THE EFFECTS OF BUSINESS PROCESS MANAGEMENT ON COMPANY'S OPERATIONS

ABSTRACT

Each year, companies save money by optimizing their business and other processes. Awareness that business results can be improved by improving company's processes is not new. Company owners and employees have always been searching for ways to improve their and company's efficiency. One possible approach is Business Process Management. In the article I will show the positive effects that Business Process Management can have on company's operations.

1   INTRODUCTION

It was year 1885 when seventeen years old Frank Bunker Gilbreth started working at Thomas J. Whidden Company as a bricklayer. By observing his co-workers at work he noticed that each of them did his work in a different manner. He also noticed that they were not taught to do their work such manner. Workers were also using different techniques when they were working on a difficult part of the wall or when they had to do their work in a hurry. He studied all those different techniques, sorted them by efficiency and tried to develop a technique that would combine all of those techniques into one optimal technique. He incorporated some of his own ideas and came up with a much faster technique of brick layering. By his twentysecond birthday Gilbreth succedded to improve a 5000 years old job and enabled bricklayers to do their work in a faster and less tiresome way. At one especially difficult part of the wall bricklayers were now capable to lay 350 bricks per hour, which was a 190% improvement compared to 120 bricks layed by using the old technique. This early success encouraged him to search for additional improvements of techniques used by himself and his co-workers. (Graham, 2003). The example above is a good analogy to approach used for business process improvement:

1.   define business process (Gilbreth studied his co-workers at work),
2.   measure business process (Gilbreth studied efficieny of his co-workers),
3.   analyse business process (Gilbreth sorted various techniques by their efficiency),
4.   improve business process (Gilbreth combined all those different techniques into one optimal technique),
5.   control business process (Gilbreth continued to search for additional improvements).

Those five steps (*Define, Measure, Analyse, Improve, Control* - DMAIC) are all part of ongoing business process improvement. Business Process Management (BPM) is an approach to manage business process improvements. BPM covers all phases in business process life-cycle (Smith, Fingar, 2003). BPM thus completely covers the DMAIC circle.

By using BPM companies can expect to speed up their business processes due to optimization of those business processes and shorter lag times (the time between two activities in a process when nothing happens). Consequently the costs associated with business process are lower. Business Process Management System (BPMS) is capable of Enterprise Application Integration (EAI), too. This enables companies to keep their existing information systems (IS) thus preserving existing investments into their IS. BPMS also provides means to change a business process in a fast and efficient way, which is a competitive advantage, because a company is more responsive to changes (of market regulations, market demands, etc.). And lastly, BPMS provides greater control over business process execution. To sum up, BPM also leads to greater customer satisfaction.

In this article I will try to show the benefits of using BPM on a real life example. I will start with a short description of BPM and BPMS. Then I will describe a case of business process automation and compare the improved process to the old non-automated process.

Results of the comparison will be used to calculate the Return on Investment (ROI). Finally, I will round up the article with a conclusion.

2 BUSINESS PROCESS MANAGEMENT

2.1 Business process defined

Business process is a set of consequent or parallel activities, performed by people or systems, with the purpose of achieving a common goal (Khan, 2004). The goal of business process is to deliver a product or service to a customer. Sharp and McDermott describe business process as a complete set of activities from start to end that provide benefit for the customer (Sharp, McDermott, 2001) and as a set of mutually connected activities, started as a response to a certain event, that achieve the desired goal for the customer (Sharp, McDermott, 2001). Company's goal is to add value at each of activities within company and consequently in internal value chain. Together with other companies's internal chains, company's internal value chain can form an external value chain. By doing that company takes part in business processes that span through multiple companies.

In summary, a business process is a set of consequent or parallel activities, which are started in response to a certain event and are performed by people or systems with the aim of achieving a common goal within one or multiple companies. Business process adds value and provides benefit to both customer and company.

2.2 What is Business Process Management?

BPM is an approach to manage changes in business processes. Compared to Business Process Reengineering (BPR) it covers business processes in a broader way. The focus is on connecting business partners's business processes and their information systems. Within a single company the focus is on development of a platform that would integrate business strategy, business model and business processes with company's information systems. Such platform is called Business Process Management System (BPMS) (Kovačič, Bosilj Vukšić, 2005).

