Proposal of a new model for ITIL framework based on comparison with ISO/IEC 20000 standard

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Abstract: - ITIL is the most popular framework for the management of IT services, while ISO/IEC 20000 is the first IT Service Management standard. Many today's researches from IT Service Management field are connected to the comparison of two or more frameworks or standards. The goal of this researches is to create a new universal framework or standard for the management of IT services which should be better than ITIL from 2011. This paper is based on two different measurements of the Billing system implementation: the first one is a measurement by using ITIL recommendations and the second one is a measurement by using recommendations of ISO/IEC 20000 standard. The aim is to see in which ITIL processes the result of measurement is bad, to find complementary ISO/IEC 20000 processes in which the result is good, and based on this to suggest a new model of ITIL framework for the design and implementation of the Billing system for x-play services of Telecom operator. The scientific value of this paper is a new produced ITIL framework which could be used also for some other Telecom operator's systems.

Key-Words: - ITIL 2011, ISO/IEC 20000, Billing system, Budgeting and Accounting services, Incident and Service Request Management, Problem Management.

1 Introduction

Information Technology Infrastructure Library or ITIL represents the best environment for the practice of a company which offer IT services as their main business function. ITIL poses a tool for implementing a service which one organization will be able to fully use with realization of the implementation of all the processes or partially use through the implementation of just a few of their processes which are considered to be helpful in developing their business results [6], [7], [8], [9], [10]. According to last version from 2011, ITIL has 5 life cycle stages: Service Strategy (which is responsible for the definition of the strategy of the organization) [6], Service Design (which is responsible for the definition of contracts with users and suppliers and for the definition of information security level) [7], Service Transition (which is responsible for the design and implementation of a new service) [8], Service Operation (which is responsible for handling with incidents and problems after a releasing into a production of a new service) [9] and Continual Service Improvement (which is responsible for continuous fully or partially improvement of IT services) [10].

Figure 1. shows ITIL 2011 with all 5 phases and 26 processes.

ISO/IEC 20000 is the first international standard for the IT Service Management [2], [3]. The goal of this standard is to integrate a set of 'best practises' into any business environment [1], [2], [5]. According to last version from 2011, ISO/IEC 20000 has 4 phases of processes: Service Delivery process (which are responsible for management of finances, for definition of contracts with suppliers and customers and for the definition of information security level), Relationship processes (which are responsible for the improvement of internal business processes for the management of suppliers), Resolution processes (which are responsible for handling and solving user's incidents and problems) and Control processes (which are responsible for the management of changes) [1], [4]. Figure 2. shows ISO/IEC 20000 standard with all 4 processes phases and 13 processes.

Section 2 of the paper describes previous research papers from this area. Section 3 of the paper presents test environment for the development of a new ITIL framework which is basically Billing system for x-play services of Telecom operator. Section 4 of the paper presents a methodology

which is used for measurements covered in this paper. Section 5 of the paper presents measurements for all 26 processes of ITIL framework which are done during the design and implementation of Billing system. Section 6 of the paper shows measurements for all 13 processes of ISO/IEC 20000 standard which are done during the design and implementation of Billing system. Section 7 is the comparison between measurements which are done in section 5 and section 6. Based on this comparison, it is proposed a new model for ITIL framework which covers all Telecom operator Billing systems.

2 Previous research

The most interesting paper from this research area is the paper [22]. Several frameworks and standards are included in IT management systems in many organizations. But, they are not comprehensive enough to serve as efficient IT management system. This paper proposes a new model for ITIL framework based on comparison with CobiT framework and ISO/IEC 27002 standard. This new model of ITIL framework is universal and it could be used in every company. This new model contains a set of 'best practices' from IT governance which is taken from CobiT framework and a set of 'best practises' from information security which is taken from ISO/IEC 27002 standard. This model also contains a set of metric parameters like Key Performance Indicators and Critical Success Factors which could be used for measurements for a new model of ITIL framework. Very interesting paper similar to this is [23] in which authors have developed a new 'maturity ITIL' model based on research in four different Portugal organizations. The authors developed a maturity model to assess an ITIL implementation and provide a roadmap for improvement based on priorities, dependencies, and guidelines. They also demonstrated a practical application of the proposed model with a questionnaire to assess the ITIL Incident Management process that was evaluated in 2 real world organizations. Finally, in paper [24] ITIL maturity to business IT strategic alignment is validated by Strategic Alignment Maturity model. Focusing on how ITIL covers business-IT alignment maturity criteria of the model, the maturity of ITIL strategic alignment practises is assessed which makes it possible to recognize conceptual and practical competencies of ITIL to aligning business and IT in strategic level. Applying ITIL to the strategic alignment maturity model identifies

opportunities to improvement in ITIL alignment perspective.

Previous research from this area is also the paper [19] which is based on description of differences between ITIL 2007 and ITIL 2011. This paper has shown how much is better ITIL 2011 than ITIL 2007 and in which processes from ITIL 2011 are needed corrections. Paper [16] presents a new model for ITIL which has only 6 processes during the implementation of IP Multimedia Subsystem in one Telecom operator in Bosnia and Herzegovina. This paper covers only processes from Service Transition phase. Paper [15] is very important for the measurements which are done here: this paper has showed that a good implemented ITIL process in some system is that process which is implemented with 75% recommendations. This research is done in test environment of IPTV/VoIP system of Telecom operator, and it is primary based on description of Supplier Management implementation. Paper [12] has introduced a new technique which is called Balanced Scorecard and which is today the most important technique for the measurement of ITIL implementation. Very similar technique to this technique is Gap analysis which was used as the main technique in this paper [10]. Paper [20] presents the difference between ITIL framework and ISO/IEC 20000 standard and shows what are disadvantages of ITIL implementation and in the same time advantages of ISO/IEC 20000 implementations in the same business environments. This paper is the introduction into research covered in this paper. The research covered is the continuous of previous research papers in improvement of actual version of ITIL [22], [23], [24], but also the first paper which gives a new model of ITIL framework from ISO/IEC 20000 standard.

