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# Improvement of Company's Performance Through Information Technology Infrastructure Library (ITIL) Methodology

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**Abstract:** In the study, researchers are trying to find a way to minimize the costs of IT-department and make the research more efficient. For that purpose ITIL methodology were used. In general, ITIL methodology can be applied to any entity regardless of its size, type and industry. Thus, processes have been automated in the company LLP "Delta-K". In of the economic crisis, there is now a growing interest in the implementation of processes in accordance with the methodology of ITIL and ITSM. To implement the project, the following processes have been selected: incident management process, configuration items management, change management process, user interaction and problem management processes. At this stage, processes were selected because they are the most necessary processes for the IT department. ITIL may be very useful, however, it is not a ready-to-use methodology, it does not have detailed process maps, does not provide (and cannot provide actually) any working instructions. Instead, ITIL focuses on the best practices that can be applied in different areas depending on the needs of the organization. It provides a framework for streamlining the methods already used in the company. That is why, each project of ITIL recommendations implementation is unique and has its own novelty as it applies to a unique organization. The results achieved allows IT department of the organization to provide timely support for service requests and new business initiatives: implement changes and maintain the stability of the current research as well as reduce the risks associated with them. In addition, availability of the documents that describes the work management processes, performance indicators for the processes helps to ensure that the services are delivered on best-practice basis. The methodology developed assumes continual improvement of the services. The study once again shows that the modernization of IT structures in accordance with ITIL guidelines ensures the stability of IT services in modern conditions of strict control of investments in IT from the point of rapidly developing businesses. As a result of the implemented measures, it becomes possible to make adjustments in strategic goals of the enterprise, to strengthen interaction between the enterprise as a whole and IT departments. Moreover, it gives the opportunity to form a progressive corporate culture of the company.

**Key words:** Service management, process, implementation, incident, benefits, methods

## INTRODUCTION

Actuality and real business' interest of processes' implementation, according to ITIL and in IT service management itself is increasing now a days also because of the economic crisis (Klosterboer, 2008). It is time when many companies, quite unexpectedly, along with the scarcity of their allocated budgets began to feel the new requirements of leadership in the form of the need for expense reports and information about the expected returns on investment in IT resources.

Currently, the financial situation in our country and in the entire world is also unstable. The methodology is useful actually for all kinds and sizes of enterprises. And for this reasons, ITIL is very relevant today (Ball, 2005). ITIL is not a new idea, it is a tool widely used in European companies but it just starts to develop in our country.

Methodology for Information Technology Infrastructure Library (ITIL) is a library of best management decisions which provides important knowledge to practical activities of IT-specialists. ITIL is widely recognized around the world. New technologies should be created due to changes in the global business environment and the increasing demands of customers. The first experience of systematization of knowledge in

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the field of computer systems belongs to IBM which released a four volume book in 1980 (Weill and Ross, 2005). In 1985, Edward Van Schaik published a book called "A Management System for the Information Business". In this book for the first time, the basic elements of ITIL were set out. Further, the agency British Central Computer and Telecommunications (CCTA) published a collection of 31 books called the Government Information Technology Infrastructure Management Methodology (GITMM). The aim of the development of these books has been the effective use of IT-resources in public institutions of Great Britain. Later, this collection was called ITIL. A second revised version of ITIL consists of seven main and two additional books (Iqbal *et al*., 2007). The latest version of ITIL V3 appeared in 2011. It consists of five main publications that contain management methodology IT-services. ITIL gives you access to the best international practices of service management (Cannon, 2011). In the context of dynamic market, organization with a traditional hierarchical structure inferior to more flexible organizations with less hierarchical structure. In organizations, the right decision goes to the lower levels. Relations between the various elements of ITIL are based on the conceptual terms such as organization, quality and service (Van Bon, 2005).

Application ITIL methodology allows to increase the efficiency of IT departments, stimulates the development of new processes, enhances setting new goals of an organization and also promotes the growth of a business (Rob, 2009). The most commonly used processes of the ITIL methodology were recognized as a separate concept of Information Technology Service Management (ITSM). The ITSM makes more emphasis on satisfaction of customer needs, it means that ITSM is a model of quality management of IT services (Taylor *et al*., 2007b). ITIL processes have a high level of abstraction, so it is difficult to identify a unique relation between daily tasks solved by IT specialists and ITIL processes (Valiente *et al*., 2012). ITIL methodology is descriptive, not prescriptive in nature. This means that there is no indication in ITIL which of the processes to be used in reality, as the sequence in which they must be performed, there is no detailed description of the operations implemented in daily activities of the enterprise. Best practices are concentrated in ITIL that can be applied in different spheres depending on the needs of the organization (Case, 2007). Each project implementation of ITIL is unique, since every company has its own characteristics. In general, ITIL methodology can be applied to any entity regardless of its size, type and industry.