From the information technology viewpoint BPMS can be seen as a merge of two previously already existing technologies. I am talking about Workflow Automation and Enterprise Application Integration (EAI). The merge occurred because there was a need for Workflow Automation Systems to support EAI capabilities and vice versa. The result of this merge is BPMS. The most important capabilites of BPMS are (Russell, 2005): adaptation of business processes to business goals, business process modelling and simulation, business process automation and control, a common view on all data related to business process, enterprise application integration and analysis of business process execution.

2.2.1 Adaptation of business processes to business goals

The capability to adapt business process to business goals enables people to dynamically change business process in accordance with business strategy and focus on customer (Russell, 2005). It is the ability to change the business process model and relatively quickly apply those changes to real life. This is a very important capability, because it enables company to quickly react to changes and maintain or improve it's competitiveness. Companies that continually invest into improving customer relationships reap operative and financial rewards. Additional attention to customers improves chances of keeping company's customers when the demand for company's products or services is low. In more positive circumstances this additional attention helps to differentiate company from competitors (Welch, 2002). Business process owners can monitor business process performance and react when the business process is underperforming.

2.2.2 Business process modelling and simulation

Business process modelling and simulation enable process analysis and testing in order to optimize and check the process for correctness (Rusell, 2005). Most BPMS include a modelling and simulation tool. The aim of modelling and simulation is primarily to get acquainted with circumstances in which processes run, experimenting on model before the process is used in real life (study of the impact that various changes would have on process execution), prediction of process performance in changed circumstances, analysis of process implementation and it's deviations from the planned process, analysis of factors that have influence on process changes, etc. (Kovačič, Bosilj Vukšić, 2005).

Compared to experimentation on real life process simulation on a process model has lots of advantages. The costs of simulation are lower, results are obtained more quickly and there is no danger of causing damage. For example: one could simulate a business process that does not comply with current laws – by only doing a simulation the company is not breaking the law.

Results of simulation help to make a decision on how the final process model should look like. The simulation is often performed on current process model (*"as is"* model) and on improved process model (*"to be"* model), that helps to determine if the changes that were made to business process model are taking us into the right direction.

Applying the new process model to real life use is not a straightforward task. The high level modelling should be done by the management, but sometimes there are still details of the process that cannot be rectified without the help of IT personel. Actually, most BPMS offer two views on process model: the already mentioned high level view for management and low level view for IT personel. In ideal world IT personel would only take part in tasks like integrating the process with some legacy application. However, in real life IT personel is often already involved in the process modelling phase and stays involved right to the end when the business process is put to use.

2.2.3 Business process automation and control

BPM optimises document and information flow between participants in the process in order to enable them to do their work without interruptions and thus achieve company's business goals. Business process can be organised traditionally, based on paperwork, or it can be partly or fully automated. A modern business process runs on BPMS, because such systems provide a better platform to optimize and/or automate business process (Kovačič, Bosilj Vukšić, 2005). Therefore business process automation is business process renovation by means of process informatisation which in turn provides a starting point for process optimisation and/or automation of process activities.

The main feature of BPMS is the ability to automize business processes. As mentioned in one of the previous sections BPMS is a merge of Workflow Automation and Enterprise Application Integration. BPMS greatly reduces lag time between a pair of activities in business process. Some business process analysts estimate that the share of lag time in whole business process execution time can be as big as 90% (Khan, 2004). Only 10% of business process execution time is actually used for meaningful activities. Business process automation greatly reduces the share of lag time, mainly because document and information flow is quicker.

What happens if we halve the lag time? Lag time could be halved by just automating the business process. BPMS also enables a simpler way of delegating tasks to another employee when the primary assignee is, for example, on vacation. That too lowers the share of lag time in business process execution time. If we start with the assumption that the lag time is 90% of whole business process execution time, then by halving it we achieve a 45% reduction in business process execution time as shown on figure 1.

savings 45%   lag time 45%   task time 10%
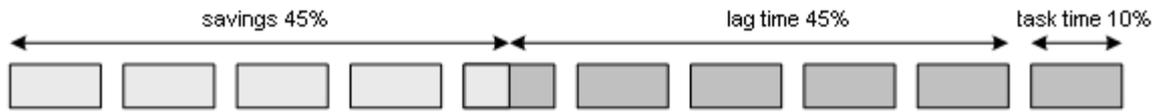
Source: Khan, 2004

Figure 1: Reduction of business process execution time when lag time is halved

By automating a business process some activities can become completely automated and are performed by some application. With the advent of Service Oriented Architecture (SOA), web services have become the preferred way to integrate business processes with information systems. Business process automation also offers a perfect opportunity to optimize business processes and to connect company's business processes with client's and other partner's business processes – again SOA makes that easier.

