Quality Engineering
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/lqen20

Quality Quandaries: Streamlining the Procurement Process at a Media and Entertainment Company

Tashi P. Erdmann [a] , Willem W. L. M. Janssen [b] & Ronald J. M. M. Does [a]
[a] Institute for Business and Industrial Statistics, Department of Operations Management, Amsterdam Business School , University of Amsterdam , Amsterdam , The Netherlands
[b] Media and Entertainment Company in The Netherlands

To cite this article: Tashi P. Erdmann , Willem W. L. M. Janssen & Ronald J. M. M. Does (2013) Quality Quandaries: Streamlining the Procurement Process at a Media and Entertainment Company, Quality Engineering, 25:4, 455-460

To link to this article: http://dx.doi.org/10.1080/08982112.2013.817016

Quality Engineering, 25:455–460, 2013

ISSN: 0898-2112 print/1532-4222 online
DOI: 10.1080/08982112.2013.817016

Taylor & Francis
Taylor & Francis Group

Quality Quandaries: Streamlining the Procurement Process at a Media and Entertainment Company

Tashi P. Erdmann[1], Willem W. L. M. Janssen[2], Ronald J. M. M. Does[1]

[1]Institute for Business and Industrial Statistics, Department of Operations Management, Amsterdam Business School, University of Amsterdam, Amsterdam, The Netherlands
[2]Media and Entertainment Company in The Netherlands

INTRODUCTION

An important principle used in the process improvement methodology Lean Six Sigma (De Mast et al. 2012) is the Pareto principle, stating that for many events roughly 80% of the effects come from 20% of the causes. The principle is named after the Italian economist Vilfredo Pareto (1848–1923), who observed that 20% of the population possessed 80% of the land in Italy. The rule was generalized and popularized in the quality field by Joseph M. Juran (1904–2008).

When an improvement project is initiated, only a limited amount of time and money is usually available. Therefore, it is important not to waste time on small things but to invest time only in issues with a large impact, the so-called big fish. In most cases, in line with the Pareto principle, problems are caused by only a few root causes, the "vital few" causes. The steps that are taken in Lean Six Sigma's DMAIC (define–measure–analyze–improve–control) roadmap bring focus to the project by zooming in until the vital few root causes of the problem are discovered.

In the define phase of DMAIC, one starts by selecting a problem that has a large potential impact for the company; for example, in terms of operational costs, revenue, or customer satisfaction. Then, in the measure phase, one selects critical-to-quality characteristics (CTQs): a few performance indicators that describe the problem for the largest part. For example, personnel costs may be determined mainly by the net processing time of the steps in the process, work volume, additional processing time due to rework, the number of productive hours per employee, idle time, or a combination of those indicators. By selecting one or two such CTQs, the problem is narrowed down. In the analyze phase, the collected data provide further focus. For example, processing times per process step reveal which steps take the most time, and data on the number of defects per failure mode indicate which failure modes occur most frequently. Then in the improve phase, the most vital few influence factors are selected; that is, the factors that have the largest effect on the CTQs and can be changed most easily. This is done based on statistical or other type of evidence. Statistically, one may choose the few factors that together explain 80% of the variation in each of the CTQs. This way, in each step of the DMAIC cycle the problem is narrowed

Edited by Ronald J. M. M. Does

Address correspondence to Ronald J. M. M. Does, IBIS UvA, University of Amsterdam, Plantage Muidergracht 12, 1018 TV Amsterdam, The Netherlands. E-mail: r.j.m.m.does@uva.nl

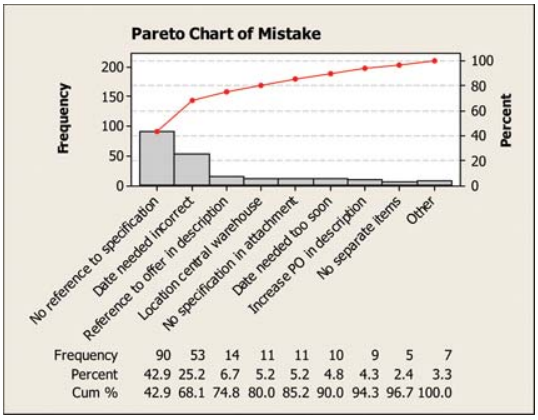


FIGURE 1 **Pareto chart of mistakes in the RTPs. (Color figure available online.)**

down until finally the root cause is discovered and a few effective improvement actions are designed.