In paper [25] is presented ITIL framework and its importance for the business today. Paper [12] presents Balanced Scorecard as the most popular technique for the measurement of ITIL processes. One similar technique which is called Gap analysis will be used in measurements in this paper. In paper [26] is described the usage of business process tools for modeling requirements on system changes. Paper [27] describes advantages of using some IT Service Management methodology or standard in the implementation of some cloud system. In paper [28] is described the spiral model development concept for one multimedia application.

3 Test environment

Telecom Operator, which Billing system is shown in this document as the test environment, has

a total of 4 packets of x-play service: Phone (it includes IPTV and VoIP), Net (it includes IPTV and Internet), Full (it includes IPTV, VoIP and Internet) and Premi (it includes IPTV, VoIP, Internet and Mobile Telephony) [16]. Services with additional charge include: Video on Demand (VoD), PayPerView (Live) and combination of VoD service and Live service (Product). Figure 3 shows the basic components of this Billing system. These components are: IPTV service and VoIP service as the main x-play service components and 3 additional components: Video on Demand, Live and Product [16].
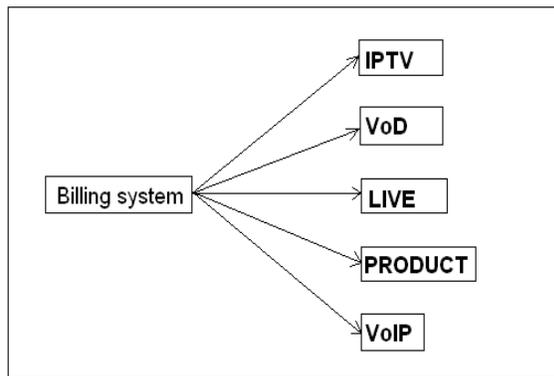

Fig. 3 - Components of Billing system for x-play services

Figure 4 presents Entity Relationship Diagram for x-play services of Telecom operator. Most important tables are signed with a red color. These tables are: table *Subscriber* which keeps all information about users, table *Cdr* which keeps information about users purchase of VoD, Live and Product contents, table *Iptvvod* which transforms data from Cdr table into final Billing tables, table *Billingvod* which makes a final consumption of VoD, Live and Product contents and finally table *Billingiptv* which makes a final consumption sum of x-play services [11], [13], [14].

4 Methodology for research

Gap analysis is a business assessment tool enabling an organization to compare where it is currently and where it wants to go in the future. This provides the organization with insight to areas which have room for improvement. This can be used to determine the gap between 'What do we want?' and 'What do we need?' for example. In last two papers [18] and [19], we have chosen Balanced Scorecard as the technique for the measurement of the implementation of ITIL processes. By using a Gap analysis technique in this paper, we want to show that this technique is also adequate for the

measurement of ITIL implementations, the same as Balanced Scorecard technique [12].

The process involves determining, documenting and approving the variance between business requirements and current capabilities. Gap analysis naturally flows from benchmarking or other assessments such as service or process maturity assessments. Once the general expectation of performance is understood then it is possible to compare that expectation with the level of performance at which the company currently functions. This comparison becomes the gap analysis. Such analysis can be performed at the strategic, tactical or operational level of an organization.

Gap analysis can be conducted from different perspectives such as [10]:
- Organization (e.g. human resources)
- Business direction
- Business processes
- Information technology.

All these perspectives are shown through Key Performance Indicators for 26 ITIL processes and 13 ISO/IEC 20000 processes in next two sections of the paper.

We will use two different parameters for measurements in this paper: Key Performance Indicators (KPI) and Critical Success Factors (CSF). Each ITIL or ISO/IEC 20000 process has a few significant KPI values which are needed for the measurement of the implementation of each process. Each KPI has an assigned value, which represents the desired value for that KPI, and which is called CSF [10]. All measurements in next two sections are done by using these two formulas:

1. *Result of the KPI implementation = (KPI Measured value/CSF)*100*, if KPI is presented by numeric value
2. *Result of the KPI implementation = CSF - KPI Measured value*, if KPI is presented by percentage value.

5 Measurements of the implementation of Billing system by using key performance indicators for ITIL framework

Table 1 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Strategy Management for IT services process. The final result shows the implementation of 80% recommendations of Key Performance Indicators for this process [6], [16], [17].

Table 1 - Key performance indicators for the process: Strategy Management for IT services

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The average number of internal factors	5	80%
The average number of external factors	8	85%
The average number of recommendations for the process: Financial Management for IT services	12	65%
The average number of recommendations for the process: Business Relationship Management	10	80%
The average number of recommendations for the process: Demand Management	6	90%
The average number of recommendations for the process: Service Portfolio Management	9	80%

Table 2 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Financial Management for IT services process. The final result shows the implementation of 70% recommendations of Key Performance Indicators for this process [6], [16], [17].

Table 2 - Key performance indicators for the process: Financial Management for IT services

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Adherence to Budgeting Process	72%	64%
Cost-/ Benefit Estimation	68%	55%
Post Implementation Review	80%	68%
Adherence to Approved Budget	82%	75%
Adherence to Project Resources	90%	77%
Proposals for Cost Optimization	85%	78%

Table 3 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Demand Management process. The final result shows the implementation of 89% recommendations of Key Performance Indicators for this process [6], [16], [17].

