

APPLICATION OF SIX SIGMA PROJECT IN THE ADMINISTRATIVE PROCESSES

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Abstract

Six Sigma concept and its practical application mostly in the form of DMAIC methodology in improving administrative processes in both manufacturing and service companies has been already in use for several years. Still, it can be said that the application of six sigma concept in administrative processes is quite new and every successful application provides a good example. When correctly applied, it can bring remarkably positive results. The aim of this paper is to explain such a successful example so that managers from the same field can take advantage of it, take lessons of it, and apply the concept in their administrative or service process improvement in order to provide better service for their customers. A case study approach was used to demonstrate based on real experience the application of Six Sigma tools and putting them into the practice in the administrative processes of business environment.

Key words: Six sigma concept, DMAIC methodology, administrative processes, process improvement

Introduction

The success of any business is based on providing the highest value, whether in the field of production, in administration, or in service. The benefit of such success is healthy business environment, efficient business processes, achieved by the effective use of company tools, which can be taken from the best concepts such as ISO standards, lean management, or Six sigma.

Many companies suffer from competition every day, and, therefore, it is important that both their production and administrative processes were properly managed in order to ensure quality and reputation of the company. As a result, many companies map their business processes and focus on their continuous improvement. Some small companies are making necessary changes in its sole discretion, without the use of proven techniques, but on the

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market, there is more and more companies using process improvement concepts and tools, which are intended to such changes. One of them is the Six Sigma concept and at the present time is gaining in its importance. Its main task is to monitor processes, map their current state and focus on the future state by removing procedural shortcomings.

The main objective of this article is to explain the application of Six Sigma concept in the sufficient detail to improve processes in the company providing services in the fields of finance and administration on the example of a case study. The company, which uses this concept is the shared service center, a representative of international company.

The application of the Six Sigma concept is directed on the mapping of administrative process used in the company and its subsequent improvement. The aim is to assess the situation, to point out on the shortcomings, and to take all necessary measures that should lead to an effective process and to the satisfaction of the employees, buyers, and customers in order to yield necessary results. The case study also seeks to highlight the advantages that the usage of the six sigma concept brings in the inspiration for others to find out other areas that needs improvement.

1 Methodology

Information about the issue in a particular company has been obtained from the real practice and manual processing of the reports in the six sigma project application. The implementation of the six sigma project was carried out in the company by thorough process mapping and subsequent implementation of activities leading to the process improvement. The process implementation was carried out by using DMAIC methodology, their subsequent view in some matrices and charts, which were used in this method, and by the detailed specification of individual areas. The entire process required the collection of many data and facts from the real company activities, their subsequent processing and adoption of proposals for improvements. The whole process went through a detailed analysis and regular monitoring of the implementation of each step. Various steps of processing are highlighted by different graphs, matrices, and tables. The result of the whole study was the successful implementation of new procedures for improvement, which ultimately can be seen in the quality of the provision of services, the efficiency of the individual process steps, a good mutual cooperation, and customer satisfaction. The project became the model for other company departments.

1.1 Shared service center - SSC

The main task of these centers is to house operating activities in the respective local countries where the corporation (or mother company) has branches. Local countries in this case take only the decision-making and control function. The basis for the existence of shared services center in local countries is the transfer of the enterprise's operations and procedures for the implementation on one stable place, which represents the contribution, and at the same time provides greater flexibility and quality of the required work. The aim is to achieve lower costs with a focus on standardization and optimization of business processes. In addition, such

transfer of activities enables a creation of centralization and at the same time it makes it easier for the enterprise the internal control of individual activities.

2 Implementation of six sigma project in shared service center

2.1 Problem identification

The subsidiary company is a very strong company built on the platform of relevant rules and regulations. In the context of its business enlargement, it must establish a system of how to develop this platform and expand into all its business activities. The business activity is a challenging activity that brings in the company a number of new operating procedures, rules, habits, and new requirements.

With the expansion of business activities in the area of creating shared service centers, namely in Bratislava, many departments had to grapple with several serious circumstances. The transfer of operative activities from local countries requires many responsible activities and newly established procedures of their implementation. So that these procedures are to be effective, the subsidiary company must create a number of projects to ensure their harmonization and transparency. Such a project is the process of improving invoices processing from logistics suppliers in the Department of Finance housing corporate activities for two western European local countries.

The role of the Department of Finance is to check and bill supplier invoices subjected to those two countries. With this invoice billing, the activities of other departments are connected, as well as persons in charge for specific purchase of a local country. Invoices from suppliers are divided by the type of service and, accordingly, they belong to a different procedure for billing. Some of the invoices are billed by specific accounts, others by using the created orders, and others by using special transactions. However, procedures are not uniform, which causes a number of problems, and it puts higher demand on employees, their development and learning. Such processes are interfering factors and their inconsistency causes the mess in process activities necessary in the event of a control.

The biggest problem, however, was with harmonisation of the invoices processing from suppliers providing services in the logistics. Data on the invoices were not fully filled in, often lacked the order number, the order has not been created, the contact information of the purchaser were also missed, or invoice was issued to the company with not valid company name. This led to a lengthy search of the data with regard to the order issuing, goods delivery to the warehouse, to the responsible purchaser, and the result was the late payment of invoices, which has reflected on the company's reputation, as well. Therefore, the subsidiary company has decided to harmonize processes and to establish a common procedure for the accounting. The harmonization was intended to ensure that such incomplete invoices would no longer exist and would be issued with all the necessary information. The method, the Department of Finance has selected for this process improvement, was DMAIC methodology from Six Sigma concept.

DMAIC methodology consists of a five-step cycle of phases which is used as a tool for optimization, stabilization, and improvement of the processes and proposals in the field of business. The five cycles of DMADV process are as follows (Voehl et al., 2014):

- Define: Define design goals that are consistent with customer demands.
- Measure: Identify and measure product characteristics that are critical to quality (CTQ).
- Analyze: Analyze to develop and design alternatives, create a high-level design, and evaluate design capability to select the best design.
- Design: Complete design details, optimize the design, and plan for design verification.
- Verify: Verify the design, set up pilot runs, implement the production process, and hand it over to the process owners.

To improve the process of billing invoices of logistics suppliers, DMAIC model has been selected and used as a driver for the implementation of Six sigma project. By using it, the whole project could be carried out in a structured way.