A helpful tool in singling out the vital few issues from the trivial many is the Pareto chart (cf. Juran 1962). Figure 1 shows a typical Pareto chart. The bars in the chart indicate the frequency of occurrence of each type of problem (an alternative would be to indicate how much money or time they cost, as in Figure 2). The most frequent problem types are placed to the left, and the trivial many are placed to the right (and the smallest ones are combined in a single category called "other"). The curve shows the cumulative contribution of the largest problem types. For example, the two largest problem types in Figure 1 account for 70% of the problems.

In improvement projects, the DMAIC structure and the Pareto principle help to provide focus. As an example, we present an improvement project that took place at a large media and entertainment company in

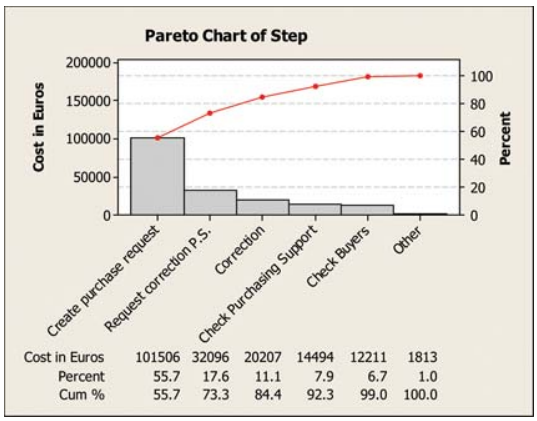


FIGURE 2 **Pareto chart of personnel cost per process step. (Color figure available online.)**

The Netherlands in 2012. The project aimed to reduce the operational costs of the purchasing process and applied the DMAIC structure to achieve this. The project manager was a Lean Six Sigma black belt.

DEFINE

In the define phase, the black belt described the process to be improved and formulated the project objectives and their potential benefits. At the beginning of the project it is important to explicitly state the financial benefits that the project aims to obtain, because this helps in focusing on important issues with sufficient impact.

The process in question is the procurement process. The function of this process is to create purchase orders in order to purchase items requested by some employee of the company. At the beginning of the project, the process was executed as follows: An employee somewhere in the business needs something to be purchased and fills out a so-called request to purchase (RTP) form in the company's enterprise resource planning (ERP) software system. Then, unless it is a standard order with size between some specified minimum and maximum (safety stock), it is judged by the department purchasing support and by the department buyers, and the budget needs to be approved by the manager or project manager of the employee ordering the goods. If it is approved, the RTP is converted into a purchase order by purchasing support.

The anticipated benefits of the process consist of the reduction of at least one full-time equivalent (FTE) from the budget of planning and control, by reducing the time spent by people ordering the goods. The idea was that a large portion of the time spent was caused by rework resulting from mistakes when filling out the RTP form. Given the large volume of about 440 RTPs per week, an improvement in this process will have a substantial impact. A reduction of an FTE would lead to a decrease in personnel cost of more than 100,000 euros. Note that, for reasons of confidentiality, the monetary benefits mentioned in this article have been slightly modified and are only indicative.

MEASURE

In the measure phase, the black belt operationalized the project objectives as requirements on

quantifiable and measurable quality characteristics and established a procedure to measure these characteristics. In Lean Six Sigma terminology, these quality characteristics are often called *critical to quality* characteristics. The way the CTQs relate to the project objectives and the strategic goals of the company can be schematically displayed in a so-called CTQ flowdown (cf. De Koning and De Mast 2007). The CTQ flowdown for this project is shown in Figure 3. Making explicit the relation between quality characteristics and strategic goals helps in focusing efforts on only one or a few quality characteristics, thus narrowing down the problem.

The two CTQs in this project are *net processing time* and *additional processing time due to rework* in the procurement process. The net processing time is the time each process step takes employees excluding all rework. The additional processing time due to rework is the extra time that employees have to spend to correct mistakes in the RTP detected by purchasing support or buyers. If the sum of these two CTQs, the total processing time, is reduced, the number of FTEs may be reduced, leading to a reduction in operational costs. The requirement on these CTQs is to reduce them as much as possible while maintaining the service level of the procurement process.

The CTQs are measured for all RTPs during 2 weeks using digital measurement forms. The employees who request a purchase record their processing time in the company's web application platform (Microsoft SharePoint), and the employees from purchasing support and buyers record on a form in Microsoft Excel.

