African Journal of Business Management Vol. 4(8), pp. 1480-1493, 18 July, 2010
Available online at http://www.academicjournals.org/AJBM
ISSN 1993-8233 ©2010 Academic Journals

Full Length Research Paper

Six sigma concept within banking system

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Accepted 2 March, 2010

Finance industry is considerably applying six sigma quality process with the aim of eliminating defects. Six sigma is a powerful system. Basically it is measuring of quality that longs for perfection (3,4 defects on 1.000.000 transactions). The very name of this philosophy is important. The word "sigma" is a Greek letter which represents standard deviation, the term that describes how distant is the data from average or middle. "Six" parts is involved when one measures the things the company does right. This work shows the example of Six sigma concept implementation on the crediting process within the bank. For realization of improvement project DMAIC model is used. The process is recorded according to SIPOC model and improved by usage of tools and quality models. All this enabled achieving faster developing crediting process that has less variation of CTQs and possibility for management to monitor the process at any time.

Key words: Six sigma, banking, improve, process, crediting.

INTRODUCTION

Finance industry is considerably applying six sigma quality process with the aim of eliminating defects. The most known corporations and banks in the world participate in assemblies where they exchange learned lessons concerning implementation of Six Sigma and talk about savings and improvements they have made.

The process model was sometimes used only in the world of production. In far 1987 Motorola was the first company in the world that initiated a new concept based on Zero-Defect philosophy. Much time ago, the same philosophy was announced by late quality guru Philip Crosby in far 1961 (Crosby, 2000). It took 26 years for the world to understand it and realize that it is possible to "work without defects".

The world of services was, for a long period of time, skeptic concerning possibility of applying Six Sigma philosophy to their own processes. Leading world companies, Texas Instrument and General Electric, have shown that Six Sigma philosophy gives more significant results within service processes. This way GE has succeeded, in the period of the year 1995 - 2000, to raise its own processes to six sigma quality level (3,4 defects on 1.000.000 opportunities for a defect) and to become the first six sigma company in the world in which service processes are dominant.

Citibank, part of Citigroup company, has planned to become the first international financial company in new millennium. In order to reach that ambitious, planned result, global giant made a decision to implement initiatives in quality that easily satisfy the customer in every interaction, on any location in the world. They have known that Six Sigma quality was present in production processes, but the question was: can it be applied in service industry? Can it function throughout world for financial organization? Citigroup has started implementation of Six sigma in 1997 and proven that the concept is applicable even in financial institutions. By doing this it has saved a few billions of dollars.

Bank of America, the biggest bank in Wichita has implemented six sigma throughout company in order to consolidate assets and its second largest position in the market (Dinell, 2003). "That is the change of culture", says Bob Vanderberry, senior vice-president. "This is the way we do our business now." This way of conducting business means paying attention to numbers, such as number of customer complaint, time needed for credit processing and time needed for feedback.

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Six sigma is a powerful system. Basically it is measuring of quality that longs for perfection (3,4 defects on 1.000.000 transactions). The very name of this philosophy is important. Word "sigma" is a Greek letter which represents standard deviation, the term that describes how distant is the data from average or middle.

"Six" parts is involved when one measures the things the company does right. Three sigma level of quality is the level at which most of companies work nowadays – it is equal to 66.807 defects on million opportunities, while Six sigma equals 3,4 defects on million opportunities - statistically possible almost perfection.

Lean and six sigma methodologies play an important role in the quality and cost driven world with high competition (Hu et al., 2008).

This work shows the example of six sigma concept implementation on the crediting process within the bank. For realization of improvement project DMAIC model is used. The process is recorded according to SIPOC model and improved by usage of tools and quality models. Pareto method enabled extraction of vital minority of characteristics that influence the quality of the process itself. Ishikawa method was used for identification of sample root and statistic process control was used for monitoring variations critical to quality characteristics (CTQs). All this enabled achieving faster developing crediting process that has less variation of CTQs and possibility for management to monitor the process at any time.

The bank was founded as the first private domestic bank dealing primarily with corporations. Nowadays it is a proprietary of one of the biggest European banks, which has become the key player at the banking market of Central and South-East Europe. Before purchase, total active capital of the bank was €136 million, net revenue €12 million, and equity capital was €69 million.

DMAIC SIX SIGMA MODEL OF IMPROVEMENT

Core of six sigma is DMAIC (define-measure-analyze-improve-control), method for analyses and improvement of business processes (Pande, 2000; Pande et al., 2000; George, 2003; Harry and Schroeder, 2006; Harry, 2000). DMAIC it self has five stages:

- To define opportunities.
- To measure performances.
- To analyze opportunity.
- To improve performances.
- To control performances.

However, Six Sigma is more than numbers. That is a method and practice that provides tools for businesses necessary for accomplishing results from their processes and products.

Bank of America, Citibank, The Korea First Bank, Chase Manhattan and other banks are conducting intensive trainings for six sigma in banks and they also implement programs. From 1997 - 1999 Citibank trained more than 92.000 employees for using quality tools used by six sigma concept. This is important since implementation of six sigma quality requires right people on right positions with the right knowledge. This makes possible to keep the factors that influence quality under "constant re-checking". Nowadays business is overseen differently in financial institutions. They focus on processes and ways the things are done. It gives them opportunity to accomplish victory for everyone involved in their processes.

DMAIC is based on original PDCA Plan Do Check Act cycle (Stoiljkovic, 2006). However, DMIAC is used for application of both efforts - improvement of processes and design/redesign of processes. Therefore, no matter if it refers to "DMAIC projects" we talk about efforts of using one or another six sigma strategy of improvement. Table 1 shows insight in main DMAIC activities, comparing the ways of "process improvement" and "design / re-design of processes" (Pande 2000; Pande et al., 2000).

