Measurement of Service Effectiveness and Establishment of Baselines

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Abstract: - In this paper the concept of the measuring service effectiveness focusing on customer-defined quality, continual improvement, employee empowerment, and measurement-based management and feedback is described. Metrics must be developed based on the priorities of the strategic plan, which provides the key business drivers and criteria for metrics. We will define these metrics and relevant information for their evaluation and establishment of measurement criteria. The most difficult part in implementation of this approach is consolidation. Described framework will captures relationship between business and IT service and will identify quantitative technique for establishing baselines and discovering possible losses during deployment of processes.

Key-Words: - service management lifecycle, service operation, balanced scorecard, strategic objectives

1 Introduction

IT Infrastructure Library (ITIL) is the most widely accepted approach to IT service management in the world today. It provides platform that can be used to leverage complementary effects between IT and business resources thereby enhancing the value of IT for business purposes. The main goal of ITIL framework is to align IT services to business needs and to business processes. Business process can be defined as a set of logically related tasks performed to achieve business outcome. On the other end according to ITIL process is defined as a connected series of actions, activities, changes etc, performed by agents with the intent of satisfying a purpose or achieving goal.

Current ITIL version is based on the Service Lifecycle stages that rely on processes to execute each element of the practice in a consistent, measurable, repeatable way. It contains five elements: Service Strategy, Service Design, Service Transition, Service Operation and Continual Service Improvement.

There are two main interfaces and communication channels between business presented by customer/user and IT service support presented by service provider. The first one is through customer service level requirement which results in agreed service level agreement. The second one is through user incident reports which result in incident resolutions and recover of service. All other process inside ITIL are invisible to user and customer, regardless of ITIL version adopted inside service provider.

It is very important to identify eventual bottlenecks in processing user incident request, and quantify the complexity and total resources cost to incident resolution.

Some authors [19] rely on categorical classification of individual complexity:

-Execution Complexity characterized by the number of tasks, roles involved in tasks and decision complexity as a sub-category

-Coordination Complexity caused by level of coordination between roles

-Business Item Complexity is referring to provide data into service process

These frameworks are facilitating into establishment of proper performance key indicators for particular process and establishing required comparison against established baseline.

It is also important to establish some modelling method in order to analyze behaviour and eventually simulate any exceptional cases. In this way we are creating proactive component of process making service provider more effective and efficient.

Figure 1 displays two main interfaces and communication between business and IT services and main actors in service management processes.

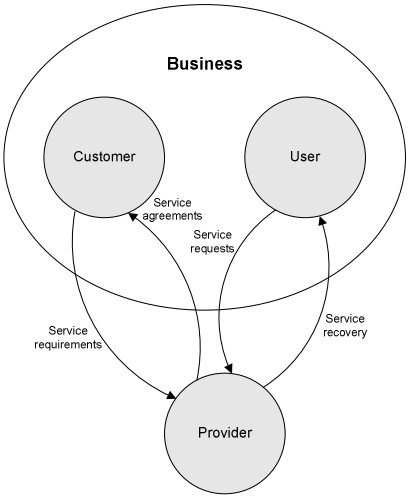

Fig.1. Business and IT service

To identify the process it is not enough to know only that interruption of telecommunication services has been occurred; incident or problem has been registered to system and escalate to proper group; request for service with low-risk nature has been raised by user; or particular type of access has been requested. It is also important to better understand all process inside element of Service Lifecycle and according to that identify are all actors performing in accordance to their particular role using adequate authority, is the process performed in expected phases and is it finished in expected time, is the legitimate procedure taken into consideration, etc. The criterions of the quality in the performing of the activities are efficiency of the realization (finishing activity as soon as possible), effectiveness of the realization (achieving the aim under existing constraints) and regularity of the action performance (according to regulated norms) [16]. If these elements are carefully evaluate it is possible to gain real metrics and degree of successfulness of operations. We want to establish linkage between information technology (IT) and business processes (BP) to use right metrics and evaluation criteria. To do this we will borrow concept of business process from the four Balanced Scorecard perspectives: a) financial, b) customer, c) internal operation and d) innovation and growth. The Balanced Scorecard is complementary to ITIL.

