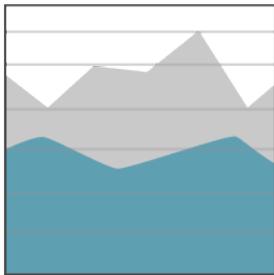


Quality Intelligence® Explained

Esko Hannula

Quality Intelligence® is measured, actionable information about quality. It was created for **understanding the value creation of digital services** as well as the **processes creating and operating them**. Experience has proven, however, that one can apply Quality Intelligence to various other purposes, too. Quality Intelligence is a registered trademark of Qentinel.

Quality Intelligence® refers to 1) the **modelling and analytics functionality** and technology included Qentinel's product Qentinel Pace™ and applied to the management and prediction of quality of software and digital services; and 2) the **quality philosophy and methodology** used by Qentinel Pace as explained in this document.



measure



understand



deliver quality

Why do we need a different quality paradigm?

Quality Intelligence is based on the assumption that the management of the phenomena of the agile, digital world cannot be based on the optimization of statically defined processes alone.

It is, for example, possible to define a process for receiving purchase invoices, scanning and entering those in an information system, and processing them through approval to payment. It is possible to use key performance indicators (KPI) such as transaction volume, throughput time, and defect ratio to measure, control, and

continuously improve such process. It is possible to use e.g. lean methodology to improve the productivity of such process. Most importantly, it is even possible to fully automate such process.

The management of the phenomena of the agile, digital world cannot be based on the optimization of statically defined processes alone.

Most industrial processes resemble the one above. There is a well-defined process that has been, at least partially, automated. The inputs, outputs, and the steps of the process are

well understood. We have learnt, by design and by experience, to measure the performance and the output of the process. We know how to detect problems and errors in the process. We can calculate the optimal yield

of the process; i.e. we know how to determine the percentage of defective outputs so that the sum of cost of production and cost of warranties is minimized.

The situation changes completely when we are dealing with a “process” that is less formal, less understood, less stable, and less linear. Building a complex information system, building a release pipeline for a software product (commonly known as DevOps), or improving customer retention through

is the process of bringing money in and taking money out from a company. Cash-flow, if anything, is the core process of a business. It is much researched and well understood and its main principles are the same in all businesses. Still, the task of drawing a process chart for cash-flow may be practically

process but a system of various non-linear dependencies and even loops. It is characteristic to this kind of “processes” that their outputs are also their inputs.

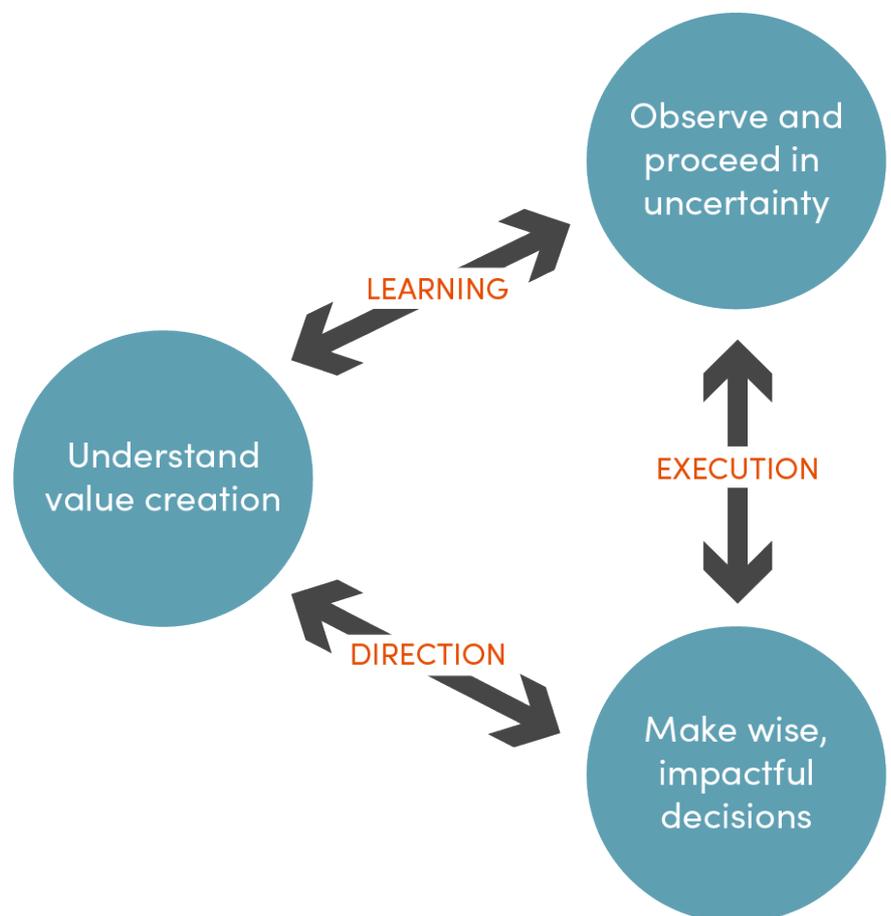
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customer experience are typical examples of such, more complex and less linear processes. It is possible to depict also these activities as linear processes, but they are, at least today, less automatable and less controllable than the processes of industrial manufacturing.