HISTORY OF QUALITY WITHIN A BANK

Bank management has, for several years, been loyal to quality. Bank leaders participated in series of seminars where the philosophy of quality or TQl total quality leadership was processed. At that point, leaders did not know they were making first steps towards six sigma philosophy. During those seminars, which were type of creative workshops, the leadership identified significant processes which directly influence the satisfaction of customers and defined the goals that were to be accomplished.

Bank made first significant step towards six sigma when it began implementation of ISO 9001:2000 standards. The aim of this project realization was not receiving of certificates, but organization and improvement of processes. Back then SIPOC supplier input process output customer model for recording processes was applied. Teams were formed for all significant processes in a bank, and the teams, in cooperation with CIM College d.o.o. representatives, recorded processes and made processes Manuals. Procedures were made according to those manuals which allowed the whole process to be connected, regardless of where the banks functional part is realized.

Parallel to recording processes and preparation of documentation for quality system, bank associates went through intensive training for numerous quality methods and tools including: visual processes for process recording, Pareto method, statistical process control, measuring customers' satisfaction, audit systems and complaint management. By completing this they received knowledge on Green Belt level without even knowing. By

Table 1. DMAIC method for analyses and improvement of processes.

	Six sigma processes of improvement	
	Improvement of processes	**Design/redesign of processes**
1. Define	• To identify • To determine requests • To set planned result	• To identify specific or general problems • To define planned result/apply vision • Explain scope and requests of customers
2. Measure	• To confirm a problem / process • To purify the problem / planned result • To measure key steps / entrances	• To measure performances according to requests • To gather data on process efficiency
3. Analyze	• To develop hypothesis on samples • To identify "vital minority" of cause root • To confirm hypothesis	• To identify "the best practice" • To evaluate process design • Adding / not adding values • Bottlenecks/interruptions • Alternative ways • To purify requests
4. Improve	• To develop ideas for removing the root of cause • To test solutions • To standardize solution / measure results	• To design new process • To check assumptions • To apply creativity • Principles of work flow • To implement new process, structures, systems
5. Control	• To establish standard measuring for performance maintenance • To correct problems when needed	• To establish measurements and re-investigate in order to maintain performances • To correct problems when needed

using this knowledge they were able, at first with the help of CIM College d.o.o. associates and then by themselves, to apply gained knowledge and analyze their own processes. Today, it is common for them to monitor stability and capability of processes through SPC, to use Pareto method in order to determine vital minority of defects or to quickly solve customers' complaint, measure customers' satisfaction and check their quality system. Teams hand in reports monthly to the Quality Board where they can see the trend of process and quality improvement delivered by bank.

We will list only some of the reports regarding to monitoring of stability and capability of processes over SPC, as well as reports on measuring customers' satisfaction.

USAGE OF TOOLS: SPC IN BANK PROCESSES

Statistic control of processes in foreign payment operations

Characteristics in this process that are monitored are number of loro and nostro remittances that are processed and correctness of orders ready for processing.

A loro is our account of their money, held by you, and a nostro is our account of our money, held by you.

LORO remittances daily

Potential capability ratio

One of the simplest methods for measuring short-term potential process capability is by comparing the process dissipation with tolerance. By dividing one value by the other, we obtain a constant which is called process potential:

$$C_R = \frac{6\sigma_{ST}}{\text{Tolerance}}$$

C_R shows how much tolerance, in percentage, is needed to fit into the $6\sigma_{ST}$ process dissipation.

6σ process dissipation for a given characteristic can be compared with its tolerance in a different way than for calculating factors C_R and P_R. The measure of capability which is discussed here represents the number 6s of dissipation which can fit into tolerance:

$$C_P = \frac{\text{Tolernace}}{6\sigma_{SR}} = \frac{USL - LSL}{6\sigma_{SR}}$$

Specified tolerance index

Since C_P index (number 6σ of dissipation fitting into the tolerance limits) is relatively complex to understand, it can be observed only if σ fits into the tolerance limits. This value is called a short-term specified tolerance limit:

$$C_{ST} = \frac{\text{Tolerance}}{\sigma_{ST}}$$

Factors C_{Pk}, C_{PkUp}, C_{PkDn}, P_{Pk}, P_{PkUp}, P_{PkDn} belong to the measures of performances and are closely connected with the above-given coefficients:

$$C_{PKDn} = \frac{\mu - LSL}{3\sigma_{ST}}$$

$$C_{PKUp} = \frac{USL - \mu L}{3\sigma_{ST}}$$

$$C_{PK} = \text{Minimum}\left(C_{PKDn}, C_{PKUp}\right)$$

Where μ represents the mean process value.

A relatively new concept of measuring the process capability is called C_{PM} index. It takes into consideration the variation between the mean value and the nominal value as well as the standard process deviation. For the case when the target value is equal to the mean tolerance:

$$C_{PM} = \frac{\text{Tolernace}}{6T_{ST}} = \frac{USl - LSL}{6T_{ST}}$$

T_{ST} is function of the standard deviation and difference between mean process value (μ) and nominal value (M). Accordingly, this is the measure of the process precision and accuracy:

$$T_{ST} = \sqrt{\sigma_{ST}^2 + (\mu - M)^2}$$

T_{LT} is function of the standard deviation and difference between mean process value (μ) and nominal value (M). Accordingly, this is the measure of the process precision and accuracy:

$$T_{LT} = \sqrt{\sigma_{LT}^2 + (\mu - M)^2}$$

Statistical conditions of analysis:

Control chart X/mR
Size of subgroup 3

Specifications:

Upper control limit 70 remittances
Target value 45 remittances
Lower control limit 0 remittances
Number of subgroups 104

Control chart

On the Figures 1 and 2, an X-bar denotes number of subgroup and Y-bar, number of loro and nostro remittances respectively.