ITIL processes are the basis for the company, it is necessary to determine what we in the beginning and what should be the output (Fhillips, 2010). With help of the ITIL processes in the organization can be effectively managed. For a particular company, acceptable processes should be designed with built-in improvement (Taylor *et al*., 2007a). Practically, in any IT department there implicitly exist ITIL processes. Using ITIL leads to standardization and structuring of services. ITIL focuses on the provision of services not on the technology forming these results (Hunnebeck, 2011). The main purpose of ITIL is to build mutual understanding between the supplier and the customer to success service management (Orand, 2011).

According to the company, the majority of companies seeking to reduce IT costs, since the maintenance of IT departments is not cheap (Glem, 2013). Some organizations spend more than half a million dollars on the introduction of new mechanisms for providing IT services. At the same time, a real businesses are concerned with expected return on investment in IT resources. In of the economic crisis, there is now a growing interest in the implementation of processes in accordance with the methodology of ITIL and ITSM (Orta *et al*., 2014). Because, the complexity and diversity of IT services is increasing from year to year, ITIL methodology is relevant today. More than 10,000 organizations around the world have been certified for compliance with the methodology ITIL. These include organizations such as Procter and Gamble, Washington Mutual, Southwest Airlines, Hershey Foods and the Internal Revenue Service. For the moment, there are about 40 companies that have been certified in accordance with the international standard ISO/IEC 20000-1:2005 (Mesquida *et al*., 2012) in a single registry organizations in Russia and the CIS countries. But in our country, the use of ITIL is just beginning to develop and only a few companies passed such a certification.

Analysis of the situation on the market shows that about 75% of IT departments today works only as providers of IT services, their activities are focused exclusively on the technological development of IT services as a whole and not in the context of a particular company. At the same time, companies want to use cost-effective IT services that meet their individual needs and characteristics and that can help them solve key business problems (Rosa *et al*., 2012).

Based on the statistical results for the implementation of ITSM processes in large corporations, we can say that the economy of the enterprise budget on IT resources can be from 10-80%, even without taking into account the

increase in the company's profits. Analysis made by IT process institute shows clear benefits of implementing ITIL processes. Below are the data from a research which show a significant increase in the quality of IT services:

- More requests solved by phone (30-50%)
- Faster requests completing (20-40%)
- Less incidents due to proactive approach of problem management (up to 80%)
- Faster development of the IT infrastructure (up to 50%)
- CMDB usage, growth of completing requests inside the SLAs (28%)
- Central database of changes, increasing level of successful changes (11%)

The list of the potential benefits and advantages of the enterprise that integrates processes ITSM are given below:

- The coordination of the business and IT purposes
- Reduction of costs due to reengineering of business processes
- Increase of competitiveness in the market
- Increase of users' satisfaction level
- Optimization of use of various internal resources
- Increase of an overall employees' performance
- Increase of reliability and availability of crucial IT resources
- Opportunity of making management decisions basing on trustworthy information.

At the moment, we are continuing to work on the problem management process and release management which are also blocks IT support services. To the release management process management and distribution of software and hardware is related which is supported by the IT department. There is much work that should be done such as the layout and configuration of releases, policy development in relation to releases, deployment planning releases, testing, acceptance releases, etc. (Howard, 2010).

The main objective of the project is to develop a methodology to implement processes that comply with ITIL, for the needs of a particular organization. To achieve the objective, the following task were performed: examination of the current state of the organization's IT infrastructure, identification and analysis of existing problems in the IT department of the company.

## MATERIALS AND METHODS

**Methodology of implementation:** The transition to a service-oriented IT Model is rather complex and to facilitate good software should be used. On the basis of regulations of ITIL other service management tools have been developed. One of the examples is MOF (Microsoft Operations Framework) designed by Microsoft Corporation. The other one is HPSM: HP Service Management used by Hewlett-Packard (Yvonne, 2010). To implement the project, the following processes have been selected: incident management process, configuration items management, change management process, user interaction and problem management processes. At this stage, processes were selected because they are the most necessary processes for the IT department. Implementation plan is presented in the form of turn-based action sequences with a detailed description and an indication of when and who should perform it. The following are some of the proposed and used stages of implementation.

