HELSINKI METROPOLIA UNIVERSITY OF APPLIED SCIENCES

Master's Degree in Industrial Management

Master's Thesis

EXPLORING COST REDUCTION OPTIONS FOR ON-GOING SUPPORT ACTIVIES IN TELECOMMUNICATIONS BUSINESS

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PREFACE

Pursuing my studies again after few years in the work life has been an uplifting experience. I have learned a great deal through this experience, and I am beginning to understand the challenges facing the telecommunications industry, challenges which were unknown to me during my Bachelor's studies. This learning process got a new direction and structure as I re-entered the academic institution for my Master's degree after working for eight years in the industry. The knowledge and exposure gained during this master's study will definitely help me attain new heights in my professional life.

This thesis is an inspiring mix of academic work combined with problem resolution regarding real world challenges. I enjoyed doing this thesis as it dealt with finding a solution to a current problem in my organization. The research problem became an important issue to the management as the recession in 2008 impacted the whole industry.

I would like to take this opportunity to express my sincere gratitude to my supervisor at work Mr Aviv Bentzium because without his advice and support this thesis would never have become a reality. I would also like to thank Dr Marjatta Huhta for all her support and helpful suggestions throughout the work in this thesis. Further, I would like to thank Dr Thomas Rohweder for his valuable ideas and comments during the process.

I wish to express my warmest thanks to my friends and colleagues, who indirectly supported me in making this possible. Last, but not least, I would like to thank my wife for her love, patience, and understanding, without which achieving this milestone would have been difficult. My thesis completed, I will continue to challenge myself in the future, with what I have learned. I am sure this is not the end but only the beginning!

Helsinki, August 30, 2010

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ABSTRACT

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The increasing competition in the telecommunications service industry is driving telecommunications service providers towards more efficient and cost effective business processes. As a result, service providers need to evaluate their internal business processes with a notion to come up with innovative ideas to cut costs. This thesis, therefore, focuses on finding a way to reduce the total cost of ownership for a service contract to provide On-Going Support (OGS) services. A further aim is to describe and analyse the principal activities performed as part of an On-Going Support (OGS) agreement for maintaining the telecommunications billing solution at the case organization - a leading telecommunication billing product and service provider company.

The method used in this study is action research, and the outcome of the study is a new OGS framework which is referred to as shared OGS methodology. The study first focused on an analysis of the existing OGS activities. Data related to the OGS activities was then collected from the OGS team members and based on the information thus collected, a detailed OGS activity map was prepared. The brainstorming sessions were conducted with a forum of technical experts and representatives of the management. The forum validated the OGS activity map and came up with a list of criteria for deciding which activities can be offshored. Improvement areas were further identified by comparing the existing OGS team structure with the new proposed structure which consists of a balanced mixture of onsite and offshore team members, working in tandem, led by Group Leaders or Experts working onsite. Finally, the information collected was used to find the gaps in the operations and to modify the existing business processes in such a way as to support the new OGS model.

Key words: offshoring, OGS, telecommunications, Action Research, IDEF3, SSM - Rich Pictures, Business Process Modelling, BPM techniques, BPRE.

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ACRONYMS

OGS	On-Going Support
HLE	High Level Estimation
UT	Unit Test
SST	Sub System Test
ST	System Test
UAT	User Acceptance Test
SLA	Service Level Agreement
LOE	Letter Of Engagement
SOW	Statement Of Work
ROI	Return On Investment
ARPU	Average Revenue Per User
CR	Change Request
SD	Service Desk
QC	Quality Centre
WH	Working Hours
IDEF	Integration Definition for Function Modeling
BPRE	Business Process Reengineering
BPM	Business Process Modeling
UOB	Unit Of Behavior
SMS	Short Message Service
VOIP	Voice Over Internet Protocol

1 INTRODUCTION

In the past few years, the telecommunication industry has seen significant growth, and today the number of mobile phones far outweighs the number of fixed lines. Millions of users worldwide now also connect to the Internet using mobile broadband services (Wansink 2009:117). Despite all this, the mobile and fixed line revenue is growing though slowly. Additionally the telecommunication operators are facing tough competition and external pressures in the form of deregulation and economic downturn (Wansink 2009:117). Also, the traditional voice-data communication has been replaced to a great extent by various other forms of communications such as email, instant messaging, SMS and other Internet based services such as VOIP services. As would be expected, to remain in the business telecommunication operators have cut down their service charges drastically, which is directly impacting their average revenue per user (ARPU) and hence the profit.

Wansink points out that, to combat this downturn, many operators are revaluating their expenditure and either trying to reduce or defer it and hence the overall telecom capital expenditure (CAPEX) is in continuous decline. Furthermore, the telecommunications industry is looking at outsourcing, managed services and infrastructure sharing arrangements as a means for cost reduction (Wansink 2009:117).

> The mobile market is also experiencing a backlash and by mid-2009 around half of all mobile operators around the world were reporting a downturn in revenue. While mobile ARPU levels differ widely between the regions of the world, on the whole all regions have experienced declines in ARPU over the past few years. ARPU from mobile voice services has been particularly affected by cuts to tariff rates and the trend towards voice-data substitution. As would be expected, markets with strong competition have also seen a considerable drop in mobile call charge (Wansink 2009: 117).

In short, telecommunications service providers are moving ahead rapidly to become increasingly cost efficient while trying to expand continuously in the era of tough price competition and increasing customer expectations. Further, to become cost effective service providers are evaluating their internal business

processes, with a notion to come up with innovative ideas to increase productivity and to cut cost.

1.1 Research Problem and Research Question

The case organisation (CO) is a leading telecom billing product and Service Provider Company with clients across the globe. The case organization has an OGS contract for its billing product with Telco, one of the leading telecommunications operators in the Nordic region. Telco has a goal to reduce its total cost of ownership and to achieve this goal Telco initiates a process to replace the existing systems and service contracts with better options available in terms of cost and level of service. The CO considers this development both as an opportunity and threat; an opportunity to expand its business with Telco and a threat as the current OGS contract may go to some other service provider who will provide a better deal. As would be expected, CO has to reduce its prices to compete with other vendors in order to win new contracts and to keep the existing contract alive. However, the dilemma is if CO reduces its price then there is a direct impact on the revenue generated and hence the profits, but if the price is not reduced then CO may be outbid by the other vendors. Thus, the higher management of CO decides to reduce the total cost of ownership to remain competitive and to tap upcoming opportunity, but at the same time to retain the profit levels. To achieve this objective the management explores various options including team size reduction, loaning resources, offshoring and so on, but opting for any of them directly impacts the level of service provided to the customer, which organizations do not wish to have. Therefore, the management asks employees to come up with innovative ideas to reduce the total cost of ownership.

This study is part of the innovation program initiated by the management, and serves to examine the following research question:

How to reduce the total cost of ownership for the OGS activities to increase profitability in the telecommunications business?

Further, the objective of this study is to propose a new OGS methodology, which will help in building a dynamic and cost effective OGS team. The outcome of this study is the shared OGS methodology which is expected to reduce the total cost

of ownership regarding OGS activities. However, it may also bring about major improvements in various critical business processes and the perception of the service delivered to the customer.

1.2 Research Design

As mentioned in the previous section, this study examines the existing OGS methodology, proposes shared OGS methodology and suggests needed modifications in the existing processes by comparing the existing OGS methodology with shared OGS methodology. Figure 1 below outlines the research design of this study.

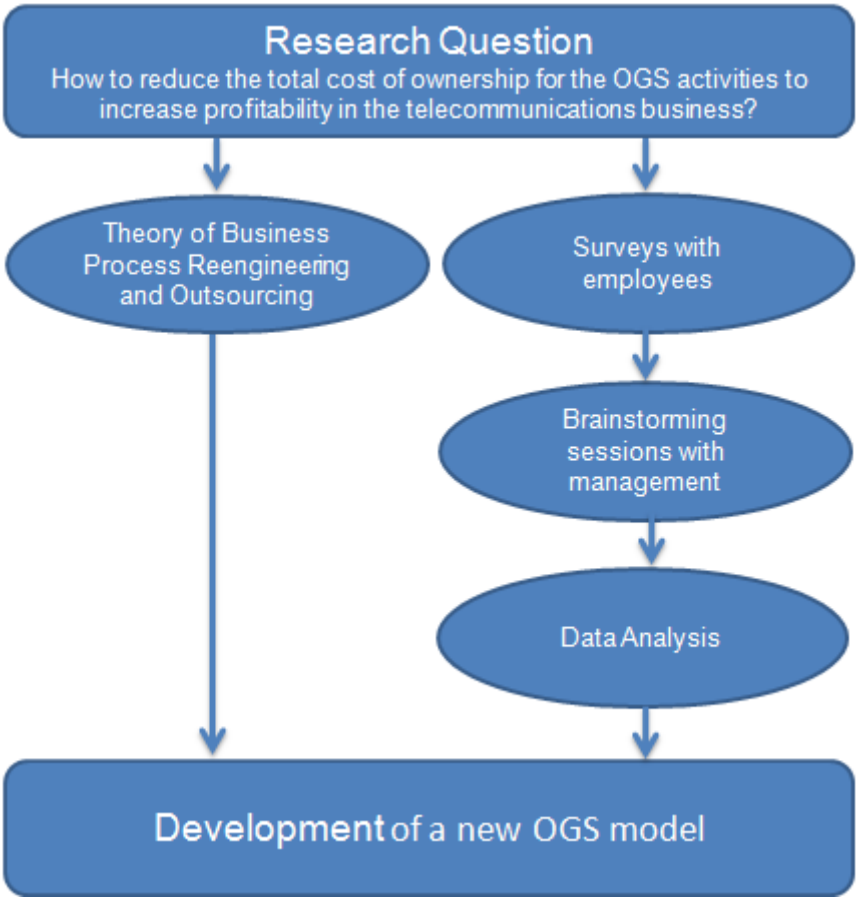


Figure 1. Research plan.

This study is in eight stages. The first stage establishes the theoretical framework by using business process reengineering (BPRE) – Business Process Modelling (BPM) techniques and outsourcing. The BMP techniques analysed and discussed in this study have been taken from research carried out by Aguilar-Savén (2004). The second stage seeks to identify the most suitable BPM

techniques. The third stage deals with creating a model for the current OGS methodology using IT Infrastructure Library and selected BPM techniques. The study then focuses on decomposing the high level process model further, and on analysing the main OGS processes. The fourth stage is about conducting a survey among the OGS team members, to gain information on the daily activities performed over a period of one month. The fifth stage includes the creation of a detailed OGS activity map using the data collected. The sixth stage concentrates on describing three brainstorming sessions conducted among the managers, project leaders and application experts. In the first brainstorming session, the activity map is analysed to check its validity and authenticity. In the next session, the forum shares its view on offshoring the OGS activities and during the last session, the criteria for selecting the OGS activities to be offshored are discussed. The seventh stage comprises the generation of various detailed reports on the basis of the activity map and the identification of a list of activities which can be off shored based on selected criteria as well as the development of a new OGS methodology. Finally, in the eighth stage, conclusions are drawn and recommendations are made based on the findings and discussion. During this study, the issues having direct business impact are considered and issues having no direct or critical business impact are left out.

1.3 Research Scope

The aim of this study is to analyse the principal activities performed by the case organization (CO) - a leading billing product and service Provider Company in telecommunications, as part of the On-Going Support (OGS) agreement for maintaining a billing solution and the ways they can reduce total cost of ownership by offshore activities while keeping the same level of service.

According to the project and commitment agreement the CO provides support and maintenance services to her client (Telco), which is one of the leading telecommunication operators in the Nordic region. The service agreement includes maintenance and development of billing software, collecting and developing new business requirements, providing the necessary reports and supporting user acceptance test (UAT). Facilitating training, providing documentation, and all other relevant activities as shown in Figure 2.

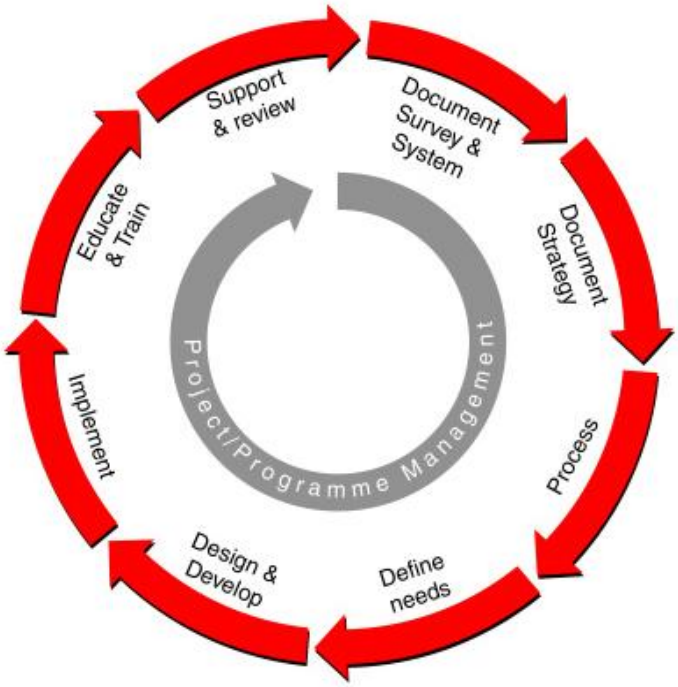


Figure 2. OGS activities.

Figure 2 shows various OGS activities performed by CO for Telco. The CO is responsible for finding out about the business requirements from Telco, defining the needs in technical terms and developing them. After the development is finished, it is tested, implemented and maintained. Additionally, the CO is responsible for providing documentation and conducting training sessions for Telco, showing how to use the billing software. To provide these services, the CO builds a team of experts at client site, which sits in the client office, and provides 24/7 support throughout the year. The CO is exploring options for cost reduction of such OGS activities. One of the options identified by the CO management is to find a way to offshore OGS activities without diminishing the level of service to Telco.

This study carried out an analysis of the current OGS activities performed in various modules, developed an OGS activity map and conducted three brainstorming sessions which were attended by representatives of high and middle level management as well as OGS team members of the CO. At the beginning of the study, the OGS team members were asked to list different activities performed by them on a daily basis. Later all these lists were merged and an activity map was prepared. Based on this activity map, and a number of criteria agreed on during the brainstorming sessions, the activities were segregated into three different groups. The first group consists of activities that

cannot be performed offshore, i.e. activities that must be kept onsite. The second group comprises activities that can be performed offshore. The third and last group consists of activities that can be performed offshore but due to strategic reasons should be kept onsite. Finally, based on the activity map and criteria agreed on during the brainstorming sessions, the researcher proposed a new OGS team structure which is more streamlined, dynamic and cost effective than the existing one. While developing the new OGS model, special attention was paid to transparency toward the customer (i.e. after restructuring and offshoring activities, the customer gets the same level of service as before and it is only enhancing the customer experience by providing extended and enhanced service due to time zone difference and scalability).

The new OGS model requires a change in the existing OGS team structure. Thus, this study also identifies improvement areas, by comparing the conventional and existing OGS team structure with the new proposed structure. The new proposed structure consists of a balanced mixture of onsite and offshore team members, working in tandem, led by Group Leaders or Experts working onsite. Finally, the information collected is used to find gaps in the operations and for modifying the existing business processes in such a way as to support the new OGS model which has been named as shared OGS methodology.

To summarize, this study intends to approach the research problem by analysing the business processes, conducting brainstorming sessions, creating detailed activity maps, proposing the shared OGS methodology and finally suggesting the necessary changes to the existing business processes in order to support the shared OGS methodology. The method of research applied in this study is action research detailed in section 2.1.

This study is limited to one telecommunications solution provider referred to as CO and one telecom operator referred to as Telco who has long term service agreement with CO for providing On-Going support for their billing system. Furthermore, this study is limited to propose shared OGS methodology, which will help the management to reduce total cost of ownership. It will also help the management to figure out which activities can be offshored and with the help of the activity map efficient staffing and work reduction plans can be chalked out. However, there are various challenges in the implementation of shared OGS methodology including practical and political issues which have been excluded

from this study. The processes are analysed, and important processes are further decomposed to identify realistic issues. The decomposition of the process is stopped at a certain level where further analysis is not desired by the managers of the project. Hence this study is not going to identify all the issues hidden deep down in the sub-process of the system. In addition, this study does not deal with the technicalities and cost associated with the implementation of the new methodology. Furthermore, the implementation of the proposed methodology is at the management's discretion which means the management may implement this methodology or implement a modified version of this methodology or it may even decide not to implement it at all.

1.4 IT Infrastructure Library (ITIL)

Telco has a long term service agreement with CO to provide OGS services to their billing software. This project can therefore be categorised as an IT based service project. There are various methodologies and IT standards which IT companies use to carry out such projects and one of them is IT Infrastructure Library (ITIL). ITIL is a widely accepted IT process framework, which provides a collection of industry best practices and approaches to plan, develop, deliver, and support IT services. UK's Office of Government Commerce (OGC) started to be developed ITIL about 25 years ago and it consists of seven disciplines (Gantin 2006: 38). Figure 3 below shows the seven disciplines of ITIL and how they are connected to each other.