Statistics:

Number of subgroups = 104
Number of active subgroups = 104
Sigma ST = 7.53
Sigma LT = 0.00
Tst = 8.86
Tlt = 4.67
Upper control limit 1 = 62.88
Middle value 1 = 40.33
Lower control limit 1 = 17.78
Upper control limit 2 = 32.76
Middle value 2 = 12.73
Lower control limit 2 = 0.00
Cr = 0.90
Cp = 1.11
Cpk = 1.31
CpkUp = 1.31
CpkDn = 1.79
Cpm = 1.32
Cst = 6.64

APPLICATION OF TOOLS: MEASURING SATISFACTION OF BANK'S CLIENTS

According to audit's reports and identified opportunities for improvement, team for improvement of processes within a bank started measuring customers' satisfaction.

Meetings with participants of seminar for measuring customers' satisfaction were held periodically and were used to give additional explanations connected to activities that were to be conducted with the aim of increasing quality level that a bank offers to its clients.

With the aim of effective and efficient start, execution and supervision of customers' satisfaction measuring, all activities were conducted by using software of CIM College Company, for whose usage the participants were

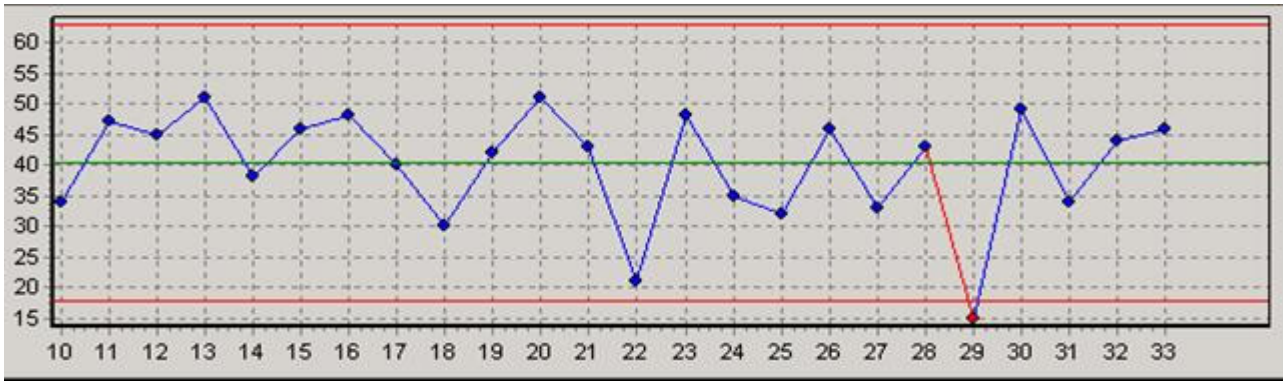

Figure 1. Control chart No. 1.

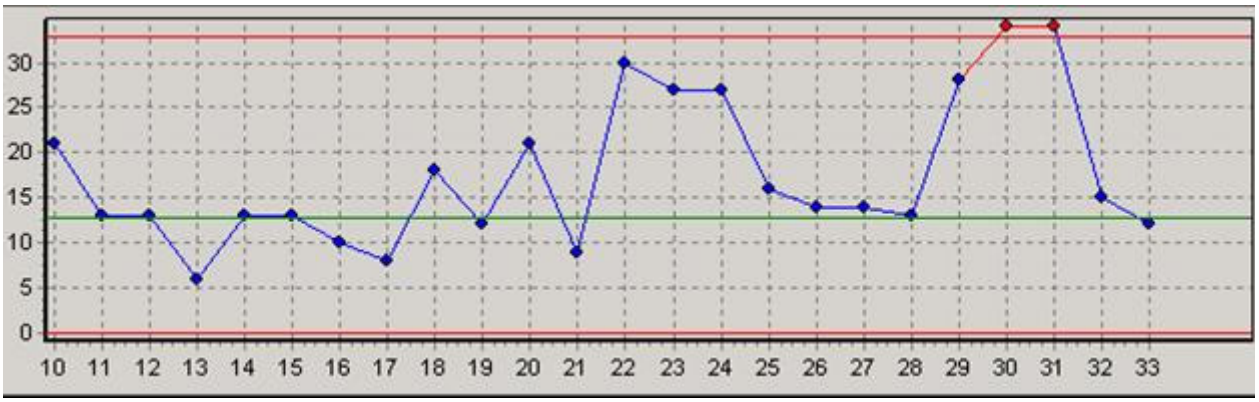

Figure 2. Control chart No. 2.

trained.

The most important effects of measuring customers' satisfaction are:

- Finding the spot for improvement in order to accomplish greater satisfaction of clients.
- Introduction of following clients needs.
- Establishing direct communication with users of bank's services.
- Interviewing of physical person, user of Bank's services in bank's branch offices.

Questionnaires for measuring customer's satisfaction are handed over to clients in all branches of the bank in Serbia. The results were processed by using the software for measuring customer's satisfaction. First measuring gathered 537 questionnaires of Bank's services users (today, this number is more than few thousand). Now we are going to show only one part of processed results for one branch office in Belgrade (Table 2).

Result of this approach and work is certificate verified by TUV Muenchen. During certification none of maladjustments were found.

