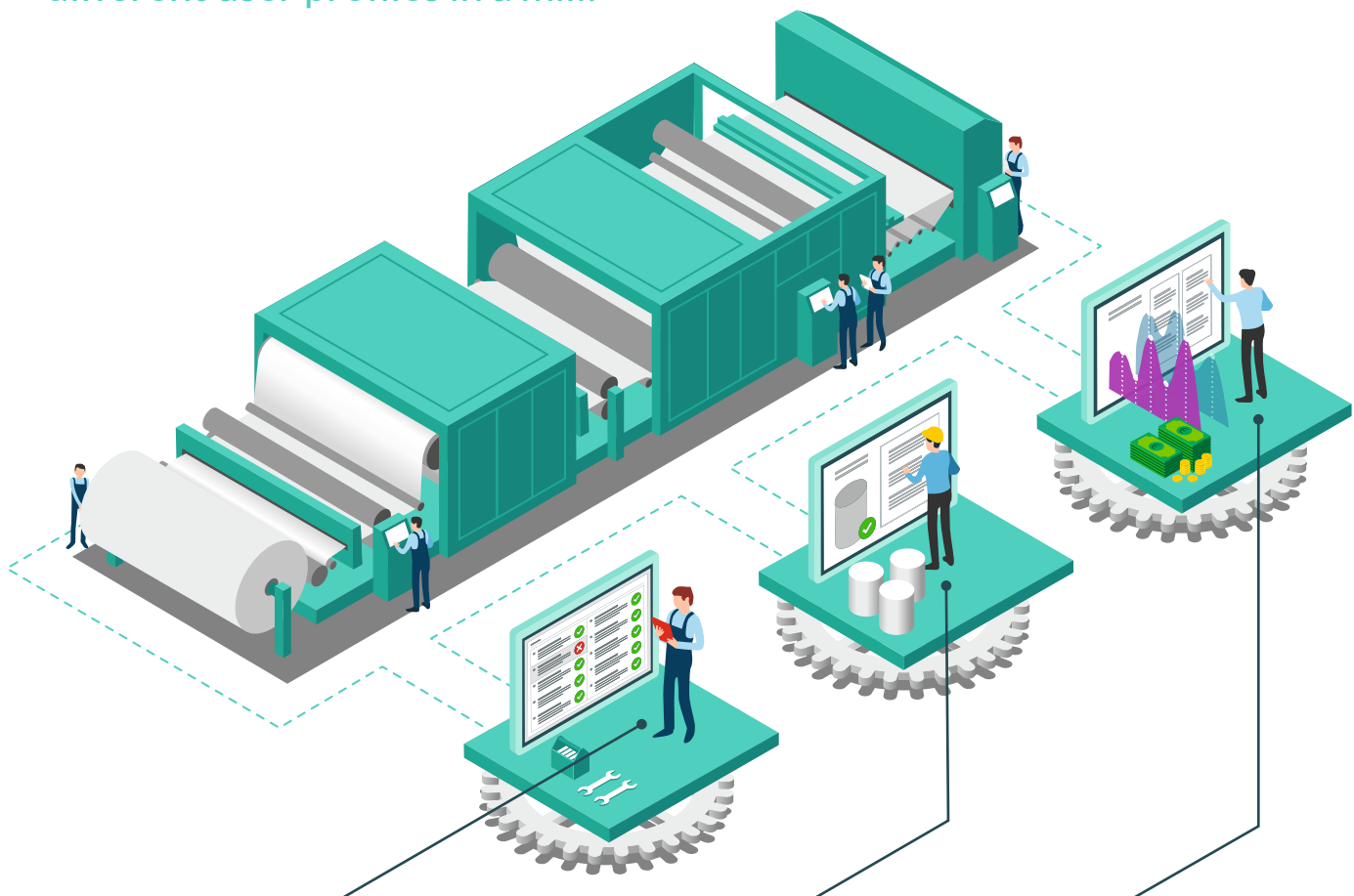
3.3. Employees' tacit knowledge is too valuable to ignore

Too often, data tools are designed by engineers for engineers and, as a result:

- their use requires special skills
- only few people in the organization benefit from them in their daily work
- improvement of the quality of processes is the concern of only a handful of people

A data tool only becomes a profitable investment when it is useful for all, engages employees in the decision-making process, and enhances the quality culture within the organization. We at Quva wanted to do things differently. That is why the service is built in a way that anyone in your organization can easily extract the exact needed information in a form that is easy to use and understand.