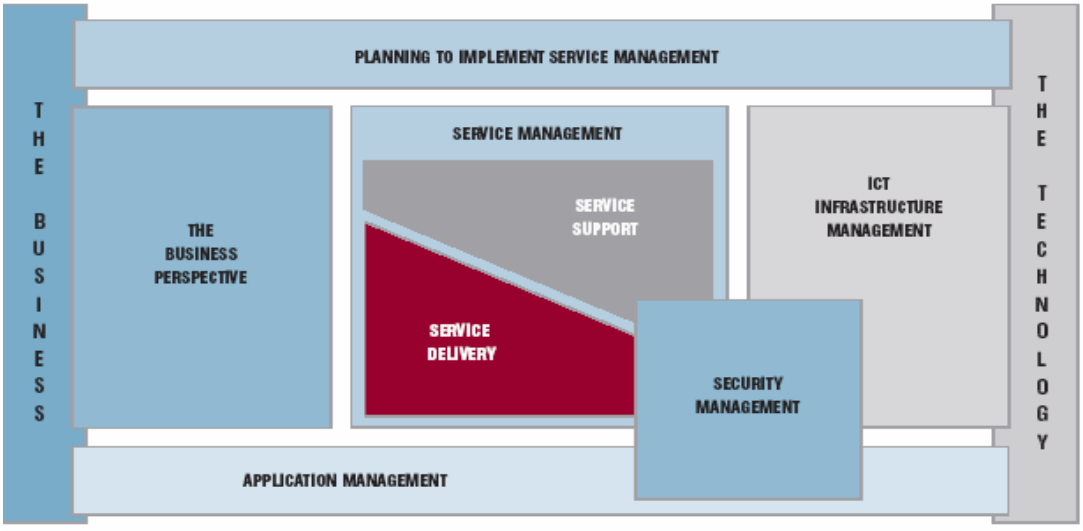


Figure 3. ITIL's seven disciplines and their interconnections (Mercury, 2005).

As depicted in Figure 3, ITIL contains seven disciplines. The first discipline is service management which is at the core of ITIL, and is concerned with delivery and support services needed to meet IT business requirements. Surrounding service management are four disciplines which includes planning to implement service management, business perspective, Information and communication technology (ICT) infrastructure management, and application management. Planning to implement service management outlines the steps needed to implement ITIL at a company. Business perspective investigates the efficiency and costs of services. ICT infrastructure management deals with the technical implementation details. Application management deals with managing applications from the business perspective, and throughout the application development lifecycle. Finally, service support and service delivery together create *Service management*, which is an integral part of IT support projects. Service management is the most commonly used discipline within the ITIL framework (Mercury, 2005). Figure 4 below shows the processes involved in support service which is the first component in the service management discipline of ITIL.

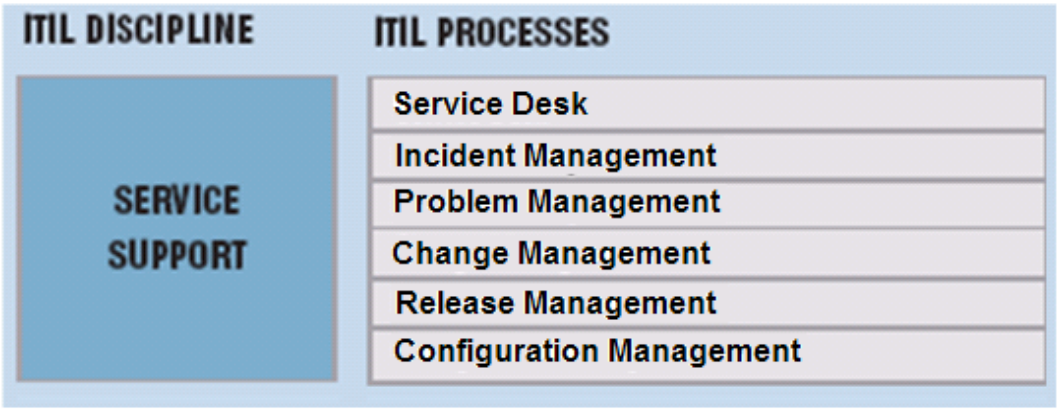


Figure 4. ITIL processes for service support (Mercury, 2005).

As shown in Figure 4, service support encompasses the support processes necessary to ensure service quality. It is mainly concerned with technology related processes and includes the following six components: Service Desk or Help Desk, Incident Management, Problem Management, Configuration Management, Change Management and Release Management. These processes manage problems and changes in the IT Infrastructure and are more control-oriented than technical in nature (Mercury, 2005). Figure 5 below shows

the processes involved in support delivery which is the second component in the service management discipline of ITIL.

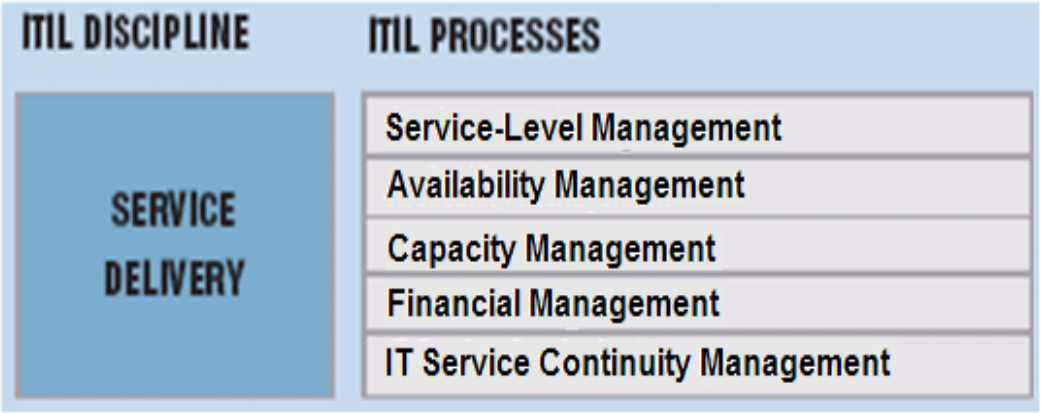


Figure 5. ITIL processes for service delivery (Mercury, 2005).

As shown in Figure 5, service delivery defines the business of IT and is concerned with customer related processes. It is used mainly to formalize the service delivery processed - to clearly define the content of services, roles and responsibilities of customers (those who pay for the services), users (those who use the services), service providers and set expectations of service quality, availability and timeliness. Service delivery has the following five components: service level management, financial management of IT services, capacity management, IT service continuity management and availability management.

1.5 Current On-Going Support (OGS) service in Case Organisation

As mentioned, the Case Organisation (CO) is a leading telecom billing product and service Provider Company, which caters to the needs of telecommunication service providers across the globe. The case organization has an OGS contract for its billing product, with one of the leading telecommunications operators (Telco) in the Nordic region. Technically OGS can be defined as a contractual framework designed to provide Telco (case organization's customer) with support after installation of the first version of the system (AGQM Methodology Group, Nov 2006).

Based on the current contract with Telco, the scope of the OGS activities are graphically represented in the following Figure 6.

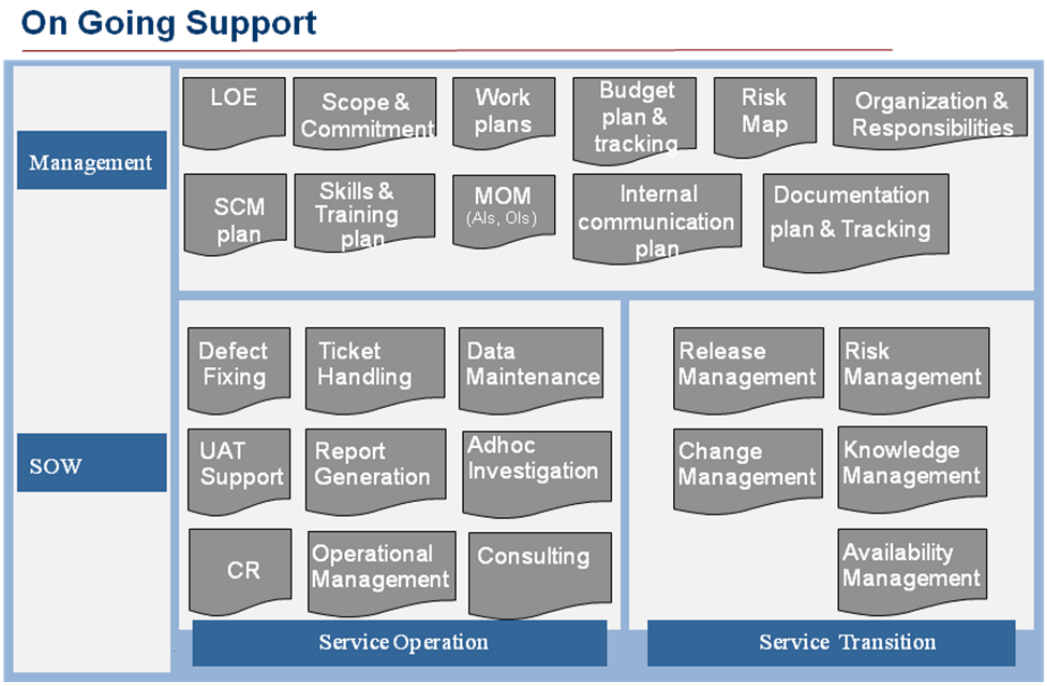


Figure 6. On-Going support architecture in Telco.

As shown in Figure 6, the OGS contract can be divided into two sections. The first section is *management,* which deals with various contractual documents, planning, budgeting and other managerial activities. The second section is the statement of work (SOW), which defines the scope of the OGS work, carried out by the OGS team. Based on the nature of the work and ITIL definition the SOW can be further divided into *service operations* and *service transitions.* The service operations consists of various operational activities performed by the OGS team, which includes defect fixing, ticket handling, data maintenance, UAT support, report generation, change request handling, and operational management and consulting. Service transition deals with smooth functioning and transitions of the software which includes release management, risk management, change management, knowledge management and availability management. As mentioned before, OGS is an IT service management contract; therefore, the activities falling under the OGS umbrella can also be correlated to the ITIL service management discipline.

In the current implementation, the case organization has an OGS team onsite which performs the operational and transitional activities mentioned above on a 24 hours, 7 days a week, 365 days a year basis. Figure 7 outlines how various work requests falling under service operations and service transition are delivered to the OGS team.

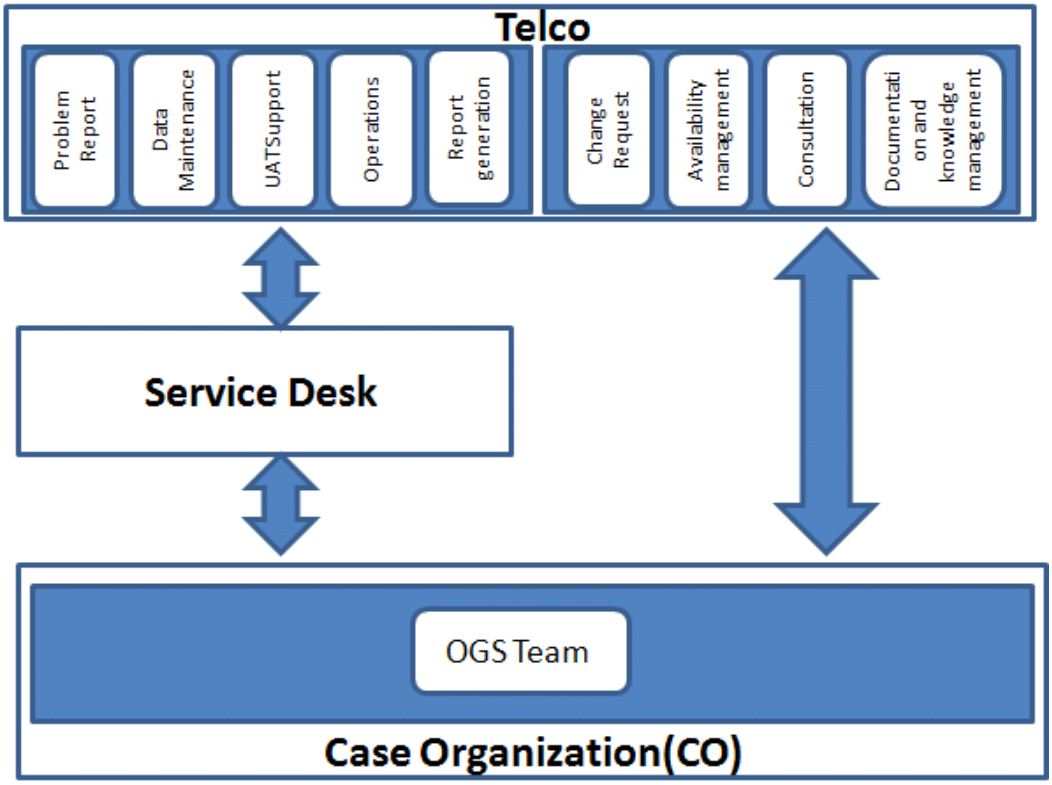


Figure 7. Current OGS methodology in Telco.

Figure 7 shows the current methodology of the OGS team in Telco. In general there are two channels for the requests coming from Telco. The first is via service desk (SD) and the second by contacting the OGS team directly using communication channels such as email or by making a call. Telco uses the first channel to send a problem report, data maintenance, UAT support and report generation requests. The request is sent to the SD and after an initial analysis the SD route it to the respective team. Once the problem is solved, or more information is needed the OGS team contact the SD again. The SD analyses the request and routes it to the respective customer representative. For change requests, availability management, consultation requests and knowledge management Telco communicates directly with the OGS project manager, project lead or respective module experts. In the current methodology, the OGS team is situated onsite. Based on the request type the CO either communicates directly with Telco or through the SD. For instance, if some communication is required related to the change request or consultancy then an onsite team member contacts the Telco representative directly via email or by making a call. However, if the issue is not critical, for instance, in case of a problem report handling or UAT support, then communication is carried out via email or through a ticket.

1.6 Research Structure

To respond to the research question of this study the research is structured in the following manner:

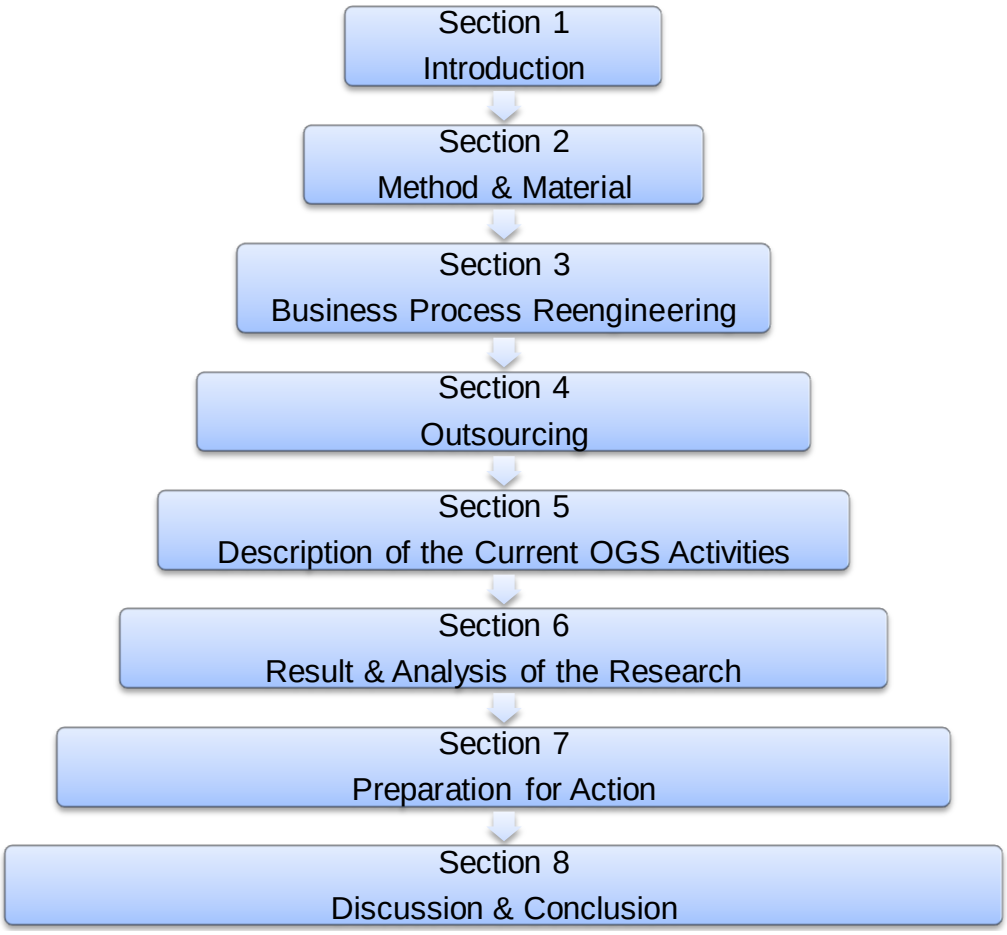


Figure 8. Structure of the study.

Section one provides a brief introduction and defines the research question of this study. Further, it defines the scope of this study and provides an overview of the architecture of the On-Going support contract in Telco. Section two discusses the method used in the study. It also discusses, in brief, the validity and reliability of the study. Section three provides an overview of the business process and business process reengineering. Furthermore it discusses various BPM techniques, their uses, advantages and disadvantages. Finally, the best suitable BPM technique for this study is identified. Section four briefly discusses about the concept of outsourcing, the driver and obstacles of it and the critical success factors. Section five describes the current OGS activities carried out by the OGS team. The main OGS processes are modelled using the best suited BPM

technique identified in section three. Then a survey is conducted with the OGS team members to capture the daily activities performed over a period of one month. The data collected from the OGS team members is then consolidated and presented in the form of a report. Section six briefly discusses the outcome of the brainstorming sessions conducted. Further, this section presents many reports prepared by the researcher based on the data collected in section five and proposes a new OGS methodology as an option for a cost reduced OGS. Finally, section seven summarises the discussion and provides conclusions based on this study.

