

Selecting Improvement Projects that Add Value to Customers

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Abstract

This paper presents a methodology to nominate and select improvement projects that are perceived as adding value to customers (both internal and external). The structure of the methodology can be explained in three “stages.” First, the methodology suggests a new way of categorizing improvement opportunities, i.e. reactive-proactive, to “upgrade” the little Q – big Q categorisation. Then, it develops a roadmap that links performance indicators and improvement projects for both reactive and proactive improvements. Finally, it suggests an algorithm to select the improvement project, where the assessment of to what extent the nominated improvement projects add value to customers relies on the comparison between Overall Perceived Benefits (OPB) and Overall Perceived Efforts (OPE). The improvement project perceived as having the largest impact on adding value to customers receives the highest priority.

Key Words: Project Selection, Quality Improvements, Perceived Added Value, Customer Value

1. Introduction

The “classical” Juran’s version views and classifies quality improvements into “little Q” and “big Q.” Viewing quality improvement in this way seems to be out of date when we consider the latest versions of quality improvement methodologies, i.e. Six Sigma quality and Lean Production, where customer value is the “ultimate” goal and the main reason to improve performance. Without reference to customer value, improvement programs will only exhaust management without generating (increasing) customer value, differentiate the com-

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pany's offering, or enhance profitability (Maklan and Knox, 1997), unless the potential contribution of programs on customer value becomes the basis of selecting improvement programs.

According to De Feo and Barnard (2004), quality improvements comprise a number of journeys of both *diagnostic* (finding the root causes of a problem) and *remedial* (changes in the process in order to remedy the root causes as well as establishing new controls in order to hold the gains), which can be described by two alternative versions of quality improvement, i.e. the classic "Juran" version and Six Sigma. In order to improve quality, Juran's model suggests that we: *identify a project, establish the project, diagnose the cause, remedy the cause, hold the gains, and replicate results and nominate new projects*. While the Six Sigma methodology suggests that we follow the path of: *define, measure, analyze, improve, and control* (DMAIC) in order to improve quality. Although these two models seem different in "anatomy," they have a similar "content."

The efforts of improving quality acknowledge, to a large extent, the importance of projects because "*all improvement takes place project by project and in no other way*" (Juran, 1989; p. 35), and project selection (i.e. a series of steps of nomination, selection, mission statement, and publication) is an essential part of a structured quality improvement approach (Juran, 1989). Therefore, it is clear that project selection is one of the critical aspects in quality improvement.

A project is defined as "*a problem scheduled for a solution—a specific mission to be carried out*" (Juran, 1989), or in the context of Six Sigma, a project is defined as "*a problem scheduled for a solution that has a set of metrics that can be used to set project goals and monitor progress*" (Snee, 2001; p. 66). We may then redefine a project as *a series of activities of goal setting, problem solving (or carrying out the mission), and progress monitoring*. This definition implies the importance of project selection, in the sense that the selected project should have the biggest enforcement on the achievement of the goal or the mission. Unfortunately, it is a common phenomenon that the link between performance indicators (such as quality cost measurements) and improvement projects is often unavailable (Juran, 1989).

Project selection is arguably the most difficult aspect of Six Sigma (Snee, 2005). If it is not conducted properly, the Six Sigma initiative can be at risk because organisations may lose belief to the initiative (Snee, 2001). Selecting the wrong projects (i.e. picking just easy projects and sidestepping the "right" projects because they are perceived to be difficult, and addressing the wrong problem) is "deadly" (Zimmerman and Weiss, 2005). Pyzdek (2003; p. 190) states: "*far too many black belts fail because they are not discriminating enough in their selection of projects. If project selection is systematically sloppy, the entire six sigma effort can fail*". Selection of good projects is a major factor in the early recognition of Six Sigma within any organization (Antony et al., 2004), and effective project selection is a key

factor in determining the effectiveness of Lean Sigma effort (George, 2004). Thus, there should be a better manner to categorise the selection and nomination of improvement projects (in general) and Six Sigma projects (in particular).

To sum up, nominating and selecting improvement projects could be difficult and problematic because: 1) the roadmap(s) that connect the performance indicator and project selection is often unavailable, and 2) the “big Q and little Q” categorisation may not be adequate to discriminate and select the “right” improvement projects from the “wrong,” when it regards the accomplishment of the goal to provide value to customers. Therefore, the purpose of this paper is to present a new way to distinguish improvement projects, and to develop a roadmap that links performance indicators and project selection.