2.2 Phase „DEFINE“

The DEFINE phase answers the question: "What exactly is the problem?" i.e. where is the problem, why does it have to be addressed, which customer requirements are to be focused on and what exactly does the road to the solution look like? (Lunau, et al., 2013). The phase is intended to collect all necessary information relating to the process. You need to focus on the objective of the project to identify the customer requirements, the requirements of the company to determine the appropriate implementation methods, project metrics, and adoption of a project that leads to success. In this phase, the project team must be created, which will plan the entire course, organize, implement, measure, and evaluate its implementation. The base is the creation of the so called project documentation.

The project aimed at improving the practice of posting logistics invoices was the supervision of five-member project team. The team was fighting with this issue for a longer time, therefore, to define that problem was not so difficult for it. The shortcomings of the process, which accompanied the team every day, the team tried to summarize and to carry out the necessary tasks and to assign them to each member of the team. Accounting department daily cooperated with 36 suppliers providing services in the logistics. Therefore, it was important to split suppliers and to design the first steps of data acquiring. The team created the so called Procedure Plan (action plan) and used instruments like SIPOC, Voice of the customer (VOC), and Voice of the business (VOB).

2.2.1 Process workflow through SIPOC

Prior to the commencement of the process improvement, it is very important to identify the phases the process has to go through, preferably before the start of the project. SIPOC shows all of the inputs, outputs, the status, and requirements of the customer. SIPOC is a high-level process map used to identify the boundaries of a process to better define a project and its charter (Martin, 2009). In the case of the Department of Finance, the SIPOC diagram shows all the process stages through them a specific invoice shall move before and after billing. It displays the entire course of the process, which provides a comprehensive

picture in the planning of the procedures of process improvements and allows a real insight into the workflow of their processing.

Table 1 View of the process phases of the supplier invoices

Sender	Input	Process	Output	Receiver
Supplier/invoice sender	Invoice	Scanning		
		Validation/ Indexing		
		Automated sorting to group inboxes		
Local Business/ Finance	Coding	Invoice verification/ posting	Booked invoice in SAP	Local Finance/ Business
		Payment proposal/ payment execution	Payment	Supplier/ payment receiver

Source: Internal company materials

Table 1 shows the real progress of the document processing from its departure until the final phase of the process. Prior to starting the particular procedure, it is important to identify the sender, which in this case is the supplier and also the process input, which represents an invoice. Then a particular process follows, which is invoice scanning into the system, and indexing of the invoice information – name and registration number of the supplier, the date and the maturity of the invoice, the amount, currency, and the order number. Then, it follows an automatic inclusion of the invoice into the group according to the type of service provision, whether it is an invoice from marketing, direct or indirect material, services, or logistics. After completing these three points, the invoice is ready to bill. However, since the process within the department does not work properly, it was not always possible. Sometimes, it was necessary to contact the responsible purchaser of local country (sender) to provide the accounting officer with the necessary order number or account (input) for the proper costs allocation. The acquisition of these data was often difficult, however, after their receiving, the invoice could be billed (output) and displayed on the particular account for the local controller (receiver). The final phase of the process of invoices processing is the preparation of invoice sum being payable on a particular day, the preparation of the final report, the implementation of payment (output), and the payment acceptance on the supplier’ account (receiver).

2.2.2 Voice of the customer (VOC) and Voice of the business (VOB)

After the application of process phases by using the SIPOC diagram, we tried to locate the requirements on the part of the customer (VOC) and also on the part of the company (VOB) and their impact on the process quality. We focused on both what the customer and what management expect from the process. When we take the VOC value concept to an operational level, it is important to understand that the external customer’s value expectation is what our operational systems should deliver every day. The customer is unhappy when

there are breakdowns in operational performance. The goal of every organization should be to design operational systems that will deliver customer value according to internal voice-of-the business (VOB) and external VOC expectations. What is the voice-of-the-customer (VOC)? It is a set of tools, methods, and techniques that allow the Lean Six Sigma improvement team to methodically collect and analyze customer needs and how customers value those needs (Martin, 2007).

Table 2 Transforming VOC into CTQ – What do the receiver or management want?

Voice of the business (VOB)	Critical to Quality (CTB)
No missing info sent	All invoices must be processed w/o missing info
Invoice is posted with PO	All invoices must be posted with PO
Voice of the receiver (VOC)	Critical to Quality (CTQ)
Invoice is posted within 3 days by AP clerk	All invoices must be processed up to 3 days
Invoice is paid on time (max 10% overdue invoices)	Max 10% is paid after the due date

Source: Internal company materials

The VOC process was carried out by means of direct communication between local purchaser and the customer, where the local purchaser tried to find out what were the customer requirements, with what he or she was not satisfied and what he or she would like to change in our process. To obtain this information, a teleconference was made with 15 suppliers and other 29 suppliers a short questionnaire was sent. The result was a late payment of invoices, and a tolerance was agreed on the dissatisfaction with the process failure with maximum 10% overdue invoices.

The VOB process was conducted in the form of a teleconference between the project team participants and the representatives of the local countries. Requirements to process were clear, each invoice must have had a created order, which will bring in the elimination of contacting local purchasers and a detailed overview on the company costs.

Customer requirements and management of the various departments were clearly passed on, so our next task was to consider who needs to be involved in the entire process, what we needed to do in order to determine any adverse factors affecting the project implementation and, at the same time, to eliminate these factors. After a common analysis, we identified the factors, which could jeopardize the project of improving the process, but at the same time, we also focused on the immediate response of their elimination.

Table 3 Factors of risk elimination of the new process implementation

	Risk	Elimination
1.	Local country will not be willing to cooperate in changes of the current process.	A detailed explanation of the benefits and advantages that changes in the process bring.
2.	Accountants will not want to participate in the implementation of changes.	The provision of the training of the new process procedures and project documentation.
3.	Suppliers will not be willing to participate in the respective process and provide the necessary data.	To create pressure on suppliers by means of representatives of the local countries.

Source: Custom processing

2.3 Phase „MEASURE“

The MEASURE phase answers the question: "How big is the problem?" i.e. how well are the customer and business requirements (VOC / VOB) being fulfilled by the current process? (Lunau, et al., 2013). In the measure phase, we focused on the measurement of defects that caused mistakeness of the business process. It was about the factors, such as the late invoice processing because of the absence of data, the realization of late payments, missing data needed to settle an invoice, poor process of ordering services.

