

WHITEPAPER

Getting a Quantifiable View on Quality whilst Keeping an Eye on Business Risk



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Management summary

This paper is about transforming an organisation that merely has a quantifiable view on achieving its business goals, into an organisation that takes a similar approach to achieving its quality goals. It shows that the quality of products and processes, and business success cannot be viewed separately but that they influence each other. It sounds like the same old story, told over and over again: the classic conflict between time, cost and quality. However, it will be referred to Nuance Communications, a multinational computer software technology corporation with a focus on server and embedded speech recognition, as a case study, where this approach has been implemented successfully.

In this particular case there are some specific challenges:

- A special focus on innovation is essential as the organisation is seen as the most innovative force in voice technology. This involves specific requirements in terms of the Time-Cost-Quality Triangle: deliver innovative products as fast as possible (time), that work as expected (quality) at a fair price (cost).

- The increasing demands of customers for the organisation to achieve a certain process maturity, in this case Capability Level 2 of Automotive SPICE.

Every organisation has its own special challenges alongside traditional concerns such as:

- Being profitable
- Achieving high customer satisfaction
- Business growth

This paper will set out the whole process, starting with finding the right quality goals, identifying suitable metrics using the Goal-Question-Metric [1] approach and finally reporting on them in a monthly dashboard whilst taking into account all these challenges. It constitutes a general approach that can equally be applied within other organisations.

Introduction

In 1954, Peter F. Drucker wrote in his Book “The Practice of Management” [2] that there is a “...need to manage business by balancing a variety of needs and goals, rather than subordinating an institution to a single value”. In his book, Drucker introduced the term “Management by Objectives”, a process of defining objectives within an organisation so that management and employees agree to the objectives and understand what they need to do in the organisation in order to achieve them. Standards like ISO 9001, CMMI and ISO 15504 often have the image of being cumbersome, bureaucratic and only adding significant burden and real cost to the organisation. But if you combine them with “lean” principles and use Management by Objectives, this can be a very powerful approach to process improvement.

Most organisations focus on financial goals like profitability, revenue/margin, utilisation and cost savings in order to manage their business risks. Having a quantifiable view of financial goals is not really very difficult, because all relevant data is available. Organisations often report on their financial status in a standardised way in their Statement of Financial Position, which allows benchmarking of figures between companies. Organisations find it relatively difficult to set up quality goals that can be quantitatively measured. Defining and measuring such goals frequently requires a specific approach and process, because achieving these aims often depends on the products themselves and the process used to produce them.

Market – current status and outlook

Achieving the right quality is a differentiator in a highly competitive market. But too many of today’s software projects still struggle to achieve the right balance between time, cost and quality [3]. In order to find the right balance, it is necessary to have a quantifiable factor on these parameters. Big data allows us to measure practically everything and there are very powerful tools available to visualise data and data analysis. Measurement and analysis are becoming increasingly relevant for successfully controlling a business.

But just because you can measure something doesn’t mean you have to. You can be selective. A framework has to be developed with powerful key success factors and key performance indicators that support the measuring process and help the business to achieve its quality goals. Plus the framework should be continually revisited to ensure it remains fit for purpose.

The expectation is that it will become more and more common for organisations to have a quantifiable view on achieving their business and quality goals.

Taking stock

The starting point is to set up a quality strategy with the following objectives:

- The quality goals over the coming years are established and set out in written form
- The quality goals are achievable financially within the organisation and the financial implications have been clarified and agreed with management
- These goals (KPIs) will be measured using a quality dashboard

This shows that it is necessary to have quality goals that are attainable but do not threaten the profitability of the company. In many cases there are also external requirements from the customer that influence the definition of quality goals. Nuance had additional requirements from their major customers

to achieve a certain process maturity. In one particular case they had to certify Automotive SPICE Level 2 for a large project (Figure 1).

A good stepwise approach is to first define the quality goals and KPIs and plot their measurement in a pilot project. Nuance selected the customer project that included the requirement to achieve Capability Level 2. For this purpose, the project already had a mechanism that could be used for improvement after measuring the KPIs. In fact, it is all about implementing the Plan-Do-Check-Act (PDCA) cycle, because simply defining (“Plan”) KPIs is not enough. They need to be measured in the pilot project (“Do”); then they need to be analysed (“Check”) and appropriate improvement actions must be identified when the goals are not met (“Act”).