The paper will be organized in the following way: first, the authors will describe the existing theory about project nomination and project selection, including the gaps (inconsistencies) found in theories. Second, roadmaps to nominate and select both reactive and proactive improvement project nomination are presented, followed by an algorithm (and an example) to determine the priority of nominated improvement projects based on the perception regarding the value that each project adds to customers. The paper finalizes with conclusions.

2. Literature Review

2.1 Sources of Project Nomination

According to Juran (1989), the sources of quality improvement can be divided into two areas, which are labeled as “little Q” and “big Q.” The little Q is a narrow view of quality within manufacturing (quality of conformance), where products are defined as the manufactured goods, processes are directly related to the manufacture of goods, customer is the client who buys the products, and cost of poor quality is the costs associated with deficient manufactured goods. On the other hand, the big Q covers a broader sense of quality (quality of design) in all types of industry (e.g. manufacturing, service, government), whether for profit or not. The big Q defines products as goods and services (both for sale or not), the term processes refer to all processes (manufacturing, business, support, etc), customer is everyone who is affected (both internal and external), and cost of poor quality is all costs that would disappear if everything were perfect. New product development, sales forecast, and the fulfillment of customer orders are some examples of areas to address within the scope of big Q.

According to Bothe (2002), the “conventional” Six Sigma methodology operates within the little Q, while the big Q is the scope of operation of the “ultimate” Six Sigma. Therefore, it seems clear that the concept of big Q and little Q is also recognized by the Six Sigma

methodology. However, another way of categorizing the sources (or the scope) of improvement projects, rather than big Q and little Q, might be necessary in order to “guide” organisations in achieving their goals (i.e. to provide value for their customers).

2.2 Approaches for Project Nomination

The opportunities for improvement in the big Q are often identified through market research and/or benchmarking, and the cost of poor quality and/or internal metrics (indicators) can be used as an aid to identify improvement opportunities from the little Q area (Juran, 1989). Looking at a new classification of the firm’s quality cost by Dahlgaard et al. (1998; pp. 206), particularly on the *loss of goodwill*, leads to the interpretation that little-Q problems and big-Q problems have a “bullwhip” relation, meaning that quality problems caused by manufacturing but found after the products have been shipped to customers will cause bigger and more serious impacts. Therefore, loss of goodwill is a condition or measure (as the consequences of one or repeated “bullwhip” events of quality problem) that can be used to describe the phenomenon of low value, where the quality performance is regarded as low but costs are high.

Within the Six Sigma or Lean Sigma methodology, as well as TQM (see e.g. Dahlgaard and Dahlgaard-Park, 2006), identification of improvement opportunities may start from customer needs and/or strategic business needs (Breyfogle et al., 2001), from gaps in key performance indicators, which reflect the organizational “pain” (Snee, 2005), or customer value (Pyzdek, 2003). Improvement opportunities can then be identified with the help of budget statements and cost of quality studies (Snee, 2001), as well as Balanced Scorecards (George, 2002).

Identifying improvement opportunities from cost of poor quality often requires a utilization of specific provision to analyse data in order to identify problem areas. This provision is a roadmap (or an algorithm), which contains a structured way of analysing data in order to determine the problem and selecting the project in order to solve the problem(s). However, a roadmap needed to choose projects is not always available, and enlarging the accounting system seldom leads to quality improvement (Juran, 1989). In other words, a roadmap that links quality costs and quality improvement projects are often not available. The link is essential if we consider that the following: quality-cost measurements are valuable only if there is a structure of identifying problem areas and selecting projects based on quality cost measurements.

2.3 Criteria of Project Selection

There are several factors that need to be considered when selecting improvement projects. According to Juran (1989), the first project should deal with a chronic problem, and should

give significant and measurable results both in money and technological terms. The projects thereafter should have significant impact on Return on Investment (ROI), the health of the product line, or criteria such as urgency, ease of technological solution, and probable resistance to change. Deming (1986, 2002) emphasizes the importance of reducing or eliminating variation during the improvements. Antony et al. (2004) emphasize that projects should be selected in such a way that they are closely tied to the strategic improvement needs and priorities of the organisation.

2.4 Algorithms/tools for Project Selection

Improvement projects can be selected using algorithms, tools, or metrics such as cost-benefit analysis, weighted scoring, throughput-based method or theory of constraints (see Pyzdek, 2003), Pareto priority index (Juran and Gryna, 1993; in Pyzdek, 2003), and project assessment matrix (Breyfogle et al., 2001). Other tools such as Analytic Hierarchy Process (AHP) and Pareto diagram may also be applicable.