In the measure phase, the following tools have been used:

- Output measurement matrix
- Data collection plan
- Measurement system analysis
- Graphical display of data.

Output measurement matrix

Output measurement matrix is a tool that we used in the second phase of the project for the measurement of areas that were identified as critical by the needs of the customer and, at the same time, by the requirements of the company. We focused on the extent to which the individual requirements of the customers using the list of critical factors affected the requirements for the functioning of the process.

On the one hand, the matrix consists of individual activities, that are in the processing of invoices important and, on the other hand, of the list of requirements or criteria of the customers and the management so that related process would work properly. The matrix assesses the degree of coupling processes with specific customer requirements. Rating scale ranges from points 0-no effect, 1-weak, 3-medium, up to 9-strong influence. The results of the measurement indicate that the activities and requirements of all participants interact and are an important factor for high-quality functioning of the process.

Processing invoices within 3 days is important for the entire process of billing freight invoices from the shipping vendors, the amount of overdue invoices shall not exceed the limit

of 10%, posting invoices with order lining is closely related to the process of order creation relating to each ordered service and putting all data needed to quickly processing them on the invoice is associated with the on-time processing of invoices (see Table 4).

Table 4 Output of Measurement Matrix - How to measure receiver/management requirements

	PLT of processing freight invoices	Overdue percentage of freight invoices	Number of freight invoices posted on PO	Number of freight invoices sent for missing info
All Invoices must be processed up to 3 days	9	1	0	1
Max 10% is paid after due date	1	9	0	1
All invoices must be posted with PO	0	0	9	0
All invoices must be processed w/o missing info	0	1	0	9

Source: Internal company materials

Data collection plan

A plan for collecting data is used to determine what needs to be done so that the data needed for process measurement are correct and the activities are carried out in a timely manner. In this plan, we focused on determining the areas of measurement, factor measurement, measurement method, and procedures, the progress of individual measurement operations, to which also a kind of data acquisition and their detailed description belong to. The process of obtaining the necessary data requires to determine the person who will be responsible for these data and to set the deadline for their total collection.

In our case, we focused on the following areas:

- 1) time of processing invoices
- 2) number of invoices paid by the contractor after the due date
- 3) the number of invoices posted by the number of created order
- 4) the number of invoices sent for the additional provision of the necessary data.

The whole process of scanning, indexing, posting, additional data and payment searching was done in the computer program Saperion, which due to the diversity of its functions allowed us to measure every area of our project. In the framework of the project team, we created a data template that was needed to measure and with the help of Saperion we downloaded the required report. Next, we continued with the manual assessment of the collected data.

Measurement system analysis

We used the analysis of measurement system for the areas that could compromise data collection and, at the same time, we also set out the ways to prevent their occurrence. We focused on the factors of time measurement of invoice processing and number of invoices sent to fill in the missing data. In the first case, the problem may occur if the indexing of data from invoices into the system will not be complete, or the data will not be true. In the latter case, it may occur that there are data on the invoice, but there were not correctly added into the system. To prevent both situations, we set the exact period of time from when to when the data would be collected and we also agreed on the manual control of the data given on the invoice. At this point, we focused on the accuracy and quality of the data collected for the measurement of the process functioning.

Table 5 Analysis of the Measurement System

Measurement name	How it can go wrong?	How to avoid collecting wrong data?
Time of processing	Wrong date entered in the collection file	Start date: Finish date:
No. of invoices sent for missing information	Manual collection → mistake at date entry	Careful analysis of the data

Source: Internal company materials

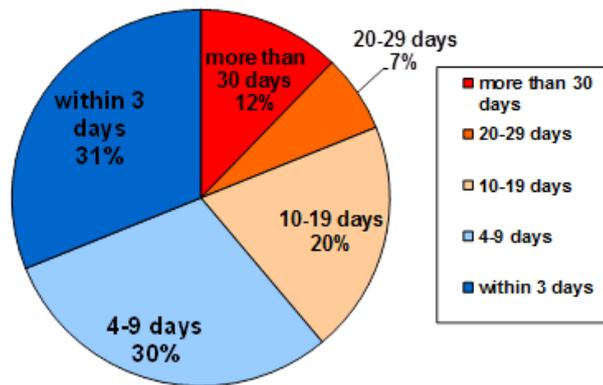
Graphical display of data

We then translated the gathered information into graphs for easier understanding of the observed situation. The measurement results display us the detailed overview of the invoice processing received from logistics suppliers. They show weaknesses in percentages that the process has and that should be the focused on in the framework of the process implementation.

1) Time of processing invoices. We measured this factor by the number of work days from the date of the invoice scanning into the system until the date of posting the invoice. For this measurement, we used a sample of 90 invoices from the total number of 1,906 posted invoices from logistics suppliers in the 6 months period in 2014.

The measured results say about the fact that 31% of sample invoices were posted during 3 days, 61% invoices were posted in a period of 9 days. The average processing time for these invoices was 12 working days.

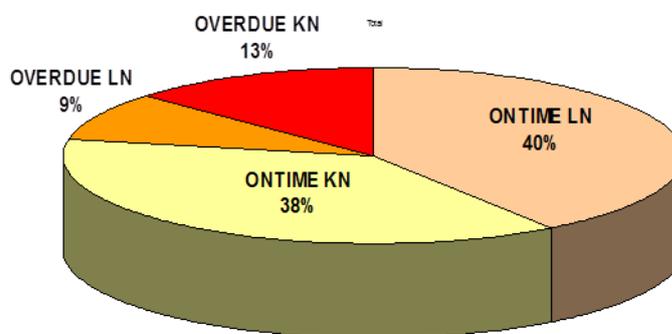
Measurement brought us information about the fact that half of the invoices could not be posted as a result of the lack of order number and one third of the invoices was without the necessary data for the allocation of costs of the administrative division of the company.



Graph 1 Processing time of invoices of the logistics suppliers (Custom processing)

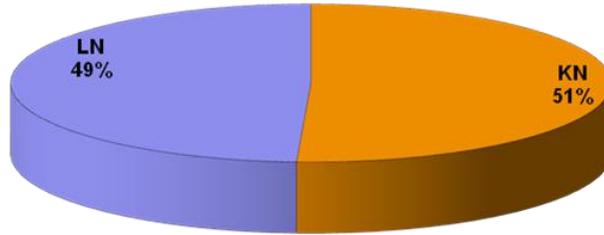
2) The number of invoices paid to the contractor after due date. To measure this factor, we used the comparison of the invoices by due date, which was set up in the system automatically depending on the date of invoice issue and the agreed maturity with the supplier with the posting date of the invoice. If the difference between the due date and the posting date of the invoice was greater than 3, it meant that the invoice was already after maturity.