In this paper we will present how Balanced Scorecard can be used to measure the effectiveness and efficiency of the Service Operation as the part of the ITIL Service Lifecycle. The Balanced Scorecard approach focuses on including customer-defined quality, continual improvement, employee empowerment, and measurement-based management and feedback. Metrics must be developed based on the priorities of the strategic plan, which provides the key business drivers and criteria for metrics. We will define these metrics and relevant information relevant and present how degradation in the information technology service level can effects violation of service level agreement (SLA) and causes losses to the business. The next section gives review of related work. Next, the Service Operation as the set of IT process is described, and the Balanced Scorecard concept is presented to tie these processes with business and organization strategy. At the end the impact of processes on ITIL performance is estimated using quantitative techniques from management science. The result is a quantitative approach for allocating IT resources to reduce potential loss.

2 Related Work

There is research effort on more general planning aspects for IT that are not limited to IT service management focused on alignment of IT and business. One example [8] propose framework that includes the planning of and setting goals for IT, and the evaluation of results, integrated with the business context. By investigating the benefits and limitations of the framework, and comparing them with other common frameworks, it concludes that the Balanced Scorecard can be a valuable contributor to implementation of an integrated business and IT planning and evaluation process.

The way of developing autonomous IT management decision and get the best value for business from IT service is discussed in [11]. By embedding operator and user level policies in resource models, specifications of composite resources may be automatically generated to meet multiple and varied requirements. It describes a model for automated policy based construction of complex environments and poses the policy problem as a goal satisfaction problem that can be addressed using a constraint satisfaction formulation.

The paper [12] introduces a new paradigm, which focuses on self-optimization according to high-level business objectives such as maximizing revenues. It replaces the more traditional optimizations that are based upon IT measures such as resource availability. A general, autonomous process is defined to enable such optimizations, and a set of technologies and methodologies is introduced to support the implementation of such a process.

IT investments are discussed by many authors. One of these approaches [13] analyzes unsuccessful efforts to implement ERP tools that have resulted in massive financial failures and corporate process disarray for many organizations. Various financial techniques a presented that can help organizations to select the right projects and better manage the implementation of enterprise systems with key practices in the fields of financial management and quantitative analysis.

The approach in [14] is very similar to the one here. It proposes usage of financial loss functions to estimate the impact that IT Service Level Agreements (SLAs) have on business process performance. The obtained result is a quantitative approach for SLA objective setting and investment allocation in order to improve business results. This approach can be served as decision support for investment policies within an ITIL Financial Management for IT Services context.

3 Service Operation

ITIL provides a comprehensive and consistent set of best practices for IT service management, promoting a quality approach to achieving business effectiveness and efficiency in the use of information systems. ITIL V 3.0 was published in 2007 recombining the best practice in IT service management according to the life cycle theory. It changed service management from linear and static implementation to a multidimensional and dynamic system which emphasizes feedback.

In this article we will focus on the Service Operation and will map it into Balanced Scorecard elements. That will facilitate process of identifying performance using each of the four elements of Balanced Scorecard and identifying possible losses.

Service Operation is the phase in ITIL Service Management Lifecycle that is responsible for business-as-usual activities. Processes and tools supporting this element of Lifecycle should enable an overall view of delivery rather than just the separate component such as hardware, software, applications and networks that make up end-to-end service from business perspective.

There are five processes inside the Service Operation that must link together to provide an effective overall IT support structure. These processes are [6]:

Event Management - monitors all events that occur through the IT infrastructure, to monitor normal operation and to detect and escalate exception conditions.

Incident Management - focuses on restoring the service to the users as quickly as possible in order to minimize business impact.

Problem Management – involves root-cause analysis to determine and resolve the cause of events and incidents, proactive activities to detect and prevent future problems/incidents and a Known Error sub-process to allow quicker diagnosis and resolution if further incident occurs.

Request Fulfilment – deals with the Service Requests from the users.

Access Management – this process grant authorized users the right to use a service, while preventing access to non-authorized users.

Processes alone are not enough for effective Service Operation. There is a need for specific groups that fall into four main functions:

Service Desk – primary point of contact for users in the case of service disruption.

Technical Management – provides technical skills and resources that are necessary for to support ongoing operation of the IT infrastructure.

IT Operation Management – executes the daily operational activities that are needed to manage IT infrastructure. It has two functions that are unique and are generally formal organizational structure. These are:

- IT operational control
- Facility Managment

Application Management – managing different application throughout their lifecycle. It is usually divided into departments based on the application portfolio of the organization, allowing easier specialization and more focused support.