Based on the tools mentioned above, the theory of constraints, that is further developed by Pyzdek (2003) from Goldratt (1990), seems to be a method that explicitly recognizes the elements of customer value (i.e. quality, time, and cost) by selecting improvement projects that are critical-to-quality, critical-to-schedule (time), or critical-to-cost. However, it seems to be insufficient only to consider customer value at a component-level without considering the possibility that those components may interact with each other in constructing the “legitimate” concept of customer value. On the other hand, cost-benefit analysis implicitly describes the concept of customer value (i.e. that value to customers involves a trade-off between benefits and costs), even though there might be a risk that the terms costs and benefits tend to be too much producer-oriented. Thus, existing project selection tools/algorithms, which are widely used within Six Sigma and Lean Production, do not adequately manifest the concept of customer value, even if these tools are often claimed to have a focus on customer value.

3. A New Categorisation and Selection of Improvement Projects

3.1 Reactive Versus Proactive [Quality] Improvements

Both little Q and big Q contain reactive and proactive elements. Reactive in the sense that improvement opportunities are relatively easy to identify because they are mostly visible and/or spoken, which often enable a “straightforward” problem definition and decision in determining the problem that need to be solved first. On the other hand, proactive quality improvements are more difficult to identify since they are usually invisible and/or unspoken,

which involve a more complex problem definition and a decision about which projects should be selected.

Identifying improvement opportunities based on internal failures is an example of reactive little Q improvement, while identifying improvement opportunities based on internal inefficiencies can be described as an example of proactive little Q improvement projects. Improvement projects that are identified from external customer complaints are examples of reactive big Q improvement projects, while improvement projects that are derived from customer dissatisfaction and/or lower customer value are examples of proactive big Q improvement projects. This additional dimension highlights that improvement projects are not only different in terms of *scope*, but also in *character* (e.g. problem definition and decision making). However, existing approaches in project selection do not sufficiently provide algorithms of project selection that adequately discriminate proactive improvement projects from reactive improvement projects, which is probably the reason why the approach of Six Sigma's project selection is not "clear-cut" (George et al., 2004). Hence, the authors of this paper suggest that selecting proactive quality improvement projects need to be distinguished from selecting reactive quality improvement projects.

3.2 Provision or Roadmap for Reactive Quality Improvement Projects

Projects that are identified from the narrow definition of cost of poor quality (i.e. scrap or complaints) can be described as reactive quality improvement projects. The following provision or roadmap (see Figure 1) provides an algorithm, a step-by-step identification of improvement opportunities based on the cost of poor quality. It is a process of narrowing a broad area of improvement into a specific problem definition that is manageable in the form of a project, which links quality cost to the quality improvement project.

The roadmap starts with determining variables that can be used to classify the costs due to scrap or complaints, e.g. product type or group, process or machine, etc. Then, a Pareto diagram is used to narrow the problem area and for determining the group that need to be prioritized for improvement by selecting the cost category with the largest cost. The next step is to identify failure types or modes, which can be used as the starting point to nominate several improvement projects. By using this algorithm in project selection, we will be able to determine the rank of priority of each improvement project. It is important that the selected improvement project has a clear connection with customer requirements and/or business strategy. Therefore, starting from the project with the highest priority, the relevance or criticality of each improvement project to customer requirements or business strategy is checked. If the project with the highest priority is critical or relevant in relation to customer requirements or business strategy, it can be declared as the selected improvement project. Otherwise, consider the project with the next highest priority.