impossible. If you really tried you probably ended up with something like the following. It is not a traditional linear process chart and it cannot be divided into clear steps and routines – moreover, it may not be possible to assign exact roles and responsibilities in the different parts of the process. The process is not actually a

In an industrial process, human beings are performing the job of a machine in routines where a human is cheaper than a machine, tasks for thinking human beings are few, and interactions among human beings have been intentionally eliminated or at least formalized. In these other, more complicated, examples, many tasks are automated or routine-based, too, but the amount of thinking is high, and human interactions are many. It is hard or even impossible to manage such semi-creative activities through a detailed process description and fixed key performance indicators.

A rather simple and well-known example is the cash-flow of a business. Cash-flow



The need for Quality Intelligence®

The roots of Quality Intelligence trace back to year 2008 in Qentinel, a software quality assurance business in Finland. Qentinel used to be in the business of helping teams to improve their quality assurance. Very often, quality assurance was improved a lot, but quality did not improve. When Qentinel improved testing, it became evident that there

organization units whose goals and KPIs may conflict with each other.

End-users all have different definitions for “success” for the new information system and therefore real success happens rarely.

their clients deliver or acquire and implement software and information systems with high quality. The QA specialists in Qentinel frequently witnessed two challenges that they were unable to cure.

The first challenge was called “Illusion of Success”. It was, and still is, quite common even in well-managed large information system investments that although the implementation project is considered a success the resulting information system fails to meet the needs of the business that invested in it. Qentinel figured out that the IT organization, their software vendors and system integrators, the business organization and the actual end-users all have different definitions for “success” for the new information system and therefore real success happens rarely.

The second challenge was called “Garbage In – Garbage Out”. Back in 2008, Qentinel was quite often invited to help struggling software development

is a large number of defects in the software. As the software teams put more and more effort in correcting defects they had less time for implementing new features. Therefore, their management asked them to work longer hours causing their productivity to fall further. Meanwhile, Qentinel automated the testing to improve throughput and productivity of the QA. Automated testing helped detect even more defects even faster but did not actually improve the quality of the software. Qentinel had hard time explaining to their clients that improvements in QA do not help unless the process creating the software improves, too.

Qentinel figured out that to heal these challenges one needs a method for illustrating and understanding the systemic, and often cyclic, cause-and-effect relationships, such as those of “Garbage In – Garbage Out” and a method for establishing meaningful KPIs. Qentinel developed a method and related modelling and measurement technology that eventually got the name Quality Intelligence®.

The need for Quality Intelligence® has further grown with the digitalization of businesses. Value chains are less and less linear, changes are more and more frequent, and value creation takes place across organization borders and business entity borders. To be effective and efficient in such a business environment calls for a shared understanding not only on what should be achieved but how it should work and how own decisions and actions may affect others.

Improvements in QA do not help unless the process creating the software improves, too.