Table 3 - Key performance indicators for the process: Demand Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of requests for a new service by user	6000	82%
Percentage of implemented user requests for a new service	95%	88%
Number of requests for a new service from the organization	10	95%
Percentage of implemented organizational requests for a new service	15	86%
Number of requests for a new service from suppliers	45	92%

Table 4 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Portfolio Management process. The final result shows the implementation of 65% recommendations of Key Performance Indicators for this process [6], [16], [17].

Table 4 - Key performance indicators for the process: Service Portfolio Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Planned New Services	5	20%
Number of Unplanned New Services	5	40%
Number of Strategic Initiatives	4	100%
Number of New Customers	20000	75%
Number of Lost Customers	2000	90%

Table 5 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Business Relationship Management process. The final result shows the implementation of 82% recommendations of Key Performance Indicators for this process [6], [16], [17]. The best implemented Key Performance Indicator is The average of test users (86%) and the least implemented Key Performance Indicator is Percentage of satisfied users (78%). The possible improvements for this process are needed in the future.

Table 5 - Key performance indicators for the process: Business Relationship Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The average number of test users	500	86%
The percentage of completed questionnaires	90%	82%
Percentage of satisfied users	90%	78%

Table 6 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Design Coordination process. The final result shows the implementation of 88% recommendations for this process [7], [16], [17].

Table 6 - Key performance indicators for the process: Design Coordination

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The time of production of IT service design packages	20 days	98%
The number of improved IT services	2	100%
The number of created policies and procedures	8	86%
The average number of work teams for a single process	6	83%
The average time for the planning of design	8 days	74%

Table 7 shows KPIs and results of the KPIs implementation in the test environment of Billing System for Service Catalogue Management process. The final result shows the implementation of 84% recommendations.

Table 7 - Key performance indicators for the process: Service Catalogue Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The number of implemented service catalogues	6	94%
The time needed for the implementation of service catalogue	8 days	85%
The time required to maintain the service catalogue	15 days	67%
The percentage of successfully inserted content	90%	88%
The percentage of unused service catal.	95	87%

Table 8 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Level Management process. The final result shows the implementation of 81% recommendations of Key Performance Indicators for this process [7], [16], [17].

Table 8 - Key performance indicators for the process: Service Level Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Services covered by SLAs	3	74%
Services covered by OLAs	3	82%
Monitored SLAs	5	90%
SLAs under Review	2	82%
Fulfillment of Service Levels	3	85%
Number of Service Issues	7	73%

Table 9 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Capacity Management process. The final result shows the implementation of 86% recommendations of Key Performance Indicators for this process [7], [16], [17].

Table 9 - Key performance indicators for the process: Capacity Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Incidents due to Capacity Shortages	7	87%
Exactness of Capacity Forecast	12	78%
Capacity Adjustments	5	80%
Resolution Time of Capacity Shortage	12h	83%
Capacity Reserves	90%	90%
Percentage of Capacity Monitoring	99%	98%

Table 10 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Availability Management process. The final result shows the implementation of 85% recommendations of Key Performance Indicators for this process [7], [16], [17]. The best implemented Key Performance Indicator is Service Availability (91%) and the least implemented Key Performance Indicator is Number of Service Interruptions (with the percentage of the implementation of 77%).

Table 10 - Key performance indicators for the process: Availability Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Service Availability	95%	91%
Number of Service Interruptions	3	77%
Duration of Service Interruptions	3h	82%
Availability Monitoring	100%	89%
Availability Measures	5	84%

Table 11 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for IT Service Continuity Management process. The final result shows the implementation of 85% recommendations of Key Performance Indicators for this process [7], [16], [17].

Table 11 - Key performance indicators for the process: IT Service Continuity Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Business Processes with Continuity Agreements	90%	65%
Gaps in Disaster Preparation	15	78%
Implementation Duration	5 days	70%
Number of Disaster Practices	10	95%
Number of Identified Shortcomings during Disaster Practices	6	88%
Business Processes with Continuity Agreements	13	94%

Table 12 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Information Security Management process. The final result shows the implementation of 87% recommendations of Key Performance Indicators for this process [7], [16], [17]. Information Security Management defines administration roles and levels of information security in Billing system. The best implemented Key Performance Indicator is Number of implemented preventive measures (94% of successful implementation) and the least implemented Key Performance Indicator is Number of Identified Shortcomings during Security Tests (85% of successful implementation). Table 12 shows a good level of successful implemented KPIs for Information Security Management.

Table 12 - Key performance indicators for the process: Information Security Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Implemented Preventive Measures	14	94%
Implementation Duration	9 days	87%
Number of Major Security Incidents	12	85%
Number of Security Tests	20	92%
Number of Identified Shortcomings during Security Tests	5	85%

Table 13 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Supplier Management process. The final result shows the implementation of 92% recommendations of Key Performance Indicators for this process [7], [16], [17].

Table 13 - Key performance indicators for the process: Supplier Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Agreed Contracts	7	92%
Number of Contract Reviews	10	88%
Number of Identified Contract Breaches	8	95%

Table 14 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Transition Planning and Support process. The final result shows the implementation of 86% recommendations of Key Performance Indicators for this process [8], [16], [17].