BPMS also offers greater control over process execution and the ability to change company's process in a quicker and more efficient way. With the use of BPMS it is very easy to know who and when performed a certain activity. All currently running instances of the business process can be monitored and if needed changes can be done to them. BPMS can also create proactive warnings when, for example, an employee is about to miss the deadline to finish his task. Those warnings enable process owner to act in time. Together with reports this gives a lot of information on how to further improve the business process. It is needless to say that BPMS offers much greater control over business process as this is the case with business processes that are built into an application (e.g.: ERP, CRM, SFA, etc.). Business processes based on paperwork don't even stand a comparison.

2.2.4 A common view on all data related to business process

BPMS offers a common view to information, including data like emails, faxes, paper forms and electronic forms (Russell, 2005). BPMS is a platform that connects all parts of a business process into entirety. Data stored in various disparate applications in company is accessed from an electronic form within business process. Each non-automated activity in business process is associated with a form which is used by the user to access all data he needs in order to complete his task. Therefore a user has a common view on all data related to his task. BPMS can therefore be seen (see figure 2) as a connection layer between various applications used by the company.
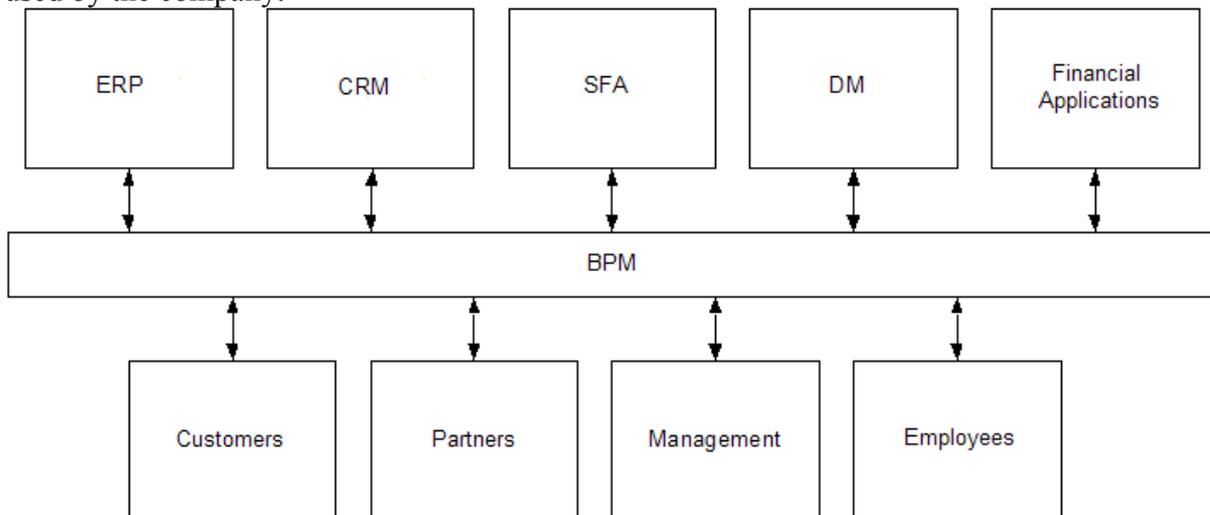
Source: Khan, 2004

Figure 2: BPMS as a connection layer between various applications

2.2.5 Enterprise application integration

BPMS uses open standards to achieve interoperability and ease of integration with applications (Russell, 2005). Some current BPMS have started their lifes as EAI systems. Using BPMS for EAI has several advantages (Khan, 2004):
1. no more custom made integrations,
2. a standard way to integrate applications,
3. no need to change interfaces when a change has been made to an application,
4. standard interfaces makes it easier to replace an application with a new one,
5. EAI offers the possibillity of fully automated business processes.