The benefits of Quva® Flow for different user profiles in a mill:



Operator

"The system gives an alert in case there are production anomalies that affect end quality. I can fix quality issues before they end up as waste. The system shows me how the product should be run to produce the best quality possible."

Quality engineer

"With a few clicks, I can retrieve an easy-to-read quality report of every reel. I also have quick and easy access to the root causes of variation. The system even helps me prioritize and assess which deviations to address first."

Manager

"I get a clear view of which quality and process variables cause problems in our KPIs. I can also monitor how improvement projects really affect quality and variation."

Human knowledge completes data

Through their experience and common sense, machine operators and quality engineers have accumulated knowledge about the products, processes, and raw materials that no data system could ever produce. It would be an enormous waste and crude underestimation of your personnel to leave that tacit knowledge untapped.

The most important thing about collecting user feedback and context knowledge and integrating it into data is the ease of it. The more time and effort that it takes to log and retrieve the information, the more probable it is that users will ignore the feature.

Quva® Flow learns automatically, making tacit knowledge available for everyone to utilize:

Automation

A lot of effort for the user

Users type their observations about the process data into the system log between work tasks and search for relevant information in other people's entries using hashtags, for instance.

A little effort for the user

The users value the relevance of information for their own work by clicking a thumbs-up or thumbs-down. The system then learns to offer more high-quality and relevant information for all users of the same user profile.

Zero effort for the user

The system continually analyzes user activity in the background and, based on that analysis, automatically offers more relevant information for all users of the same user profile. For example, the system presents the detected anomalies in the order that the previous users of the same user profile have preferred.

Do you purchase an expensive data system for three people to use?

3.4. Complex data is useless for people unless it is simplified

““With production performance measures, we usually strive for extremities and not averages. No one wants average productivity or average costs. We want high productivity and low costs. And the same applies for production performance data. The extremities are where the most potential for improvement lies.” – Gregory H. Watson

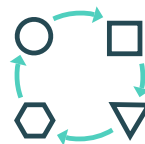
You run hundreds of different products in a complex, multivariate manufacturing process. The amount of data cumulated from that is enough to bring a cold sweat to anyone's forehead. In the midst of all that data chaos, we run the risk of cursory analysis of data with too much focus on the average or summary data.

Average data don't allow you to see what is really going on in the process. It only shows you the average of what is going on. Thus, the majority of issues go undetected, as they usually occur in the extremities of process performance.

Harness the right tool to reveal the extreme values of your data and utilize the information in day-to-day choices as well as extensive improvement initiatives for the benefit of your business. That way you get the best return on your data investment.



Data is easily derived into useful information for each user and their work.



The system observes the differences between sets of data from different products and product grades, making it possible to get to the bottom of issues specific to certain products or grades.



The reports are so easy to use and understand that no extra time or effort is put into trying to decode them.



Complex data is presented in a simple manner that still captures the multidimensional nature and the extremities of phenomena.



Data is continual instead of sporadic. The user can go back to the past, monitor the present in real time, and predict the future.

4. This is what continual improvement looks like in leading industrial companies in 2019

Experiences from quality and production managers in process industries: Less variation and waste, more efficient process

“The system’s value in decreasing waste and losses is that it continually analyzes data in real time. We detect anomalies in production earlier than before, making it possible to fix the process before the problem becomes so bad that it causes internal or external costs. We have gone from fixing things afterward to proactively preventing issues.”

“Before, the mind set on our production line was that as long as we are within the specification, everything is all right. But as we want to further reduce variation, we need to be aware of the direction in which things are going to develop even when within the specification limits. Is the feature showing statistical deviation even though it is still within the specification? Quva’s data tool allows us to monitor this development.”