Table 14 - Key performance indicators for the process: Transition Planning and Support

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The percentage of implemented plans	98%	95%
The number of IT services versions	9	86%
The percentage deviation from the expected real goals	85%	78%
The percentage of satisfied users	92%	91%
The number of reduced deviation	10	80%

Table 15 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Change Management process. The final result shows the implementation of 79% recommendations of Key Performance Indicators for this process [8], [16], [17].

Table 15 - Key performance indicators for the process: Change Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Major Changes	20	85%
Time for Change Clearance	48h	70%
Change Acceptance Rate	95%	82%
Number of Urgent Changes	25	80%

Table 16 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Asset and Configuration Management process. The final result shows the implementation of 78% recommendations of Key Performance Indicators for this process [8], [16], [17].

Table 16 - Key performance indicators for the process: Service Asset and Configuration Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Verification Frequency	7 days	84%
Verification Duration	3 days	78%
Effort for CMS Verifications	48h	90%
Automatic CMS Update	36h	68%
Number of CMS Errors	7	72%

Table 17 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Release and Deployment Management process. The final result shows the implementation of 84% recommendations of Key Performance Indicators for this process [8], [16], [17]. The best implemented Key Performance Indicator is Proportion of Automatic Release Distribution (91% of successful implemented KPI) and the least implemented Key Performance Indicator is Number of release backouts (78% of successful implemented Key Performance Indicators). The result of 84% shows that improvement for this process are possible.

Table 17 - Key performance indicators for the process: Release and Deployment Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Releases	15	82%
Duration of Major Deployments	3 days	86%
Number of Release Backouts	10	78%
Proportion of Automatic Release Distribution	12h	91%

Table 18 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Validation and Testing process. The final result shows the implementation of 81% recommendations of Key Performance Indicators for this process [8], [16], [17].

Table 18 - Key performance indicators for the process: Service Validation and Testing

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Percentage of Failed Release Component Acceptance Tests	91%	84%
Number of Identified Errors	6	74%
Time for Error Fixing	12h	90%
Incidents Caused by New Releases	10	81%
Percentage of Failed Service Acceptance Tests	86%	75%

Table 19 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Change Evaluation process. The final result shows the implementation of 73% recommendations of KPIs for this process [8], [16], [17].

Table 19 - Key performance indicators for the process: Change Evaluation

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The percentage of a new services which are released into production	80%	78%
The percentage of implemented changes which are released in the production	82%	68%
The average number of interactions with the Change Management process	30	75%
The average number of IT services that are immediately put into production	4	72%

Table 20 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Knowledge Management process. The final result shows the implementation of 84% recommendations of Key Performance Indicators for this process [8], [16], [17].

Table 20 - Key performance indicators for the process: Knowledge Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The percentage of employees who finished the training	95%	87%
The average number of trainings during one year	15	84%
The percentage of time that is reduced in the maintenance of the system	92%	90%
The number of correct action in the maintenance of the system after the training	14	75%

Table 21 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Event Management process. The final result shows the implementation of 78% recommendations of Key Performance Indicators for this process [9], [16], [17].

Table 21 - Key performance indicators for the process: Event Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The number and the percentage of events which are connected to incidents	400	78%
The number and the percentage of events which are connected to problems	30	81%
The number and the percentage of events which are connected to changes	20	79%
The number and the percentage of recurring events	12	74%
The number and the percentage of significant events for the performance	18	78%

Table 22 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Incident Management process. The final result shows the implementation of 67% recommendations of Key Performance Indicators for this process [9], [16], [17].

Table 22 - Key performance indicators for the process: Incident Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Repeated Incidents	36	68%
Remotely Resolved Incidents	95%	72%
Number of Escalations	5	65%
Incident Resolution Time	3h	80%
First Time Resolution Rate	2h	58%
Resolution within SLA	2h	58%

Table 23 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Request Fulfillment process. The final result shows the implementation of 71% recommendations of Key Performance Indicators for this process [9], [16], [17].

Table 23 - Key performance indicators for the process: Request Fulfillment

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The time resolution of requests for the service	6h	70%
Requests for services completed in accordance with the time	95%	68%
Cost of requests for the service	92%	75%
The percentage of satisfied users	90%	70%

Table 24 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Problem Management process. The final result shows the implementation of 69% recommendations of Key Performance Indicators for this process [9], [16], [17]. The best implemented Key Performance Indicator is Time until Problem identification (only 84% of successful implemented KPI) and the best implemented Key Performance Indicator is Number of incident per problem (55% of successful implemented Key Performance Indicator). The process is pretty bad implemented and the improvements are needed.

Table 24 - Key performance indicators for the process: Problem Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Problems	14	68%
Problem Resolution Time	24h	70%
Number of Incidents per Problem	7	69%
Number of Incidents per Known Problem	11	55%
Time until Problem Identification	6h	84%

Table 25 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Access Management process. The final result shows the implementation of 82% recommendations of Key Performance Indicators for this process [9], [16], [17].

Table 25 - Key performance indicators for the process: Access Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The number of requests for the access	120	86%
The number of unsuccessful applications for a daily access	14	75%
The number of unsuccessful requests for access in one year	20	78%
The number of unsuccessful requests for access in one month	2	84%
The percentage of incidents which is caused by the wrong approach	92%	89%

Table 26 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Continual Service Improvement process. The final result shows the implementation of 85% recommendations of Key Performance Indicators for this process [10], [16], [17]. Key Performance Indicator which is the most implemented is Number of Identified Weaknesses (97%), and Key Performance Indicator: Number of completed improvement initiatives is least implemented (79%). Results for this process have shown and the phase of Continual Service Improvement is pretty good implemented in this system so improvements are needed in some other ITIL phases (especially in Service Operation phase).