Even a few years ago, most EAI systems had it's own standards for application integration. Nowadays integration is mostly done by using web services. The buzzword is Service Oriented Architecture (SOA). The advantage of web services are open standards on which web services are based. Those standards are: Simple Object Access Protocol (SOAP), Extensible Markup Language (XML), Web Service Description Language (WSDL) and Universal Description, Discovery and Integration (UDDI). The results of a research made by Delphi Group (Delphi Group, 2002) showed that 14% of companies are already developing solutions based on web services that will integrate them with partner's information system, 8% are planning to open their information systems to partners with the use of web services and 33% of them uses web services to integrate internal applications. Zhao and Cheng believe that web services have the following positive effects when used in conjunction with Business Process Management (Zhao, Cheng, 2004):
1. Connection effect; web services can be used to request a service from an application or to start a business process. This is the most basic function.
2. Architectural effect; simplification of EAI. BPMS architecture is simplified due to the fact that only one standard is used to integrate applications.
3. Infrastructural effect; web services provide various services that may be, with help of BPMS, used in business processes.

2.2.6 Analysis of business process execution

Business process execution analysis helps to understand the performance of business process and thus ensures the attention of process owner in order to meet the business goals (Russell, 2005). BPMS offers various measurements such as: the number of active business process instances, costs related to a specific instance of business process, the number of active tasks, costs of each activity, availability of resources, activities that are running late etc. (Khan, 2004).

Additional reports can be defined for each business process. Those reports enable process owner to monitor how the business process meets business goals. Business Activity Monitoring (BAM) gives process owner the necessary tools to establish, for example, which activities in the business process are causing bottlenecks, are very expensive, where the employees have a very high workload etc.

One of the explanations for BPM acronym is Business Performance Management (McGregor, 2004). BPM therefore ensures that process owner has the means to monitor and act upon unsatisfactory results. Business process should be continually improved to meet and possibly even exceed business goals.

3   USE CASE

The methodology used in this case was Ultimus Workflow Development Methodology (UWDM) (Ultimus, 2001). The first step of business process automation is the Workflow Needs Analysis. After the analysis has been done it is time to establish priorities – business processes that need to be automated first. There is no need to automate all company's business processes in one push. When the priorities are known it is time to prepare "to be" business process models and detailed functional specification for these business processes.

This section describes a case of business process automation in a small company. In total the company has chosen to automate eight of their business processes. Those business processes are: Mail processing, Invoice payment, Business travels, Procurement, Supply, Tender participation, Custom application development and User support. In the continuation I'll describe Mail processing business process in detail.

Company receives mail every working day. Incoming mail is of different categories, such as invoices, documents related to tenders on which company takes part, documents related to various projects etc. The business process starts immediately after mail arrival. An authorized employee takes over the mail, which takes a couple of minutes. The mail is then reviewed and sorted by a the same employee, who is the only one in company with appropriate authorization to do this. His responsibilities are to keep records about all incoming mail and take care of archiving scanned invoices in company's collaboration and communication system. It takes him from 1 to 2 hours to complete this task for 10 mails. Due to employee's other responsibilities this activity also has a lag time of 1 to 2 hours. Finally, the mail is delivered to end recipients. When the recipient is not present he or she receives an email notification of received mail. Delivery takes cca. 15 minutes. With the completion of this activity the instance of business process ends. Current "as is" business process model is shown on figure 3.
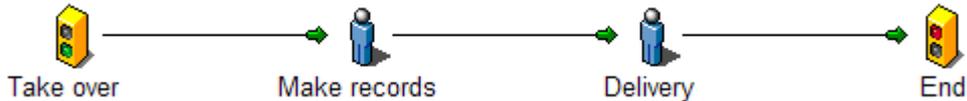

Figure 3: "As is" business process model for Mail processing

The current business process has several downsides. First, the information about who and when took over the mail is not recorded. The name of mail's end recipient is also not recorded. If the mail gets lost there is no way to determine where and when the mail has last been seen. Lag time duration in activity "Make records" is also a source of concern. Furthermore, this activity requires a lot of time for invoice scanning and archiving. Not surprisingly this activity owns the biggest share of time in whole business process execution time. End recipients should always be notified of received mail and email sending in this case could be automated. Finally, but not least important: everything is done by a single person.