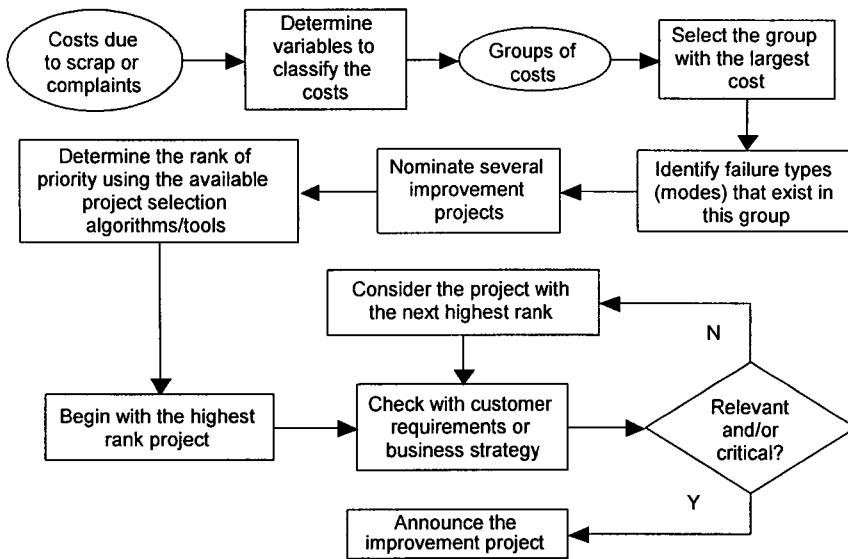


Figure 1. A roadmap that links cost of poor quality to the improvement project

3.3 Provision and Algorithm for Proactive Quality Improvement Projects

Added value to customer (AV) is a relevant concept in the proactive approach to select quality improvement projects because when defects or failures are no longer used as the only reference to indicate what to improve, then customer value will provide guidelines for improving products in order to satisfy and retain customers. Hence, improvement projects should be selected based on their potential contributions to customer value (which in this case is perceived by the producer).

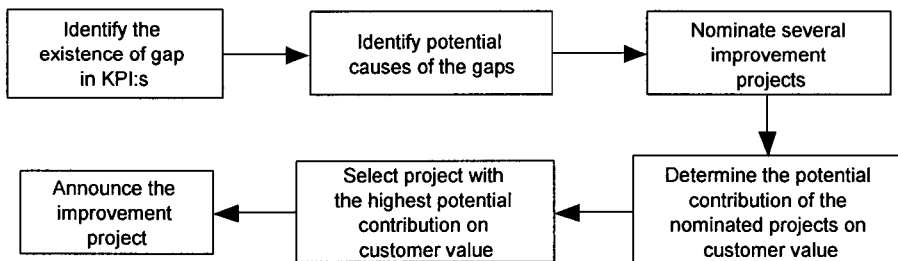


Figure 2. A roadmap to select proactive quality improvements

Provision for selecting a proactive quality improvement project (see Figure 2) starts from the identification of “gaps” in key performance indicators (KPI’s), i.e. differences between targets and achieved results. Then, the next step is to identify the potential causes of the gap, which leads to the nomination of improvement projects. The selected and announced

improvement project is the project that is perceived as having the highest added value to customers.

3.4 Algorithm for Selecting Proactive Improvement Projects

Pyzdek's fundamental ideas of the *theory of constraint* and *cost-benefit analysis* should be "merged" in order to develop a "new" method that can be used to select improvement projects. The selection of improvement projects is based on the perception regarding the contributions of the projects in adding value to customers (in terms of quality, time, and costs) and other benefits for the producer, as well as the perception regarding the efforts that the producer needs to make in order to perform the projects. Thus, the "new" method for selecting improvement projects basically assesses the "worth" of performing improvement projects by comparing the benefits gained from the projects and the required efforts to perform the projects.

Perceived added value (*PAV*) is therefore defined as a ratio between stakeholders' (or company's) perception on the overall benefits of the improvement project (*OPB*) and the perception on the overall efforts required to perform the improvement project (*OPE*).

$$PAV = \frac{OPB}{OPE} \quad (1)$$

The *overall perceived benefits* (*OPB*) should include several variables, which represent the perceived benefits due to the project's output (e.g. the impact on quality of product or service, delivery time, cost reduction) and the perceived benefits due to project execution (e.g. the project motivates the cooperation between functions in the organization, the impact on learning, etc).

The *overall perceived efforts* (*OPE*) include several variables which represent, e.g. the perception on project resources required, such as time and cost (e.g. perception whether the project is costly or not, perception that the project can be completed within x months), and other efforts that are rather difficult to measure, e.g. efforts to deal with resistance for change or friction in the cooperation. Each variable in *OPB* is weighted between 0 and 1, so that the sum of weights (*w*) is equal to 1. The same rule is applicable for *OPE*.

Before measuring the perception scores using e.g. a 1-7 scale or a 1-10 scale, it is important to define the meaning when a variable has either a "low" score or a "high" score. The following definition is applicable for such a purpose: On the benefits dimension score "1" indicates "low" benefits while score "7" indicates "high" benefits; on the efforts dimension score "1" indicates that the amount of required efforts is "low", while score "7" indicates high efforts are required. Further, it might be necessary to transform these perception scores into normalized perception scores of benefits (*NPB*) and normalized scores of percep-

tion on effort (*NPE*), so the results are comparable regardless which measurement scales are used.