Graph 2 shows that 22% of the invoices received from the shipping companies, has not been paid on time. The causes of late payment, the missing information about the posting, for example, added order number of the invoice copy or required account of the correct cost allocation is almost equal.



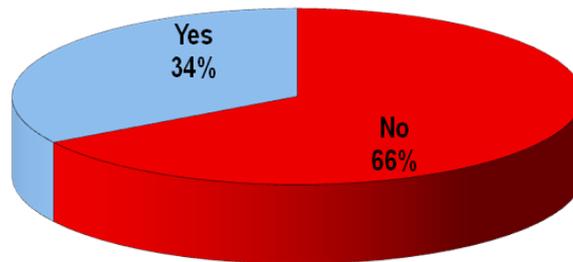
Graph 2 Invoices posted overdue (Custom processing)

3) The number of invoices posted according to the number of created orders. This area of the observed project defects was measured in the period of six months in 2014. In this period, a total of 1,836 invoices from shipping vendors were posted, where 902 invoices were posted using the order number and the remaining 932 without that number. The measurement points to the shortcomings in this area, where 51% of the invoices were posted without the created order. The aim is clearly to reduce this number and to focus on the effective functioning of this process.



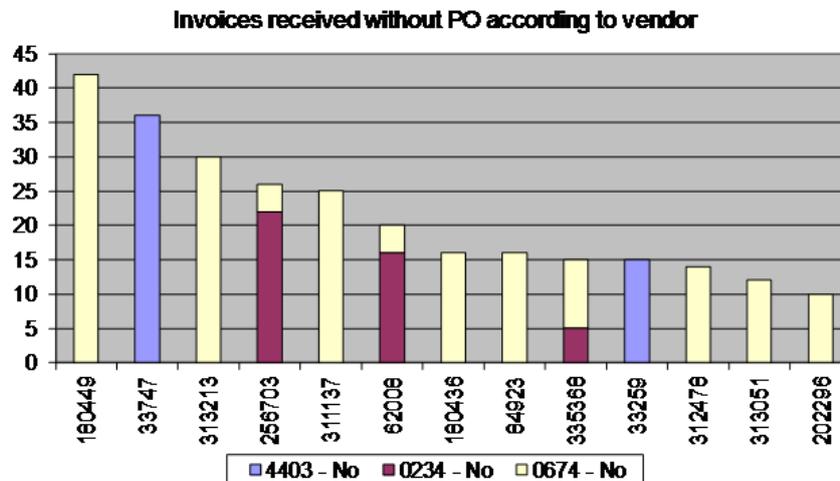
Graph 3 Invoice posting with / without created order (Custom processing)

4) The number of invoices sent to obtain the additional necessary data. In this measurement, we focused on the number of received invoices and their subsequent data tracing required to be posted. The data are in the form of order number, which should be written on each received invoice. In the period of six months in 2014, the department has taken 3,450 invoices from the logistics suppliers. The invoices were not complete and more than 2/3 were sent to the local countries in Western Europe in order to obtain necessary data. Most of the invoices that were not posted correctly, belonged to the suppliers for one specific country and amounted to 57% of the total number of invoices.



Graph 4 Number of invoices accepted with the data required for posting (Custom processing)

By the measurement of this point, we focused on a particular specification of vendors, who are also in this area critical and are the most threatening to the whole process. 13 selected suppliers amount to even 73% of the total number of invoices received without the necessary data for posting.



Graph 5 Invoices received without created order according to individual countries (Custom processing)

Graph 5 displays the number of invoices received with no information about the order number according to countries covered by the accounting department of our company. Each representing country is marked by the internal code for a better selection.

2.4 Phase „ANALYZE“

The ANALYZE phase answers the question: "What are the root causes of the problem?" - Why is the current process not capable of fulfilling the customer and business requirements sufficiently? (Lunau, et al., 2013). The results obtained in measurement phase allowed us in the analysis phase to search for the specific causes of the deficiencies in the framework of the processing of invoices from logistics suppliers. This process was quite difficult, because it required detailed tracking of individual steps and their subsequent assessment, or even further acquiring of data. Phase analysis was a key phase of the project.

An important task of this phase was to identify all the defects emerging within the processing of invoices and to identify their causes and to focus on all the factors that influence the field of observation and to focus on removing them. The final finding of the analysis was that the whole process was fragmented and the participants in the process such as accountants, local purchasers, suppliers did not have information on how the process should work and how important is their participation in the process implementation. The problem is the unmapped procedure of the process, lack of information on the responsibilities of all participating parties and the different understanding of requirements. Transparency and awareness of the procedural steps is the foundation of every business activity and leads to the satisfaction of all parties involved.

We carried out the analysis of a process by using the following tools:

- 5 why analysis,
- Cause-and-effect diagram,
- Fishbone diagram,
- Swimlane (as is).

By examining the causes and consequences of defects arising within the framework of the process of invoice processing, we identified through 5Why analysis the main sources of emerging issues. This analysis was beneficial for the subsequent creation of the cause and effect diagram and its graphical display by means of fishbone diagram.

Cause and effect diagram was created on the basis of the following steps:

1. Determination of the problem that we wanted to solve, in this case, it was to ensure the quality of the processing of invoices from the field of logistics.
2. Characterization of the area, the environment – the subject is the service area.
3. Determination the nature of the problem cause.
4. Specification of the problem causes – for each category was to be assigned at least 5 other possible causes.
5. Determination of the factors of importance.
6. Determination of special kinds of causes – each category required at least 2 additional causes of the problem.

Application of this analysis allowed us to identify problem areas, to identify problem in a given area, and to propose a way of removing it. It pointed out on the factors causing instability of the process.

The results of the analysis were:

1. Many invoices were sent to the local countries in order to obtain the necessary information needed for billing. The reason for that was that the information about the created order of a particular service was not disclosed.
2. Posting invoices without information about particular order did not provide the accounting officer with a proof that service was really ordered and, at the same time, provided. Orders were not available because of the local customer (the purchaser).
3. The overall process of invoice processing was critical. In this case, two kinds of problem were identified:
 - a) the payments of invoices were realized after the due term,
 - b) time of invoice processing was too long.