Based on those weaknesses a proposition for new business process has been made. Business process has been breaken down to two processes. The first one – Mail processing – is the main process, in which take over, invoice scanning and delivery takes place. "To be" model for this business process is shown on figure 4.
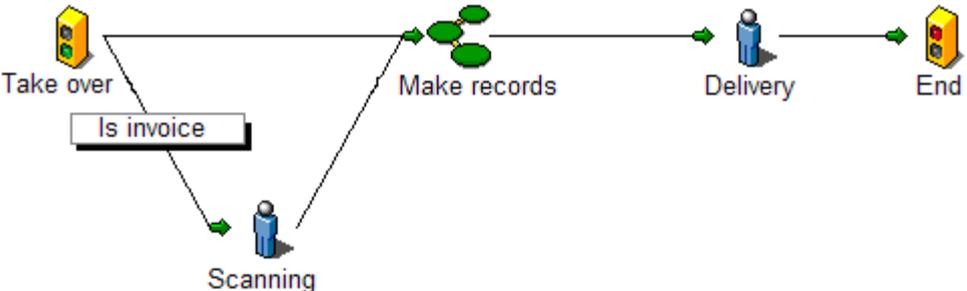

Figure 4: "To be" business process model for Mail processing

The main process triggers subprocess Make records for each mail. This subprocess takes care of making records, invoice archiving, end recipient email notification and, in case of invoice, starts Invoice payment business process. Corresponding "to be" business process model is shown on figure 5.
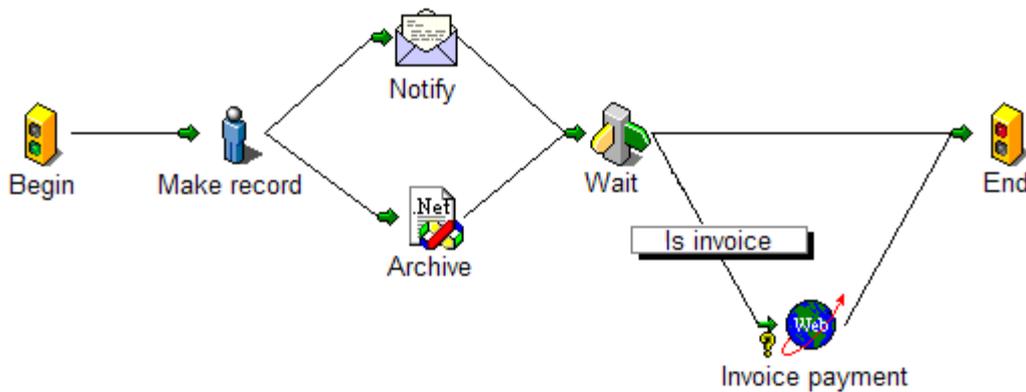
Figure 5: "To be" business process model for Make records

Activity "Take over" now requires to enter date of reception from employee. By doing that the employee actually starts the automated business process. Any employee can now start this business process. Activity duration has not changed compared to old business process. Invoice scanning is now an independent activity and is usually performed by the same employee that took over the mail. The intention behind making it independent was to remove some workload from the employee who did everything in the old business process. Scanning takes on average about 30 minutes. The consequence of this change is also shorter duration of activity "Make record" in subprocess Make records. This activity now takes only two thirds of the time needed to process one mail in old business process. Lag time is also reduced to two thirds of previous time. Subproces Make records is started for each received mail. Email notification and invoice archiving have been automated. Beside invoice scans basic data about other mail is stored in collaboration and communication system, too. As a final touch automatic start of Invoice payment business process has been added to the new business process. Delivery in Mail processing process takes place after all Make records subprocesses have been finished.

Next Discrete Event Simulation (DES) was used to compare "as is" and "to be" business process models. The following assumptions were used for simulation of "as is" business process:

1. results are computed as an average of 100 executed instances of the business process,
2. only one instance of the process starts each working day,
3. on average 10 mails arrive each working day,
4. 10% of mails are invoices,
5. "Take over" activity's duration is uniformly distributed between 1 and 5 minutes,
6. "Make records" activity's duration is uniformly distributed between 1 and 2 hours,
7. "Make records" lag time duration is uniformly distributed between 1 and 2 hours,
8. "Delivery" activity's duration is uniformly distributed between 10 and 20 minutes,
9. employee's hour costs 5.900 SIT.