SIX SIGMA CREDITING PROCESS IN A BANK

Recording of crediting process

As it was already said, bank's associates, divided into teams for specific processes, have recorded their own processes the way they are by using SIPOC model and Visual Processes, CIM College software for visual presentation of process chart or, that is, for making process Workflow. There are standardized forms for recording of processes according to SIPOC model. On a macro level, process is presented by process chart that has three processes (Figure 3).

Process of establishing and processing credit request describes the course of activities, resources, documents and data base that allow establishing of contract consignments on basis of financing clients. Process starts with receiving request of a client, entrepreneur, small and medium companies, follows with request processing, check of solvency and making a decision on crediting, and finishes with forming and completing the necessary documentation for credit activity verification. After signing of contract and releasing the funds starts

Table 2. Questionnaires for measuring customer's satisfaction

Survey		
Physical persons-branch office		
Choose one of offered answers		
Q1.1 You must often come for		
Percent (%)	**Number**	**Answer**
44.3	35	Payment cash
16.46	13	Cash withdrawal
2.53	2	Cheques withdrawal
36.71	29	Bill payment
Q1.2 How often do you use bank's desk services?		
Percent (%)	**Number**	**Answer**
36.25	29	Less than 5 times a month
15	12	From 5 to 10 times a month
16.25	13	More than 10 times a month
Q1.3 How do you evaluate the service?		
Percent (%)	**Number**	**Answer**
87.34	69	Very satisfied
11.39	9	Satisfied
1.27	1	Dissatisfied
Q1.4 How do you evaluate spent time and duration of queuing in a bank?		
Percent (%)	**Number**	**Answer**
87.34	69	Minimal
12.66	10	Acceptable
0	0	Unacceptable
Q1.5 Do you own a current account?		
Percent (%)	**Number**	**Answer**
63.29	50	Yes
36.71	29	No
Q1.6 you most often use Dina credit card :		
Percent (%)	**Number**	**Answer**
41.94	13	As a cheque card
19.35	6	For withdrawing cash out of automatic teller
38.71	12	For payment of goods and services
Q1.7 How much are you interested in following bank services?		
SQ1.7 How much are you interested in following bank services? - Internet banking		
Percent (%)	**Number**	**Answer**
49.02	25	Very interested
41.18	21	Interested
9.8	5	Not interested

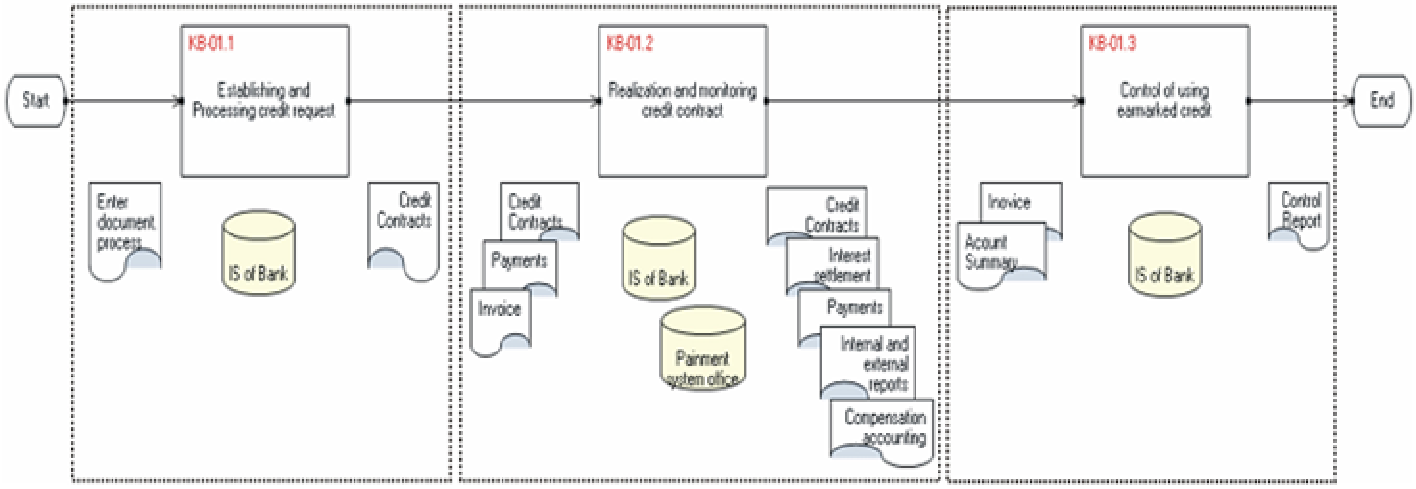

Figure 3. Crediting process on a macro level.

the phase of monitoring realization. Figure 4 shows the chart establishing and processing credit request process.

Every sub-process activity in this process is described in details according to the interview made with team members. Process of realization and credit contract monitoring describes the course of activities, resources, documentation and data bases that provide monitoring of every credit contract realization, or, monitoring of specific payments regarding the contract in question. Figure 5 shows a chart of process, realization and monitoring credit contract.

Planned results defining

Bank leadership, together with general manager has, during the realization of the project ISO 9001:2000 defined strategic quality goals. Banks' quality goals refer to articulated targeting or reactions of a bank for dedicating to main change or improvement, competitive decisions and/or advantages in banking business. Quality goals generally focus externally and connect with important customer, market, service or technologic opportunities and challenges. Widely formulated, they represent what the bank wants and has to accomplish in order to maintain its position or become more competitive. Quality goals influence bank's decision making important for its survival and growth. In order to realize these goals, bank plans needed resources and reorganizes existing ones.