Suggestions for improvement:

1. Problem of point 1 can be solved by improving the automatic creation of orders for a particular service, and its subsequent sending to the vendor. The purchaser shall inform the supplier about the importance of the order number on the invoice, which will lead to a transparent image for the purchaser about the costs incurred.
2. Point 2 requires the establishment and the provision of specific order number when ordering the service. Ordering the service without specific order should not be accepted by the supplier.
3. The solution to the problem of point 3:
 - a) The accounting officer will be selected in the team, who will do a review of suppliers with agreed shorter maturity than 30 days. Its task will be to create a list of all such suppliers and to inform all process parties about the urgent processing of these invoices. The staff responsible for scanning invoices will be required to see to the proper indexing of these invoices and local countries will consider those invoices in their processing as urgent, the required answer must be given to the accounting officer not later than 7 days.
 - b) It is to be ensured that for each subscribed service an order is created, its number was provided to the contractor, the contractor wrote it on the invoice, and informed the supplier about the proper address for the transmission of invoices.

After making this analysis, we focused on the processing of the inputs by using the Fishbone diagram that affect the respective process. These are:

- People – local purchasers, accountants, team leaders, managers, controllers, ...
- Technology Equipment –the programs that the company uses – Saperion, Proweb, and various other IT programs.
- Procedures – the required procedures during the process.
- Policies – internal rules for processing invoices.

Fishbone diagram was created for all three problem areas, see Figures 1, 2, and 3. We can see the main inputs, where each are assigned the causes to the lower the degree of importance that affect the causes of higher level. In the fishbone diagram, we also focused on the labelling of the individual causes, depending on whether they are the causes of constant, variable, or extremely tiring.

Most of the causes of the problem are in the area of No 1 - sending invoices to the local countries in order to obtain the information necessary for posting. In the people input, problems derived from the lack of information regarding the use of the system of creating orders. Local purchasers did not have the necessary training, they had lack of experience, or they deemed using a manual for the order creation as not necessary.

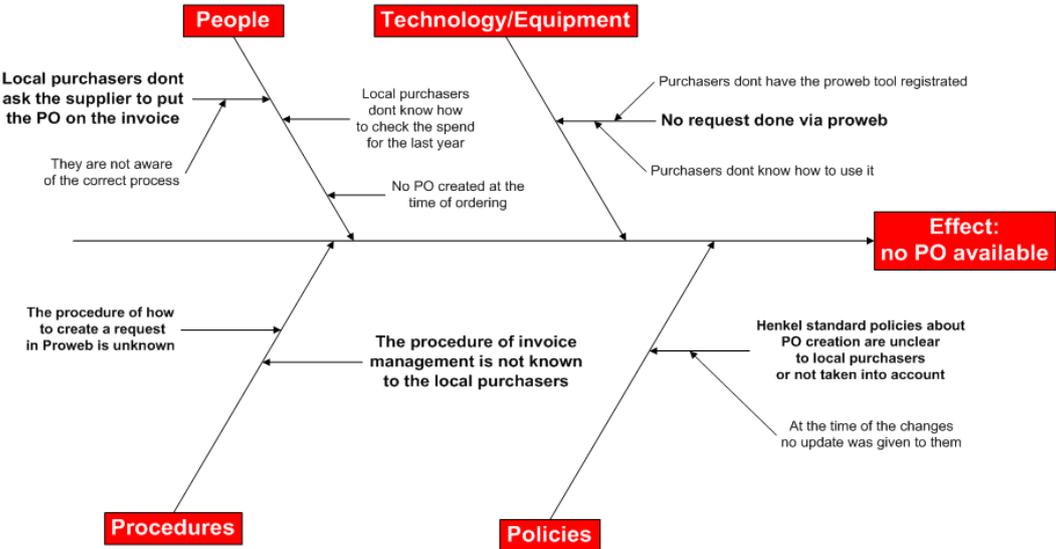


Figure 1 Fishbone diagram - causes and effects of posting invoices without an order (Internal company materials)

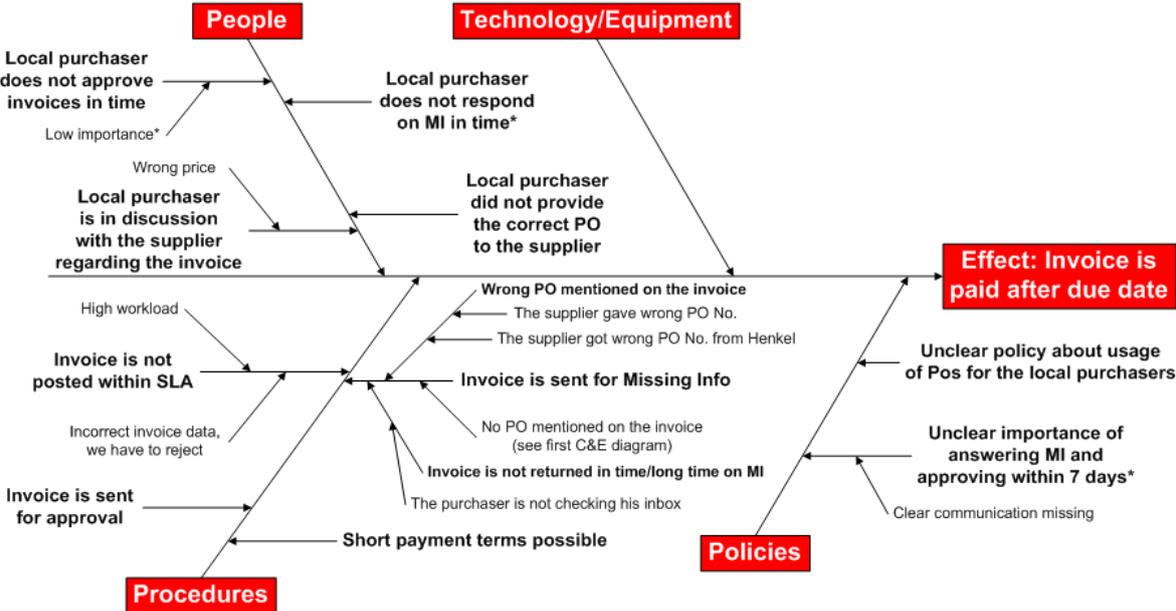


Figure 2 Fishbone diagram - causes of making payments of invoices after their due term (Internal company materials)