The first six assumptions were the same for simulation of "to be" business process model as well. But the following six assumptions were different to the previous simulation:

1. subprocess Make records is started 10 times,
2. "Scanning" activity's duration is uniformly distributed between 15 and 45 minutes,
3. "Make record" activity's duration is uniformly distributed between 1 and 10 minutes,
4. "Make record" lag time duration is uniformly distributed between 3 and 9 minutes,
5. employees who perform "Take over" and "Scanning" activities cost on average 4.200 SIT per hour,
6. employee who performs all other activities costs 5.900 SIT per hour.

Table 1 shows comparison between results of both simulations.

		"As is"	"To be"	Diff.	% Diff.
Take over	Elapsed time [min]	2,94	2,91	0,03	0,97
	Costs [SIT]	289,3	203,9	85,4	29,50
Scanning & Make record (together)	Lag time [hrs.]	1,50	0,99	0,51	34,21
	Elapsed time [hrs.]	1,50	0,96	0,54	36,29
	Costs [SIT]	17.708,4	11.166,5	6.541,9	36,94
Delivery	Elapsed time [min.]	14,88	14,96	-0,08	-0,56
	Costs [SIT]	1.463,3	1.471,5	-8,2	-0,56
Total	Elapsed time [hrs.]	3,30	2,24	1,06	32,05
	Costs [SIT]	19.461,0	13.055,5	6.405,4	32,91

Table 1: Comparison between the results of both simulations

The times in activities "Scanning" and "Make record" were added together to make the comparison easier. Based on the results we can conclude that "to be" business process model is faster than "as is" business process model by 32,05%. The costs are lower by 32,91%. Most of the time and cost savings are due to shorter lag and elapsed time in activities "Scanning" and "Make record". Other activities don't have a significant influence on the results.

The benefits of automated business process do not stop here. Now the process owner is able to determine who took over the mail on a certain day and who was the final recipient of the mail. That simplifies many other things as, for instance, trying to find a specific mail. All applications that were used in the old business process were integrated into the new business process. And finally, as in the case of starting Invoice payment process, the company has the option of starting other business processes (like Tender participation) from Mail processing process in a similar way.

The third phase of the project – Detailed Workflow Design – is here finished. The next phase is Workflow Implementation and after that Workflow Maintenance. The phase in which the business process continually evolves. But that is a subject for another article

3.1   Return on investment

The company will need to buy licenses for BPMS. Estimated time needed to complete the automation of eight business processes is 6,56 man-months. Time and cost estimates for each phase of the project are shown in table 2. As mentioned, the methodology used was Ultimus Workflow Development Methodology (UWDM) (Ultimus, 2001). Estimated total costs of the project are 18.582.800,0 SIT (Slovenian tolar). Estimated maintenance costs per year are 1.008.000,0 SIT.

	Duration [days]	No. of people	Costs [SIT]
1. Workflow Needs Analysis			
1.1. Determine project goals	15	1	504.000,0
1.2. Determine development strategy	15	1	504.000,0
2. Project Discovery			
2.1. Analyse of "as is" process models	30	1	1.008.000,0
2.2. Functional specification preparation	30	1	1.008.000,0
2.3. Project plan preparation	15	1	600.000,0
3. Detailed Workflow Design			
3.1. Modeling of "to be" process models	30	1	1.008.000,0
3.2. Detailed specification preparation	30	1	1.008.000,0
3.3. Test plan preparation	15	1	504.000,0
4. Workflow Implementation			
4.1. Implementation	60	2	3.264.000,0
4.2. Testing	30	2	2.016.000,0
4.3. Production roll out	15	1	504.000,0
5. Workflow Maintenance			
5.1. Maintenance (yearly)	30	1	1.008.000,0
Total work costs	315	4	12.936.000,0
BPMS license costs			5.000.000,0
Unexpected costs (cca. 5% of total project value)			646.800,0
Total costs			18.582.800,0

Table 2: Time and costs estimates for each phase of the project

Automated business processes will cut costs by 20.878.106,0 SIT each year. Savings per each business process are shown in table 3.