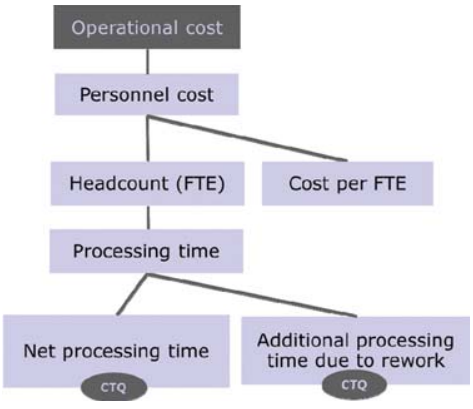


FIGURE 3 **CTQ flowdown. (Color figure available online.)**

ANALYZE

In the analyze phase, the current performance of the CTQs is determined, based on the collected data. A thorough analysis leads to a diagnosis of the problem and a list of potential influence factors.

From the measurements, the black belt concluded that, excluding rework, creating the RTP takes 4.4 minutes of *net processing time* on average, the check by purchasing support takes 0.7 minutes, and the check by buyers 0.5 minutes. Given the average number of about 23,000 RTPs per year, this net processing time corresponds to around €130,000 of yearly personnel costs. The *additional processing time due to rework* consists of corrections by the ordering employee, by purchasing support, and by the buyers. Yearly, about 4,500 RTPs have to be corrected by the ordering employee, which takes 4.5 minutes per RTP. Purchasing support corrects 3,700 RTPs per year and spends 9.8 minutes each time, and the buyers correct 500 RTPs, taking 3.3 minutes. This corresponds to yearly personnel costs of around €50,000.

A useful tool for describing the process flow in detail and visualizing forms of waste in the process is the so-called value stream map (see Kemper et al. 2010; Womack and Jones 2003). In a value stream map for each process step, the average processing time and average waiting time is given, and for each conditional routing the percentage following that routing is given. Different forms of waste in the process can be shown in the value stream map. The value stream map in Figure 4 shows how the RTPs flow through the process. At each step the yearly number of RTPs is given and the processing time per step: PT stands for net processing time and APT stands for additional processing time due to rework. Note that waiting times are not given, because they are not CTQs in this project.

In the Pareto chart displayed in Figure 2 for each constituent of the total processing time, the corresponding yearly personnel cost is given in euros. It shows that the "biggest fish" among the processing times is clearly the processing time of the ordering employee (€102,000), followed by the additional processing times due to rework by purchasing support (€32,000) and by the ordering employee (€20,000). This gives the black belt a direction where to look: apparently filling out the RTP form in the ERP software system is relatively cumbersome (taking almost

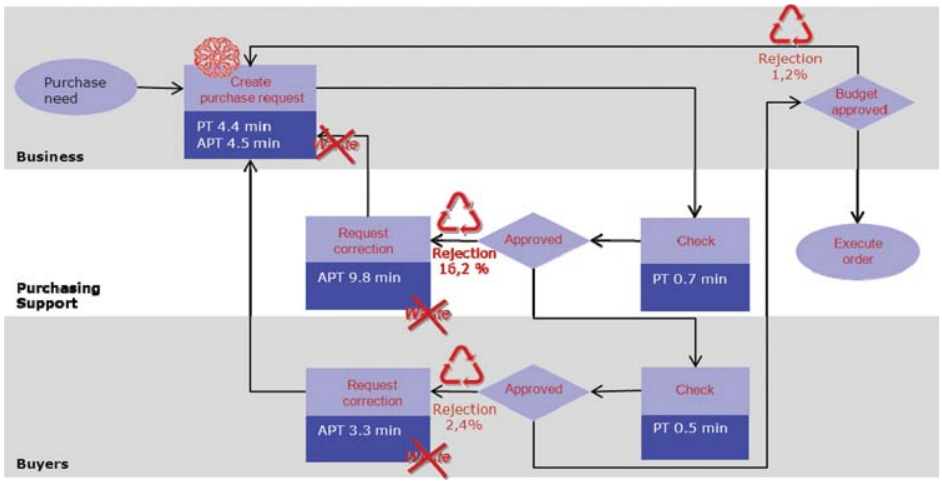


FIGURE 4 **Value stream map. (Color figure available online.)**

5 minutes per RTP). Another Pareto analysis the black belt performed was a comparison of the number of RTPs per department. He observed that 58% of RTPs were submitted by the company's technical cluster, and therefore he decided to restrict attention to that department.