First of all, the current situation in IT department has to be extensively analyzed. The processes maturity has to be estimated. In order to speed up the process, Microsoft Operations Framework self-assessment tool can be used. It provides a user with a set of questions which are aimed to determine different processes level of maturity. It helps to understand better the issues that organization's IT department currently face and even gives some advices based on MOF which can be used to solve the issues. The maturity levels have been evaluated and commented in Table 1. Then, based on an evaluation of maturity levels, we determined the order of priority of the process. Based on Table 1, we selected processes with high impact and low estimates of maturity.

The IT department should work closely with the business to identify the most important processes for the business that are necessary for implementation. Therefore, we once again held a coordination of business objectives and IT department.

In this step, selected processes were described and all the requirements and strategy were developed. For each process the main objectives and key success factors were identified, for the first phase, the inputs and outputs of processes, resources for the implementation process as well as the sequence of processes. We then assessed, the possible risks. Develop process maps: they shouldn't be detailed too much; however, it should be clear for everybody involved in the processes what to do in which cases. Develop key performance indicators for each of the processes. Only KPIs which are actually measurable must be used.

Selection and implementation of application systems: if the processes are fully designed and documented in the form of detailed ITIL process flows, their actual implementation can be initiated. Software for the IT

Table 1: Measurement Of ITIL processes maturity levels

| Process name | Level of maturity (5 is maximum, 1 is initial) | Level of impact on IT services (5 is high, 1 is lowest) | Comments |
|---|---|---|---|
| Incident management | 2 | 5 | There is registration of incidents, however not all the information is recorded, no performance reporting |
| Problem management | 1 | 5 | Only initial steps are done in this area. Problems are not registered and not linked to incidents |
| Change management | 2 | 5 | Request for changes are signed when making changes that have a significant impact, have process for standard change but there is no processes for emergency changes |
| Release management | 1 | 3 | Only initially developed, no standard procedure |
| Configuration management | 2 | 5 | Have a CMDB in Excel spreadsheet, updated manually |
| Service level management | 1 | 4 | Some services are defined but mostly there are no SLAs and OLAs |
| Financial management | 3 | 4 | Quite well maintained but there is no standard process |
| Capacity management | 3 | 4 | Resources are planned for short, medium and long term business requirements |
| Availability management | 2 | 4 | The availability is not measured |
| IT service continuity management | 3 | 4 | Risks are not seriously measured, however good backup and disaster recovery plans have been developed and work |
| Service desk function | 3 | 5 | There is a service desk function, however second and third lines are not properly defined |

infrastructure governance should be considered primarily as help to support the methodology and its automation.

Implementation phase: description of the plans, testing and initial usage of the processes developed, corrective actions in order to have processes aligned with the business.

Operational; training of specialists and testing. It is necessary to pay attention at testing due to the ideology of the 3rd version of ITIL, main aim is to provide quality IT service, and not only restoring failed services. Therefore, the quality of the services should be high. All process participants must be made familiar with the new processes. So, IT staff should receive thorough training in order to be able to apply the new processes in practice and clients or users might need to be informed in so far as these are affected by the new ITIL processes. It is necessary to mention that all the steps have been documented and described and got approval from the business. Also, it is necessary to take notice of the continuity and repetition of the steps as one of the main ideas of ITIL is continual service improvement. So, when the most necessary processes were implemented, we have switched the attention to other processes.

Measurement results have led to some modifications in the plans and objectives of the company which led to an adjustment of strategic objectives. In particular, changes were made with provisional time-bound borders respectively to the situation. Also issues related to the proportionality of the results of the estimated costs were discussed.

**Description of processes in IT department:** ITSM implementation has been carried out by stages and at each stage in the framework of the project one or more processes were implemented. We have not tried to implement several processes simultaneously, as this could lead to violations of conflict and resentment staff and it would be difficult to adjust the integration between processes. That is why, those which are most necessary at the moment were selected: change management process, incident management process, configuration items management, user interaction and problem management processes.