Table 26 - Key performance indicators for the process: Continual Service Improvement Process

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Process Benchmarkings, Maturity Assessments, and Audits	12	82%
Number of Process Evaluations	30	84%
Number of Identified Weaknesses	50	97%
Number of Improvement Initiatives	25	84%
Number of Completed Improvement Initiatives	20	79%

6 Measurements of the implementation of Billing system by using key performance indicators for ISO/IEC 20000 standard

Table 27 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Capacity Management process. The final result shows the implementation of 88% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 27 - Key performance indicators for the process: Capacity Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Incidents due to Capacity Shortages	12	98%
Exactness of Capacity Forecast	95%	62%
Capacity Adjustments	95%	90%
Resolution Time of Capacity Shortage	12h	98%
Percentage of Capacity Monitoring	100%	94%

Table 28 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Continuity and Availability Management process. The final result shows the implementation of 93% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21]. The best implemented KPI is The percentage of IT services which is implemented in compliance with the

availability and continuity plans (96% of successful implemented Key Performance Indicators).

Table 28 - Key performance indicators for the process: Service Continuity and Availability Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Availability of IT services	100%	98%
The number of service interruptions	15	95%
Duration of service interruption	6h	92%
Monitoring the availability of services	98%	97%
Measuring the availability of services	96%	88%
The number of business processes with continuity plan	18	91%
The percentage of service continuity plan which is implemented	96%	90%
The percentage of IT services which is implemented in compliance with the availability and continuity plans	99%	96%

Table 29 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Level Management process. The final result shows the implementation of 89% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 29 - Key performance indicators for the process: Service Level Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Services covered by SLAs	90%	86%
Services covered by OLAs	95%	88%
Monitored SLAs	90%	94%
SLAs under Review	90%	86%
Fulfilment of Service Levels	92%	90%
Number of Service Issues	95%	88%

Table 30 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Service Reporting process. The final result shows the implementation of 80% recommendations of Key

Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 30 - Key performance indicators for the process: Service Reporting

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The number of reports in one month	3	80%
The percentage of reports which are submitted properly	90%	84%
The percentage of satisfied managers	92%	78%
The percentage of documented processes	87%	79%

Table 31 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Information Security Management process. The final result shows the implementation of 89% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 31 - Key performance indicators for the process: Information Security Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Implemented Preventive Measures	12	92%
Implementation Duration	4 days	85%
Number of Major Security Incidents	8	78%
Number of Security Tests	6	84%
Number of Identified Shortcomings during Security Tests	10	98%
Number of Implemented Preventive Measures	8	95%

Table 32 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Budgeting and Accounting services process. The final result shows the implementation of 93% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21]. This result shows a good level of Budgeting and Accounting services process so that this process can be a replacement for some similar ITIL process. The least implemented KPI is The percentage of successfully implemented procurements (90%).

Table 32 - Key performance indicators for the process: Budgeting and Accounting services

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The average annual income	350.000.000 E	94%
The average annual expenditure	610.000.000 E	92%
The average annual earnings	150.000.000 E	95%
The average annual investment	110.000.000 E	90%
The average daily consumption and earnings	500.000 E	96%
The percentage of Increasing the budget of the organization	95%	92%
The percentage of successfully implemented procurements	98%	90%

Table 33 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Business Relationship Management process. The final result shows the implementation of 87% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 33 - Key performance indicators for the process: Business Relationship Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The average number of test users	2000	95%
The percentage of completed questionnaires	90%	84%
Percentage of satisfied users	85%	82%

Table 34 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Supplier Management process. The final result shows the implementation of 91% recommendations of KPIs for this ISO/IEC 20000 process [20], [21].

Table 34 - Key performance indicators for the process: Supplier Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Agreed Contracts	7	100%
Number of Contract Reviews	15	87%
Number of Identified Contract Breaches	10	86%

Table 35 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Incident and Service Request Management process. The final result shows the implementation of 90% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 35 - Key performance indicators for the process: Incident and Service Request Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Repeated Incidents	12	97%
Remotely Resolved Incidents	20	88%
Number of Escalations	15	91%
Incident Resolution Time	6h	88%
First Time Resolution Rate	2h	85%
Resolution within SLA	2h	90%
The time resolution of requests for the service	2h	88%
Requests for services completed in accordance with the time	95%	93%
Cost of requests for the service	95%	88%
The percentage of satisfied users	95%	90%

Table 36 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Problem Management process. The final result shows the implementation of 88% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 36 - Key performance indicators for the process: Problem Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Problems	15	87%
Problem Resolution Time	24h	85%
Number of Incidents per Problem	8	92%
Number of Incidents per Known Problem	8	90%
Time until Problem Identification	12h	86%

Table 37 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Problem Management process. The final result shows the implementation of 82% recommendations of Key

Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 37 - Key performance indicators for the process: Configuration Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Coverage of system configuration management	90%	87%
Automatic change of system configuration management	92%	85%
Number of errors in system configuration management during the period of one month	8	75%
Number of errors in the system for configuration management during the period of one year	35	82%
Number of units in the configuration of IT service	12	85%
Reduced number of incidents	95%	80%

Table 38 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Change Management process. The final result shows the implementation of 80% recommendations of Key Performance Indicators for this ISO/IEC 20000 process [20], [21].

Table 38 - Key performance indicators for the process: Change Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Major Changes	7	87%
Time for Change Clearance	12h	82%
Change Acceptance Rate	92%	84%
Number of Urgent Changes	3	67%

Table 39 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for Release and Deployment Management process. The final result shows the implementation of 86% recommendations of Key Performance Indicators for this ISO/IEC 20000 process   [20], [21]. The least implemented Key Performance Indicator is Number of reelase backouts (78% of successful implemented KPI for this recommendation).