“If variation is detected in the thickness or durability of a certain paper grade, an improvement project is launched to locate the cause of the variation. Is the root cause in the input of raw material or in a certain phase of the process, for instance? Quva’s system can pinpoint the inputs that cause the output to change. Once this is defined, the system then measures these parameters in real time and alerts when changes occur. It is possible to adjust the parameters in time so that the variation doesn’t result in waste in the end product.”

“One change that Lean Six Sigma 4.0 brings is that the operators no longer have the option to run products using their own parameters. The reports clearly indicate which parameters produce the required end quality for each product. This is a welcome change for the employees, also. Now they can spend their time purely on monitoring the production line instead of running around fixing problems, preventing stoppages, and restarting production lines after downtime. Putting out fires is replaced by running a more controlled process.”

Experiences from quality and production managers in process industries: Continual improvement is based on facts and reality

“Even though the development is increasingly based on data, the human input is still crucial, and the personnel should be involved in the development work just like before. The difference is that now the work is done based on what real information we have about the process, instead of going blind on assumptions and beliefs. It is important for the employees, too, that the improvement can be done more easily, accurately, and reliably.”

“The major benefit for our Lean Six Sigma operations is the increased visibility into what needs to be improved and how. We can see where the regular lean method is not enough to produce the desired outcome. Then we know that we need to turn to the heftier tools of Six Sigma.”

“The system creates a new kind of foundation for the traditional Lean Six Sigma. We have access to a data lake into which we can dive to retrieve the exact right data. And it is not just a random mass of raw data. The system refines the data into an accurate representation of the indicators that are relevant in each context and gives us quick and easy access to that information. Thus, the chances of conducting a successful improvement project and solving the issue quickly, correctly, and accurately are substantially better.”



5. Champion's next steps in continual improvement

Every day in your production process, an enormous amount of knowledge is cumulated both as data and as human experience and observations. Combine these two to gain maximum production efficiency and get a head start on your competitors.

Road map into implementation of Quva® Flow:

- **Make sure the company management has a solid shared view** that driving continual improvement and competitive strength through data is a strategic emphasis.
- **Define user needs, roles, and profiles.** How do you build a system that guarantees access to relevant information for all users in their daily work?
- **Set goals and define how you measure success.** Is your target to cut internal quality costs or reduce the number of quality claims to a certain level, for instance?
- **Conduct an internal pilot project to validate the management's belief in the importance of the theme.** Choose one mill or production line and put together a small team to build the system and measure the impact.
- **Launch an expansion project.** The system is scaled and implemented from one unit and mill to another in a determined manner.
- **Measure short-term results,** such as the number of solved quality claims, user experience, time between actual problem and its identification, as well as number of identified issues and bottlenecks in processes and quality.
- **Measure long-term results,** such as reduced costs from waste, customer satisfaction, mean deviation conformance, and utilization rate of the system.

Tom Anderzén's tips for choosing the pilot unit:

- 1 **Figure out which unit has clear potential for boosting efficiency.** The pilot has to prove the profitability of the investment. Use your business data to evaluate the potential benefits, savings, or enhanced productivity the unit might achieve.
- 2 **Ensure management's readiness for change.** It takes a bit of a psychological skill to find out the level of commitment the unit management has in continual improvement and change management.
- 3 **Make sure the unit has sufficient internal resources.** Although management and their commitment play the biggest role, the unit has to have quality and production engineers with enough time to develop and implement the system.
- 4 **Don't choose your biggest and most significant unit for the pilot.** If the project fails in the most visible unit due to internal resistance, for example, it is difficult to implement the project in other units.
- 5 **Don't choose your smallest unit for the pilot.** It is easy for the critics to question the results by claiming that a small unit is not a good representation of your organization and operations.

“To take full advantage of the benefits of data, you need to have an experimental culture and a willingness to experiment with your processes. You don’t always have to be the first one to accept change, but you should be among them. Otherwise you will fall behind.”

– Gregory H. Watson

**You already have everything you
need to gain the upper hand
over variation and waste,**
and it is hidden in your data and
the tacit knowledge of your people.
Let’s dig up these treasures together.

Book a demo now at <https://quva.fi/en/contacts>