**Incident management process:** As a result of incident management implementation, we expected to see fastest results which were to be seen by end users. Moreover, we have assumed that it would facilitate the implementation of the following processes. Incident management enables to categorize and track various types of incidents (such as service unavailability or performance issues and hardware or software failures) and to ensure that incidents are resolved within agreed on service level targets. Aim of this process is to restore normal service operation as quickly as possible and minimize the adverse impact on business operations, thus ensuring that the best possible levels of service quality and availability are maintained. Incidents are prioritized based on impact and urgency:

- Impact is based on the scale of actual or potential damage to the customer's business
- Urgency is based on the time between the incident being detected and the time that the customer's business is impacted

Roles in incident management are incident manager, service desk and configuration manager. Details for this process are described in Fig. 1.

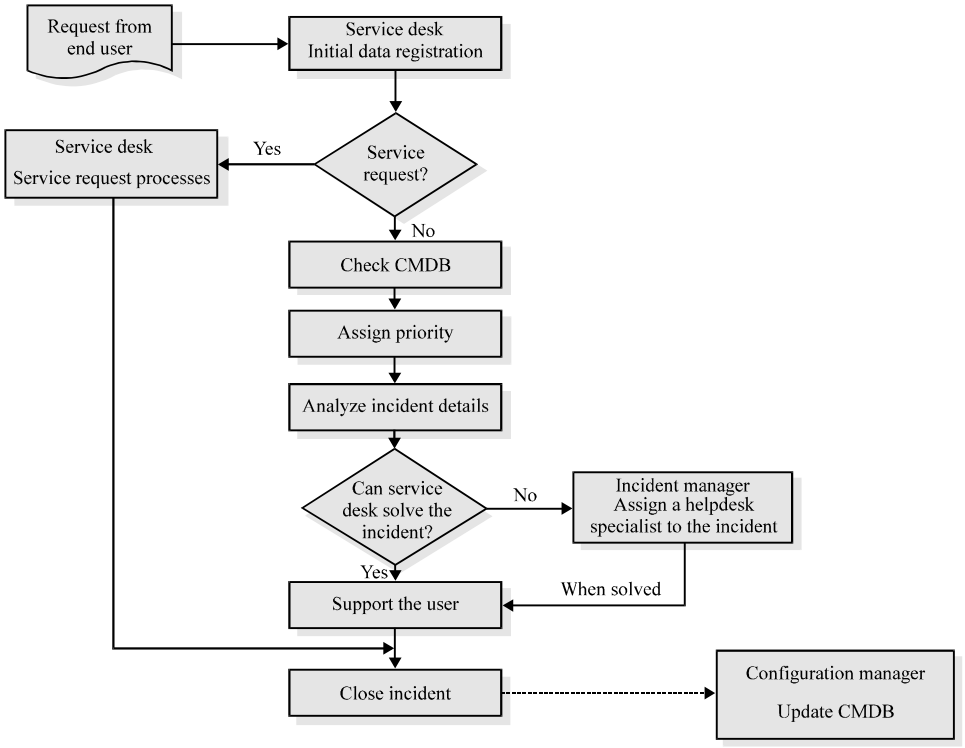


Fig. 1: Incident management process general description

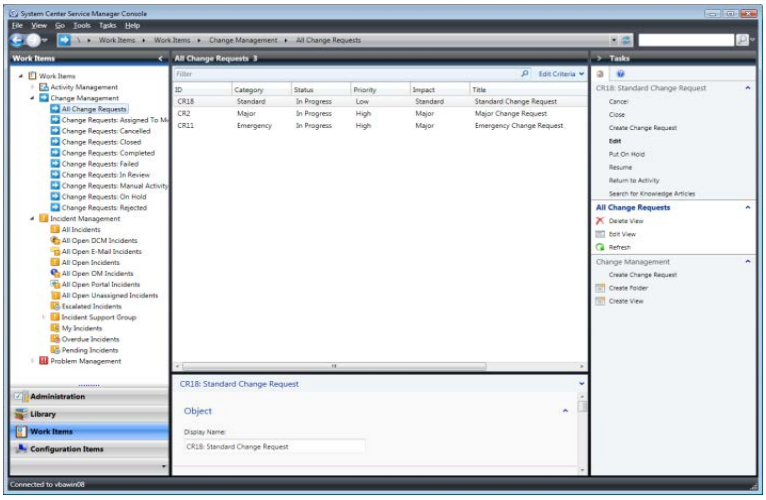

Fig. 2: Microsoft system center service manager 2010 change management

**Change management process:** Change management process is described in ITIL Service Transition Book. ITIL change management approach deliver direct benefit to the bottom line for the business by delivering early realization of benefits (or removal of risk) with saving of money and time. The objective of the change management process is to ensure that changes are registered and then evaluated, authorized, prioritized, planned, tested, implemented, documented and reviewed in a controlled manner. Details for the change management process are described in Fig. 2.