	Mail processing	1.537.306,1
	Invoice payment	1.702.088,2
	Business travels	717.892,8
Yearly savings per business process	Procurement	2.286.337,8
	Supply	894.732,6
	Tender participation	1.259.783,0
	Custom application development	2.296.204,7
	User support	10.183.760,7
Total yearly savings		20.878.106,0

Table 3: Savings per each business process

The company will, after the investment pays off, save 19.870.106,0 SIT per year (yearly savings minus costs of maintenance). The investment will pay off after a bit more than eleven months. That can be calculated with the use of ROI formula as shown below.

$$ROI = 0 = \frac{(years * savings - investment)}{investment} \rightarrow years = \frac{investment}{savings} = 11,22 \; months$$

4 CONCLUSION

As showed in the article, business process executes faster when using BPMS. Undoubtelly lag time has an important role in speeding up the business process. In the example shorter lag time contributed to final improvement nearly as much as improvements to activities. Inevitably shorter execution time leads lower execution costs. A small share of cost reduction is also due to lower labour costs in "Mail reception" activity.

As said, BPMS has EAI capabilities, which enables company to keep their existing IS. And by doing that the company avoids unnecessary application rewrites etc. In the particular

example described in this article the existing collaboration and communication system is integrated into new business process. EAI can be done in a variety of ways, but nowadays the preffered way to do it is the use of web services.

BPMS greatly improves the control over business process execution. All data about activities such as start time, end time, assignee etc. is stored and available for later review. Data that is directly associated with business process can be stored, too. For example mail type, mail recipient, etc. in our example. That gives process owners a chance to create and analyse various reports about business process execution.

Making changes to business process is a relatively easy task in BPMS. In it's simplest form it is just a simple change to business process model. Some changes though, can require some coding – such as integration of another legacy application into business process. Nevertheless, the control over business process has now shifted towards the hands of management. IT personnel often does not have the necessary business know how to make changes to business process. By being able to change business process more quickly the company is able to adapt to changes more quickly. This is nowadays of paramount importance in the ever tougher battle for customers.

5 LITERATURE

1. Daneu Aleš : Vpliv managementa poslovnih procesov na poslovanje organizacije. Magistrska naloga. Ekonomska fakulteta Ljubljana, 2006. 79 pages.
2. Delphi Group : BPM2002 : Market Milestone Report. A Delphi Group White Paper, 2002.
3. Graham Ben B. : Article – Classic Process Improvement. Work Simplification : From Bricklayer to Microcomputer. Business Process Management Group, 15.7.2005. [URL : http://www.bpmg.org/downloads/Articles/BenBGraham_ProcessImprovement.pdf]
4. Khan Rashid N. : Business Process Management. A Practical Guide. Meghan-Kiffer Press, 2004. 334 pages.
5. Kovačič Andrej, Bosilj Vukšić Vesna : Management poslovnih procesov. Prenova in informatizacija poslovanja. GV Založba, 2005. 488 pages.
6. McGregor Mark : The Three "M"'s of BPM. Business Process Management Group, 15.7.2005. [URL : http://www.bpmg.org/downloads/McGregorsView/mcg_sideways0404.pdf]
7. Russel Steve : Six Critical BPM Capabilities Close the Loop for Success. KMWorld.com, 13.8.2005. [URL : http://www.kmworld.com/publications/magazine/index.cfm?action=readarticle&article_id=1978&publication_id=126]
8. Sharp Alec, McDermott Patrick : Workflow modelling : tools for process improvement and application development. Artech House Inc., 2001. 196 pages.
9. Smith Howard, Fingar Peter : Business Process Management – The Third Wave. Meghan-Kiffer Press, 2003. 292 pages.
10. Ultimus Inc. [URL : http://www.ultimus.com]
11. Welch Rick : Bull or Bear, Business Process Management Drives Productivity and Reduces Costs. KMWorld.com, 13.8.2005. [URL : http://www.kmworld.com/publications/magazine/index.cfm?action=readarticle&article_id=1354&publication_id=77]
12. Zhao J. Leon, Cheng Hsing Kenneth : Web services and process management: a union of convenience or a new area of research? Decision Support Systems 40, 2005. pages. 1–8.