Bank has a planned result to be one of the first banks in Serbia which will achieve best-in-class quality level of its processes of providing services. In order to achieve this clear and ambitious planned result, the bank has already implemented initiative in quality by introducing ISO 9001:2000. New initiatives, which will be realized, should satisfy customers quickly and without a mistake during each interaction in headquarters or in any of the branch offices.

Bank has the goal to improve total satisfaction of its clients by defining and realization of next quality goals:

- Simplification of service providing processes and removing activities which do not make additional value so the part of those activities in the whole process is less than 20%.
- Increasing customer's satisfaction – clients for 50% every two years, so it can accomplish customer's satisfaction on a level of 95%.
- Decreasing mistakes in processes that make additional value for 50% every year in comparison to previous with the end goal of achieving best-in-class process.
- Faster providing services to customers– clients and reducing cycle time for 20% each year in comparison to previous.
- Increasing profit by share- 10% more every year in comparison to following.

In order to realize above mentioned goals bank focuses itself on speed and expenses so it can increase banks profit. To speed up its processes and decrease expenditures bank will relay on its employees to whom will:

- Provide additional education for understanding new concepts and their implementation and for process improvement.
- Create conditions for team work and improve process of design and providing services.
- Provide training for quality methods and tools which will enable them to solve problems easily and reliably and to improve processes.
- Provide foreign experts as trainers and guides on a road to perfection.

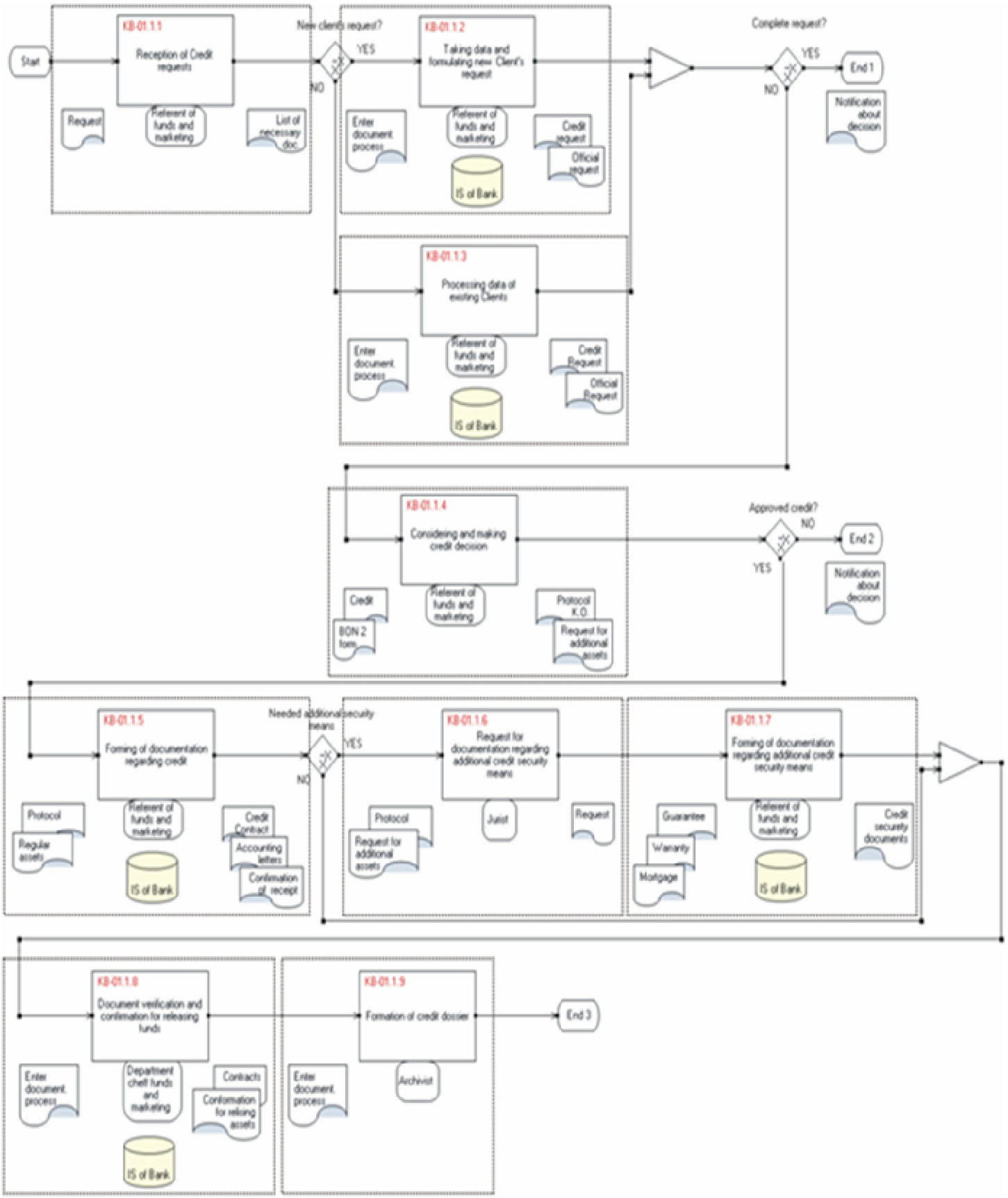

Figure 4. Establishing and processing credit request process chart.