Table 39 - Key performance indicators for the process: Release and Deployment Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Releases	15	84%
Duration of Major Deployments	5 days	90%
Number of Release Backouts	12	78%
Proportion of Automatic Release Distribution	18h	90%

7 Comparison between the implementation of ITIL framework and ISO/IEC 20000 standard

Table 40 shows the list of complementary processes of the ITIL framework in ISO/IEC 20000 standard. The list of these complementary processes is shown in book [4], in which are described differences between ITIL framework and ISO/EC 20000 standard. As we can see from this table, 14 ITIL processes has complementary processes in ISO/IEC 20000 standard. Processes from all 5 ITIL phases are placed in this table [20].

Table 40 - Complementary processes of the ITIL framework in ISO/IEC 20000 standard

ITIL process	Complementary process in ISO/IEC 20000 standard
Capacity Management	Capacity Management
IT Service Continuity Management	Service Continuity and Availability Management
Availability Management	Service Continuity and Availability Management
Service Level Management	Service Level Management
Information Security Management	Information Security Management
Financial Management for IT services	Budgeting and Accounting services
Business Relationship Management	Business Relationship Management
Supplier Management	Supplier Management
Incident Management	Incident and Service Request Management
Request Fulfillment	Incident and Service Request Management
Problem Management	Problem Management
Service Asset and Configuration Management	Configuration Management
Change Management	Change Management
Release and deployment Management	Release and deployment Management

Measurements from section 4. show that only 6 processes are implemented with the percentage of KPI implementation smaller than 75%. These processes are: Financial Management for IT services (total KPI implementation: 70%), Service Portfolio Management   (total KPI implementation: 65%), Change Evaluation   (total KPI implementation: 73%),   Incident   Management   (total   KPI

implementation: 67%), Request Fulfillment (total KPI implementation: 71%) and Problem Management (total KPI implementation: 69%). Table 41. shows complementary ISO/IEC 20000 processes for all these ITIL processes. Only Service Portfolio Management and Change Evaluation don't have complementary ISO/IEC 20000 processes. For other 4 processes (Financial Management for IT services, Incident Management, Request Fulfillment and Problem Management), we will do the same measurements as in section IV, only now we will use a set of new Key Performance Indicators. Incident Management and Request Fulfillment will be treated as the same process Incident and Service Request Management [4], [20].

Table 41 - Replacement of ITIL processes which have achieved poor results with complementary processes from ISO/IEC 20000 standard

ITIL process	Complementary process in ISO/IEC 20000 standard
Financial Management for IT services	Budgeting and Accounting services
Service Portfolio Management	No process
Change Evaluation	No process
Incident Management	Incident and Service Request Management
Request Fulfillment	Incident and Service Request Management
Problem Management	Problem Management

Table 42 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for a new process: Budgeting and Accounting services. The final result shows the implementation of 84% recommendations of KPIs for this process [20].

Table 42 - Key performance indicators for the process: Budgeting and Accounting services

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
The average annual income	350.000.000 E	80%
The average annual expenditure	610.000.000 E	84%
The average annual earnings	150.000.000 E	86%
The average annual investment	110.000.000 E	85%
The average daily consumption and earnings	500.000 E	82%
The percentage of Increasing the budget of the organization	95%	86%
The percentage of successfully implemented procurements	98%	84%

Table 43 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for a new process: Incident and Service Request Management. The final result shows the implementation of 84% recommendations of Key Performance Indicators for this process [20].

Table 43 - Key performance indicators for the process: Incident and Service Request Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Repeated Incidents	12	88%
Remotely Resolved Incidents	20	82%
Number of Escalations	15	86%
Incident Resolution Time	6h	82%
First Time Resolution Rate	2h	79%
Resolution within SLA	2h	82%
The time resolution of requests for the service	2h	90%
Requests for services completed in accordance with the time	95%	85%
Cost of requests for the service	95%	79%
The percentage of satisfied users	95%	83%

Table 44 shows Key Performance Indicators (KPIs) and results of the KPIs implementation in the test environment of Billing System for a new Problem Management process. The final result shows the implementation of 79% recommendations of Key Performance Indicators for this process [20]. The best implemented Key Performance Indicator is Problem Resolution time (81%) and the least implemented Key Performance Indicator is Time until Problem identification (74%).

Table 44 - Key performance indicators for the process: Problem Management

Key Performance Indicator (KPI)	Critical Success Factor (CSF)	Result of the KPI implementation
Number of Problems	15	79%
Problem Resolution Time	24h	81%
Number of Incidents per Problem	8	80%
Number of Incidents per Known Problem	8	80%
Time until Problem Identification	12h	74%

8 Conclusion

All these three measurements which are described in chapter VII have achieved good results according to paper [15]. Based on this, we propose a new model for ITIL 2011 framework which contains all these three processes. Changes are only present in two ITIL phases: Service Strategy and Service Operation. Processes that are placed in Service Strategy phase are now: Strategy Management for IT services, Budgeting and Accounting Services (a new process), Demand Management, Service Portfolio Management and Business Relationship Management. Processes that are placed now in Service Operation phase are: Event Management, Incident and Service Request Management (a new process), Problem Management (a new process with a new set ok Key Performance Indicators) and Access Management. A new proposed model for ITIL framework contains now 25 process (one process less than actual ITIL framework). In this new model of ITIL framework, only two processes are implemented with a less than 75% of Key Performance Indicators in the implementation of Billing system for dual play, triple play and quad play services of Telecom operator. Figure 5. shows a new model for ITIL framework.