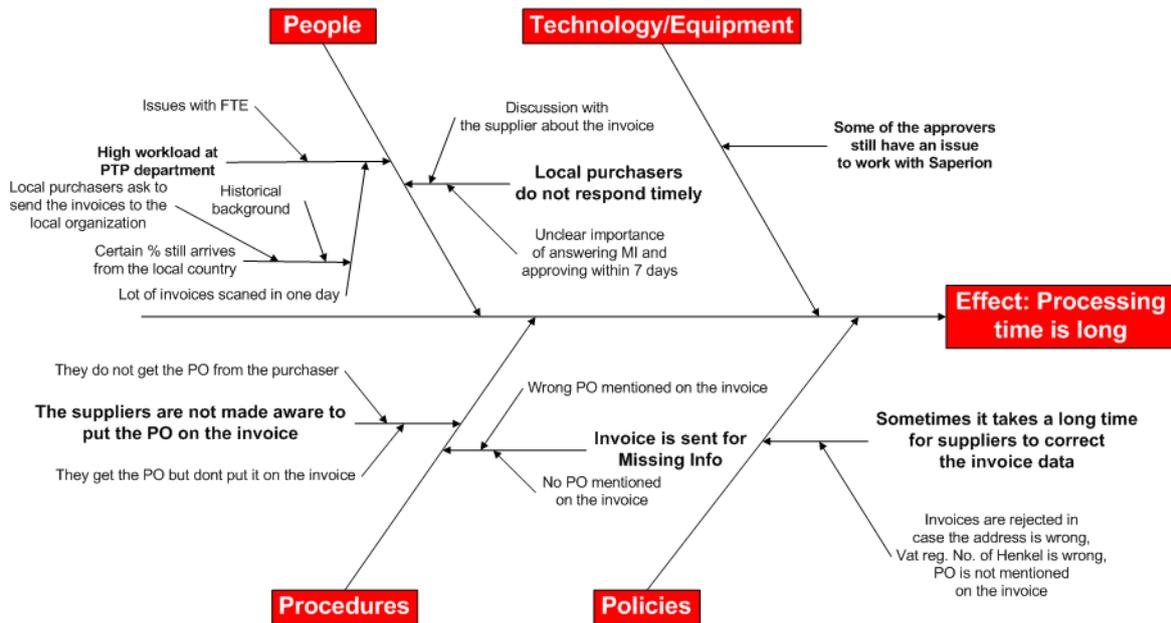


Figure 3 Fishbone diagram - causes of lengthy process of invoice processing (Internal company materials)

The look at the possible causes from the other side, in turn, pointed to the fact that the process of making orders was them clear, but they did not provide this information to the supplier. They didn't want the suppliers to know the annual limit for ordering their services and they also used an incorrect way to control costs. The beginnings of all the causes originate from the people area and, consequently, are reflected in other process areas. Tackling with the root causes in the people area will bring improvements in other process steps.

Fishbone diagram showing the causes of practices relating to issues in points 2 and 3 are shown in the Figures 1, 2, and 3. The data and information obtained in the analysis phase provided us with an accurate picture of the process. Through them, we compiled a list of contractors, where the process of invoice processing was not set up correctly, and we could focus on the stages of their gradual improvement. Figure 4 shows the fishbone diagram showing the causes and consequences of the absence of accounting data on the invoice.

2.5 Phase „IMPROVE“

The IMPROVE phase answers the question: "What are the top solutions for eliminating the root causes?" i.e. how can the cause(s) be eliminated so that the project goal can be reached. This requires solution ideas to be created, evaluated and selected, all based on the root causes with a detailed implementation plan then being developed (Lunau, et al., 2013).

After lengthy stages of measurement and analysis in order to obtain the necessary data, the improvement phase follows. This is the stage which focuses directly on creating activities within the framework of finding out the proposal for the process standardization and optimization. The phase of improving processes is oriented on transforming the process into the form of costs and time savings, and improving the quality and effectiveness of the work undertaken.

At the improvement phase, we took advantage of the following tools:

- Brainstorming
- Short term solution
- Long term solution
- Effort / benefit matrix
- Raci responsibility matrix
- Implementation plan.

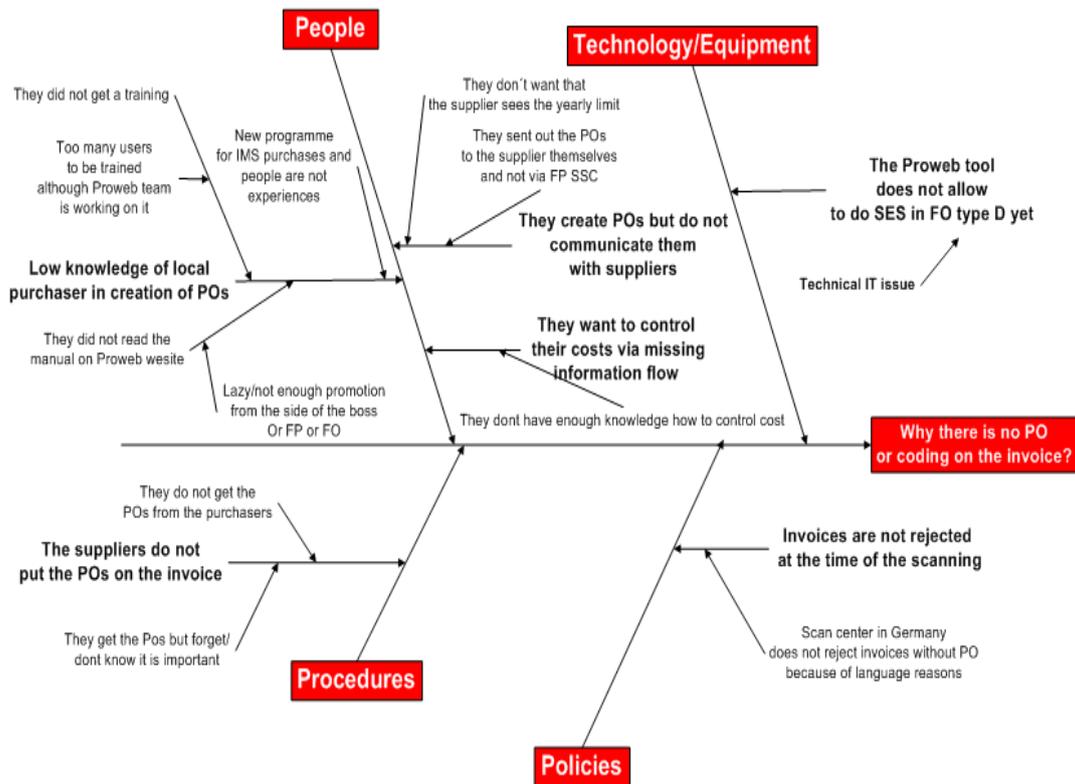


Figure 4 Fishbone diagram showing the causes and consequences of the absence of accounting data on the invoice (Internal company materials)