Both challenges discussed above are common still today. They are hard-to-grasp because they are systemic by nature and because their resolution would require collaboration of multiple

The change of pace, driven by digitalization, has also resulted in a need to agile management, i.e. being able to both move decisively but at the same time continuously monitor the

business environment and own progress and be ready to re-plan or change direction whenever needed. Such agile management needs great transparency into the progress. Such transparency can be achieved through rigorous, largely automated, collection and analysis of metrics. To be useful, the metrics need to reflect the chains of cause and effect so that one can use leading indicators to spot early signals before they affect the outcome.

To be effective in such a business environment calls for a shared understanding on what should be achieved, how it should work, and how own decisions may affect others.

Key principles of Quality Intelligence®

1 Quality is multi-dimensional.

2 The dimensions of quality are understood through value creation modelling.

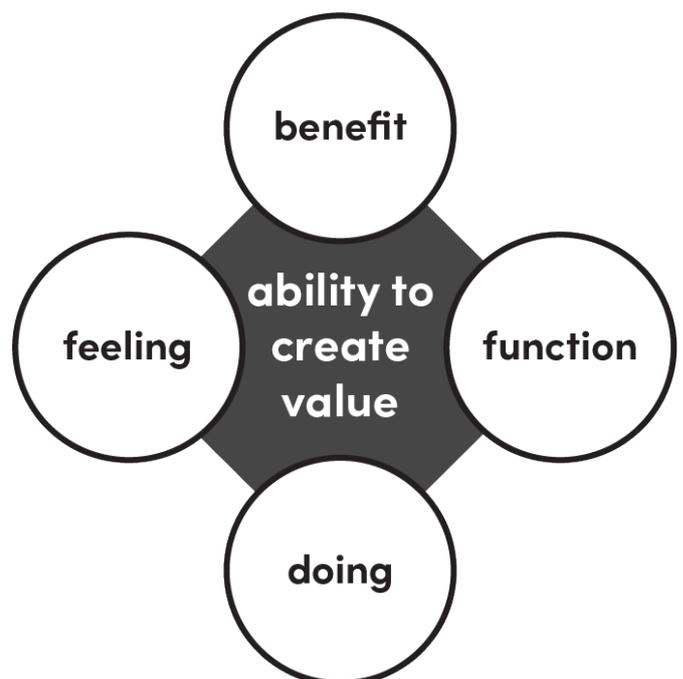
3 Measurement of quality is agile and aims first to accelerate learning and understanding.

Multi-dimensional quality and Qentinel Quad™

Quality is traditionally defined as absence of defects. The more defects there are, the lower the quality. While this works well for industrial manufacturing and any deterministic, repeatable process, it is inadequate for complex, systemic problems. It is noteworthy, though, that many of the things that are complex, systemic problems today, are likely to be reduced to fully automated deterministic processes some day in the future. As long as this is not a case, we need something more than one dimension of quality for describing them.

The four dimensions of quality are

- 1) quality of function;
- 2) quality of doing;
- 3) quality of feeling; and
- 4) quality of benefit.



Quality of **function** refers to directly observable behavior and characteristics of a product, service, or other deliverable. This is very close to the traditional engineering definition: quality is considered high when there are no defects in the functionality or appearance of a product. Having no defects is usually understood as conformance to specifications and regulatory requirements.

A product may have extremely high quality in terms of conformance to specifications but still feel awkward to use and appear inferior in real-life comparison while some other products may have miserable “quality” but still feel great, satisfying, and desirable in the hands of the consumer. When Apple launched the iPhone it was inferior to almost any other mobile phone: its battery life was

short, its radio was unreliable, it lacked some of the key features of a normal mobile phone, and it broke if you dropped it. In short, the first iPhones had terrible quality. However, they became more desirable than any other mobile device and, eventually helped re-shape the definition of “quality of product” for a mobile phone. This is the quality of **feeling**, or quality of experience as some people prefer to call it.

Quality of **doing**, often called also quality of process, refers to the quality of those activities that are needed to design, produce, market, distribute, and consume a product. It is well known that quality of product cannot happen without the quality of the process of producing it. Traditional quality management is usually applied to the production process and traditional quality

measurement is usually applied to the product itself. The cause and effect relationship of the two is obvious.