Normalized perceived benefits (*NPB*) score is defined as the ratio between the distance of perceived benefits score (*PB*) from the lowest possible score (PB_{min}) and the range between highest and lowest possible score in the same scale (PB_{max} and PB_{min} respectively). Then:

$$NPB = \frac{PB - PB_{min}}{PB_{max} - PB_{min}} \quad (2)$$

Using the same procedure, normalized perceived efforts (*NPE*) could be expressed as:

$$NPE = \frac{PE - PE_{min}}{PE_{max} - PE_{min}} \quad (3)$$

Thus:

$$PAV = \frac{\sum_{i=1}^n w_i * NPB_i}{\sum_{j=1}^m w_j * NPB_j}, \text{ in which } PAV \in [0, \infty) \quad (4)$$

Where:

PAV : Perceived added value

NPB_i : Normalised perception score of a certain benefit-related variable

w_i : The weight of a certain benefit-related variable

n : Total number of benefit-related variables

NPE_i : Normalised perception score of a certain effort-related variable

w_j : The weight of a certain effort-related variable

m : Total number of effort-related variables

3.5 Example

Let's assume that there are three projects nominated by the improvement team. The team is then going to select a project with the highest priority for improvement. A project has the highest improvement priority if the project has the highest "perceived value added" score, which means that this project has the largest potential for adding value to the customers. The team then lists several variables, both benefit-related and effort-related. Benefit-related variables represent the intended results or conditions, which becomes the reasons why the improvement project is necessary to be performed. Effort-related variables represents the necessary resources in order to perform the improvement project successfully. Some variables might be more important than others, which becomes the reason for giving each variable a certain weight. For each project, the improvement team then gives a score

(using e.g. a 1-10 scale or a 1-7 scale) on those benefit-related and effort-related variables, which are shown by Table 1 and Table 2 respectively.

Table 1. Weights and scores of perceived benefits for the nominated projects

	Weight	Project 1	Project 2	Project 3
PB1	0.25	7	5	2
PB2	0.2	5	3	6
PB3	0.4	5	6	6
PB4	0.15	4	6	5

Table 2. Weights and scores of perceived efforts for the nominated projects

	Weight	Project 1	Project 2	Project 3
PE1	0.35	6	5	2
PE2	0.2	2	2	4
PE3	0.2	4	5	6
PE4	0.25	3	4	3

In order to have a similar interpretation whether we use a 1-10 scale or a 1-7 scale, the perceived benefit scores and perceived effort scores need to be normalized. Table 3 and Table 4 shows the normalised scores of perceived benefits and perceived efforts respectively.

Table 3. Weights and normalized scores of perceived benefits for nominated projects

NPB	Weight	Project 1	Project 2	Project 3
NPB1	0.25	1.00	0.67	0.17
NPB2	0.2	0.67	0.33	0.83
NPB3	0.4	0.67	0.83	0.83
NPB4	0.15	0.50	0.83	0.67
Total		0.72	0.69	0.64

Table 4. Weights and normalized score of perceived efforts for nominated projects

NPE	Weight	Project 1	Project 2	Project 3
NPE1	0.35	0.83	0.67	0.17
NPE2	0.2	0.17	0.17	0.50
NPE3	0.2	0.50	0.67	0.83
NPE4	0.25	0.33	0.50	0.33
Total		0.51	0.52	0.41

We are now able to calculate the perceived-value-added score for each nominated project, which is shown by Table 5.

Table 5. The perceived added value to customer for the nominated projects

Project	Value
1	1.43
2	1.32
3	1.57

Since project 3 has the highest score on added value to customers this project should be selected.

4. Conclusions

Performance measurements, such as quality costs, are often useful to identify the opportunities of improving quality performance. However, the roadmap that links the measurements to improvement projects is not always available. The nominated improvement projects usually become the way to find solution for a problem, which are identified based on the area problem that occurs in the production process (little Q) or in the business process (big Q). Selecting an improvement project among several nominated projects is not an easy task. Therefore, it must be done wisely with the help of various project selection approaches.

According to Six Sigma and Lean Production improvement methodologies, improvement projects are not merely the way to solve problems, but also the way to improve customer satisfaction and customer value. The orientation towards customer value brings a new view on performance improvement, that improvements should not only be reactive (solving problems) but also be proactive (a better performance to satisfy customers and provide more value). Therefore, the attempts to improve quality and performance should be both reactive and proactive, where the selected project is the project with the largest potential to add value to customers. Both reactive and proactive improvements require a roadmap that connects performance indicators and improvement projects. Improving quality performance proactively means that customer value is the main consideration when determining the priority of nominated improvement projects and selecting the project to work with.

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