2 METHOD AND MATERIAL

The research method used in this study is *Action Research*. This section first discusses the action research method and then introduces the brainstorming technique used to capture the management's and experts' view. This is followed by a discussion on reliability and validity of this study and finally the structure of this study is depicted using a flow chart.

2.1 Action Research

This study draws on action research methodology. The action research methodology is part of a wider group of qualitative research methodologies, which involve observation and fieldwork, interviews and questionnaires as well as the researcher's impressions and observations. Other qualitative research methodologies only focus on studying what the problem is, without acting on the subject-of-study. The same does not happen with action research as the researcher has a problem that needs a solution and, at the same time, he/she studies the whole process in order to expand his/her scientific knowledge, thus action research is integration of theory and practice. Also, action research is cyclical so that the knowledge accumulated in one cycle can be used in the following cycle (and so on), which makes this methodology an iterative research approach. Additionally, it is participative, close to methods such as experiential learning (Kolb, 1984) and reflective practice (Schön, 1983). **Error! Reference ource not found.** pictures the action research methodology.

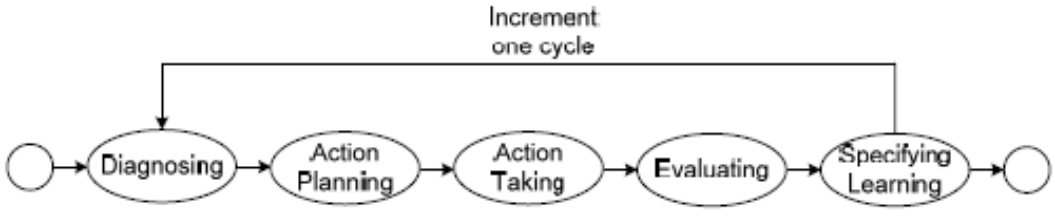


Figure 9. Action research cycle (Lee, 2007).

According to Lee (2007), action research comprises five key steps that occur in a sequential order. As shown in Figure 9, the action research cycle consists of five stages which are diagnosing, action planning, action taking, evaluating the action

and specifying the learning. Additionally, the context and purpose should be defined before the action research cycle starts. The first stage in the action research cycle is Diagnosis. At this stage, a problem is identified, and data is collected for a more detailed diagnosis. This stage is followed by action planning, which is the second stage in this methodology. After the issues are identified and the purpose is established, planning for the action takes place. The third stage of action research is action taking where the plans made in the previous stage are implemented, and interventions are made. The fourth stage is the evaluation of the action, where the action outcome of action taken in the previous stage is examined. At this stage, the researcher finds whether the diagnosis and the actions taken were correct. In the fifth and final stage of action research, an analysis is carried out and learning is specified. This learning will be used in the next cycle of action research. This process continues till the desired goal is achieved.

2.2 Action Research in this Study

Figure 10 depicts how the action research methodology is implemented in this study.

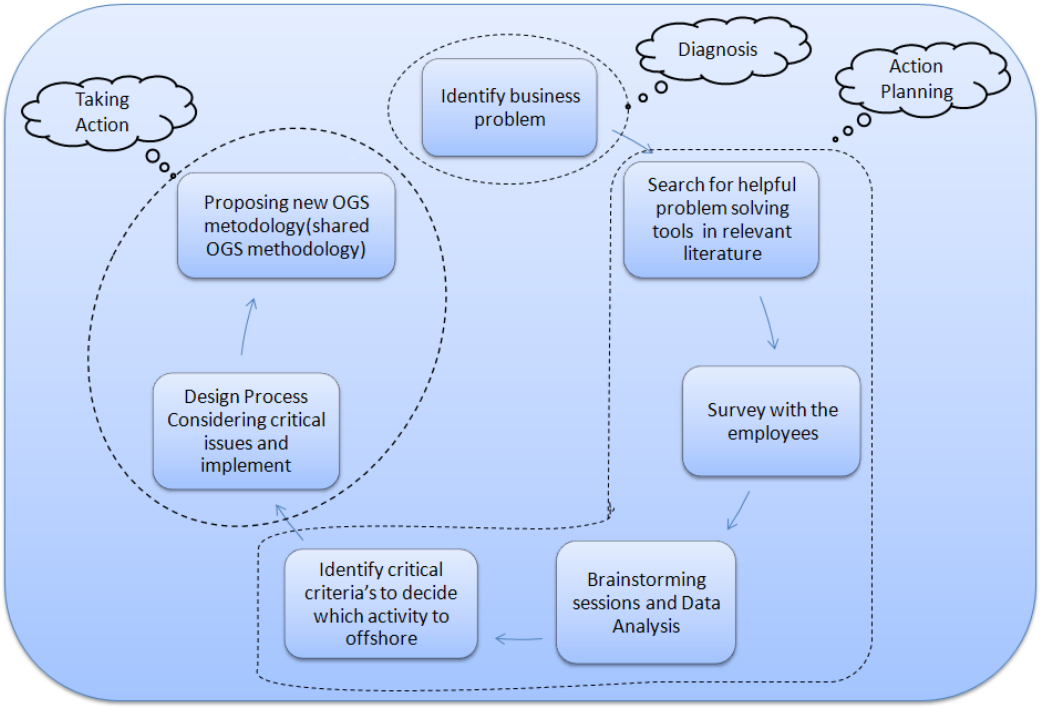


Figure 10. Action research in this study.

As shown in Figure 10, a partial action research cycle is implemented in this study. This study started with providing the background of the business problem

put forward by the management followed by the identification of the primary problem and self-interpretation of it. The primary problem formulates the research question for this study; thus this stage corresponds to the *diagnosis* phase of the action research cycle. After identifying the research question various business process reengineering (BPRE) techniques were analysed and finally a suitable BPRE technique was selected for this study. Then a survey was conducted with the OGS team members, and a detailed activity map was outlined. Further, this activity map was analysed during the brainstorming session and the criteria was decided on to find out which OGS activity should be kept onsite and which should be offshored. This part of the study established the target for change and the approach to change. Thus, this stage corresponds to the *action planning* phase of the research cycle. Finally, process maps were prepared for the critical business processes using the selected BPRE technique. Then the new OGS methodology was proposed based on the analysis made. Further, this study suggested the modifications needed in the existing business processes to implement the new OGS methodology and provided various tools and reports for the management. During this part of the study various actions were taken and active intervention into the OGS processes was made. It therefore, corresponds to the *action taking* phase of action research. However, this phase of action research was not fully implemented and limited to suggesting the new OGS methodology only. As mentioned before, the implementation of the proposed methodology is at the management's discretion and out of the scope of this study.

2.3 Brainstorming

Brainstorming is an informal, group creativity (creativity techniques are methods that encourage original thoughts and divergent thinking) problem solving technique. The main benefit of brainstorming is that it creates innovative ideas, solves problems, motivates and develops teams. During brainstorming sessions, there should be no criticism of ideas and any judging and analysing should be done at the end. Therefore, brainstorming is not simply a random activity; rather it is a well-structured activity and follows certain predefined rules. There are mainly four basic rules in brainstorming (Osborn, 1963), first *Focus on quantity:* This rule states that the greater the number of ideas generated, the greater the chance of producing radical and effective solutions to the problem. This rule is a means for enhancing divergent production, aiming to facilitate problem solving through the

saying “quantity breeds quality”. The second *rule is Withhold criticism:* Osborn (1963: 129) identified that when people apply "the principle of deferred judgment, they generate almost twice as many good ideas as when they allow judgment concurrently to interfere". The third *rule is Welcome unusual ideas:* To get a substantial and a long list of ideas, unusual ideas should also be considered. New ideas can be generated by looking at the problem from new perspectives and suspending assumptions. These new ways of thinking may provide better solutions. Finally, the fourth rule is *Combine and improve ideas.* Good ideas may be combined to form a single better idea, as suggested by the slogan "1+1=3" (Osborn, 1963). The basic intentions behind these rules are to reduce social inhibitions among group members, stimulate idea generation, and increase the overall creativity of the group. However, brainstorming is one of the time consuming techniques and requires lots of preparation. The following flow chart depicts the basic process of preparation for a brainstorming session.

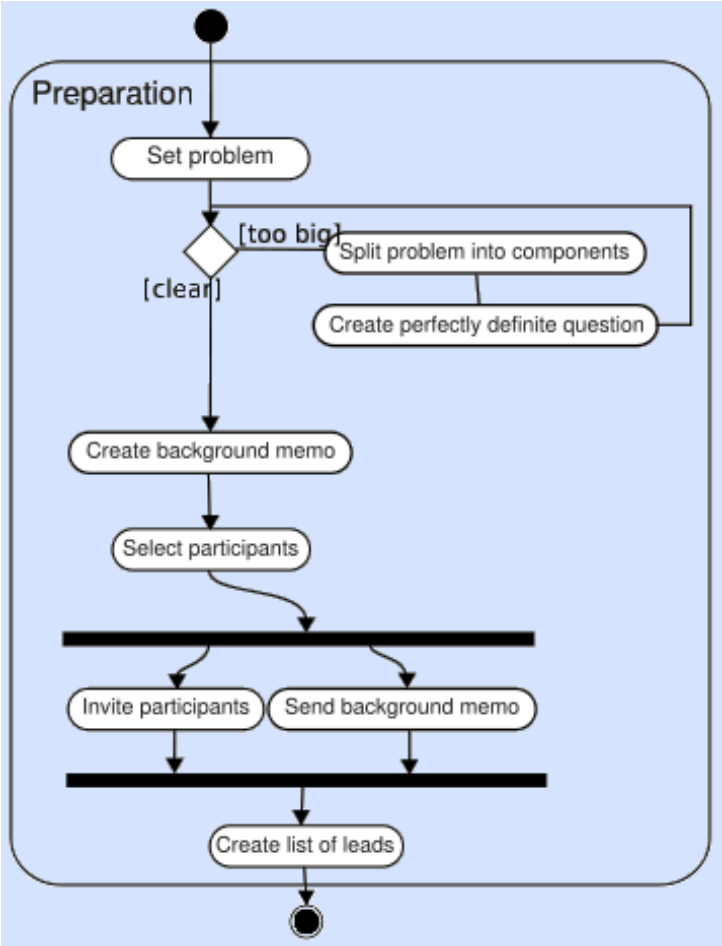


Figure 11. Process of preparing for a brainstorming session (Marttinen, 2006).

Conducting successful brainstorming sessions is an art, which requires pre session preparation which includes setting *the problem.* Before a brainstorming session, the problem should be clearly defined by the facilitator. If the problem is complex or too big then it should be broken into smaller components each with its own question. *Creating a background memo* is about creating a memo which is an invitation and informational letter sent to the participants, containing information such as session name, problem, time, date, and place. The problem is presented in the form of a question, and example ideas are suggested. The memo is sent to the participants well in advance, so that they can familiarise themselves with the problem and come up with some ideas beforehand. In s*electing participants* the facilitator should select the brainstorming panel very carefully. The panel should be neither very small nor too big. *Creating a list of lead questions* serves during the brainstorming session the situations where creativity may decrease. At this moment, the facilitator should stimulate creativity by suggesting a lead question to answer such as can we combine these ideas? or how about looking at this from another perspective? It is best to prepare a list of such leads before the session begins.

To carry out brainstorming sessions, a forum of managers and module expert's is formed. The forum consists of a Production manager, who is responsible for managing all technical operations of the system, Module/Project leaders, Sales director, Project managers and Application experts. One of these is the author of this study. The facilitator of the brainstorming session is the author of this study, who is responsible for conducting and leading the sessions. A background memo is sent to the participants, inviting them and providing session information, which includes session name, problem, time, date, and place. The problem is described in the form of a question, and other supplementary information is sent. The memo is sent to the participants well in advance, so that they can think about the problem beforehand.

During this study three brainstorming sessions were conducted and the problem was presented in the form of following questions:

Session 1:

What do you think about the validity of Task Summary report which contains a list of daily activities performed by the OGS team members?

Session 2:

What do you think about offshoring part of the OGS activities?

Session 3:

What should be the criteria for selecting the activities to be offshored?

2.4 Reliability and Validity

Reliability means demonstrating that the operations of a study, such as the data collection procedure can be repeated with the same result (Yin 2003: 34).

> The reliability of a study depends on whether the means of the research is natural in its cause, and if they would provide the same result if the researcher is a part of the research means, the definition of reliability changes. It then becomes defined by the degree of the result that would be the same if another researcher did the research again (Denscombe, 2000).

Thus, considering the reliability of this study, the critical issues identified can be identified in another study with a similar method and background. A similar activity map and various proposed reports can be easily created for any organization using the technique shown in this study. There are some processes, which are not shown in this study due to confidentiality and hence the issues pertaining to them are also not listed in the result. In order to ensure the validity of the findings in this study, suitable BPM techniques are selected. Validity refers to the accuracy or truthfulness of a measurement. According to Denscombe (2000) there are many ways to control the validity of the collected data. However, it is vital that the results are triangulated towards other sources to confirm the validity. Triangulation simply means spotting a specific result by referring to two or more sources. In this study triangulation is used to validate the data collected against the data present in the system. For instance, hours reported by the OGS team members, in Task summary sheet is checked against the working hours reported by the OGS team members in the official working hour system. Additionally the Task summary sheet is presented in the first brainstorming session with a notion to judge its accuracy. Further, both experts' views and analysis of business process models are used to identify critical issues. Each

process model is drawn based on the documentation belonging to the case organisation. The correctness of the process models are also endorsed by the management and the technical experts involved in the day to day operation of OGS. Additionally, the researcher has eight years of working experience in the telecommunications billing domain and having access to the internal documents of the CO. Thus the analysis carried out and conclusions made in this study should be considered reliable and unbiased.

3 BUSINESS PROCESS REENGINEERING

This section first defines a business process, and then introduces *business process reengineering (BPRE)* and describes the various stages of it. *Business process modelling (BPM)* is an integral part of BPRE and therefore this section introduces *BPM* and its classification according to Aguilar-Savén (2004). Finally it compares various BPM techniques and selects the most suitable BPM techniques for this study. The researcher has selected BPRE for this study because the activities performed by the OGS team are repetitive in nature and hence it is very easy to chalk out business processes out of them.

A *business process* is nothing but a collection of structured and interrelated activities, working together to serve a particular goal for a customer or customers. A business process should have a specific goal, a specific Input, a specific number of activities performed in a predefined order, Outputs and it should create value for the organization. A well-defined business process increases effectiveness (value for the customer) and efficiency (less costs for the company) and is designed to add value to the organisation, so it is very important that they do not consist of unnecessary activities. Also a business process emphasises on how the work is done within the organization rather than by whom it is done.

> A process is a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization (Davenport 1993: 5).

Business process reengineering (BPRE) is a concept facilitating improvements by elevating efficiency and effectiveness of the business process or processes existing within and across organizations. The core of BPR is a radical change in the way, in which organizations perform business activities.

> The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed (Hammer and Champy 1993: 31-2).

The BPRE is not limited to designing new processes rather it can be used for implementing a new process as well as modifying an existing one and as an approach towards organizational redesign. Further, it provides a continuous improvement cycle, to help the organization to attain the benefits of functioning in a better manner. Figure 12 shows a generic model for BPRE proposed by Vakola M. et al. (2000).

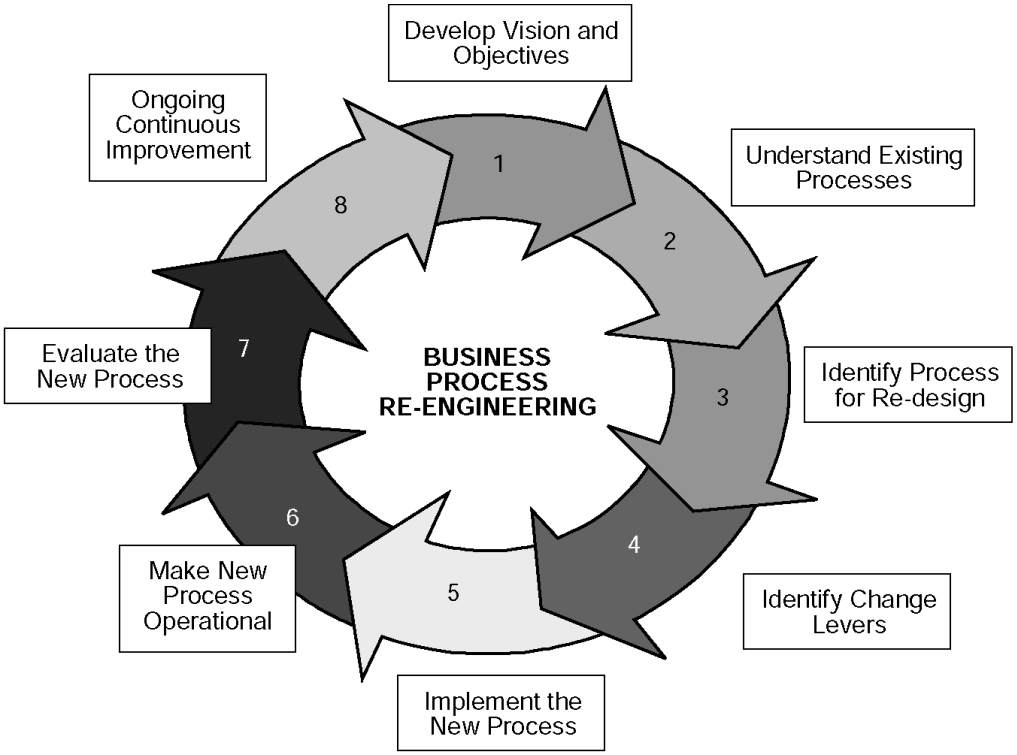


Figure 12. A generic model for business process re-engineering (Vakola M. et al. 2000).