It is of paramount importance to monitor and control services. The measurement and control of service is based on a continual cycle of monitoring, reporting and subsequent action. Regarding control the most common model is the Monitoring Control Loop. Figure 2 shows how different norms, that can be also from class of normatively regulated activities [16] position towards control and monitor of particular activity inside the process.

Service measurements and metrics should be used to drive decision. Depending on what is being measured the decision could be strategic, tactical or operational. Another key use of measurement and metrics is for comparison purposes.

Comparing and analysing trends against service levels targets or an actual Service Level Agreement is important as it allows for early identification in service quality.

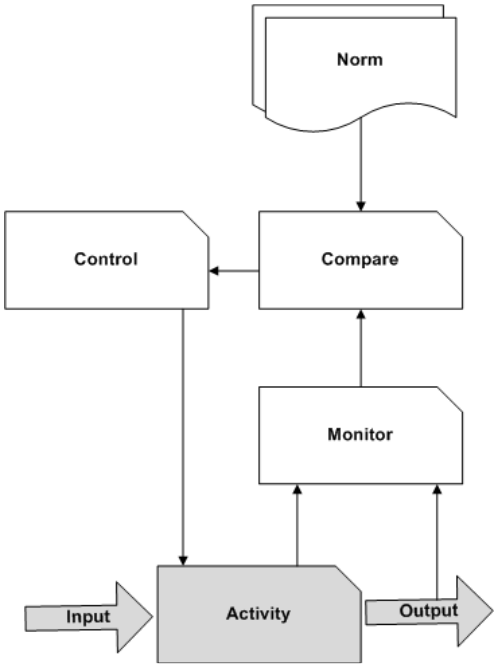

Fig.2. The Monitor Control loop

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4 Incident Management

Each of the ITIL Service Support processes is maintaining its key artifacts and controlling their lifecycle. Table 1 shows artifacts and related processes.

Artifact	Process
Service calls	Service Desk (function)
Incident records	Incident Management
Problems and Known Errors	Problem Management
Configuration Items	Configuration Management
Change request	Change Management
Software or hardware releases	Release Management

Table 1. Service support processes and their artifacts

In our paper we will describe also Incident Management process and lifecycle of incident in one telecom service provider. Incident has identification in the system as incident record, and many actors have different responsibilities during its lifecycle.
Today IT environments are generally very complex and distributed. Some incidents can cause undesirable and costly effect on business. Incident Management ensures that users can access services which they require to support their business. This process is structured, dynamic, predefined, multi-person and automated centric.

To utilize resources in better way provider in our use case engaged skilled service desk. Service desk (SD) operators have basic knowledge to deal with any telephone or Internet problem if it has been already recorded in incident knowledge database (IKDB). IKDB is the integral part of service provider configuration management database CMDB.
Operator can be aware of incidents by monitoring tools or be informed from user by e-mail or by phone. Each incident has to be recorded into system. After incident collection operator is responsible to manage incident furthermore using guidelines about knowing incidents and knowledge base. Operator can, according to type of incident escalate to Tier2 support, or resolve and close the incident.

We will formally present processes in the call centres. To be familiar with one of these activities we will present only one segment of operation in the service call centre, which is incident management. The activity is very complex and we will only describe the most substantial part. Call centre is responsible for continuous monitoring of data and communication links of organization and registration of any incidents. Main tasks are:

-monitoring systems using available monitoring tools

-receive call from user

-receive mail from user

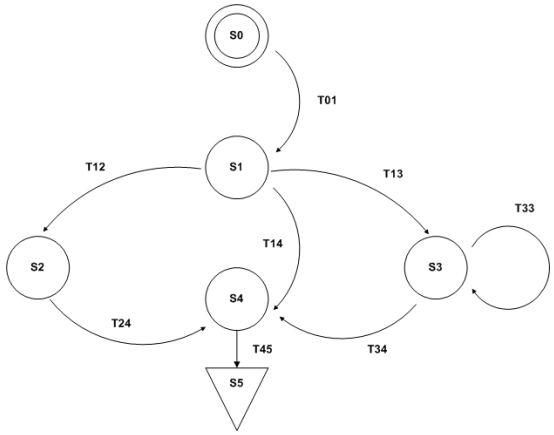

Fig. 3: Activity Diagram for Incident Management.