Brainstorming

Brainstorming phase belongs to the major ways of obtaining new procedures through proposals, ideas and the ideas relating to process improvement. Brainstorming is an improvement tool for a team to generate, creatively and efficiently, a high volume of ideas on any topic by encouraging free thinking (Basu, 2011). In the framework of the project team, we tried to gather ideas and insights, that belonged to the most crucial factors of the process identified in the analysis phase. Each team member had his opinion and in the process framework they noted some other factors that influenced the process. On the basis of common discussions, we agreed on the areas requiring procedural changes.

Short-term solution

In the phase of the short-term solution within the framework of the joint communication in project team, we focused on the areas where there was the possibility to solve the problem quickly (Staudter, 2009). The implementation of changes did not require a lot of time and training to implement them. Within this phase, we agreed with the department responsible for creating orders of the local purchasers on making two copies of the order document where one copy would be automatically sent to the supplier and another to local purchaser. In the context of the end-to-end process, the presentation for all purchasers and their managers would be organized for the purpose of being informed about the proper functioning of the process.

Some local purchasers still have access to create orders in the SAP System. Through the project of creating orders, a list of such users would be created and access to the system would be for them gradually blocked. Another point of this improvement model would be the implementation of training of all users of the business programs (SAP, Saperion, Proweb).

Long-term solutions

Long-term solutions phase is focused on areas of improvement, which require longer preparation and more time for their overall implementation (Staudter, 2009). The object of this phase was the creation of the total process documentation and its subsequent presentation to all necessary parties (road shows). As the next point was the improvement aimed at the compliance with the rules from the suppliers' part. You need to provide them with information about their roles in the process and ask them officially about observing those roles. They must also be aware of the situations when this process will not be fulfilled from their part. This part is rather difficult regarding time, as well as, material consumption.

A late payment of invoices required the revision of vendors, where the agreed maturity of invoices was too short, less than 30 days and then following contacting of the local buyers for the confirmation of the identified information. From them it depends whether or not maturity was set correctly and whether the posting of these invoices required a higher priority level, or they worked on the new agreement regarding their maturity.

To locate the problem with missing data on the invoice, it required to create a list of suppliers who belong to this area and with the help of that list to contact the responsible purchasers for creating a limit order. A continuation of the improvement phase was sending the number of the order to the competent supplier with the information to place that number always on each invoice issued.

For invoices that were received with incorrect or missing information, a special inbox will be created for the forwarding of these invoices. Invoices required manual data review and the gradual transmission of data back to the supplier with the necessary explanation. In the event of recurrence of receiving invoices from the same vendor, a telephone communication was needed.

Effort / Benefit Matrix

Effort versus benefit matrix can be characterized as a graph that shows the effort made to create better process compared to the benefits that the improvement will bring in the factors of time saving and necessary resources from the beginning to the end (Staudter, 2009).

Collecting all of the data about the process of billing supplier invoices and identifying points of improvement areas led us to the use of the effort and benefit matrix. By using it, we set the order of importance of the various steps with respect to the exerted effort and the expectations.

The results showed that most of the effort would have to be made in the area of creating orders and their subsequent communication with the supplier, where its mastery would bring to the company the required results, as well. Revision of the maturity of invoices of less than 30 days required a medium degree of attention and communication with the customer company did not require high effort, but implementation of the teleconference couldn't bring high results (see Figure 2).

RACI Matrix

A RACI matrix of responsibilities is the method used to display and assign the responsibility of specific people or jobs in the implementation of any task or project (Staudter, 2009). In our case, we used it to assign the individual activities in the phases of the improvement project implementation to specific individuals, teams, and departments. By using it, we set out the working methods, which should be carried out and we divided the tasks within the framework of all parties involved in the process.

Implementation plan

The implementation plan contains the individual application steps of the process improvement in the framework of the determination of specific individuals responsible for the exact procedure (Staudter, 2009).

The implementation of the whole improvement process was focused on the organization of teleconferences with one division in respect of the information provision about the rules for the proper process functioning and changes that were starting to be implemented in the process.

Another point of the improvement was the revision of the maturity of invoices. Finding the reception of invoices with maturity of less than 30 days required passing on this information to the purchaser for the purpose of determining the priorities for posting these local invoices.

The last point of the implementation was to create a list of troubled suppliers, contacting local purchasers to create an order for the provision of services with the biannual or annual limits, sending the order number to a specific vendor and providing it with information on the number of orders for each invoice.

Table 6 RACI Matrix

						Input	Output	Notes
Explanation of cost controlling possibilities	R/A		I	R				training
Revision of PT		C	R/A		I		List of suppliers	
Decision of correctness of PT		R/A		C/I				
Asking for PO/FO creation		C	R/I		R/A			
Communication of PO/FO to the supplier					R/A	PR creation	PO sent out	
Rejection of invoices without PO	C	C	R/A			Wrong invoice	Rejection by email	

Source: Internal company materials

The improvement implementation was carried out with minor problems. The most crucial point was the communication with local buyers due to a change of the existing process and requirement of the use of new procedural settings. These changes were very difficult for them, but by means of workshops and implementation of trainings in order to facilitate the daily use of them, we tried to provide as much information as possible.

2.5 Phase “CONTROL“

The CONTROL phase answers the question: "How will sustainability be ensured?" i.e. how the improvement is to be measured, verified and sustainability sustained? All the knowledge gained about the process and how it performs will be utilized in building a suitable process control system. Capturing and documenting the organization's increase of knowledge as a result of the project must be done in a transparent and comprehensible fashion so that others may leverage this learning and experience (Lunau, et al., 2013).