Next, the black belt utilized a variety of strategies to identify potential influence factors affecting processing time. The results from the Pareto analysis helped him to focus attention on factors that influenced the three most relevant process steps and the most relevant department. He facilitated brainstorm sessions with several groups of employees to generate ideas. A fish bone diagram (Ishikawa 1990) was used, with six categories (employee, computer, information, working method, customer, external factors) to make sure that the focus would not be too narrow. In addition, he interviewed a number of employees including IT experts about possible causes and solutions. Furthermore, he performed a process failure modes and effects analysis (cf. Rausand and Hoylan 2004) in order to identify potential mistakes and errors in the process. Finally, he used the order process of a large electronic commerce company as an example. This resulted in a long list of potential influence factors and improvement ideas.

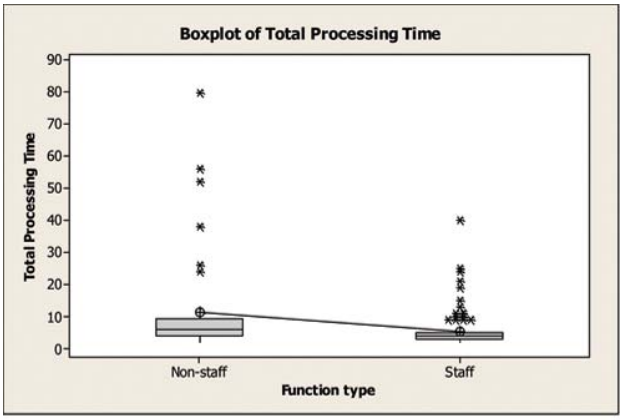
IMPROVE

In the improve phase, the black belt selected the most important influence factors and provided evidence of their effect on the CTQs. Based on these influence factors he designed improvement actions that would result in a large improvement in the CTQs. He also used a so-called priority matrix, a diagram with effect and changeability as its axes, to categorize the influence factors. Influence factors that are easy to change and have a large effect have priority. This is yet another tool that helps to narrow down the problem. The influence factors that were thought to be large in both effect and changeability were

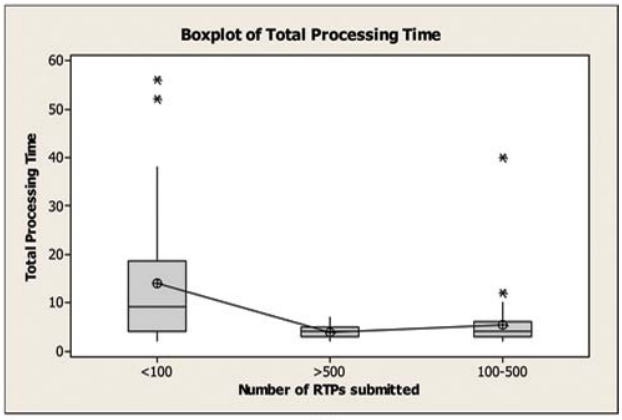
- the employee's knowledge of and experience with RTPs;
- whether the ordering employee had authorization to use the RTP tool in the software system;
- the number of mistakes made when filling out the RTP form;
- the ease of use (user interface) of the order form.

The black belt used analysis of variance to show the effects of the first two influence factors. The results are graphically displayed in Figures 5a–5c. In each graph the differences are statistically significant based on both analysis of variance and the nonparametric Kruskal-Wallis test.

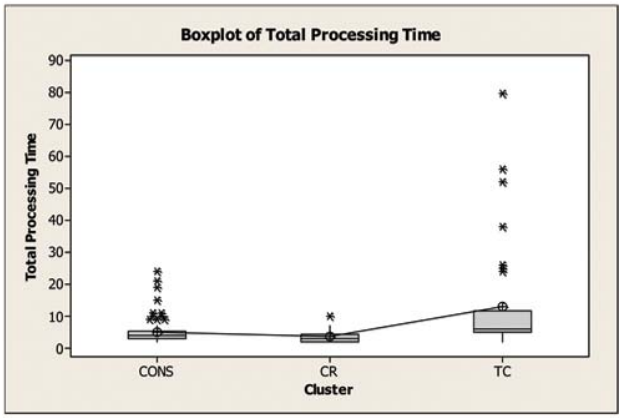
Figures 5a and 5b give an indication of the effect of knowledge of and experience with RTPs. Figure 5a compares RTPs submitted by non-staff employees and staff members. It indicates that the total processing time is about two times shorter on average if staff members submit the RTP. Staff members generally have more knowledge of RTPs than non-staff members. Another indication of the effect of experience is given by Figure 5b, comparing the RTPs submitted by employees with different levels of experience. It



(a)



(b)



(c)

FIGURE 5 **(a) Box plot of total processing time versus employee type. (b) Box plot of total processing time versus number of RTPs submitted. (c) Box plot of total processing time versus cluster. (Color figure available online.)**

shows that employees who have previously submitted fewer than 100 RTPs on average need three times as much time as their more experienced colleagues.