According to described model of incident management and implemented formal model we can

give the following statement: S={S0,S1,S2,S3,S4,S5}

State S0 is start state and it is initiated by occurrence of incident. The rest of the states related to figure 3. can be expressed as:

State S1 "Registered Incident",

State S2 "External Support",

State S3 "Assigned Incident",

State S4 "Incident Resolved",

State S5 "Incident Closed"

States in organizational activities are generally defined by a set of information accumulated by transition into that sate. States in our activity defined not only by informative content of state but also with perfomative content of state:

Informative content of state presents complete set of the information accumulated by performance of the activity till that state. It is determined by new information content in the action, which precedes that state. This can be documents (incident record, configuration item record) and data (type of incident, serial number). If there are more sequences of the actions that are led to the same state, then each of them generates different set of the information i.e. different information structure.

By some action normative contest can be changed, new roles or new role holders can be established. That is expressed in perfomative content of state, which is not further discussed in this paper. Distinction between informative and performativne content of state activity reflects distinction between "objective world" and "social world", as it is defined by Habermas [22].

Actions related to this organizational activity are:

a10 (ServiceDesk: Collection_and_registration (type of incident, caller information, configuration item information) ON t1)

a12 (ServiceDesk: Assign_to_Tier3 (incident priority, configuration item information) ON t2)

a13 (ServiceDesk: Assign_to_Tier2 (incident priority, configuration item information) ON t2)

a33 (Tier2: Reassignment (incident update, changed configuration item) ON t3)

a14 (ServiceDesk: Resolved (incident update) ON t3)

a34 (Tier2: Resolved (incident update, IKDB update) ON t4)

a25 (Tier3: Resolved (incident update) ON t4)

a45 (ServiceDesk: Closed (None) ON t5)

Each action that is performed by actors brings some additional knowledge into given situation and also causes change of activity state. For each action there is responsible actor for bringing about the action, depending on his/her role, authority and obligations.

Operator can be aware of incidents by monitoring tools or be informed from user by e-mail or by phone. Each incident has to be recorded into system and status "assigned" is given to the incident [24].

After incident collection operator is responsible to manage incident furthermore using guidelines about knowing incidents and knowledge base. Operator can, according to the type of incident:

-reassigned incident to one of technical groups responsible for specific area

-assign to external support and to one of his own service providers

If operator manage to solve incident after it has been assigned to him, he can change status to resolved and than to closed. If he is not able to solve it after some time, he has to assign it to one of technical groups responsible for specific area or to external support.

When technical group receive assignment of incidents they can:

a) Resolve it by identifying the cause or finding the fastest workaround, status of incident is changed to "resolved". Operator is responsible to change status to "closed". This workflow allows operator to control updated knowledge base, to learn from incident collection and to be able to solve problems in the future without additional re-assigning and re-routing. Each incident has saved history that senior management can analyze further and see number of incidents that could be resolved by operator, but have been reassigned

b) Assign it to other technical group to which problem is more relevant. The other technical group than follows the same workflow as it is assigned by operator. Management can analyze later incidents history and see are there too many incidents going back and forth between technical groups.

Status of cases assigned to external support have to be monitored and updated by operator or by technical group, because external support and service provider don't have access to internal incidents records of organization. After provider send notification about resolution of problem status is changed to "solved" and than to "close". Incident has to have record with information about external number case, and solution given by provider. This

statistic allows management to keep record of incidents with particular provider.

Different statistics and analysis will help to improve business process. Some of these statistics are:

-How many times action a33 from figure 3 has been performed. Identification of high number can point to delay of incident resolution and can require control of knowledge base and competence of actors who processed the incident

-Difference in number of actions a13 and a14. Main goal is to have higher number of incident resolved by operator. This would reduce time of incident resolution and improve business process. Increase of actions a13 compare to actions a14 can indicate lack of knowledge transfer and missing updates with proper incident solutions.

To have process efficient we have to analyze performance of each action. We have to use key performance indicators (KPI) to establish measurement and baselines. With formal model we can simulate and test any of possible scenarios, and discover eventual bottlenecks.

Coordination of the process is always determined by starting the activity, assigning the tasks, remanding of the deadlines, alarming using applications or e-mail.