The change management process main aim is to manage and control changes that modify the organization infrastructure. This includes assets such as network environments, facilities, telephony and resources. Change management enables to control changes to baseline

service assets and configuration items across the entire service life cycle. Its idea is to enable beneficial changes to be made with minimal disruption to IT services. Changes are recorded and then evaluated, authorized, prioritized, planned, tested, implemented, documented and reviewed in a controlled manner. Change management objectives are achieved by rigorous adherence to the process steps. The change management process includes the activities necessary to control changes to service assets and configuration items across the entire service life cycle. It provides standard methods and procedures to use when implementing all changes (Fig. 2). The change management process should be focused upon the following core objectives:

- Efficient and error free implementation of changes to assets and processes
- Minimizing the level of service disruption

There are several different types of changes:

- Standard change: ITIL defines a standard change as "a change to the infrastructure that follows an established path is relatively common and is the accepted solution to a specific requirement or set of requirements"
- Emergency change: An ITIL emergency change is the highest priority change that can be defined in an organization. Emergency changes are defined as changes that need to be evaluated, assessed and either rejected or approved in a short space of time
- Change which is not emergency and not standard

## RESULTS AND DISCUSSION

**Economical results:** Existing IT management processes are performed by IT staff: IT manager, system administrator and engineer for security and administration. To implement the one of the ITIL processes, for example "Problem Management" requires hiring at least one more staff member who will serve as the problem manager. The ITIL process is one of the most expensive because it requires hiring skilled professionals (serious analysts who have high qualifications in several areas of IT). According to it, the cost of implementing the process will consist of monthly salary of the problem manager, the cost of equipping his workplace with hardware and software equipment. The cost of monthly maintenance of "Problem Management" process will consist of the salary of problem manager on the challenges and costs of changes in the IT infrastructure required to problem solving (buying a more powerful server, software upgrades, hardware upgrades). But, such costs are difficult to calculate, so in Table 2 are given the cost of implementing this process.

Within successful implementation of this process, the cost (time and material) to resolve incidents has to be significantly decreased. The main emphasis is placed precisely to prevent the problem by preventing incidents. Of course, the economic effect of implementing this process can only be seen over time (from 5-6 months). It significantly reduced downtime of users, respectively the saving of the cost of downtime of users is significant. A sample calculation (for average values) of costs for each sub process is provided in Table 3. Below Table 4 shows detailed expenses on incident management process.

Almost all methods for calculating cost-effectiveness based on the performance of investments invested in the project (Addy, 2010). We can conclude that implementation should take place in stages, investing entirely in the whole project pointless, since it may be necessary to stop the project. After the selection of indicators we must calculate: for labor costs; the absolute reduction in labor costs given in Eq. 1:

$$\Delta T = T_0 - T_1 \quad (1)$$

Where:

$T_0$ = Labor costs for processing information on the base case

$T_1$ = Labor costs to process the information on the proposed option

Table 2: The costs of implementing "problem management" process

| Costs | Amount (tenge) |
|---|---|
| Salary of problem manager | 2,00000 |
| Workplace | 1,50,000 |
| Hardware | 1,00,000 |
| Software | 50,000 |
| Total | 3,50,000 |

Table 3: Summary table of costs for the process of "problem management"

| Subprocess name | Cost per1 day | Cost per 1 time | Cost per 1 year |
|---|---|---|---|
| Prevention of problems | 3300 | 27500 | 825000 |
| Control of problem | 5320 | 11500 | 1330000 |
| Control of errors | 5320 | 11500 | 1330000 |
| Total for process | 13940 | 50500 | 3485000 |