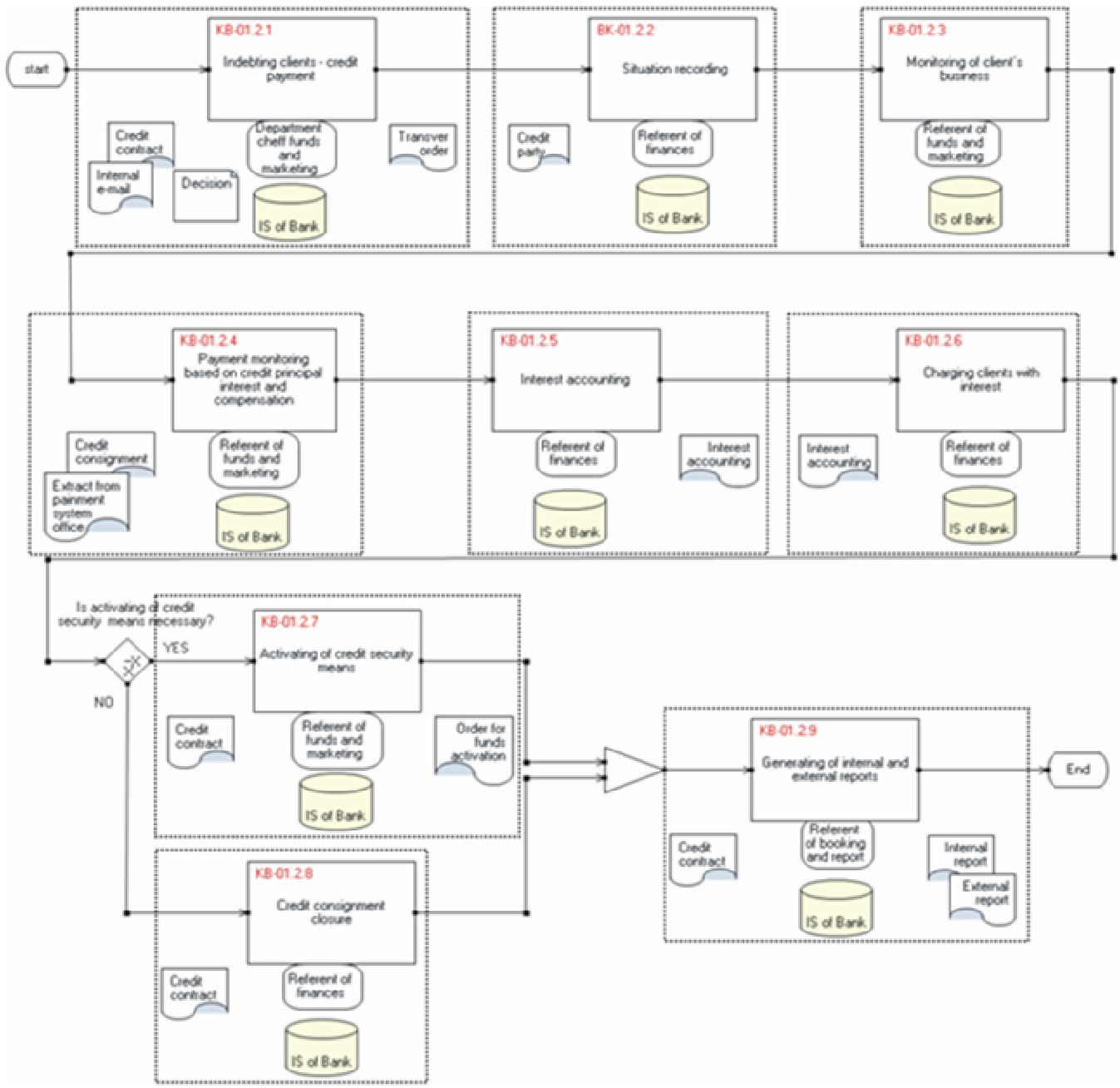

Figure 5. Process of realization and credit contract monitoring.

- Provide time and other necessary resources for achieving quality goals.
- Provide informational support of improved processes.

Story board for crediting process

Bank's General Manager, in cooperation with CIM College representatives, has prepared a document called STORY BOARD for crediting process improvement. Story board is a means for helping bank to ease crediting process improvement by documenting initiative for improvement over its main phases, while, at the same time, gives a team standard method for presenting accomplished results and improvement of team's presentations. In other words, story board documents one project through described figures and diagrams followed by simple text.

Japanese have applied story board concept on their industrial quality control measures. They named it “quality

Table 3. Story board for crediting process improvement.

Story board for process improvement		
Crediting process in Bank		
Team information	**Improvement reasons**	**Current situation**
Team's name	Charter	Process activities
Team's members	Statement	Process chart "as it as"
Meetings		Basic measuring
Gathering and data analyses		
Data that identify key causes:		
Ishikawa diagram	Histogram	Correlation diagram
Form for gathering data	Pareto diagram	
Suggested improvements and implementation	**Result evaluation**	**Future plans**
Suggestions	Data for improvement evaluation	Suggestions for other PAT-s
Implementation strategy or	Run charts	Observing methods
Improved process chart	Control charts	

Table 4. Information about the team for crediting process improvement.

Team information		
Name	**Crediting champions**	
Team was named by General manager		Date
Sponsor		
Team leader		
TQL coordinator		
Team members		
Name and surname	Sector	Telephone number
	Funds and marketing	
	Funds and marketing	
	Legal and general	
	Credit board	
	IT	
	Internal revision	
	SKUP	
Held team meetings		
Topic	Date	Recorder
Forming of team and introducing project goals		
Detailed recording of crediting process		

control story" and they initially used this technique for documenting and reporting on improvement measures. This pattern shows logical data flow with the help of graphic techniques like Pareto diagrams, cause-and-consequence diagrams and control diagrams. Table 3 shows story board for crediting process.

A team has been formed for improvement of crediting process to Six Sigma level of quality. Team information is given in Table 4.