Figure 12, depicts the eight stages of BPR. In the first stage, the business need is analyzed and BPRE objective is determined. In the second stage, the existing business processes are analyzed till desired level and mapped using the selected business process modeling (BPM) technique. In the third stage, processes are analyzed and processes which should be re-engineered in order to improve efficiency and effectiveness are selected. In the fourth stage, change is proposed based on the decision factors identified. In the fifth stage, new processes are designed and implemented based on the change levers identified. In the sixth stage, the modified process is implemented and made operational in

the real environment. In the seventh stage, the newly implemented process is measured against the old process in order to gauge the improvement. Finally, the eighth stage, which is very well known as the stage of on-going continuous improvement underlines that the modification process is on-going, and the process should be improved until it meets the expectation.

Business *Process Modelig (BPM)* is an integral part of BPRE. It allows the identification of avenues for further improvement such as the use of new technology, aligning the process by reducing the steps and normalising them, automatisation or better sharing of information.

> Business process modelling enables a common understanding and analysis of a business process. A process model can provide a comprehensive understanding of a Process (Aguilar-Savén 2004: 129).

There are different BPM techniques available in the market; however it is critical to select the most suitable technique at the beginning. Otherwise it will lead to rework and sometimes to BPR project failure. After identifying a suitable BPM technique, the process should be mapped out as it actually happens. If the process map is a complex one a high level map is first needed and it is then decomposed further to include sub-processes as necessary. Finally, the finished map should be self-explanatory, so that it can be used for identifying areas of improvement. The next section discusses different BPM techniques and selects a suitable BPM technique for this study.

3.1 Process Modelling Techniques

A Business Process Modelling is a method to graphically represent the processes of an enterprise with a view to enable analysis and improvement of it. As mentioned before, there are different BPM methods and techniques, each one having some advantages and disadvantages. So it is very important to select the most feasible and suitable BPM technique, to represent the target business processes of the organisation.

Aguilar-Savén (2004), studied different BPM techniques and proposed a classification framework to select among business process modelling techniques as shown in Figure 13.

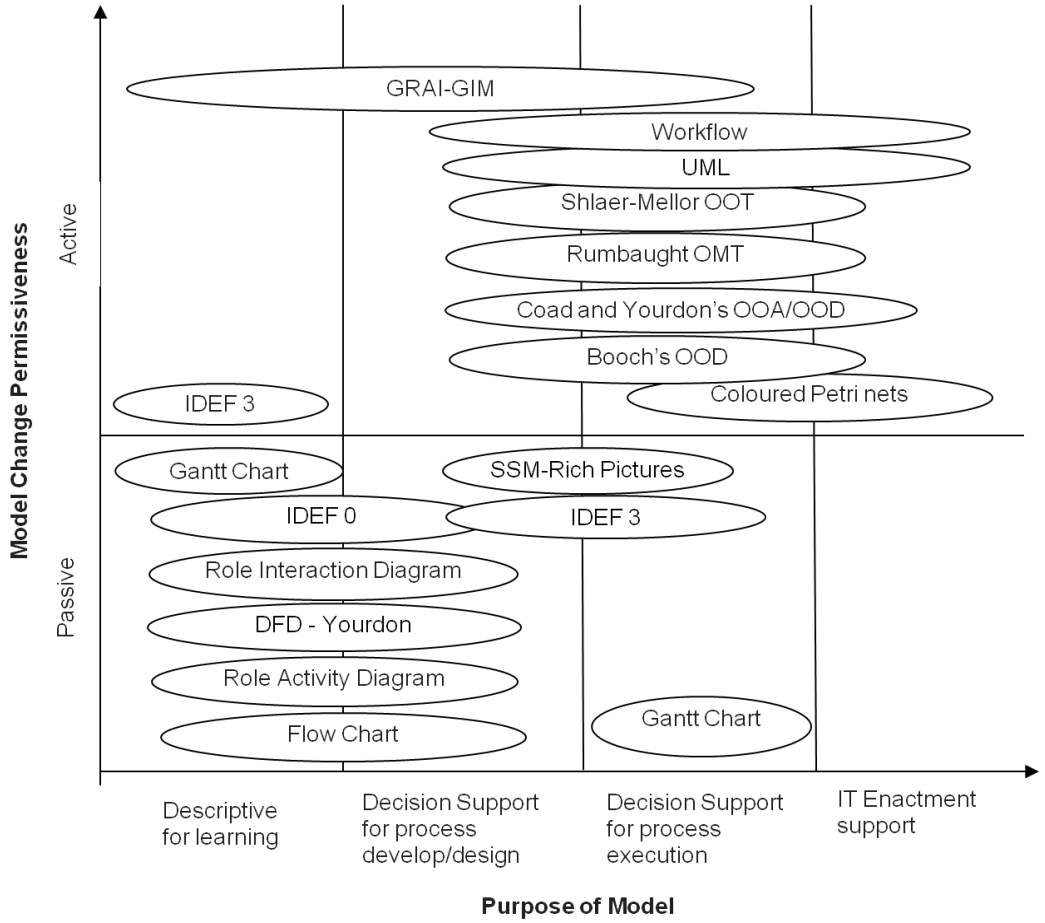


Figure 13. Classification of BPM techniques (Aguilar-Savén 2004: 146).

In the framework, Sara Aguilar-Savén considered the two main parameters of the BPM techniques. Firstly, the *Purpose of the model,* as it is very important for the modeller to understand the purpose of the model to be constructed. Secondly, the *model change permissiveness,* as it is equally important to consider the flexibility and feasibility of the model towards changes. As shown in Figure 13, the purpose of the model is further classified into *descriptive models for learning*, *decision support for processes development and design*, *decision support for process execution* and *IT enhancement support*. Similarly, the model change permissiveness is categorised in *active* methods and *passive* methods. The active techniques are techniques which are dynamic in nature, or allow the user to make changes easily, for instance simulation and enact able models. The passive techniques are those techniques which do not have the capability to

allow user interaction or are very difficult to modify. In the next section the most suitable BPM technique is selected for this study.

3.2 Selection of most Suitable BPM Technique for this study

As mentioned in the previous sections, this study aims to find a way to reduce the total cost of ownership, without compromising the level of service to Telco. Additionally, this study proposes a new OGS methodology, which is based on the analysis of the current OGS methodology, and the OGS activity map created by the researcher. Further, this study proposes essential modifications to the existing OGS processes to support new OGS methodology. Thus, this study has selected such a BPM technique, which possesses at least the following five attributes. Firstly, it should be able to capture business processes relating to OGS. Secondly, it should show precedence, relationship and dependency between activities. Thirdly, analysing it should be easy. Fourthly, it should be descriptive. Finally, it should be possible to decompose it further, to present sub-activities.

In this study, the researcher has analysed the existing business process and suggested improvements to it. Additionally, to improve the effectiveness and efficiency of the new processes some decision might be required during the execution. Thus, the techniques under the categories *Decision Support for process develop/design* and *Decision support for process execution* suit the best. However, OGS is a time critical activity and hence while executing a process some decision might be required to ensure correct performance; in other words this study requires such a BPM technique, which enables control and monitoring of the processes as well as provides information in order to support decision making. Further, OGS work is fixed (as per the contract) and hence the processes do not change very often. This makes passive techniques the obvious choice. Based on the argument presented in this paragraph, one can conclude that the P*assive* BPM techniques, which can be categorised under *Decision support for process execution* are the choice for this study.

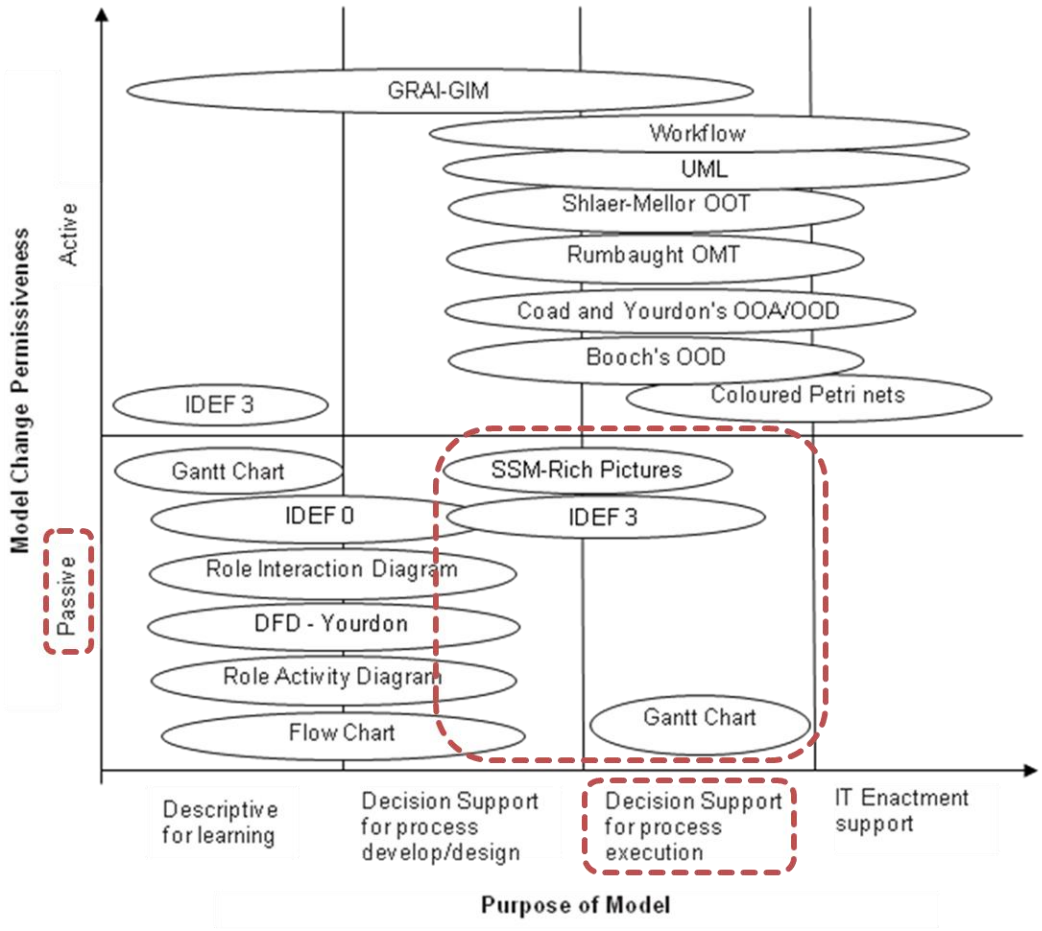


Figure 14. Applicable BPM techniques (Aguilar-Savén 2004: 146).

Figure 14 above, shows different BPM techniques and their classification according to Aguilar-Savén (2004). Additionally, the BPM techniques which are passive in nature and suitable for decision support for process execution are highlighted in the Figure 14. In the following sections, selected BPM techniques *SSM-Rich pictures*, *IDEF3* and *Gantt Chart* are described in brief and the most suitable BPM technique is selected for this study.

3.2.1 Soft Systems Methodology – Rich Pictures

Soft Systems Methodology (SSM for short) was developed by Checkland and colleagues at the University of Lancaster. The Soft systems methodology (SSM) is a BPM technique for organisational process modelling and can be used both for general problem solving and in the management of change. Checkland described SSM using a seven-stage model which is very well known as Checkland's seven-stage overview or 'mode 1' SSM. Figure 15, depicts the SSM investigation procedure step by step, making a clear distinction between system think-

ing (conceptual in nature) and things which happen in reality (the real world representation).

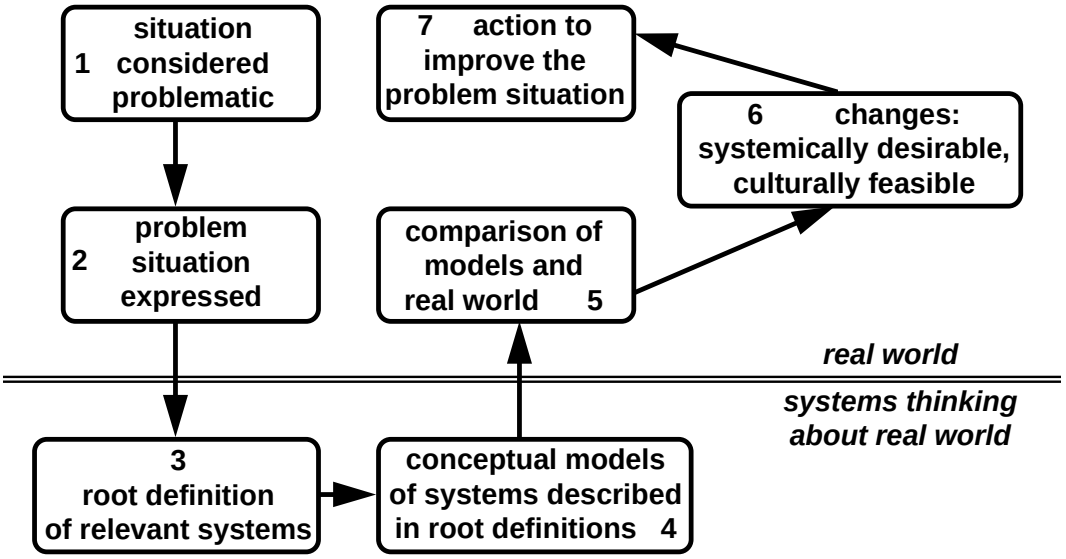


Figure 15. Checkland's seven stage SSM overview model (Checkland 1981: 163).

As shown in Figure 15, in the first stage the problem situation is identified. In the second stage the problem situation is expressed using one or more rich pictures, capturing the human activity aspects. In the third stage formal root definitions are provided, highlighting the purpose of the system and its main elements. In the fourth stage, the root definitions are translated into an activity model. An activity model consists of a linked set of activities and dependencies between them. In the fifth stage, a comparison is made between the conceptual model created in the fourth stage and how the activities are actually happening in reality. In the sixth stage, suggestions for improvement are given based on the comparison done in the fifth stage. In the seventh and last stage, suggestions for improvements are implemented in the system.

As mentioned before, rich pictures are mainly used in stage two - *Problem situation expressed* of Checkland's seven stage overview. The Rich pictures normally consist of drawings or pictures, which may include elements of process, issues, concerns or development and so on. Additionally, there are no rules for drawing rich pictures, and this is exactly the point why it is so famous and still in use.

Generally rich pictures are like cartoons, i.e. funny, sad, political and preferably all this at once (Business Process Transformation, Spring 1996).

3.2.2 Gantt Chart

A Gantt chart is a type of bar chart that illustrates a project schedule. In a simpler term it is a matrix representing tasks or activities against the time factor. In the Gantt chart a task or activity is presented on the Y-axis (vertical axis) and time duration (absolute or relative) is presented on the x-axis (horizontal axis). Thus it enables an activity to be plotted against a time unit, typically in weeks or months and other time units (Aguilar-Savén R.S. 2004: 135). Since the Gantt chart plots activities against time, it can be used to control a process during execution in terms of performance (time consumed doing specific tasks or set of tasks). For the same reason it can be used for planning as well. A Gantt chart is a very simple graphical representation but it does not show clear dependency between activities (Aguilar-Savén R.S. 2004: 136). However, the strength of a Gantt chart is its ability to display the status of each activity at a glance.

3.2.3 Integrated Definition for Function Modelling 3 (IDEF3)

Integrated Definition for Function Modelling (IDEF) is a modelling language, which was first developed for the modelling of manufacturing systems. Initially it had four different notations to model an activity from a certain viewpoint. These were IDEF0, IDEF1, IDEF2 and IDEF3 for functional, data, dynamic and process analysis respectively. The IDEF3 is a process description capture method capable of capturing behavioural aspects of a process and hence IDEF3 is officially named as *Integrated DEFinition for Process Description Capture Method*, which is a BPM complementary to IDEF0 (Mayer et al. 1993).

IDEF3 is a scenario-driven process flow modelling method created specifically to describe a situation or process in an ordered sequence of events or activities. A Unit Of Behaviour (UOB) is the main construct of this IDEF3 models. They may become functions, activities, processes, depending on the surrounding structure.

The IDEF3 can be defined as a scenario-driven process flow modelling method, intended to capture the knowledge about how a particular system works (Friel and Blinn 1989). IDEF3 can be further categorised in two modelling modes: first, the process flow description (PFD), which is suitable for describing how things actually work and second, the object state transition description (OSTD), which is

suitable for depicting an object's allowable transitions in a particular process. However, these two approaches are not mutually exclusive and hence IDEF3 allows cross-referencing between them to represent complex process descriptions. (Mayer et al.1993). The basic notation of the IDEF3 method consists of a series of boxes, and circles and arcs which link them (IDEF, 2003). An IDEF3 model for process flow description is primarily composed of UOBs (Unit Of Behaviour), junctions and links (Please refer to Appendix 2 to see more details).