The fourth dimension of quality is quality of **benefits**. People buy products and services to achieve some benefits, such as increased wealth, increased well-being, increased joy, or increase security. Those benefits rarely materialize by having a product. Instead, they materialize by using the product.

Quality Intelligence states that all four dimensions of quality must be adequate for all actors whose opinion matters before quality can happen and value can be created.

Hospital quality for different stakeholders

	BENEFIT	EMOTION	PRODUCT FEATURES	PERFORMANCE
PATIENT	Recovering from sickness	Security Feeling better	Hospital reputation	Competence Speed Predictability
CARE PROFESSIONALS	Salary Ease of working	Good workplace Workplace wellbeing	Effectiveness Equipment Medicine	Procedures Practices Workflows
MANAGEMENT AND BOARD	Finances Hospital reputation	Smoothness of operations Manageability	Effectiveness Patient safety	Process efficiency Reliability Predictability

Qentinel Value Creation Model™

As discussed above, the factors contributing to quality are many, they may depend on each other directly and indirectly in non-linear ways, and they may appear

As can be seen, the dependencies among the different parts of the Value Creation Model affect each other in a non-linear manner, there

on human assumptions, may be partially incomplete or even faulty. When seeking to understand complex systems, one must make simplifications and assumptions but one also needs to be ready to improve their model once more information and understanding is available. Even if the assumptions were initially wrong it is better to have them wrong consistently among the involved individuals and organizations than having them wrong in multiple unique ways.

To create value, one needs to understand what factors of quality matter and how they connect to each other.

different to different people. To create value, one needs to understand what factors of quality matter and how they connect to each other.

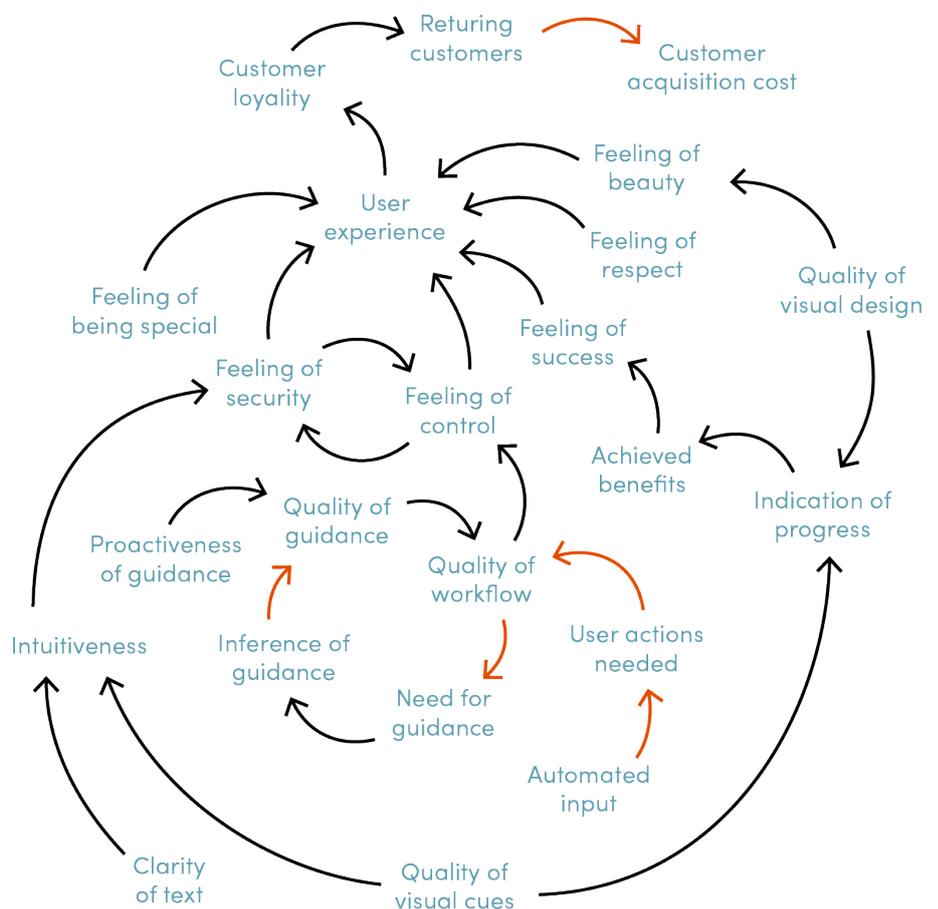
may be timing delays before a certain dependency starts to work. For example, the quality of customer experience affects customer satisfaction instantly, but will have an impact on customer retention only later.