Control is determined by control of the process flow, process deadline, process duration, and established protocol of the behaviour [25]. Simulation process will help us to estimate:

-Service desk response time

-Effectiveness in usage of IKDB

-Accuracy of IKDB and frequency of updates in order improve service support efficiency

-Determine assignment of the right actors to the roles

-Creation of the classification of incident for the actors

-Enable selection from the classification list

-Determine optimal number of the actors

-Efficiency of the actors

-Priority for each case

-Proper complexity of the case

In our dynamic model we analyze model in order to have values shown in table 2. For each transition n#Tkm presents number of transitions during process execution.

Desired value	System improvement
n#T13 → 0	No need for escalation
n#T10 → 0	No incidents
n#T14 → n#T01	All incident has been resolved by service desk
n#T45 → n#T01	No ”lost” incidents
n#T33 → 0	Minimum reassignment of incident
n#T13 < n#T12	Most of the incident escalated to internal Tier 2 support

Table 2. Desired values and system improvements

5 Balanced Scorecard

The balanced scorecard was devised in the early 1990s by Robert Kaplan of the Harvard Business School and David Norton as a method to help companies manage complex business environments. It was observed that limitations exist in the case of relying only on financial measures, particularly in short-term financial goals. Lagging indicators conveyed past performance but did not provide good indicator of future performance. The Balanced Scorecards is a common method of tracking metrics and performing trend analysis. It helps to focus not only on financial targets but also on the internal processes, customers and learning and growth issues. Four perspective with general and ITIL key questions are as follows:

a) Perspective: *Financial*
General Key Question: To succeed financially, how should we appear to our stakeholders?
ITIL Key Question: What is the cost of IT?

b) Perspective: *Customer*
General Key Question: To achieve our vision, how should we appear to our customers?
ITIL Key Question: What do customers expect of IT provision?

c) Perspective: *Internal processes*
General Key Question: To satisfy our customers and shareholders, at what business process must we excel?
ITIL Key Question: What must IT excel at?

d) Perspective: *Learning and growth*
General Key Question: To achieve our vision, how will we sustain our ability to change and improve?
ITIL Key Question: How does IT guarantee that the business will keep generated added value in the future?

The answers to the key question become a perspective’s objectives. We can than measure performance against the objectives. Metrics

measures objectives or desired outcomes. They are quantifiable performance statements that indicate how an imitative is performing relative to its objectives. Metrics have to be:
-Relevant to the strategy
-Stated in the context of a goal to achieve in a defined time
-Capable of being tracked and owned by a person or group with the power to influence the outcome.
The four perspectives are interdependent and the relationship among them is called the Balanced Scorecard theory of business. Organizations that continuously improving their capabilities for learning and innovation achieve better performance in their internal business processes which in turn leads to more effective execution of their customer value proposition and results in competitive advantage and improve financial performance.
Organizing business processes into four classes that matches four perspectives makes easier effort to determine the impact of service incidents and violations of agreed level of Service Operation to the business processes. This framework consists of three levels presented on figure 4. It is important to emphasize that information about IT services that support business processes can be found in the configuration management database (CMDB) and can be used for development of intelligent software system.

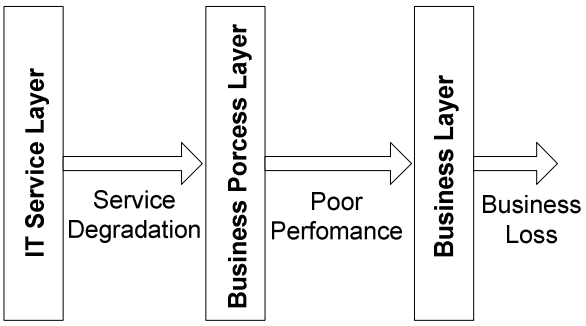

Fig. 4. IT service-Business Framework

6 Perfomance estimation

To have process efficient we have to analyze performance of each action in our process during Service Operation. We have to use key performance indicators (KPI) to establish measurement and baselines. With formal model we can simulate and test any of possible scenarios, and discover eventual bottlenecks.

Coordination of the process is always determined by starting the activity, assigning the tasks, remanding of the deadlines, alarming using applications or e-mail.

Control is determined by control of the process flow, process deadline, process duration, and established protocol of the behavior. We have to know:

-Service desk response time

-Effectiveness in usage of Incident Knowledge Database (IKDB)

-Accuracy of IKDB and frequency of updates in order improve service support efficiency

-Determine assignment of the right actors to the roles

-Creation of the classification of incident for the actors

-Enable selection from the classification list

-Determine optimal number of the actors

-Efficiency of the actors

-Priority for each case

-Proper complexity of the case

We'll need set of extended indicators to develop enough information estimation of each of factors that will belong to one of four perspectives inside Balanced Scorecard for Service Operation. Part of these indicators is presented in table 3.