Table 4: Expenses on incident management process

| Names of expenses | Amount |
|---|---|
| The cost of downtime of hardware (tenge $h^{-1}$) | 2,750 |
| The cost of downtime of IS (tenge $h^{-1}$) | 3,750 |
| The cost of downtime of software (tenge $h^{-1}$) | 4,250 |
| The cost of downtime of telecommunication (tenge $h^{-1}$) | 4,750 |
| The cost of downtime of DB (tenge $h^{-1}$) | 3,000 |
| The cost of downtime of server (tenge $h^{-1}$) | 5,750 |
| The company's IT department staff | 10 |
| The average salary of IT specialist | 1,10,000 |
| The number of work places in company | 200 |
| The average number of requests by incidents | 40 |
| The cost of servicing a work place in a month | 2,100 |
| Hour of work is a specialist | 600 |
| The costs of software in a month | 5,000 |
| The cost of the hardware | 25,000 |

Coefficient of relative decline in labor costs (Eq. 2):

$$K_T = \Delta T/T_0 \times 100\% \quad (2)$$

The index to reduce labor costs and increase productivity (Eq. 3):

$$Y_T = T_0/T_1 \quad (3)$$

And as for cost expenses: an absolute reduction of cost expenditure (Eq. 4):

$$\Delta C = C_0 - C_1 \quad (4)$$

Where:

$C_0$ = Cost the cost of information processing in the base case

$C_1$ = Cost the cost of processing the information on the proposed option

Coefficient of relative decline in labor costs (Eq. 5):

$$K_C = \Delta C/C_0 \times 100\% \quad (5)$$

The index to reduce labor costs and increase productivity (Eq. 6):

$$Y_C = C_0/C_1 \quad (6)$$

And then calculate the payback period (Eq. 7):

$$T_{Payback} = K_P/\Delta C \quad (7)$$

Calculation of cost-effectiveness of the project. Based upon the Eq. 7 above, we have made the following calculations given in Table 5. And, then try to calculate the target and current performance: and then try to calculate the target and current performance:

$$T_0 = 22\text{day} \times 11\text{month} \times ((50\text{req} \times 3\text{ min})/3\text{person}) = 12100$$

$$T_1 = 22\text{day} \times 11\text{month} \times ((30\text{req} \times 3\text{min})/3\text{person}) = 7260$$

Now, we calculate the absolute reduction of costs using (Eq. 1):

$$\Delta T = T_0 - T_1 = 12100 - 7260 = 4840\text{min}$$

Next, calculate the overall index lower labor costs:

$$Y_T = T_0/T_1 = 12100/7260 = 1.67$$

Table 5: Summary table of performance indicators

| Indicators | Existing | Planned to achieve |
|---|---|---|
| Number of requests designed for the wrong month (assigned to the wrong or lost in the process of approval) | 15 requests | 0 |
| Time to register a single request by hand | 3 min | 1 min |
| Time for approval of one request | From 20-50min | 10-15 min |
| Number of requests processed in a mailbox on the day | 50 messages | 30 messages |

This index shows that the rate of labor costs were significantly improved by implementing ITIL processes. There are five employees, operators in the IT department. With such a high ratio of cost reduction as well as paying attention to the increasing number of clients by implementing may reduce the staff to three people. Salaries of each office employee is 100000 tenge a month, so you can get the cost figures on the costs of processing the information on this operation:

$$C_0 = 12 \times 6 \times 100000 \text{ tenge} = 7200000 \text{ tenge year}^{-1}$$

$$C_1 = 12 \times 4 \times 100000 \text{ tenge} = 4800000 \text{ tenge year}^{-1}$$

Now we calculate the absolute reduction in cost of expenses:

$$\Delta C = C_0 - C_1 = 2400000 \text{ tenge year}^{-1}$$

Next, calculate the total index value lower costs:

$$Y_C = C_0/C_1 = 7200000/4800000 = 1.5$$

The main indicators are the indicators of time and labor costs for operations. To calculate the cost-effectiveness, we compared two types of indicators. Factors that were at the beginning stage of the project, the base case and those indicators which will be achieved through the implementation of this project, the proposed option.

## CONCLUSION

Main target of the project was to analyze, improve and optimize the work of IT department according to ITIL best practices. In order to achieve it, it was necessary to develop methodology and processes description which should meet the business cases for different scenarios.

It is a universal truth that it is impossible to improve something if you cannot measure it. This is the main

cause why different metrics, or KPI (Key Performance Indicators) used to measure the processes quality, had to be developed. ITIL bases on continual improvement of the services and processes. Metrics serve to check whether they satisfy business needs what and how can be improved.