Value Creation Model is a systemic modelling method and technique that helps understand the drivers of value. We call it Value Creation Model instead of "Quality Creation Model" because we are really after creating value and the drivers of value are usually the different qualities of the various things affecting value creation.

The Value Creation Model, must like any other model or process description is a simplification of the reality and, being based

Following picture illustrates a highly simplified value creation model of customer experience of a website.

This value creation model shows how (the quality of) customer experience contributes to customer satisfaction, customer retention, and customer recommendation and how these, in turn, may contribute to each other. It also shows how different qualities of this website contribute to the experience of its users.



Measure to understand

Traditional quality management views key performance indicators as something that have a fixed target level. If the process metrics deviate from the target only marginally quality is considered good. Continuous improvement of quality means narrowing the deviation margin. Metrics are used for control and continuous improvement.

When dealing with complex and systemic problems, we don't understand the process well enough. Probably we aren't even able to describe it exactly. Therefore, there is not much we can control or improve.

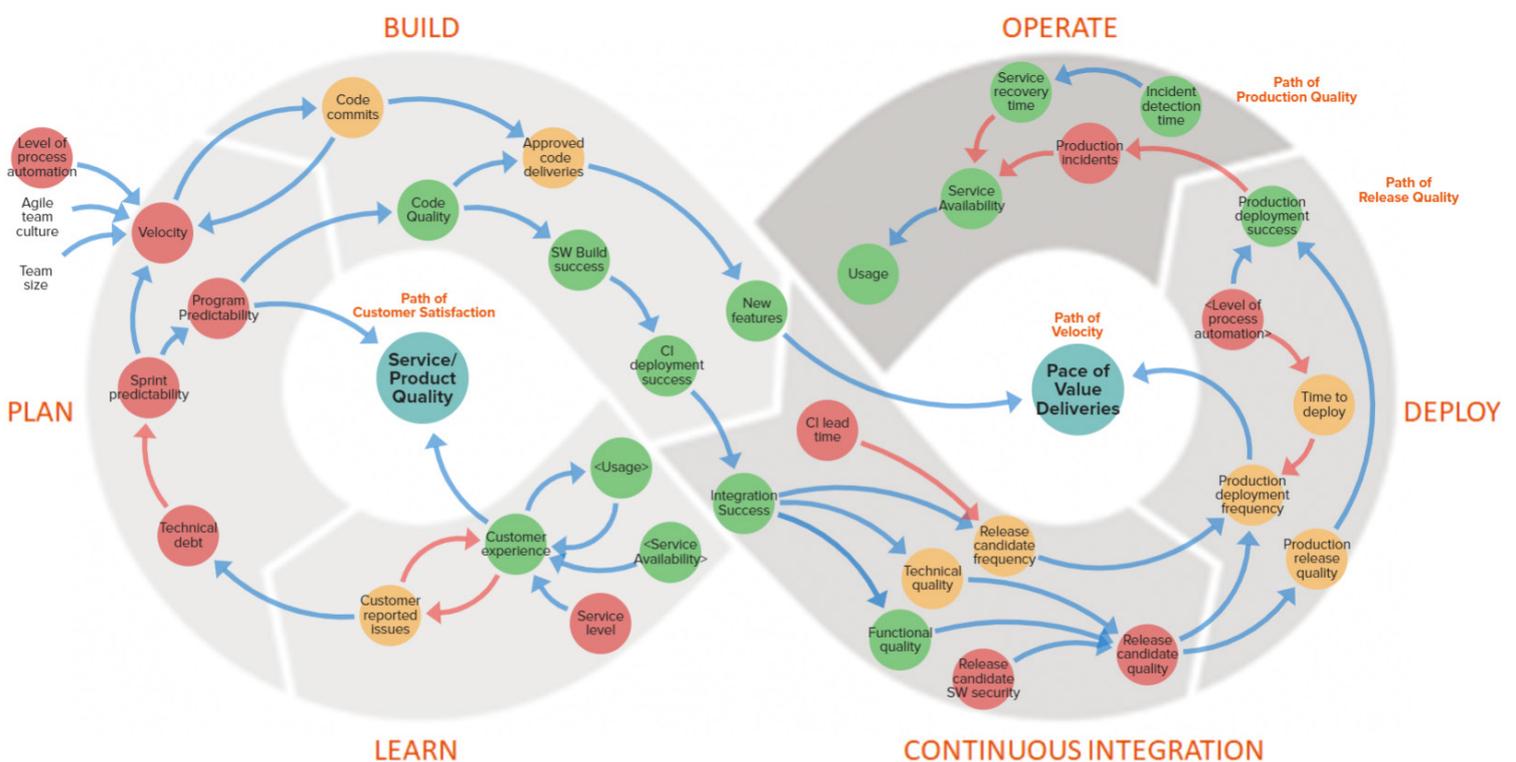
In Quality Intelligence, the prime purpose of measurement and KPIs is to accelerate our learning. To deal with a complex, systemic problem means seeking to understand it better and to gradually reduce its complexity.