As mentioned before, the Gantt chart is a very simple graphical representation but it does not show clear dependencies between activities (Aguilar-Savén R.S. 2004: 136). Furthermore, they cannot be decomposed to show sub activities, and hence it is not a suitable BMP technique for presenting OGS activities. The SSM Rich Pictures are used to *problem situation expressed* and hence can be used to capture the brainstorming session, in order to tap ideas and emotions. Therefore, this BPM technique is suitable for this study. However, using SSM - Rich pictures neither activities nor their dependencies can be presented. Additionally it cannot be decomposed; therefore some other suitable BPM technique should be used for this purpose. The next BPM technique identified is IDEF3. The IDEF3 technique is the most suitable technique for this study because, by using IDEF3, the activities, and dependencies/relationship between them can be presented easily. Also, these techniques support decomposition of activities, and hence it best suits the purpose best. Based on this comparison and feasibility, this study chooses to use both *SSM - Rich Pictures* and *IDEF3*.

One of the aims of this study is to reduce the total cost of ownership and improve the existing OGS processes. The existing OGS process has a system as well as a human perspective and hence any change in it will definitely affect the employees of the CO. To capture the human aspect, this study selected the SSM rich pictures methodology, proposed by Checkland and to picture the processes IDEF3 technique is used. This study proposes to outsource some of the OGS activities to reduce the total cost of ownership, and suggests improvements to the OGS processes. Hence, the following section discusses outsourcing and the success factors releated to it.

4 OUTSOURCING

This study explores options for reducing the total cost of ownership for OGS activities. One of the options is to outsource the activities to developing countries such as India where the operational and labor costs are much lower than developed countries. Outsourcing is a very generic term and does not have a specific definition and thus the term is used inconsistently. Overby (2007) defines outsourcing as “involving the contracting out of a business function to an external provider“. To put it simply, outsourcing can be viewed as transfer of an organizational function to a third party. There are different kinds of outsourcing, and one of the flavors of outsourcing is offshoring which can be technically defined as the transfer of an organizational function to another country, regardless of whether the work stays in the corporation or not (Mukherjee S. 2008). Further, offshoring is all about doing the right thing and doing it right. Aron and Singh (2005) did an extensive study on different types of offshoring and came up with a matrix shown in Figure 16, summarizing what type of offshoring is suitable for what type of activity.

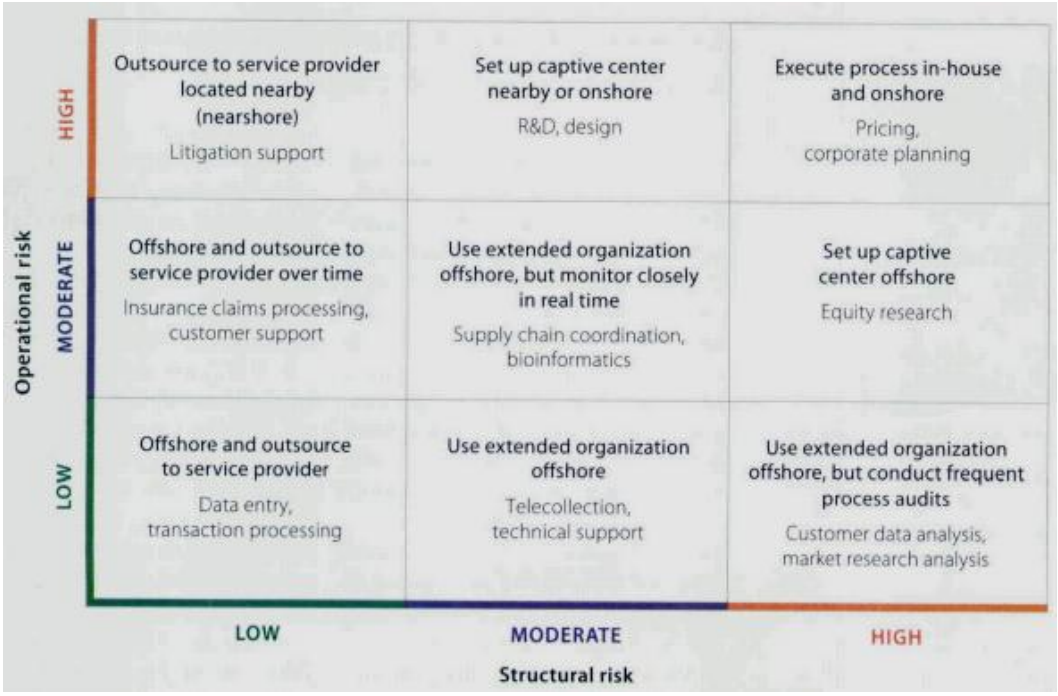


Figure 16. Offshoring - choosing the right organizational form (Aron and Singh 2005).

As shown in Figure 16 the matrix exhibits nine cells depicting the optimal offshoring response to a different level of risks. The vertical axis of this matrix depicts Operational risks (i.e. the risk that processes will not operate smoothly

after being offshored) and the horizontal axis depicts Structural risk (i.e. the risk that relationships with service providers may not work as expected).

> Once a company has determined the operational and structural risks of outsourcing its processes, it can use this grid to choose the best locations and organizational forms for those tasks. The nine cells in this table show the optimal offshoring responses to different levels of risk (Aron and Singh 2005: 141).

Aron and Singh suggested that companies should consider one of the structures mentioned in Figure 16, based on the needs and considering the operational and structural risks involved in offshoring the process. Further, Aron and Singh think that an organization can use location - onshore, nearshore, or offshore to combat operational risk, and organizational structures - such as captive centers and joint ventures to respond to structural risk.

> When both the operational and structural risks of offshoring processes are low, companies can outsource them to overseas service providers. As the operational risk of offshoring processes rises, locating them offshore becomes more dangerous. Companies should transfer processes that possess high levels of operational risk to nearby countries rather than to distant overseas locations. When the operational risk is very high, setting up captive centers locally is often the best solution. Outsourcing is less attractive in the case of processes with moderate or high structural risk; here, other forms of governance, such as joint ventures and captive centers, become better options. In the case of processes that have very high levels of structural risk, outsourcing isn't feasible. Companies must set up captive centers to execute those processes. Finally, when both operational and structural risks are very high offshoring and outsourcing are out of the question. Companies must execute those processes onshore and in-house (Aron and Singh 2005: 141).

The CO has two development centers in India, and these centers already have the knowledge about the billing product and the customization done for Telco. Thus, CO has a very low operational and structural risk involved while offshoring the processes. However, the OGS tasks are time critical and require strong

coordination between teams, so it would be recommendable to opt for captive offshoring.

4.1 Drivers and obstacles of offshoring

There are different reasons why organizations offshore activities. The following figure shows most general reasons why organizations opt for outsourcing and what are the obstacles in the implementation.

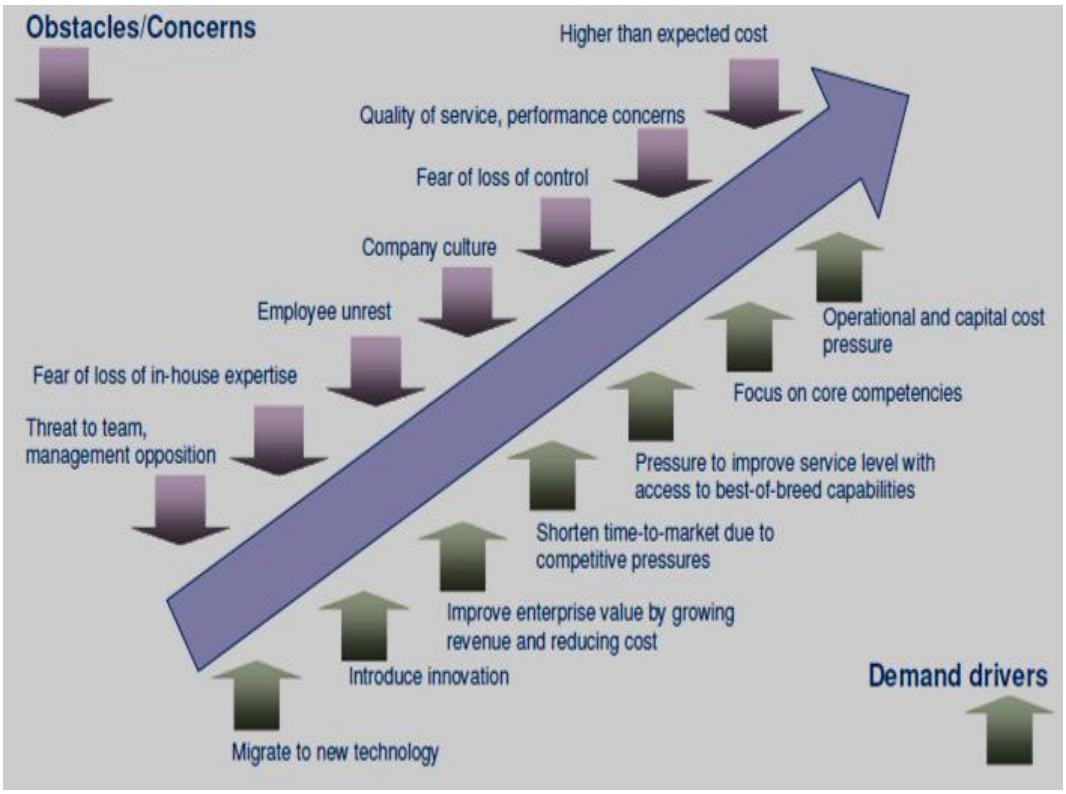


Figure 17. offshoring drivers and obstacles.

As shown in Figure 17, the main driving forces behind outsourcing are direct cost savings (lower resource costs, lower recurring costs) and increased profit margins. Additionally, outsourcing allows companies to concentrate on core and customer facing functions, improvements in quality and level of service to the customer, economies of scale, (because the outsourcing company has built expertise in those) and wage arbitrage and so on. However, there are various risks and threats involved which includes higher outsourcing cost than budgeted, risk to organization reputation, fear of the unknown as well as fear of loss of expertise and control, cultural issues, resistance from the employees and so on.

4.2 Success factors of offshoring

Even though there are various risks involved in offshoring, it still is the mega trend for our time. Offshoring can be extremely successful if the following factors are understood and considered well during the implementation. First, take time to identify a quantifiable business problem and establish that an offshore solution is the best solution. Second, plan carefully and execute, in order to achieve an ROI. Third, realize it may be a long and difficult process requiring preparation and hard work. Fourth, the quality of onshore and offshore teams must be the best available and staff must be given the tools and skills needed (Hetch 2005: 23). Fifth, the selection of offshore locations should not (only) be based on low cost (Skill base, Stability, Shared values and ethic are also critical). Sixth, offshore programs require a strong governance model with clear definitions of expectations and roles. Seventh, outsource service provider's personnel should be trained to understand the outsourcing organization's business environment, culture and goals. Eighth, consider a Service Level Agreement and ninth, fix organizational processes before offshoring. Finally, be prepared to measure performance (Waltham M. 2006).

As discussed in the previous sections, there are various driving forces behind outsouring, which lure companies to opt for it. However, there are various side effects and if outsourcing is not planned and executed properly it may lead to failure of the project resulting in significant financial losses. Thus, in order to ensure long term value creation offshoring should be considered in the context of a portfolio of the sourcing, process improvement and complexity reduction decisions. Further, before taking an offshoring decision one should have a concrete answer for the following four questions: What ? Where ? How ? and Who ? These questions provide details on what activities to outsource, where they should be outsourced, what organisational form should be used, and last but not the least to which vendor it should be offshored. Inshort if organizations consider carefully what processes to offshore, where to offshore, dedicate sufficient forethought and put the needed monitoring in place then they can realize noticeable improvement in operational efficiency and productivity which intern help companies to reduce total cost of ownership and earn more profit.

There are multiple benefits to outsourcing. Again, the argument is clear. Using the expertise from another organization, to perform non-core activities such as back office operations, frees organizations to focus on their core business.

Whether offshore, nearshore or onshore, there are pitfalls to avoid. The first rule of thumb is careful vendor selection. Secondly, regular and clear communication is vital to the success of outsourcing. Similarly, it is equally vital to find the right staff mainly when work is offshored to a third party supplier. In this case, the recruitment decision lies with the third party; therefore, finding a supplier who can be trusted to find the right staff is particularly important. Further, it is extremely important to understand that the organizations who outsource IT services are also taking on risks. This risk arises from differences in language, culture, regulations, work practices and political environment. These factors can potentially negate the main driving force of outsourcing - reduced cost. These barriers make collaboration more challenging and can thus increase the cost. Therefore, offshoring is not suitable for every organization, and careful consideration needs to be taken before any decision is made. Lastly, it is vital to understand that even though offshoring is not the answer to every problem, in many cases it may be beneficial.

5 DESCRIPTION OF CURRENT OGS ACTIVITIES

This section captures the conventional OGS process model presented in Section 1.5 by using the BPM IDEF3 technique. The idea is to create a detailed process model for each activity performed by the OGS team. This will give a better understanding of the processes, and help in identifying the dependency between the processes. Furthermore, it provides an idea how these processes will be modified in order to achieve maximum feasible offshoring. Figure 18 is a simplified IDEF3 process model of the current OGS methodology implemented for Telco.

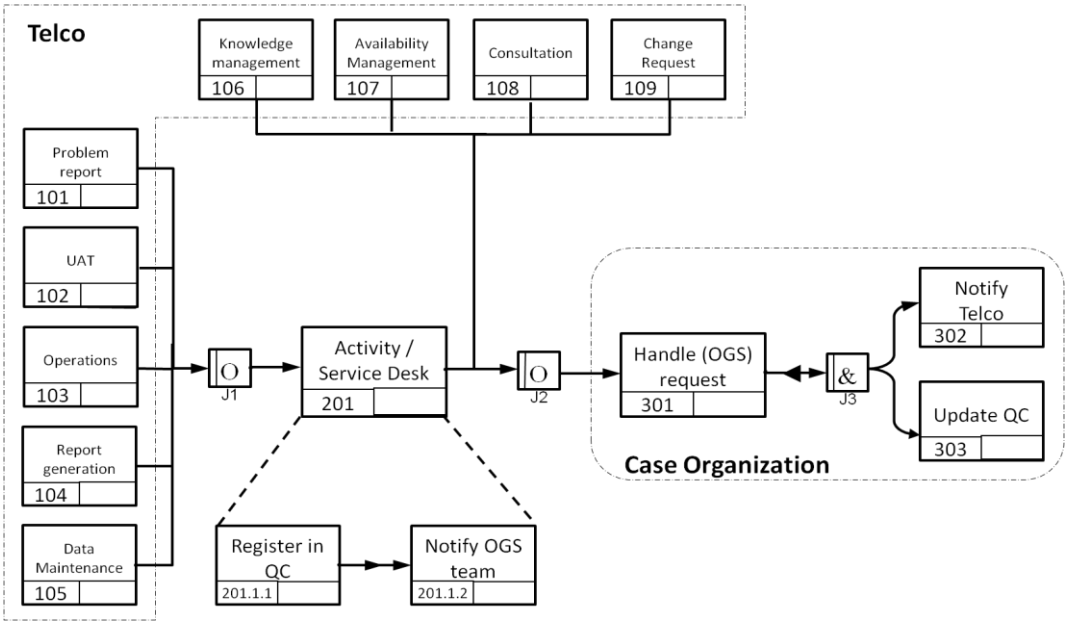


Figure 18. IDEF3 representation of the OGS methodology in Telco.

As depicted in Figure 18 there are mainly two channels through which Telco sends requests to the OGS team. The first method is sending a work request through the service desk and the second method is sending a work request directly to the OGS team member, using a formal or informal communication method. As shown in Figure 18, the requests such as PR (UOB#101), UAT support (UOB#102), operations (UOB#103), report generation (UOB#104) and data maintenance (UOB#105) come through the service desk. On the other hand requests related to knowledge management (UOB#106) such as request to conduct training session and request to provide documents comes directly to the OGS. Similarly, requests such as availability management (UOB#107), consulta-

tion (UOB#108) and change request (UOB#109) come as direct work request to the OGS team. The process flow via service desk (SD) initiates as soon as Telco raise either problem report (UOB#101) request or UAT support (UOB#102) request or Operational (UOB#103) support or Report generation (UOB#104) request or Data Maintenance (UOB#105) request. After SD receives the request (UOB#201), it is first registered in Quality Centre (QC) as ticket (UOB#201.1.1), and then it is forwarded to the respective OGS team (UOB#201.1.2) for further handling. The "OR" Junction J2 shows that OGS team can get requests either from SD or directly from Telco. The request received goes to the respective OGS team's work queue and is handled (UOB#301) as per the indicated priority/severity, SLA and importance of the issue reported. The "AND" junction J3 shows, that after handling the request OGS team member updates the QC with the details (UOB#303) and a notification is sent (UOB#304) to Telco. Additionally, a constraint precedence link between UOB#301 and junction J3 indicates that without successful handling of the request, the OGS team cannot update QC or notify the customer.

On the other hand the process flow via direct channel initiates as soon as Telco raises either knowledge transfer/training sessions (UOB#106) request or operational request such as a software upgrade or testing environment upgrade or rerun of certain jobs and so on, which falls under availability management (UOB#107) or Consultation (UOB#108) request or change request (UOB#109). The request received goes to the respective OGS team's work queue and is handled (UOB#301) as per the indicated priority/severity, SLA or agreed schedule with Telco and important of the request. Once the request is handled successfully, QC is updated with the details (UOB#303), and a notification is sent (UOB#304) to Telco, as depicted by "AND" junction J3. Further, a constraint precedence link between UOB#301 and junction J3 indicates that without successful handling of the request, the OGS team cannot update QC or notify the customer.

As shown in Figure 18, there are various activities carried out by the OGS team and for each of them a different process is defined. However, there are mainly two processes, CR and PR, which are used very frequent and are very important from Telco's point of view. Other process flows also form subsets of the process flows of CR and PR. The following section discusses two major types of requests,

PR (UOB#101) and CR (UOB#109), which occur very frequently and in fact cover the process flows of all the other request types.