Bank's general manager has, based on strategic quality goals and vision for a bank to achieve best-in-class processes, and defined the reasons for improvement and tasks for the team to realize. This is shown in a document in Table 5.

Current state in crediting process

After it got the tasks, the team started project realization. The first step was to identify existing situation and find problems which were appearing in crediting process.

The team for crediting process improvement in a bank,

Table 5. Reasons for improvement.

Reasons for improvement
Charter
Improvement processes
Crediting process in Bank
Process improvement tasks
Tasks according to adopted quality goals
To lower the time period of credit approval cycle for 50% in comparison to current situation
To decrease not-paid credits for 50% in comparison to current situation
To increase client's satisfaction by crediting process for 20% in comparison to current situation
Tasks for crediting process parts improvement
To decrease time period of clients request receipt procedure-client qualification-for 50%
To decrease time for long-term credits approval to 5 working days
To decrease expenses for preparation and distribution of documents for 50%
To conduct crediting processes audit every second month
To introduce simple parameter for measuring crediting capability processes
To provide monitoring of crediting processes over processes charts
To provide dynamic modification of crediting processes during its processing
To provide monitoring of processes with minilal paper documentation
Charged resources
Internal reviser
SKUP
Branch office
Way of reporting
Once a week over EDM-every Friday till 15.00
Once a month on a Quality and business improvement board meeting- second Wednesday in month from 14.00-15.00

with the knowledge it owns about a process and learned methods and quality tools, has started quality process audit with the goal of identifying problems within a process. We are listing some of noticed problems.

(1) Communication with branch offices.

(a) Submitting solvency reports over fax or e-mail.

(2) Numerous hand written records.
(3) Time deposits – operations are not automated through application.

(a) Following maturity time.
(b) Interest accounting.
(c) Annexing.
(d) Needed greater coordination with branch offices with the goal of notification.
(e) Time deposits do not go through credit board, although interests and specific arrangements are contracted.

(4) Commercial records.

(a) Recording.
(b) Annexing.
(c) Interest and compensation accounting.

(5) Orders are hand written

(a) Writing of orders.
(b) Signing.
(c) Entering orders.
(d) Verification of releasing funds.

Consequences of noticed problems in crediting process are errors that appear and influence clients' satisfaction, and, at the same time, banks profit. All remarks can be brought to a point that long period of the cycle is credit approval.

Duration of a cycle for providing services is the biggest problem that servicing organizations are faced to. Rough analyses of cycle duration show that there are large

Table 6. Measuring in crediting process.

Basic measuring	
Gathering data plan	
Process	**Crediting process within bank**
Characteristic that is measured	To conduct payments and measuring: period from submitting request to completion of documentation number of clients' visits with the aim of documentation completion period needed for credit request qualification period needed for decision making and releasing of funds relation to tidiness of obligations servicing (completeness and maturity) percentage of non-paid claims clients' satisfaction period between work activities
Goal of gathering data	Finding of activities and causes in a process that lead to: -increasing of time period needed for credit approval cycle and funds payment -bad credit payments -clients' dissatisfaction -finding opportunities for improvement
Operational definitions	Crediting process is thought to be qualitative if the time period from completing credit request to funds payment is less than a working day for short-term credits and less than 5 working days long-term credits and if a client does not have to bring a single document.
Process owner	
Person responsible for data gathering	IT sector - data from IS bank Marketing sector - client satisfaction data
Data is gathered by	Taking over documents for statistic analyses from informational system of bank

reserves and possibilities for shortening.

In order to get precise information and make decisions based on those information, team for process improvement started realization of process measuring phase.

Measuring in a process

In order to improve something you have to know how big it is. This means that after defining the process and planned results, and receiving charter from general manager, improvement team has to decide what will be measured in a process, which means, it needs to prepare measuring chart in a process. A number of requests for measuring are already defined on a story board for crediting process improvement. Charter for basic measuring, issued by bank's general manager is given in Table 6.

Since the processes in banks are informatively supported, not on a process model but as electronic memorizing of data, it is possible to gather a lot of data necessary for crediting process analyses from existing data basis. For real measuring in a process, analyses and improvement, banks will have to change existing informational systems with a new one, based on a process model.

Data analyses

Defining activities that create value

Bank employees are aware that there are opportunities for crediting process improvement. They know there are activities that do not create additional value and slow process activities. Therefore it is understandable that one of banks quality goals is removing activities that do not create additional value. Work that does not add value in the eyes of our customers typically includes 50% of total service expenses. This presents enormous potential of "white dollars" for achieving significant speed, quality and expense improvement, all that can provide main strategic advantage to a bank in comparison to competition.

If you monitor work flow in a process, it soon becomes obvious that some activities add value in the eyes of our

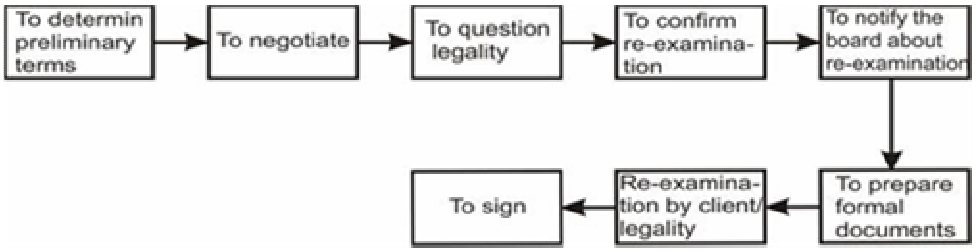

Figure 6. Value flow analyses on a process chart.

customers (and therefore it is considered as work that adds-value). Other approach to adding-value work is to ask yourself whether your customers will be willing to pay for it, if they have the choice to pay for it or not and if they know that it was a part of their ordered price. If they refuse to pay, if that is a given choice, they will direct their business to find another deliverer who does not have expenses, and that is work that does not-add value.