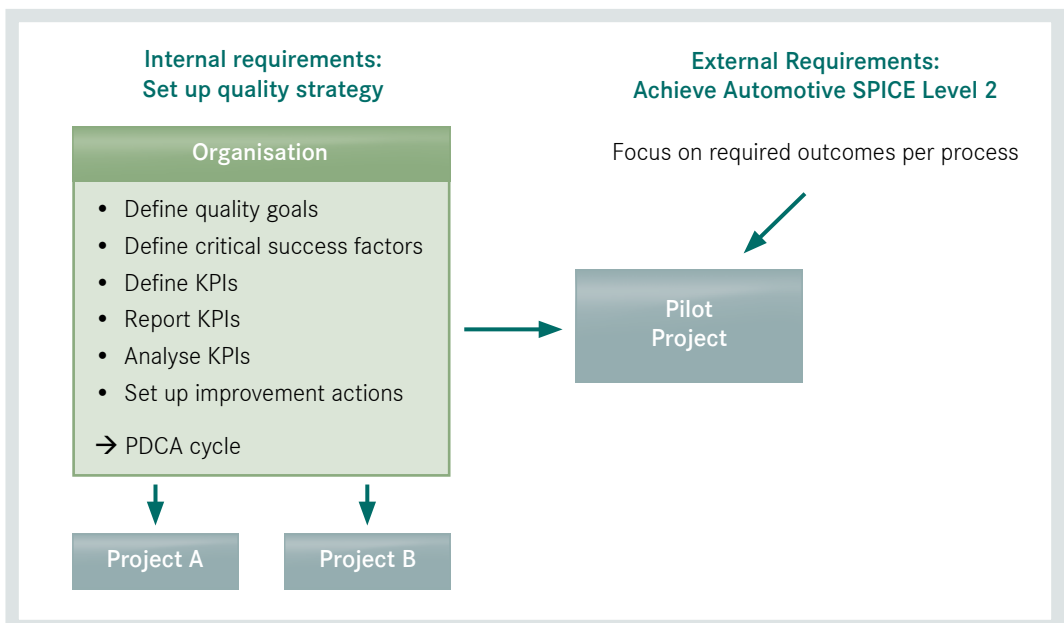


Figure 1: Stepwise approach

It is very important that your chosen pilot project has a working PDCA cycle so that improvements can quickly be implemented. Once the quality dashboard is complete, it can then be rolled out to other projects within the organisation.

Before focusing on defining the quality goals, it makes sense to take stock of what is already on the table regarding goals, objectives and targets. In many cases you will find some kind of high-level mission statement, but mostly with no specific focus on quality. Derived from that there are usually some business goals defined, focused on P&L, revenue/margin, utilisation and cost savings. At Nuance some other goals were also identified:

- The quality of work and services must be right first time
- Don't lose customer projects due to poor quality
- Meet customers' project requirements without impacting on the innovation roadmap
- Focus on improving customer solutions, and increasing customer satisfaction and growth
- Deliver innovative solutions as fast as possible

Achieving these goals places you in the classic conflict between quality, time and costs. Most organisations want to increase their productivity and efficiency, and realise that quality is an important differentiator. What is perhaps something special at Nuance is their focus on innovation, as they are viewed as the most innovative force in voice technology.

Defining quality goals

After analysing the implicit goals identified within the organisation, continue by capturing the "Voice of the Customer" (VOC). This term is used in Six-Sigma improvement initiatives to describe the stated and unstated needs or requirements of the customer [4]. At Nuance this showed that the customer wanted:

- Engineering stability: to find defects before the product is delivered to the customer
- Expectations to be met, i.e. what has been promised to the customer is actually delivered
- The best technology, i.e. good quality innovation over low price
- A world-wide presence and solutions
- Process repeatability

If you take a look at the VOC at Nuance, it isn't actually peculiar to the company but is in fact valid for many organisations.