5.1 Problem Report (PR)

The first major activity handled by OGS team is problem report (PR) handling.

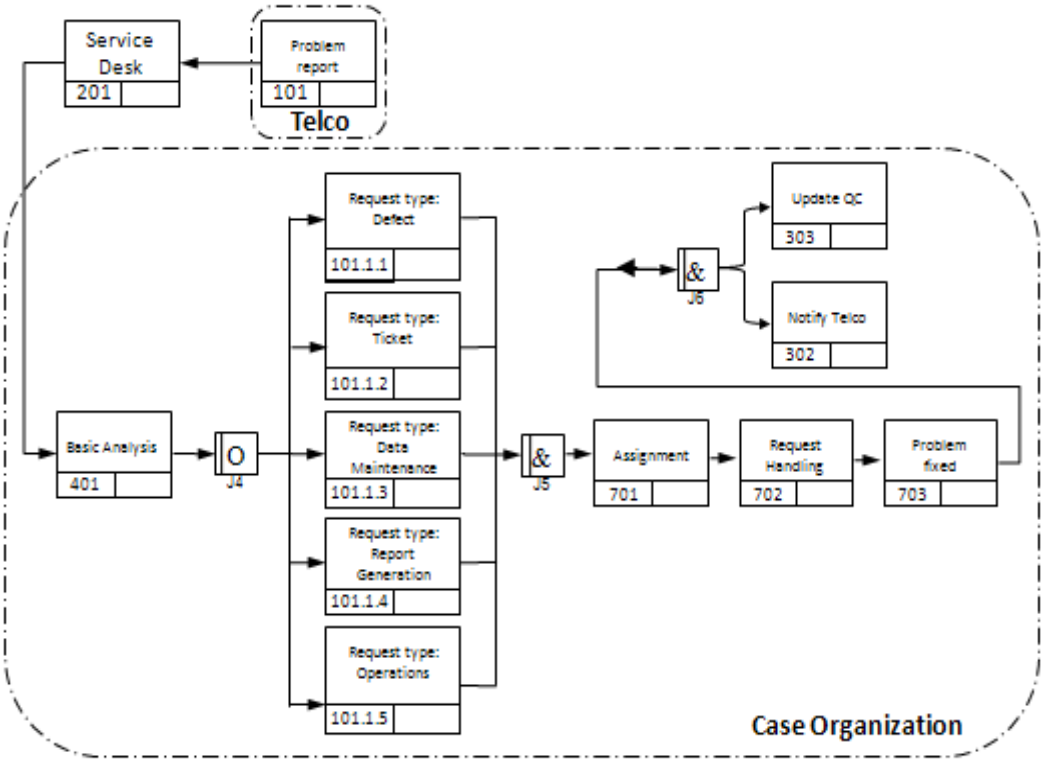


Figure 19. Problem report – decomposed.

Figure 19 shows the process flow of a problem report (PR). The PR flow initiates, as soon as Telco sends a request to SD (UOB#201). SD registers the problem in QC and notifies OGS. Once OGS receives the request, a basic analysis is carried out (UOB#401), and information such as request type and responsible team is added. As shown by ”OR” junction J4, the request can be categorised as Defect (UOB#101.1.1), Ticket (UOB#101.1.2), Data Maintenance (101.1.3), Report generation (UOB#101.1.4) or Operations (UOB#101.1.5). After the problem is analysed and its type is identified, it is assigned to the OGS team member (UOB#701) by the respective application leader. Then the OGS team member handles the request (UOB#702) and once the problem is fixed (UOB#703), he/she updates the QC (UOB#303), and also notifies Telco (UOB#302) about the completion of the task.

5.2 Change Request (CR)

The second major activity handled by the OGS team is change request (CR) handling.

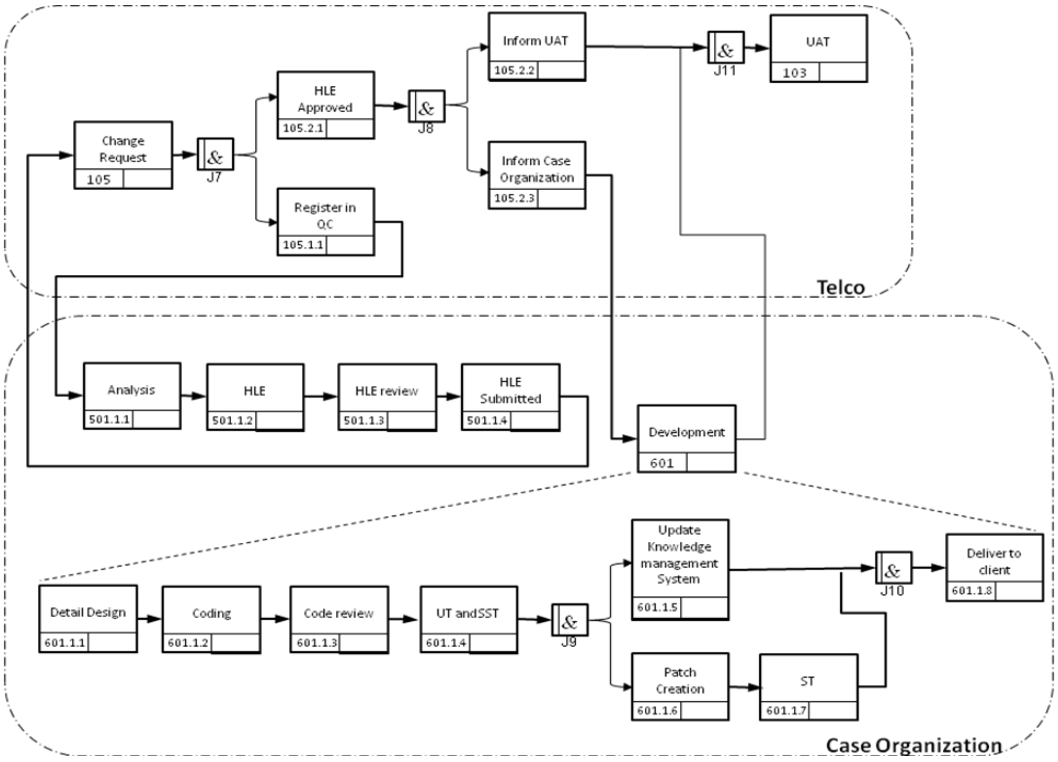


Figure 20. Change request – decomposed.

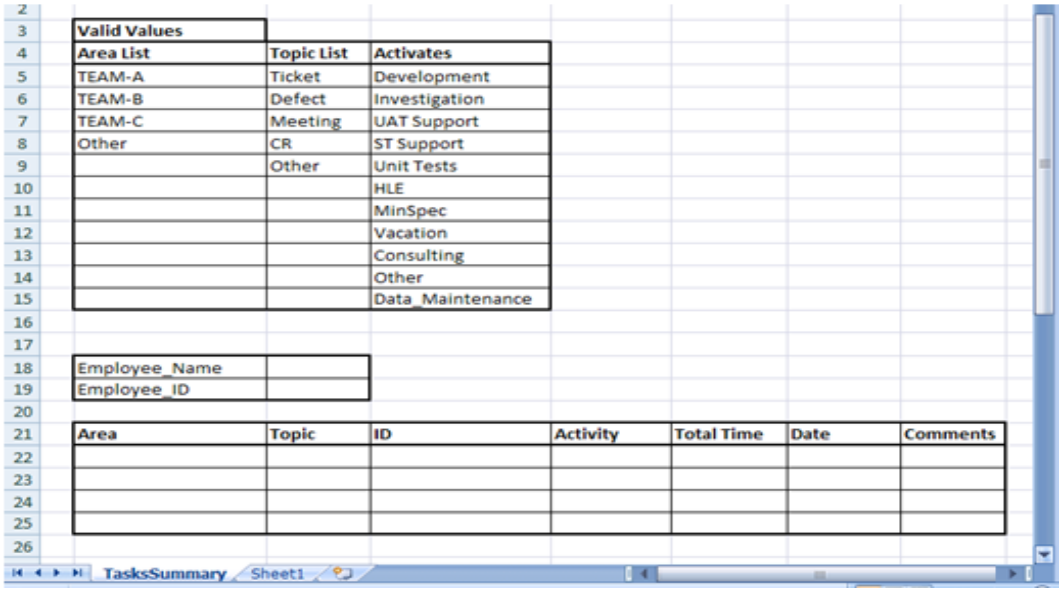
Figure 20, shows the process flow of change request (CR). The CR flow initiates as soon as Telco opens a CR request (UOB#105) and registers it in QC (UOB#105.1.1). Once the CR is registered in QC, Telco sends a notification to OGS. After receiving the request the OGS team starts analysing it (UOB#501.1.1). After the analysis a High Level Estimate (HLE) is prepared to estimate how many man hours are required to finish the development and testing (501.1.2). Many times there is more than one application in which changes are required. In this case, each application involved prepares their estimation and then a consolidated master HLE is prepared. Once the master HLE is done an HLE review meeting with all the applications involved is arranged, where the HLE is reviewed as a whole and approved (UOB#501.1.3) for sending it to Telco (UOB#501.1.4). After the HLE is submitted, it is reviewed by Telco. If it is approved then the CR status is changed to HLE Approved (UOB#105.2). After the HLE is approved, Telco sends a notification to the CO to start development (UOB#105.3) and also inform UAT(UOB#105.4) to start preparation for UAT testing, as shown by ”AND” junction J8. After the OGS team receives an approval, development starts (UOB#601). The development activity is

decomposed further to show details of the activities which consists of Detail Design (UOB#601.1.1), coding (UOB#601.1.2), code review (UOB#601.1.3), followed by UT and SST (UOB#601.1.4) in sequence. After the fix passes SST, a patch is created (UOB#601.1.6) and delivered for ST, in parallel with this activity, the developer updates all the relevant documents and uploads it in Knowledge management system (UOB#601.1.5). As shown by ”AND” junction J10, after the knowledge management system has been updated and the fix has passed ST, the patch is delivered to the UAT team (UOB#601.1.8) in other words the patch is delivered to the client. Further, as shown by ”AND” junction J11, the UAT starts (UOB#103) after the patch has been delivered to the client, and information from Telco related to the CR has been received.

As described in the above sections, the work request handling processes are well defined and provide strict guidelines to the OGS team members - how each kind of work request should be handled. In general any deviation from the predefined status is not allowed, however if needed it should be discussed with the OGS manager. Once the manager finds it reasonable then it is discussed with Telco and the required procedure is modified.

5.3 Survey with OGS Team Members

In this study a survey was conducted with the OGS team members to capture the daily activities performed over a period of one month. The employees were asked to fill in their daily activities in an Excel template shown in Figure 21, and to send it to the project manager on a weekly basis.



Valid Values		
Area List	Topic List	Activates
TEAM-A	Ticket	Development
TEAM-B	Defect	Investigation
TEAM-C	Meeting	UAT Support
Other	CR	ST Support
	Other	Unit Tests
		HLE
		MinSpec
		Vacation
		Consulting
		Other
		Data_Maintenance

Employee_Name	
Employee_ID	

Area	Topic	ID	Activity	Total Time	Date	Comments

Figure 21. Task summary template.

Figure 21 shows the sample template which is used for this study. The template is divided into three sections including valid values, employee details and task details. The first section contains a valid list of Area, Topics and Activity which should be used throughout task reporting. The second section contains employee related information which includes employee name and employee identification number. This information is used later for generating employee base reports. The third section contains the list of activities performed by the employee. The area, topic and activity values should be selected from the drop down list for which valid values are defined in the first section of the template. The values are defined in order to standardize the report, so that analysis can be carried out easily. Further, these valid values are attached to the respective column of the template; this restricted employees to deviate from the valid values provided. If the employees try to enter a non-valid value then the template show an error message of invalid value, as shown in Figure 22 below.

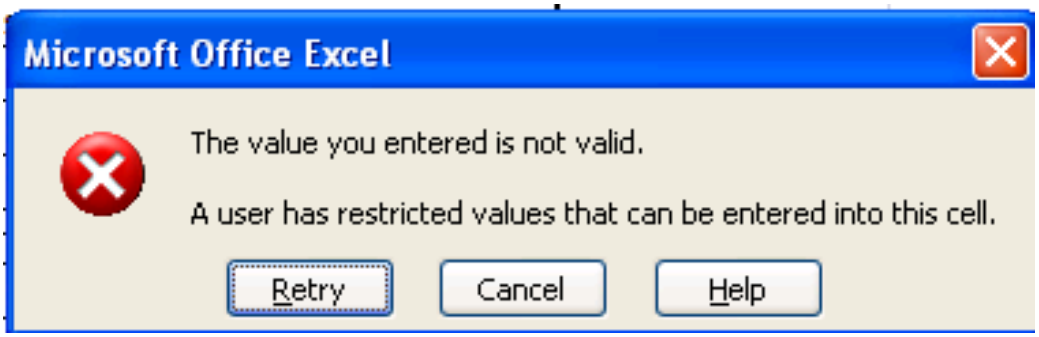


Figure 22. Task summary template – error message.

Employees were advised to contact the project manager, in case they think other items should be added to the valid values.

The reports collected throughout the week were merged on a weekly basis into a common file and a consolidated Task Summary report is prepared. Figure 25 shows an example of the Task Summary Report.

	A	B	C	D	E	F	G
1	Area	Topic	Employee Name	Activity	Total Time	Date	Comments
25	TEAM-C	Other	EMPOLYEE-A	Consulting	0.08	04-Feb-10	TASK DESCRIPTION
26	TEAM-C	Defect	EMPOLYEE-A	UAT Support	0.33	04-Feb-10	TASK DESCRIPTION
27	TEAM-C	Defect	EMPOLYEE-A	UAT Support	0.75	04-Feb-10	TASK DESCRIPTION
28	TEAM-C	Ticket	EMPOLYEE-A	Consulting	0.33	04-Feb-10	TASK DESCRIPTION
29	TEAM-C	Meeting	EMPOLYEE-A	Consulting	1.50	04-Feb-10	TASK DESCRIPTION
30	TEAM-B	Meeting	EMPOLYEE-A	Consulting	1.00	04-Feb-10	TASK DESCRIPTION
31	TEAM-C	Ticket	EMPOLYEE-A	Consulting	1.17	04-Feb-10	TASK DESCRIPTION
32	TEAM-C	Meeting	EMPOLYEE-A	Rollout Related	1.00	04-Feb-10	TASK DESCRIPTION
33	TEAM-C	Defect	EMPOLYEE-A	UAT Support	0.33	04-Feb-10	TASK DESCRIPTION
34	TEAM-C	CR	EMPOLYEE-A	UAT Support	0.50	04-Feb-10	TASK DESCRIPTION
35	TEAM-B	Meeting	EMPOLYEE-A	Rollout Related	0.33	04-Feb-10	TASK DESCRIPTION
36	TEAM-A	Other	EMPOLYEE-B	Management	4	01-Feb-10	TASK DESCRIPTION
37	TEAM-B	Other	EMPOLYEE-B	Management	4	01-Feb-10	TASK DESCRIPTION
38	TEAM-A	Other	EMPOLYEE-B	Management	4	02-Feb-10	TASK DESCRIPTION
39	TEAM-B	Other	EMPOLYEE-B	Management	4	02-Feb-10	TASK DESCRIPTION
40	TEAM-A	Other	EMPOLYEE-B	Management	4	03-Feb-10	TASK DESCRIPTION
41	TEAM-B	Other	EMPOLYEE-B	Management	4	03-Feb-10	TASK DESCRIPTION
42	TEAM-A	Other	EMPOLYEE-B	Management	4	04-Feb-10	TASK DESCRIPTION
43	TEAM-B	Other	EMPOLYEE-B	Management	4	04-Feb-10	TASK DESCRIPTION
44	TEAM-A	Other	EMPOLYEE-C	Other	2	01-Feb-10	TASK DESCRIPTION
45	TEAM-A	Other	EMPOLYEE-C	Other	1	01-Feb-10	TASK DESCRIPTION
46	TEAM-A	Ticket	EMPOLYEE-C	Data_Maintenance	2	01-Feb-10	TASK DESCRIPTION
47	TEAM-A	Other	EMPOLYEE-C	Investigation	2	01-Feb-10	TASK DESCRIPTION

TasksSummary | SummaryBasedOnDates | SummaryBasedOnArea | SummaryBasedOnActivity

Figure 23. Sample task summary sheet.

The Task summary report shown in Figure 23 is a detailed OGS activity report, which gives a fair idea of what activity is performed by the OGS team on a regular basis and how much time is spent on them. Further, this report provides a bird eye view on the overall activities carried out by each OGS team member and can be used to produce various types of reports such as employee based activity report, team based activity report, time spent per activity wise report and so on. These kinds of reports are very useful for planning and management purposes.

In order to reduce the total cost of ownership and to improve the existing OGS processes, the first step is to understand and map out the main OGS activities using the selected BPM technique. Thus, this section discussed the process flow for two major types of requests, PR and CR, which occur very frequently and cover the process flow of all other request types. Further, a survey was conducted with the OGS team members, to capture daily activities performed over a period of one month. In the next section the information presented in the task summary sheet is analysed and discussed in the brainstorming sessions conducted with a forum of technical experts and representatives from the management of CO.