We can see from customer perspective that from all the functions inside Service Operation Service Desk and SLA are the major indicators. They are two entry points how customer see the service provider, channels of communications and answer to "How do we appear to our customer". All other function and processes inside Service Operation are not directly visible to the users.

Figure 5 present one of the performance indicators for service provider we used for our case study. Reference is made during initial establishment of Service Operation during the first year of operation and implementing processes. Total number of incident stays around the same number. Our indicator is number of SLA violations that can be caused by delay in servicing call, availability of service below agreed percentage etc. Graph shows positive trend in the Service Operation. It brings provider to faster resolution time and increase of customer satisfaction.

Financial perspective	
Goals	Indicators
-Ability to control cost of Service Operation functions -Economy of Service Operation functions -Value of Service Operation functions	-Accuracy of Service Operation functions forecast -Competitiveness of service -Cost of Service Operation functions
Customer perspective	
Goals	Indicators
-Quality of Service Operation functions services -Reliability of functions -Performance of each function	-Availability of Service Desk -Decrease of SLA violations -Recovering and restore of the service
Learning and growth perspective	
Goals	Indicators
-ITIL awareness -Flexibility -Business productivity	-Improvements in business turnover -New ways of improving service -Reduction in costs ascribable to Service Operation functions
Internal perspective	
Goals	Indicators
-Incident resolution -Problem resolution -Access right resolved -Meeting operation level agreements (OLA) -Meeting SLA -Implemented standard operating procedures	-Time spent on resolution by functions out of Service Desk -Incident resolved by Service Desk -Number of problems created -Number of problems resolved -Obtained ISO 20000, ISO 27000 certifications

Table 3. Service Operation Balanced Scorecard

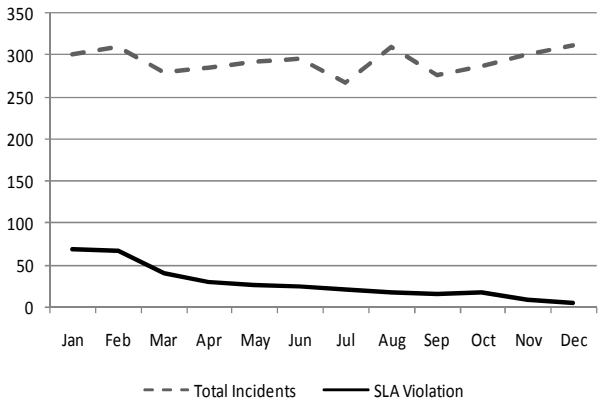

Fig. 5. Monitoring performance in Service Operation

We want to show quantitatively how each of these indicators from the table 3 contributes to total performance and produce possible loss for provider. For each indicator we can define weight factor w_k in the range from 0 to 1 according to empirical study. E.g. for "Availability of Service Desk" we will assign w_k = 0.9 and for "New ways of improving service' w_k= 0.4. We can calculate possible loss which does not have to mean only financial, but also users trust and business credibility loss:

$$Loss = \sum_{k \in I} w_k \int Atdt$$

I – Set of indicators
w_k – Weight factor
A – Total loss for wholel period

Integral is taken on the period of the time where performance indicators did not meet expected values. Cost distribution is not considered in this loss. Values of the weight factors can be determined according to specific organization structure and service portfolios.

7 Conclusion

In this paper the concept of the Balanced Scorecard applied to Service Operation is described as one example for continuous service improvement. We captured status of system through different states. We made baseline of the system through process of changes and monitoring simulation for specific action into achieving optimal weight parameter values and identified a number of decision variables sensitive to changes in input. The most difficult part in implementation of Balanced Scorecard is not

implementation, it is consolidation. We propose implementation of Balanced Scorecard on Service Operations level that consolidates all function facilitating process itself. Described framework captures relationship between business and IT service and identify quantitative technique in identifying possible losses. For each of objectives it is important to identify adequate indicators and the most propitiate weight factors. Further analysis can lead into more depth identification of all indicators and better accuracy of weight factors. We find approach useful for service provider to identify service measurement information and to set quantified objectives that have to be attained.

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