For determining activities that add or do not add value it is necessary to make value flow analyses. It means that process chart (Figures 4 and 5) analyzes activities and determines if their expense is seen as necessary or unnecessary by a client.

It is in human nature that everyone who works in managerial, financial, administrative and other processes of services thinks that all he/she does "adds value". This is the reason for poor recognition of waste in servicing processes that are done daily. In order to see this it is good to use questions which can help people to start settling their sensitivity towards wastage. Questions can be:

(1) Does client want to pay for this activity?
(2) Is the service changed?
(3) Is this finishing operation?
(4) Is client waiting or is the service unnecessary?
(5) Is this activity of inspection?
(6) Is this activity for adjustment or preparation?
(7) Is activity internal re-examination or reporting?
(8) Is activity requested by a supervising organ?

By answering given questions, it is possible to divide activities within the process to ones that create-added-value, which means they are needed in the process, and the ones that do not-create-added-value, or the ones that should be, if possible, deleted from the process (Figure 6). Activities that most often not add value refer to waiting, re-examining, controlling, approving etc.

Analyses of duration of approval cycle and credit realization

If you analyze cycle duration from receiving credit request to its approval you can conclude that there are credit dossiers that "wait in a line", or, wait for the approval. It happens with normal process activities. However, if an error occurs (mortgage is missing, non-solvency, etc.) it can result in piling credit dossiers that wait for the approval.

Let's presume that some process has cycle time of 10 days and it does not have quality problems. If it suddenly gets disturbed with 10% defects, what will be the influence on cycle and quantity of work-in-a process? You can think the answer is that cycle time will also increase for 10%. But the fact is that the influence is much worse: cycle time will increase for 38%, and number of things-in-a process will increase for 54%. Therefore, it can be said that an activity within a process that produces 10% defects will be the source of enormous increase of delay and expenses that do not add-value (George, 2003).

Analyses result of duration of credit approval process cycle can be shown in a graphic in Figure 7. It can be seen that involvement of activities that add value (green color on a graphic) presents less than 5% of total cycle period. More than 95% of time within the same process is spent on activities that do not create additional value and that lower customer's satisfaction. It is clear that in such a process there are more opportunities for improvement, which will be realized in a bank.

CONCLUSION

Bank has decided to become one of leading banks on the Balkans and wider. It means that it wants to improve quality of its processes and to achieve best-in-class processes which operate without an error. In order to accomplish this, bank has chosen crediting process, as one of most important for a bank, and started realization of that process. For processes improvement it has decided to use Six Sigma philosophy and DMAIC improvement model.

Team for process improvement got all necessary resources (time, space, necessary equipment and training) and started process realization according to defined methodology and by using visual tools for process presentation, or story board.

The process is completely finished and implemented.

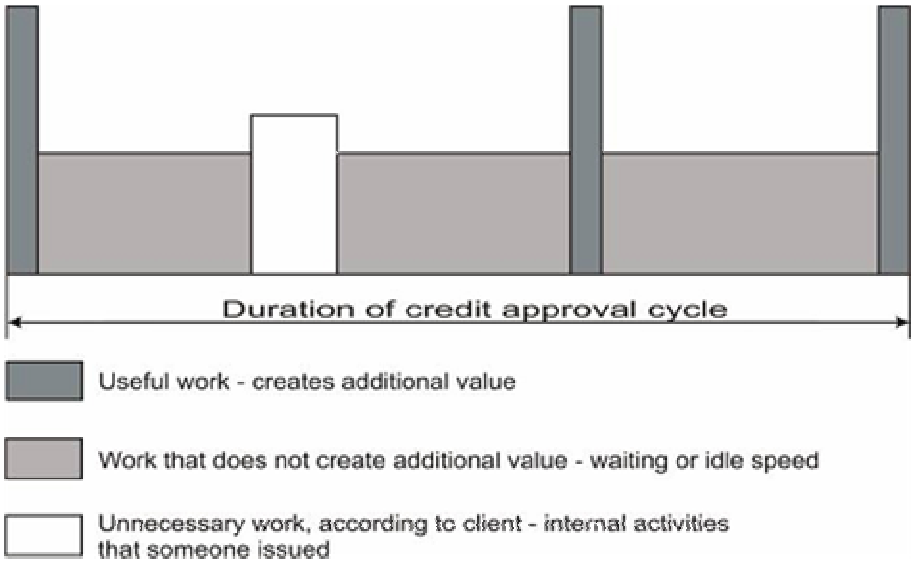

Figure 7. Duration of credit approval cycle analyses.

For the purpose of improved process, software on OPISys™ platform was developed and implemented in the bank's headquarters and all the branches. This gave bank's management an opportunity to monitor the achievement of planned results and goals defined on a story board on-line. General managers and managers with authorisation can, by using Pareto diagram, at any time see which branch has approved most credit lines, at which interest rates, what kind of profit have they achieved, etc. By monitoring control cards, managers in charge can see what is the stability and capability of returning received credits by clients. By monitoring other characteristics (as loro and nostro) the management has the insight into stability and capability of the whole crediting process.

Developed software that supports crediting process has enabled dramatic shortening of time period needed for credit approval. Gathering necessary documentation from a client is done only once and the same documentation is being transfered into electronic form and sent to Crediting Board for approval. Crediting Board receives other necessary documentation, also in electronic form, and makes the decision during the day or next day at least. Time period from submitting application for credit until credit approval has surpassed planned result given at the beginning of project realisation.

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