6 RESULTS AND ANALYSIS OF RESEARCH

This section describes the outcome of the brainstorming sessions conducted with a forum of technical experts and representatives of the management. The forum validated the OGS activity map, and came up with a list of criteria to decide which activity can be offshored. Improvement areas were further identified by comparing the existing OGS team structure with the new proposed structure. Finally, the information collected is used to find any gaps in the operations. This information is further used to modify the existing business processes.

6.1 Planning

During this study three brainstorming sessions were conducted. The first session was conducted to check the validity of the data collected. The second session focused on getting the opinion of the forum concerning the offshoring of the OGS activities. The third and final session was conducted to decide on the criteria to determine whether to offshore activities or not. Further, the conclusions made in one session served as the basis for conducting the next session, since if the forum felt that the Task activity sheet was not reliable or it did not contain valid information then there was no point going ahead with the next brainstorming sessions to discuss offshoring. Likewise if the forum and hence the management rejected the idea of offshoring then there was no point of finding criteria to decide if the activity should be offshored or not. The results of each session are detailed below.

Session 1:

The following question was asked.

What do you think about the validity of Task Summary report which contains a list of daily activities performed by the OGS team members?

The first brainstorming session was conducted to check the validity of the data collected in the Task Summary report shown in Figure 23. This step was critical to this study as an activity map was created based on this information, which intern was the basis for the new OGS methodology.

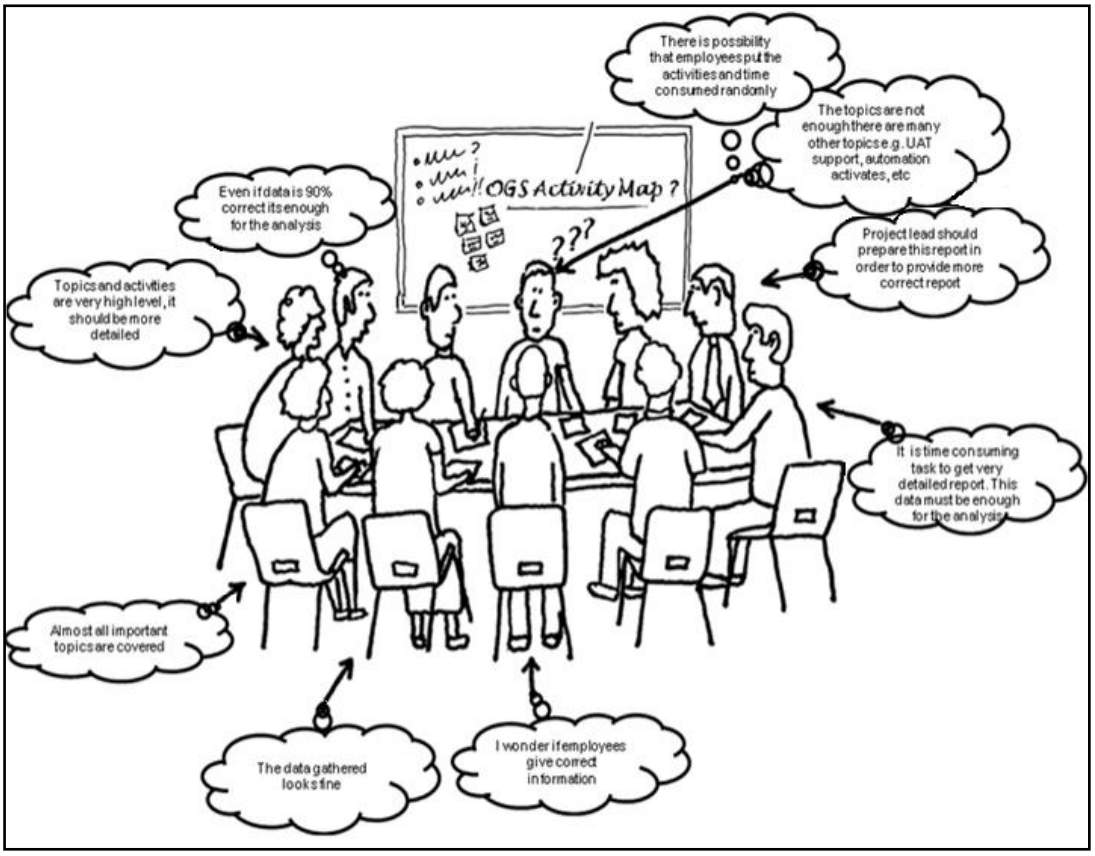


Figure 24.The Forum view on Task Summary report.

Various key issues and concerns were raised and discussed during the session. However, only important points were noted down and presented in Figure 24, using SSM rich pictures technique. As discussed before, the rich picture technique is used to picture thoughts, concerns and comments given by the forum during the discussions. Many members of the forum were concerned about the validity of the data as it is collected from the employees directly. They believed in most of the cases employee do not provide accurate information due to the fact that it reveals information related to how they work, and how much time they actually spent on each activity. Also, it is an additional task for them, and hence they tend to provide information in general and not in details, which can also be seen in the Task Summary report. They were also of the view that this kind of report should be prepared by project leaders, by closely monitoring the activities as they are the ones who assigns the tasks to the team and have the better control on it. Further, some members raised their concern on the list of topics mentioning that it is too generic and does not contain detailed information. Some others supported the validity of the Task Summary report, suggesting taking detailed information is a tedious and time consuming task. Further, the Task Summary report gives a fair idea about what activity is performed on a regular basis and

how much time is spent. Some other members favoured the report saying even if data is 80% - 90% correct, it provides a clear picture of the OGS activities. Finally the forum concluded that the data collected and presented in the Task Summary report is fair enough and provides a clear picture of the OGS activities performed on a daily basis.

Session 2:

The question below was asked.

What do you think about offshoring part of the OGS activities?

The second brainstorming session was conducted in order to get the view of the forum on the offshoring part of the OGS activities.

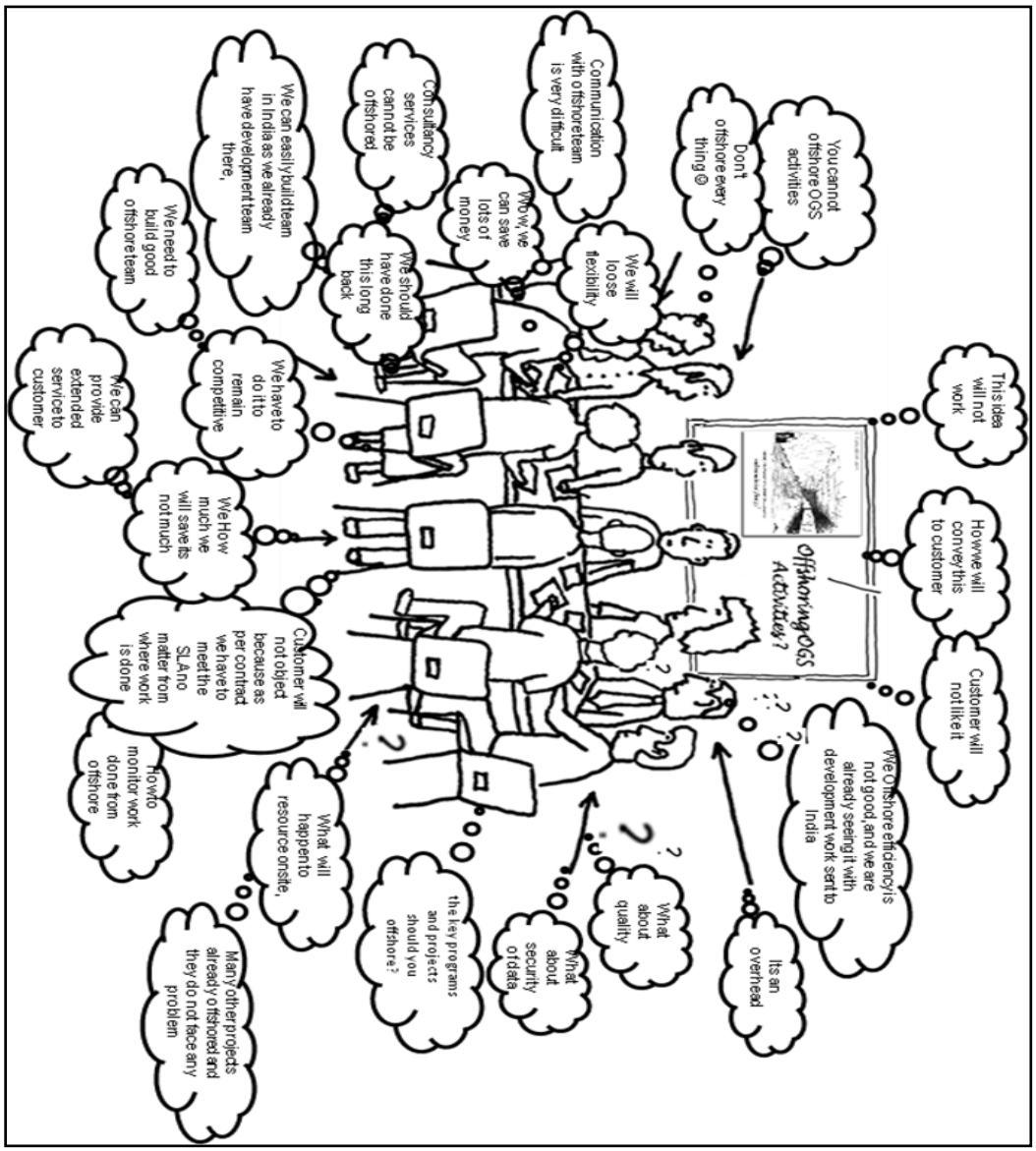


Figure 25. The Forum view on offshoring.

The topic was very sensitive, so the forum was asked to not to share this information with anyone in or outside the OGS team. The discussion went on for longer than expected, until a vague conclusion was made. Various concerns and key points were raised during the discussion which is presented in Figure 25. Many forum members' view was that it is not safe and strategically correct to offshore OGS activities. They argued that OGS activities are time critical, and any delay in performing them may result in Telco losing money. Further, as per the OGS contract, CO has to pay penalties, in case Telco file reclamation or SLA is crossed. Others objected this transition concerning managerial aspects, quality of work, security issues and so on. On the other hand many supported the idea and argued that many projects successfully offshored the activities throughout the industry. Others felt that in order to remain competitive we will have to do it one day so why not now. Finally the forum agreed upon the need for offshoring the activities with a note to having a very detailed plan made with caution and considering both the human and managerial aspects. Some forum members also felt that the OGS activity should be offshored to the CO development centre in Pune, India, due to the fact that the CO is has a small development team present there who is responsible for doing development work which does not fall under the OGS agreement.

The session finished with following remarks and recommendations:

Conclusion 1: In order to remain competitive and to reduce the total cost of ownership for the OGS activities, part of the activities should be offshored.

Conclusion 2: It is critical to have a strong coordination between the onsite and offshore teams.

Recommendation 1: The offshore team should be treated as an extension of the onsite team. This means the work will be assigned by the onsite team project leaders and the offshore team members will report directly to the onsite project leader.

Recommendation 2: This recommendation is an extension of recommendation 1. Project management and task assignment should be carried out by onsite management and managers at the offshore site will act as facilitator and HR manager.

Recommendation 3: The offshore team members should visit onsite a few times a year in order to meet the onsite team and to enhance their knowledge as well as to get hands on experience working closely with the customer.

Recommendation 4: The onsite team members should visit the offshore centre a few times a year to meet the offshore team in order to understand their problems and to carry out some knowledge transfer sessions.

Recommendation 5: The task should be offshored to India development centre (CO already has two development centres in India), as part of the development activity is already carried out in India (not part of OGS activities) and knowledge about the product and customization carried out for Telco is already present.

Recommendation 6: In order to reduce risk and to ensure a smooth transition, the OGS activities should be moved to the offshore centre one by one and slowly.

Session 3:

The following question was asked.

What should be the criteria for selecting the activities to be offshored?

The third and final session was conducted to determine the criteria for selecting the OGS activities to be offshored.

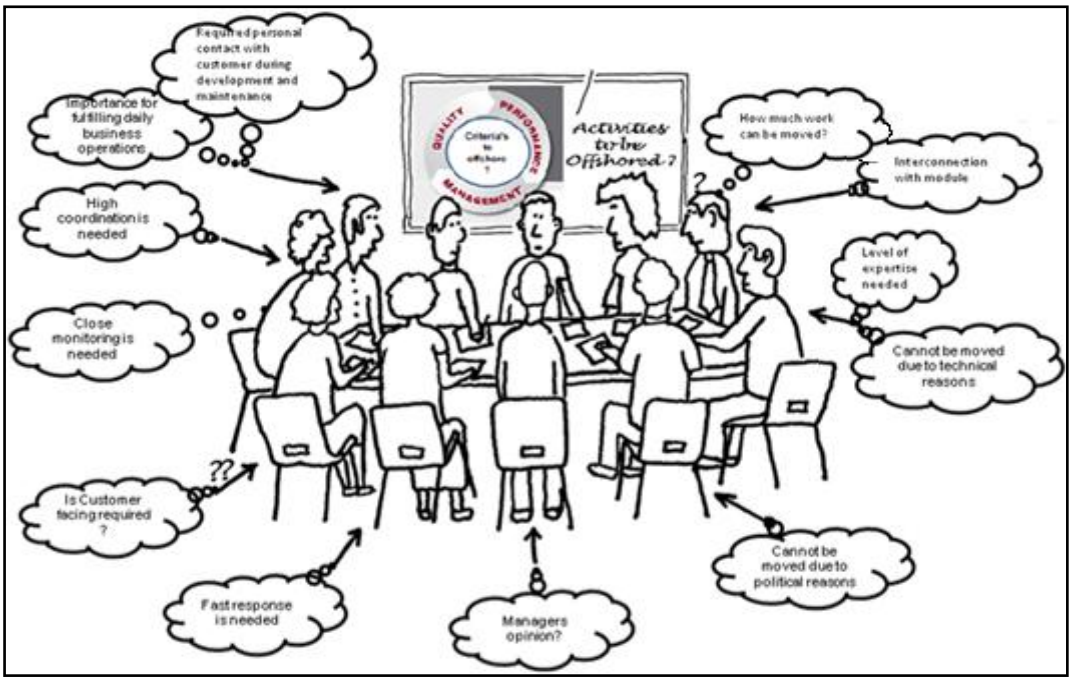


Figure 26. Forum view on criteria to offshore an activity.

Various key criteria and concerns were raised and discussed during the session. However, only the important points have been written on the rich pictures shown in Figure 26. The forum came up with an idea to consider only a few important criteria to find out which OGS activity should be kept onsite and which should be offshored. The session finished with the recommendation to use the following four criteria to identify which activity should be kept onsite.

1. Customer facing - Activities which require frequent meetings with the customer. The idea is that face to face meetings and discussions are more effective and fruitful than telephone conversations, video conferencing and other such mediums.

2. Technical reasons - Activities which are critical for the business of the case organisation or to the customer. The idea is that the activities which are critical need better coordination and monitoring. Further, the response time may impact the level of service and hence customer satisfaction.

3. Managerial reasons - Activities which requires strong coordination and monitoring. The OGS is a critical activity which requires immediate action in case of system error, which includes fixing the problem, root cause analysis and customer communication. The most important thing in such cases is to provide precise information to the management and to the customer and to find the solution or work around the solution so that Telco's business can run normally. These kinds of activities require lots of coordination, monitoring reporting and sometimes a joint effort from both OGS and Telco personals.

4. Strategic or Political reasons – These refer to business reasons the management may have for keeping a particular activity onsite. The reason may be a future business prospect or customer request, or to strengthen a specific area of the OGS team or any other such reason.

6.2 Preparation for action

This section provides a brief overview of various trend reports produced by the researcher. Additionally, based on the task summary report shown in Figure 23, a detailed OGS activity map is created. Based on the OGS activity map and the criteria decided on in section 6.1, the OGS activities which can be offshored were identified. Then the new OGS methodology is proposed based on the analysis.

Further, this study suggested the needed modifications in the existing business processes to implement a new OGS methodology and provided various tools and reports for the management. During this part of the study various actions were taken and active intervention into the OGS processes was made. It therefore, corresponds to the action taking phase of the action research.

6.2.1 Trend reports and Data Analysis

The researcher carried out an analysis of the data collected from the OGS team members and produced various trend reports. The report includes a date based trend report of the daily OGS activities, area or application based trend report, activity based trend report, employee based trend report, and finally an OGS activity map. Additionally, to check the authenticity of the data, the time spent on the OGS activities was compared against the working hours reported by the OGS team members in the reporting system of the CO.

The reports were prepared on MS Excel, using pivot table and pie charts. In the following sections example trend reports are described in detail.

1) Trend report based on Dates

A detailed trend report was prepared based on the Task Summary report exhibited in Figure 23. The idea is to capture how much time is spent on each activity, per area/application every day. The following Figure 27 shows an example report which was prepared during this study.