Future research of authors in this area is connected to the improvement of ITIL framework based on comparison with other ITSM frameworks: PRINCE2 and CobiT and ITSM standards: eTOM, ISO/IEC 27001 and ISO/IEC 27002. This project is working on University of Sarajevo, on Faculty of Electrical Engineering in test environment of IPTV/VoIP service. The aim is to create a new model of ITIL framework which should contain a set of parameters from all other ITSM frameworks and standards. The aim of this model is also to increase the level of implementation of Key Performance Indicators in two rest ITIL processes which don't have complementary processes in ISO/IEC 20000 [20]: Service Portfolio Management and Change Evaluation.

Acknowledgment

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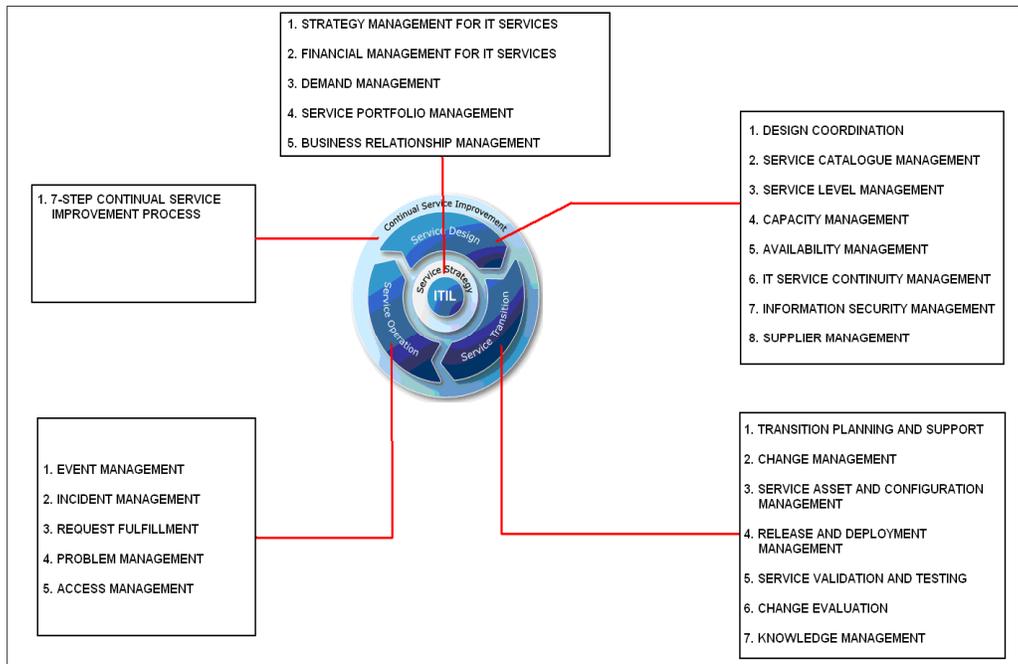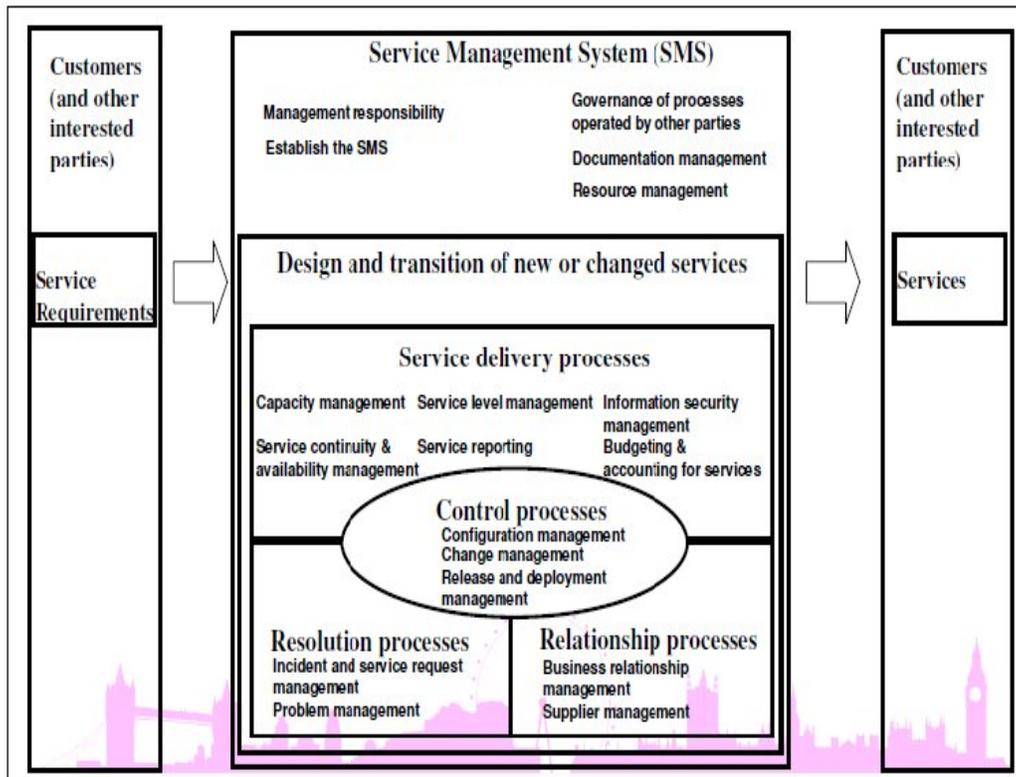
Fig. 1 - ITIL Framework
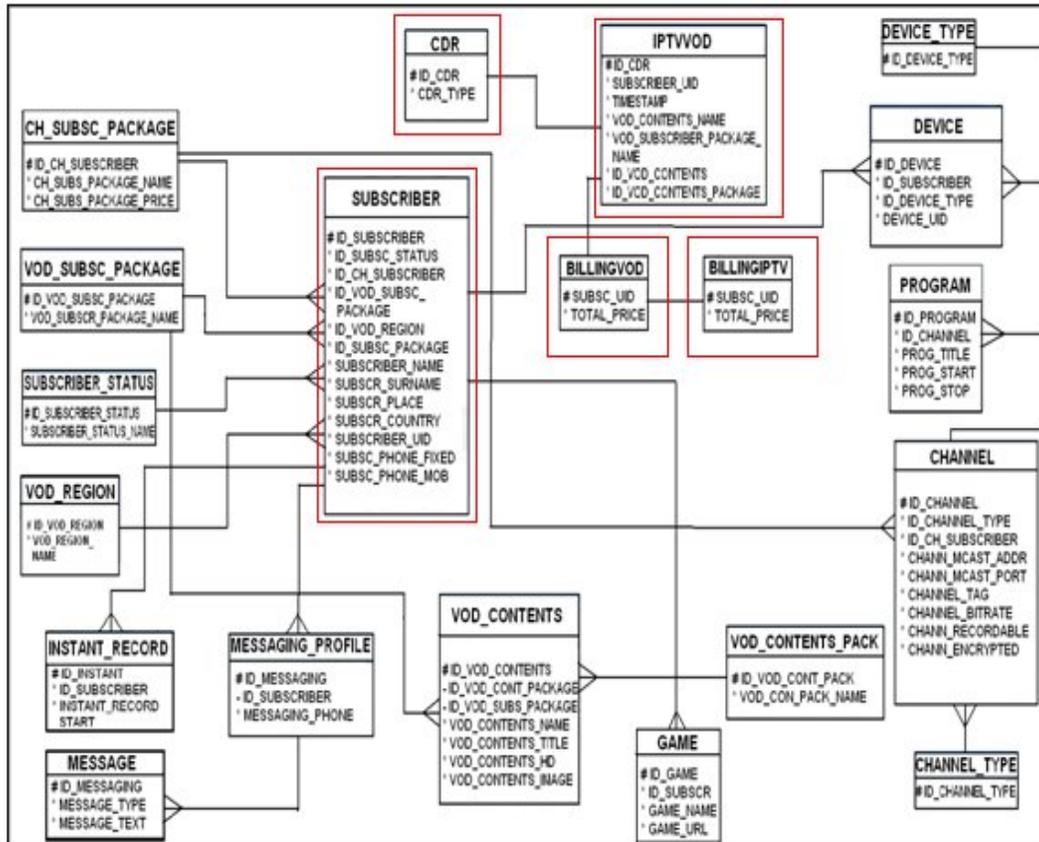