In the modern competitive environment certainty is seldom present. If we wait until we know enough we will almost certainly be late. If we start moving before we know enough we will almost certainly go wrong. The only way is to start moving with incomplete understanding and build in tools and methods for learning while moving.

Building a modern software release pipeline applying the principles of DevOps is a great example of learning while moving. It is practically impossible to "buy DevOps" and start using it. So many things need to change in tools, technology, processes - and particularly in people. We know that DevOps will help us accelerate the software releases, but we don't know what our initial speed will be and how fast we can improve it. We know even less about our quality, its state and its improvement speed. And still less about how speed and quality depend on each other.

Following picture, depicts the DevOps value creation model used in Qentinel Pace. The concept of DevOps itself is rather well understood although it is hard to describe as a linear process. However, the way a particular organization implements DevOps is still not well understood because there are so many different forces affecting its performance.

Each element in the value creation model can be associated with a number of metrics. These metrics comprise the "value" of that element. If we know through measurement that some element does not meet its requirement we can be almost



certain that soon, the elements that depend on it won't meet their requirements either. The traffic light colours in the picture above depict the performance of each of the elements of the value creation model.

The metrics and the Value Creation Model helps us figure out what is wrong and what the consequences will be.

When we see that something is wrong, i.e. red, we still don't always know why, and we don't know what the consequences will be. The metrics and the Value Creation Model helps us figure the answers out fast. By digging into the individual metrics of an element that is red we'll find out what is wrong. By looking at the cause-and-effect arrows of the Value Creation Model we can figure out why it is wrong and what will follow from it being wrong. A bit more review of the metrics is probably going to reveal what levers to turn to make things better fast.

However, because we are dealing with systemic issues that are not well understood, our models and metrics are never complete. The more we know the more we also know about what we don't yet know. This is agile measurement. Some metrics

are important for understanding the unknown. Once the unknown is not unknown anymore its metrics may be used to control or predict its behaviour or – if we are convinced that no further improvement is needed, we

may just simplify our model by eliminating it and its metrics. Quite likely, we'll also find out that something essential is missing: our model may fail to capture some important causes and effects, or our metrics may be incomplete for understanding them. We need to be able to add new elements and new metrics while we learn more

The purpose of agile measurement is first to understand, then to simplify, and only then to control and improve.

Quality Intelligence® is intelligence about quality

This paper is a short but hopefully concise introduction to Quality Intelligence®, intelligence about quality. Our purpose is to make the connection of quality and value creation explicit, make it measurable, transparent, and actionable, and help people make better decisions with the information we create

We believe Quality Intelligence is important because, in the digital world, any business can be only as good as the software driving it and the omni-presence of software makes the quality of the human life dependent on the quality of software.



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