After identifying the VOC, the next step is to do a SWOT analysis, focusing on the VOC and involving the relevant stakeholders. For confidentiality reasons and as we are looking into the methodology, these are not revealed in detail. Instead of, let us regard some opportunities and threats.

It is important to identify the key **opportunities** and consider them relative to the strengths and weaknesses defined, i.e. looking forward:

- Create products and solutions that are out of reach of the competition
- Step up to provide fully quality-assured applications
- The requirement to achieve Capability Level 2 is a clear motivator to progress, and because major competitors have not yet attained this, it could become a real sales advantage

Furthermore possible future **threats** or issues are examined:

- The increasing complexity of systems and organisations is challenging for system/solution quality
- Complexity leads to high dependency on individual experts
- Lack of balance between innovation and daily project operation
- Global competitors becoming stronger
- Loss of customer satisfaction

- Misunderstanding of the customer's exact requirements (even if the customer is not entirely sure of these itself)

None of this information came as any surprise! The threats (and weaknesses) in particular are very common to many organisations. And even if there are threats, the organisation still delivers high quality products and is still the global market leader.

After doing the SWOT analysis, the next step is to sit down with the relevant stakeholders and identify the quality goals. At Nuance, we finally came up with these five goals (again: no surprises!):

1. The quality of work and services must be right first time
2. Achieve and maintain a balance between innovation and daily project operation
3. Project requirements are properly managed and tracked
4. Achieve maturity levels for the projects as agreed with the customer
5. Ability to provide clearly defined and transparent product plans/roadmaps to our customers

Per goal, the following information was added (cf. Table 1):

- Desired outcome ("What?" – measurable)
- Why this goal?
- How is it measured?
- Who is responsible for achieving it?
- Accountable owner

Table 1 shows the goals that have been identified, together with the desired outcome and the reason for measuring it. For confidentiality reasons, the names of the responsible and accountable persons have been removed.

| | Goal Description | Desired outcome ("What?" – measurable) |
|---|--|--|
| 1 | The quality of work and services must be right first time | <ul style="list-style-type: none"> • Low rate of defects found in our products on the customer side • Lower total cost of quality |
| 2 | Achieve and maintain a balance between innovation and daily project operation | <ul style="list-style-type: none"> • Increase the number of innovative features in projects • Secure investment for innovation • Reduce the total cost of quality to be at the sweet spot |
| 3 | Project requirements are properly managed and tracked | <ul style="list-style-type: none"> • All requirements are documented and traceable, and results can be verified |
| 4 | Achieve maturity levels for the projects as agreed with the customer | <ul style="list-style-type: none"> • Increasing number of (large) projects meet the required maturity level • Standardised processes where appropriate |
| 5 | Ability to provide clearly defined and transparent product plans/roadmaps to our customers | <ul style="list-style-type: none"> • Transparency of plans • Fewer deviations from actual and committed (or expected) delivery |

Table 1: Identified quality goals

Finding metrics

This kind of goal description is a very good starting point for applying the Goal-Question-Metric method to represent the goals in a quantifiable way. GQM offers abstraction sheets that divide the goals into five parts:

- **Object (process)** – Which elements are considered?
- **Purpose** – What we need this goal for, e.g. improve, increase, reduce, ...
- **Quality focus** – Which aspect is affected, e.g. correctness, productivity, timeliness, ...
- **Viewpoint** – Who has an interest, e.g. project manager, customer, ...
- **Context** – In what context/environment is the analysis performed?

Figure 3 shows how this was used for goal 2, “Achieve and maintain a balance between innovation and daily project operation”. The power of the Goal-Question-Metric approach is that once you have defined goals, you can derive meaningful questions that characterise the goals in a quantifiable way. This allows you to identify metrics that will answer the questions.

| Goal: Achieve and maintain a balance between innovation and daily project operation | |
|---|-------------------------|
| Analyse the ... | new features |
| For the purpose of ... | improving |
| With respect to ... | quality |
| From the viewpoint(s) of ... | the customer |
| In the following context ... | the automotive division |