Fig. 2 - ISO/IEC 20000 standard
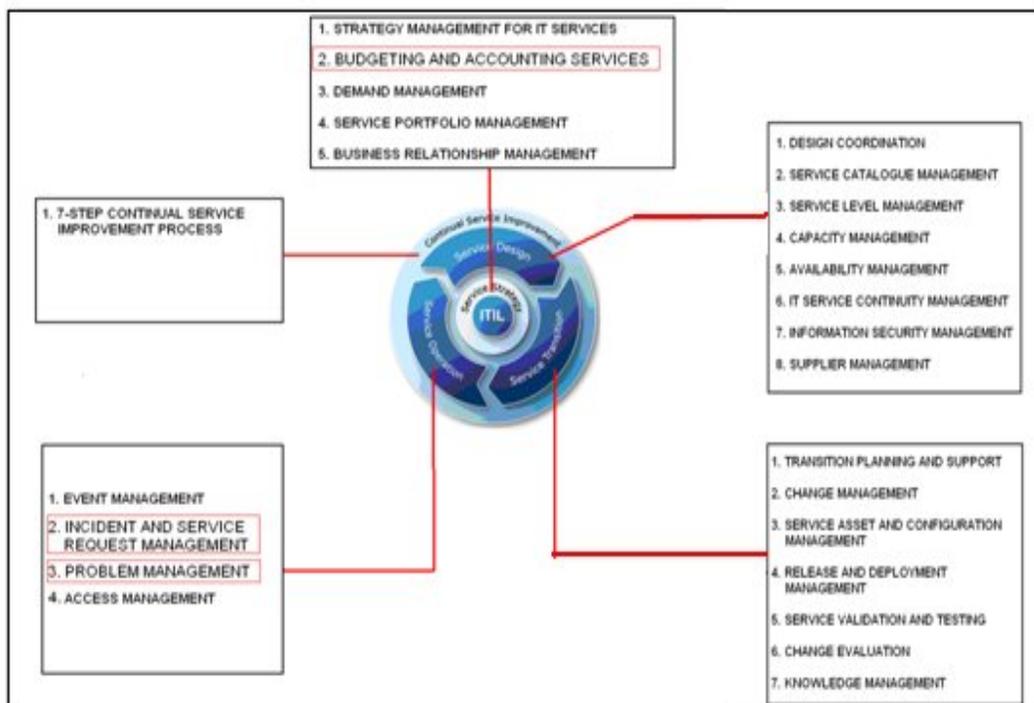
Fig. 4 - Entity Relationship Diagram for Billing system

Fig. 5 - New model for ITIL framework