The effect of having authorization to use the RTP tool is shown by comparing the total processing times of different departments. The black belt knew that in the technical cluster most employees had this authorization, whereas in the other departments most employees did not and had the form filled out by more experienced colleagues. Figure 5c indicates that for RTPs submitted by the technical cluster the total processing time was about three times as long as for the departments consumers and commercial cluster.

Additional processing time due to rework was caused by mistakes by the employee when submitting the RTP form. The frequencies of each type of mistake are given in the Pareto chart in Figure 1. From this, the black belt knew that he could focus attention on the most frequently occurring mistakes. It was self-evident that these mistakes could be prevented by an easy-to-use and mistake-proof user interface of the order form, instead of the complex RTP form in the company's ERP software system.

After analyzing the effect of the most important influence factors, the black belt designed a number of improvement actions. The most important improvements were as follows:

- User-friendly and mistake-proof order form in Microsoft SharePointRTPs (web application);
- Purchasing request directly submits RTPs in ERP system;
- Non-staff authorizations for using the RTP tool are withdrawn;

The new order form would immediately reduce the number of mistakes. If an entry is not completed correctly an error message appears. The form is also easier to use. Items to be purchased are automatically found by inserting search criteria. Most entry fields are completed automatically. Unnecessary entry fields have been removed. Purchasing support can then easily submit the RTP in the ERP system. It takes them much less time to do this because of their knowledge of and experience with RTPs. Non-staff members no longer have access to the RTP tool in the ERP system, particularly in the technical cluster. These improvement actions would reduce the number of mistakes and prevent most of the additional processing time due to rework. It would also reduce much of the processing time by the employee filling out the form.

CONTROL

In the control phase, the black belt improved the process control system. He documented the improved process, created a control plan to deal with irregularities in the process, organized continuous improvement, and defined roles and responsibilities.

To control the process after the improvement, a number of indicators were to be monitored, including the processing time of creating an RTP, the number of rejected RTPs, and the number of times support is required. An intervention would take place if one of the indicators exceeded its norm. The indicators were also displayed weekly on dashboards. In case of persisting problems, a small improvement project would be started.

After the improvement actions had been implemented, measurements showed that the net processing time of the ordering employee and purchasing support had been reduced to 3.4 minutes (previously 5.2 minutes, thus a reduction of 35%). This represented a reduction in personnel cost of approximately 75,000 euros. In addition, most of the additional processing time due to rework could be prevented, resulting in another 35,000 euros of benefits. These benefits were realized by removing one FTE from the budget of the department planning and control of the technical cluster. Additionally, the withdrawal of 180 non-staff licenses for the RTP tool in the ERP system led to a reduction in license costs of 20,000 euros. Altogether, the benefits for the media and entertainment company were 130,000 euros.

CONCLUSION

In the project of streamlining the procurement process at a media and entertainment company, the Pareto principle that most of the effects derived from only a small part of the causes was applied several times; for example, by focusing on the processing time of the ordering employee, the technical cluster, and the mistakes that occurred most frequently.

The project illustrates how Lean Six Sigma's DMAIC roadmap helps in providing focus. Through a concrete and specific benefit analysis in the define phase, a definition of CTQs with a large impact in the measure phase, a data-based diagnosis in the analyze phase, and a focus on the vital few influence factors in the improve phase, a problem is narrowed down step by step.

REFERENCES

De Koning, H., De Mast, J. (2007). The CTQ flowdown as a conceptual model of project objectives. *Quality Management Journal*, 14(2):19–28.

De Mast, J., Does, R. J. M. M., De Koning, H., Lokkerbol, J. (2012). *Lean Six Sigma for Services and Healthcare*. Alphen aan den Rijn, The Netherlands: Beaumont Quality Publications.

Ishikawa, K. (1990). *Introduction to Quality Control*, (Trans. J. H. Loftus). Tokyo: 3A Corporation.

Juran, J. M. (1962). *Quality Control Handbook*. New York: McGraw-Hill.

Kemper, B. P. H., De Mast, J., Mandjes, M. R. H. (2010). Modeling process flow using diagrams. *Quality and Reliability Engineering International*, 26(4): 341–349.

Rausand, M., Høyland, A. (2004). *System Reliability Theory: Models, Statistical Methods, and Applications*, 2nd ed. New York: Wiley.

Womack, J. P., Jones, D. T. (2003). *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. Florence, MA: Free Press.