Table 2: Description of quality goal 2

Table 3 shows the questions and metrics that were identified for goal 2:

| Questions and Metrics | |
|-----------------------|--|
| Q.2.1 | How much effort is spent on requirements compared to total effort spent on the sprints? |
| M.2.1.1 | Average percentage of effort spent on requirements compared to total effort for a sprint |
| Q.2.2 | How often do we need to step back to an older technology in a customer project? |
| M.2.2.2 | Number of customer projects with a rollback to older technologies compared to the total number of customer projects |
| Q.2.3 | Do innovations to be transferred from Research & Development to Professional Services meet the required quality level? |
| M.2.2.3 | Number of serious bugs found by the customer and assigned to R&D compared to the total number of serious bugs |

Table 3: Applying GQM abstraction sheets

For each metric, a metric definition sheet is used that contains the formula showing how to calculate the metric, and what thresholds are used to define the RAG* status. To finalise the definition, several project reviews may be necessary in order to verify whether the metrics that were defined can really be measured in practice.

Figure 2 is an example of how the metrics definition sheet is used.

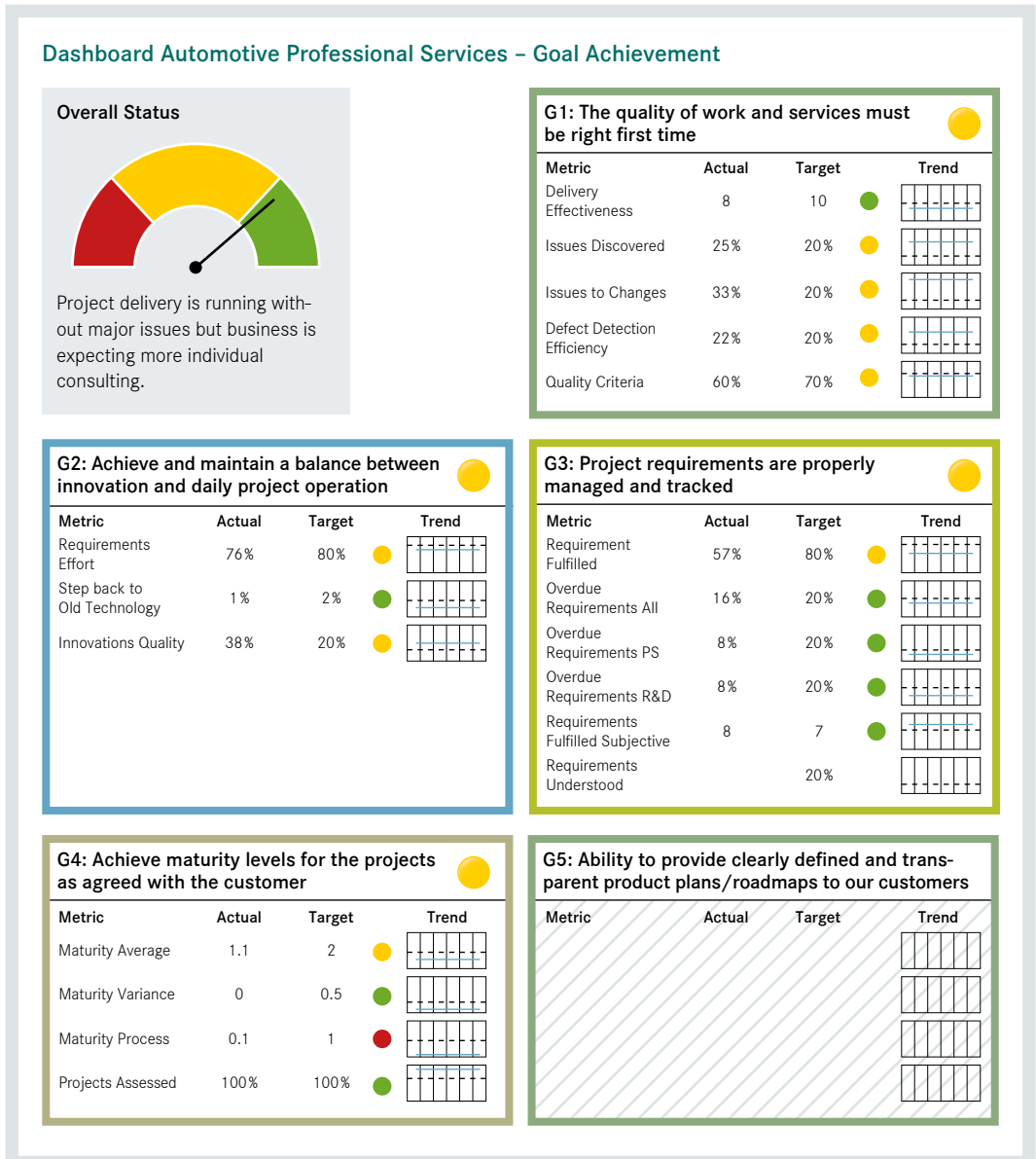
* A traffic light rating system is a system for indicating the status of a variable using the red, amber, or green of traffic lights, also known as RAG status.