Proved the potential benefits and advantages to a particular enterprise in which methodology ITIL implemented. At the moment new models of IT services were developed, processes have been automated in the company LLP "Delta-K". A variety of ways of managing organizational change were reviewed. When using the tools major gaps were identified and have been modified to improve the overall performance of the department. Stages of implementation of new processes for IT department's long-term perspectives were proposed.

The results achieved allows IT department of the organization to provide timely support for service requests and new business initiatives: implement changes and maintain the stability of the current work as well as reduce the risks associated with them. In addition, availability of the documents that describes the work management processes, performance indicators for the processes helps to ensure that the services are delivered on best-practice basis. The methodology developed assumes continual improvement of the services. In the development of the IT department, we assume a gradual implementation of the recommendations of ITIL. The ultimate goal of these reforms is improving the stability and quality of information service, since they are important determinants of business performance.

## REFERENCES


Addy, R., 2010. Effective IT Service Management to ITIL and beyond, Sprynger, pp: 342.

Ball, E., 2005. ITIL: What It Is and Why You Should Care. Global Knowledge Network, pp: 18.

Cannon, D., 2011. ITIL Service Strategy 2011 Edition, TSO (The Stationery Office). 2nd Edn. Published for the Office of Government Commerce (OGC), pp: 469.

Case, G., 2007. IT Management Consultant and Pink Elephant. ITIL V3: Where To Start and How To Achieve Quick Wins. Pink Elephant. http://www. ngi-library.nl/Player/eKnowledge/itil_v3_where_to_start_how_to_achieve_quick_wins.pdf.

Fhillips, J., 2010. IT Project Management: On Track from Start to Finish, 3rd Edn., pp: 640.

Glem, O.D., 2013. Forrester Research official site. Research page: https://www.forrester.com/The+State+And+Direction+Of+IT+Service+Management+2012+To+2013/fulltext/-/E-res86722.

Hunnebeck, L., 2011. ITIL Service Design 2011 Edition, TSO (The Stationery Office). 2nd Edn. Published for the Office of Government Commerce (OGC), 456 p.

Howard, D., 2010. ITIL Release Management: A Hands-on Guide, CRC Press, pp: 344.

Iqbal, M., M. Nieves, Sh. Taylor, 2007. ITIL v3. Service Strategy, TSO (The Stationery Office), Published for the Office of Government Commerce (OGC), pp: 373.

Klosterboer, L., 2008. Implementing ITIL. Configuration Management. IBMPress, pp: 264.

Mesquida, A.L., A. Mas, E. Amengual, J.A. Calvo-Manzano, 2012. IT Service Management Process Improvement based on ISO/IEC 15504: A systematic review, Information and Software Tehnology, 54 (3): 234-247.

Orand, B., 2011. Foundations of IT Service Management with ITIL 2011, CreateSpace Independent Publishing Platform. 2nd Edn., pp: 346.

Orta, E., M. Ruiz, N. Hurtado and D. Gawn, 2014. Decision-making in IT service management a simulation based approach. Decision Support Syst., 66: 36-51.

Rosa, D.M.M., N. Gama and M.M. da Silva, 2012. A Method for Identifying IT Services Using Incidents. Eighth International Conference on the Quality of Information and Communications Technology, pp: 172-177.

Rob, E., 2009. Owning ITIL a skeptical guide for decision makers.

Taylor, Sh., D. Cannon and D. Wheeldon, 2007a. ITIL V3. Service Operation, pp: 396.

Taylor, S., S. Lacy, I. Macfarlan *et al.*, 2007b. ITIL V3. Service Transition, pp: 399.

Valiente, M.C., E. Garcia-Barriocanal and M.A. Sicilia, 2012. Applying an ontology approach to IT service management for bussines-IT integration. Knowledge-Based Syst., 28: 76-87.

Van Bon, J., 2005. Foundations of IT Service-Management: based on ITIL. 2nd Edn. Van Haren Publishing, pp: 231.

Weill, P. and Ross, J., 2005. IT Governance: How Top Perfomers Manage IT Decision Rights for Superior Results. Harvard Business Press, pp: 269.

Yvonne, B., 2010. HP Service Manager 9.20 Best Practices Guide, 2010. Hewlett-Packard Development Company.