In the control phase, we focused on the areas in which by means of the analysis phase and the improvement phase we proposed changes. Our aim was to monitor the process, to follow its progress, and to compare results with the results prior to the application of the procedural changes. The control phase was very important, because it many times draws attention to the shortcomings that in the implementation of the changes may occur in spite of the fact that in the measurement and analysis phase have not been identified. The control phase was carried out using the following steps:

- Process monitoring,
- Making the Plan of reaction,
- Process documentation,
- Project documentation,
- Handover protocol.

Process monitoring was oriented to control functioning of the process following the implementation of various procedural changes, where it was checked point by point what the change brought about and whether it ever was applied in the field (see Figure 3). The control was carried out by using the downloaded data of invoice documents and their subsequent comparison with the data from the period before the implementation of required changes.

Plan of reaction follows the monitoring process. Our goal was to design a way to address the adverse situation, that would be discovered in the monitoring process and to determine on a provisional basis which areas of change may still be at risk. We didn't want to leave it to chance and would prefer to be prepared in advance.

Process documentation, project documentation, and handover protocol are documents, which must be handed over to the process owner where, in our case, was the accounting team responsible for the processing of invoices of customer company. They're the evidence materials in respect of the implementation of project, marking the troubled areas, suggestions to improve the process, the measures which must be applied in the process and the distribution of activities between the parties, on which the process is to apply.

Process control after implementation of the proposed changes brought about the positive process results. From the beginning, the proposed changes required a greater amount of work spent on manual data control, constantly repeating and alerting local countries to non-compliance with a new standard of the process, a large number of phone calls from suppliers, however, in the course of four months, everything has stabilized and the process started to function by the newly set up procedures.

3 Results of six sigma project

The mother company is very strong and well recognized company in all markets of the world, and, therefore, its operation and the use of administrative processes within the business is pretty important. Within that, the company constantly checks their processes, and in their improvement and development of processes uses multiple methodologies. A great attention is paid to the Six Sigma concept, which has already been successfully applied in a number of its departments.

The use of Six Sigma concept is focused on saving company costs, improving the quality of business processes and effectiveness of the overall work. The project on the Department of Finance and specifically invoice billing from the suppliers for customer countries was successful. Processes used in this department have become more stable, the time and effort spent on nonstandard activities was reduced.

The platform of the entire process rested on creating orders in the system for each ordered service and then providing its number with a specific vendor. The pursuit of this change has not been easy at all from the beginning, the whole process of changes required the extensive paperwork, creating spreadsheets and reports on mapping out the process to be used. The results have led to the shortcomings in the process, which required the production of manuals and presentations needed for proper use of the various procedures. Patience and a greater amount of work led to the successful implementation of the project. Local purchasers have begun to accept the rules of the process by creating the required orders, they learned to

work within the system Proweb program. Communication with suppliers has improved, which led to the correct posting of invoices, accelerating the process of their billing and payment realization to the maturity date. The implementation of this process has brought in the work efficiency, quality of the services provided and the transparency of monitoring the costs. Changes in the functioning of the process were also visible in the monthly KPI reports.

The use of the Six Sigma concept requires high costs of training on the proper use of its tools and correct embracing the practices, therefore, the company expects that its application will yield the desired results and also the Six Sigma project will be successful. The use of this concept in the mother company is quite common, even a separate department is created that deals with the application of this method in each process. The staff of this department are successful owners of green belts and are currently planning to recruit new members. It's a great opportunity for employees from other departments to gain new knowledge and skills from green belts. The company plans to continually use and implement the Six sigma in other business areas in order to expand the quality of its processes and to create interesting working environment for its employees.

The implementation of the Six Sigma concept at the Department of Finance that takes under umbrella customer companies brought about desired results. The whole process has gained a new image, new procedures, accounting rules, has broaden the workers' knowledge and brought in effective results, and not only in the harmonisation process with setting of the exact procedures being used, but also in the overall relations of that department. Communication within the team raised its level and cooperation in the project within the framework of the follow-up of individual steps strengthen relations, it pointed out to the importance of cohesion and allowed employees to expand their knowledge. In the absence of any one member of the team, everyone through the implementation of the project has gained the required knowledge and, if necessary, they know how to replace each other.

Another benefit was the consolidation of relations and enhancement of cooperation with departments established in the local countries. The transfer of a large part of the operational activities into the shared services in Bratislava, did not have a great acclaim in the local customer countries and cooperation was not easy. We met with the reluctance of the provision of the required data, non reply via e-mail, phone calls, or with poor organisation of the importance of individual activities. The operations, which required urgent treatment from our side, in local countries were not considered to be urgent. Problems also arose as a result of the language barrier, the internal SSC language was English, and also in the diversity of culture. However, by means of the project of processing invoices from logistical suppliers, a number of training sessions were created in respect of the important process activities, follow-up of each of the steps, the extension of the knowledge necessary to use software programs and the importance of using them on a daily basis. Created documentation allowed for faster and more efficient processing of invoices and strengthened relationships between the process of local customer countries and SSC in Bratislava. Everyday trainings provided to colleagues from local countries and daily communication focused on addressing problem areas eventually led to the process adoption, creation of the trust, and the removal of any barriers impeding cooperation. Regarding suppliers, relations are also much improved. Suppliers have realized that, so that the process works rightly, not only the accounting officer shall be liable, but all the players must cooperate each other and create appropriate conditions for each other.

Suppliers also changed their approach and have been more or less open to the demands of mother company, because in the end it was about to receive the salary for their services on time.

The use of the Six Sigma concept is currently very familiar, but still in Slovakia, it is not used by many companies. The reason is the lack of finances and knowledge about it and also the fear associated with the introduction of new methods in the business. Many small business owners lack experience and as a result of the lack of funds, they use the simplest procedures, which ultimately may require much more costs than an entrepreneur expects.

Conclusion

The case study was directed to the implementation of the project improvement in a particular establishment in the field of provision of services. This was an application of the various phases of the improvement process, based on the knowledge and experience gained from real practice. The project has been applied in the Accounting Department of a company that provides services foreign countries. The issue was a lengthy and poor accounting invoice from vendors who provide logistical services to that company. The main problem was the lack of information on the procedural steps, incomplete communication between departments and invoices issued with incomplete data. The project was carried out using the DMAIC methodology and the progress of all its phases was described in detail in this paper. The implementation of changes has been tedious, but it brought in the department and the company positive results. It reflected in the efficiency and quality of services provided, in particular to local purchasers it brought in better overview of the costs incurred by ordering and was created a detailed procedural documentation.

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