| | | | | | | | |
|--------------------------|--|--|--------------|-----------|-----|------|--|
| Metrics ID | G2-M.2.3.1 | | | | | | |
| Metric Purpose | Analyse the ... | new features | | | | | |
| | For the purpose of ... | improving | | | | | |
| | With respect to ... | quality | | | | | |
| | From the viewpoint(s) of ... | the customer | | | | | |
| | In the following context ... | the automotive division | | | | | |
| | Question: | Do innovations to be transferred from R&D to PS meet the required quality level? | | | | | |
| | Benefit: | Less critical issues (assigned to R&D) are found by the customer, more innovations meet the required quality level | | | | | |
| Metric Description | Number of serious bugs found by the customer and assigned to R&D compared to the total number of serious bugs | | | | | | |
| Metrics Formula | Average (number of serious bugs found by the customer and assigned to R&D/total number of serious bugs) | | | | | | |
| Metrics Value | Average | 37.54% | Target Value | green | min | 0% | |
| | | | | max | 20% | | |
| | Standard deviation | 0.00% | | amber | min | 20% | |
| | | | | | max | 50% | |
| | | | | red | min | 50% | |
| | | | | | max | 100% | |
| Frequency | Quarterly | | | | | | |
| Measurements | Description | Value | Source | Frequency | | | |
| | Measure Q4 2014 | 37.54% | Project A | Quarterly | | | |
| | | | | | | | |
| | | | | | | | |
| Related Metrics | G1-M.1.2.1 | | | | | | |
| Technical Implementation | | | | | | | |
| Comments | | | | | | | |

Figure 2: Metrics definition sheet

The dashboard

Setting up a Metrics Definition Sheet for each metric is essential as this puts all relevant metrics into a dashboard that shows the achievement of all goals and the underlying metrics at a glance:



For confidentiality reasons, all the data contained in the dashboard is fictitious.

While presenting the result to some of the managers at Nuance, it became clear that quality is not the only criterion considered. They wanted to include – already available – metrics about profitability, utilisation and cost savings as well. For confidentiality reasons, these results cannot be shown here. In

this case the dashboard becomes a view of the organisation looking at quality and financial aspects, a view of the “Quality Risk Model” [3]. And you really close the loop if some of the quality goals are incorporated into the overall set of business goals. A true transformation from just looking at “business goals” to also looking at quality. Nuance has understood that this is the only way to remain the leading and most innovative force in voice technology.

Conclusion & outlook

Although it will certainly take some time to establish the first version of the dashboard containing the quality goals, merely discussing them – at management level also – will lead to a much greater awareness of quality within the organisation. The dashboard underpins the statement by Peter F. Drucker that there is a requirement to manage business by balancing a variety of needs and goals, rather than subordinating an institution to a single value. It also shows that achieving the right quality is a differentiator in a highly competitive market.

As mentioned before, big data allows us to measure practically everything and there are very powerful tools available to visualise data and data analysis. Measurement and analysis are becoming more and more relevant for successfully controlling a business. Having a quantifiable view of the differentiating factor, quality, will become increasingly common. But as always, just having a view is not enough. Organisations need to have an improvement mechanism in place in order to roll out improvement activities when measurements show that goals have not been achieved.

References

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- [3] M. Wieczorek, D. Vos, H. Bons (2014). Systems and Software Quality: The next step for industrialisation. Springer-Verlag, Berlin/Heidelberg
- [4] <http://www.isixsigma.com/dictionary/voice-of-the-customer-voc/>

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