Area	CR	Defect	Meeting	Opertional	Other	Reports	Ticket	Grand Total
⊞TEAM-A	69.0	89.4	38.0	0.5	239.0	1.0	215.3	652.1
⊞TEAM-B	127.9	13.7	18.2		126.5		10.5	296.8
⊞TEAM-C	24.7	48.8	19.9		111.1	1.5	67.3	273.3
⊟TEAM-D	5.0		16.7		267.5		0.5	289.7
01-Feb-10					2.0			2.0
02-Feb-10					6.5			6.5
03-Feb-10			1.5		10.5			12.0
04-Feb-10					6.0			6.0
09-Feb-10	1.0		6.5		14.0			21.5
08-Feb-10					9.0			9.0
10-Feb-10	0.5		0.5		63.0		0.5	64.5
11-Feb-10	0.5		0.5		17.0			18.0
12-Feb-10			1.2		9.0			10.2
13-Feb-10					9.0			9.0
15-Feb-10					9.0			9.0
16-Feb-10					9.0			9.0
17-Feb-10					9.0			9.0
18-Feb-10					9.0			9.0
19-Feb-10					9.0			9.0
22-Feb-10	0.5		1.0		14.0			15.5
23-Feb-10	0.5		1.0		14.5			16.0
24-Feb-10	2.0		2.5		21.0			25.5
25-Feb-10					18.0			18.0
26-Feb-10			2.0		9.0			11.0
Grand Total	226.6	151.9	92.8	0.5	744.1	2.5	293.6	1511.8

TasksSummary | SummaryBasedOnDates | SummaryBasedOnArea | SummaryB

Figure 27. Summary based on date.

As shown in Figure 27, the rows depict activities performed and the columns represent areas sub-grouped by dates. This report was helpful for getting an overall picture by providing information such as if the activity is consistent and how much time was spent on the activity per month. Once the management has this information they can easily estimate what will be the expected work per activity during the upcoming months and thus better resource planning can be done.

2) Trend report based on application/area

This report provides answers to questions such as how much time was spent on various activities by individual area/application. Figure 28 is an example report where each row represents a distinct application/area sub grouped by activity, and in the column the sum total of time consumed to perform the activity is presented. Further, the pie chart shows the percentages contribution for each application – activity pair.

Row Labels	Sum of Total Time
TEAM-A	658.6
CR	69.0
Defect	89.4
Meeting	38.0
Opertional	0.5
Other	239.0
Reports	1.0
Ticket	215.3
Investigation	6.5
TEAM-B	296.8
CR	127.9
Defect	13.7
Meeting	18.2
Other	126.5
Ticket	10.5
TEAM-C	273.3
TEAM-D	289.7
Grand Total	1518.3

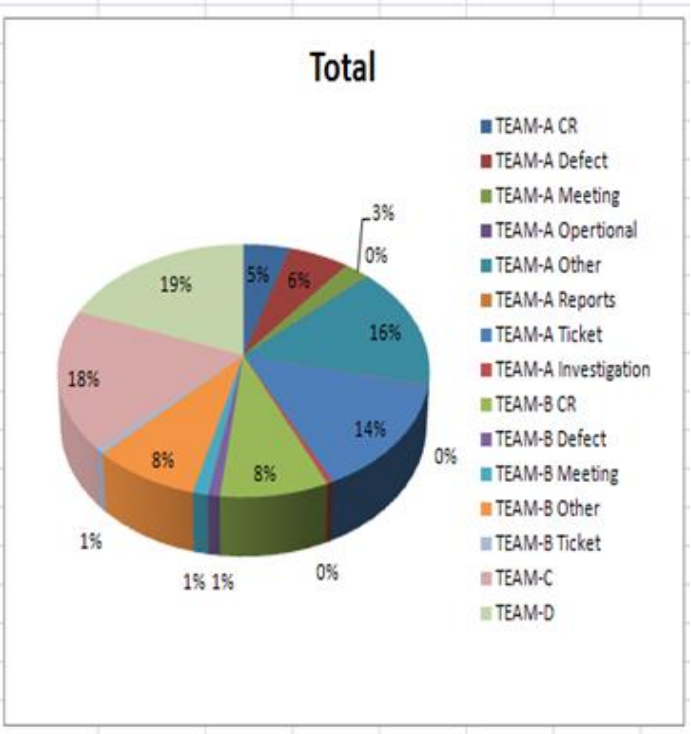


Figure 28. Summary based on area.

3) Activity based trend report

This report has two columns named “Activity” and “Sum of Total Time” which contains a list of topics sub grouped by activities and provides detailed information such as per topic how much time is spent on each activity. Further,

the percentage contribution of each topic – activity pair is presented using a pie chart, providing information at a glance.

Activity	Sum of Total Time
CR	226.6
Consulting	22.7
Data_Maintenance	1.0
Development	42.2
Investigation	25.4
Other	48.9
ST Support	22.8
UAT Support	12.7
Unit Tests	22.1
MinSpec	2.5
Code Review	7.0
HLE	19.3
Defect	151.9
Meeting	92.8
Opertional	0.5
Other	744.1
Reports	2.5
Ticket	293.6
Investigation	6.5
Consulting	2.0
Investigation	4.5
(blank)	
Grand Total	1518.3

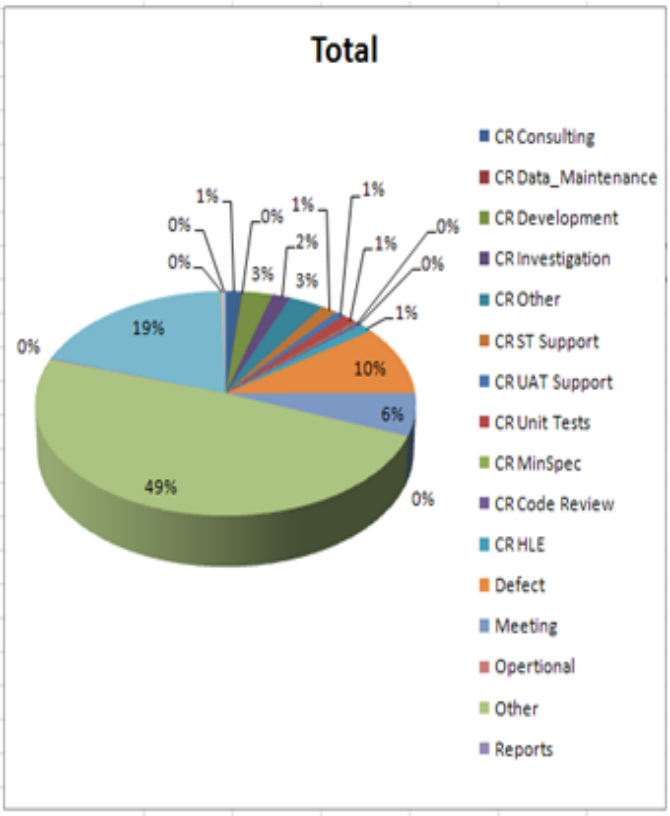


Figure 29. Summary based on activity.

4) Employee based trend report

In this report each column represents one activity and each row represents employees sub grouped by topics, and hence provides detailed information such as which employee is working on activity under which topic? This report is very helpful for doing resource planning and work allocation. Moreover, this report provides information on how many working hours spent by each employee will be saved if ticket handling is moved offshore, and can this time be utilised for other tasks onsite. Take, for instance, Employee C. The major tasks handled by this employee are “Data Maintenance”, Investigation – “Ticket handling” and “Development”. So if the management plans to move these activities offshore then Employee C can handle other activities performed onsite. Furthermore, such analysis will help the management estimate how many man hours/month of a task can be moved offshore. In other words this report helps the management in resource management, productivity improvement plans and budget management.

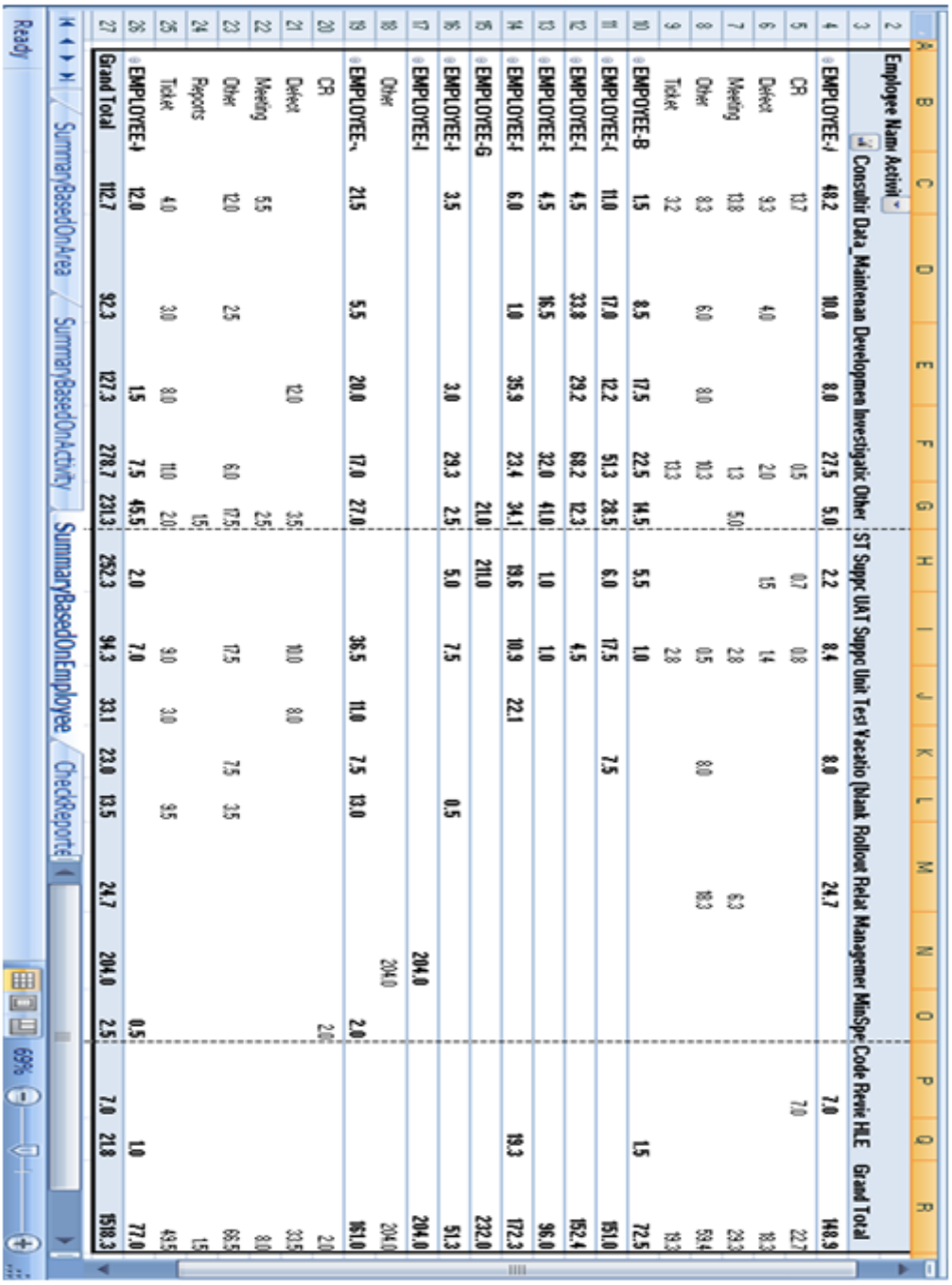


Figure 30. Use of work time per employee.

*5) Sum*mary of working hours reported in the official working hour system

This report contains various columns named “Date”, “Sum of Total Time”, “Expected reporting Hours”, and missing hours, and the rows represent each working day during the survey period. The data presented in this report is extracted from the case organisation’s working hour system, where each employee fills in their working hours for the week and approves it. Further, the working hours are approved by the group leader and then by the respective project manager. The approved working hours are used by the payroll

department to calculate the salary and over time payment for the employee. Therefore, this is the most reliable source for checking the hours reported in the survey against the hours reported in the working hour system. Hence, this report is used as a reliability check of data populated in the activity sheet. During the study, it was decided that a 5% deviation is acceptable, and should be considered as correct information. Also, by comparing this report and the hours reported by the employees during the survey, the manager can easily find out why there is a gap and take the necessary action.

Row Labels	Sum of Total Time	Expected Reported Hours	Missing Hours
01-Feb-10	88	83	-6
02-Feb-10	75	83	8
03-Feb-10	79	83	3
04-Feb-10	72	83	11
05-Feb-10	43	83	40
08-Feb-10	73	83	9
09-Feb-10	90	83	-7
10-Feb-10	130	83	-48
11-Feb-10	91	83	-9
12-Feb-10	75	83	7
13-Feb-10	46	83	37
15-Feb-10	58	83	24
16-Feb-10	56	83	27
17-Feb-10	64	83	19
18-Feb-10	66	83	16
19-Feb-10	55	83	27
22-Feb-10	55	83	27
23-Feb-10	51	83	31
24-Feb-10	70	83	13
25-Feb-10	58	83	25
26-Feb-10	46	83	36
01-Mar-10	16	83	67
02-Mar-10	8	83	75
03-Mar-10	8	83	75
Grand Total	1475		

SummaryBasedOnActivity | SummaryBasedOnEmployee | CheckReport

Ready

Figure 31. Report on working hours by date.

As shown in Figure 31, the working hours reported in the WH system total 1475 hours, whereas in the survey the number for total hours is 1518 hours. So the deviation is:

mod(1518 – 1475) = 43 hours

It turns out to be (43/1475)*100 = 2.91 % which is within the threshold limit set for this study. Therefore, the data represented in the reports should be considered correct, and it is safe to make conclusions based on the reports.

6.2.2 OGS Activity Map Creation

Based on the reports presented in the previous section an activity map is chalked out. It is then extended with the criteria decided on during the brainstorming sessions. The following table contains all the activities performed by the OGS team.

Activity	Sum of Total Time	Customer facing required?(A)	Should be kept on site due to other defined criteria (technical or politi-cal rea-sons)? (B)	Activities which should be kept onsite? A OR B
CR	**226.6**			
Consulting	22.7	+	+	+
Data Maintenance	1.0	-	-	-
Development	42.2	-	-	-
Investigation	25.4	-	+	+
Other	48.9	+	-	+
ST Support	22.8	-	-	-
UAT Support	12.7	+/-	+/-	+
Unit Tests	22.1	-	-	-
MinSpecs	2.5	-	N	N
Code Review	7.0	-	+/-	+
HLE	19.3	+/-	-	+
Defect	**151.9**			
Consulting	13.8	+	+	+
Data Maintenance	4.0	-	-	-
Development	37.9	-	-	-
Investigation	32.2	-	-	-
Other	9.5	+	-	+
ST Support	17.5	-	-	-
UAT Support	28.9	+/-	+	+
Unit Tests	8.0	-	-	-
Meeting	**92.8**			
Consulting	30.8	+	+	+
Development	1.5	-	-	-

Activity	Sum of Total Time	Customer facing required?(A)	Should be kept on site due to other defined criteria (technical or politi-cal rea-sons)? (B)	Activities which should be kept onsite? A OR B
Investigation	4.8	+	-	+
Other	41.5	+	-	+
ST Support	3.0	-	-	-
UAT Support	2.8	+	+	+
Rollout Related	6.3	+	-	+
HLE	1.5	+	-	+
Operational	**0.5**			
Other	0.5	+/-	-	+
Other	**744.1**			
Consulting	35.8	+	+	+
Data Maintenance	34.5	-	-	-
Development	12.0	-	-	-
Investigation	58.8	-	-	-
Other	120.2	-	+	+
ST Support	204.0	-	-	-
UAT Support	29.0	+	+	+
Vacation	23.0	-	-	-
Rollout Related	18.3	+	+	+
Management	204.0	+	+	+
HLE	1.0	+	+	+
Reports	**2.5**			
Other	2.5	-	+	+
Ticket	**293.6**			
Consulting	7.7	+	+	+
Data Maintenance	52.8	-	-	-
Development	33.7	-	-	-
Investigation	152.9	+/-	+	+
Other	8.3	-	-	-
ST Support	5.0	-	-	-
UAT Support	20.8	+	+	+
Unit Tests	3.0	-	-	-
Grand Total	**1511.8**			

Legend: (+) Fully meets the criteria (+/-) Partly meets the criteria (-) Do not meet the criteria

Table 1. Activity map.

Table1 shows the activity map for the OGS activities. The table contains four columns named”Activity”, ”Sum of Total time”, offshoring criteria#1 – ”Customer facing required”, offshoring criteria#2 – ”Should be kept on site due to other defined criteria (technical or political reasons)?” and finally “Activities which should be kept onsite?” Each row in this table represents a topic sub-grouped by activities. At the end a grand total of time consumed in all the OGS activities is presented. In order to show if an activity can be offshored or not, the following legends were used.

Legend: (+) Fully meets the criteria
(+/-) Partly meets the criteria
(-) Does not meet the criteria

Based on the criteria decided on, each activity is scrutinized and marked with a suitable legend (+,- or +/-), showing if the activity can be offshored. Furthermore, to decide if the activity can be offshored or not, the logical OR function is used and the result is presented in the last column named ”Activities which should be kept onsite ?” And hence all the rows with a + symbol in this column are candidates for offshoring. The following is a subset of the OGS activity map shown in table 2, and contains only those rows which have ‘+’ in the last column. In other words this table contains only those activities which are candidates for offshoring.

Activity	Sum of Total Time
CR	**90.6**
Data Maintenance	1.0
Development	42.2
ST Support	22.8
Unit Tests	22.1
MinSpec	2.5
Defect	**99.6**
Data Maintenance	4.0
Development	37.9
Investigation	32.2
ST Support	17.5
Unit Tests	8.0
Meeting	**4.5**
Development	1.5
ST Support	3.0

Activity	Sum of Total Time
Other	**309.3**
Data Maintenance	34.5
Investigation	58.8
ST Support	204.0
Ticket	**102.7**
Data Maintenance	52.8
Development	33.7
Other	8.3
ST Support	5.0
Unit Tests	3.0
Grand Total	**606.7**

Table 2. Activity map – Activities that can be offshored.

Table 2 contains two columns named ”Activity” and ”Sum of Total time”. Moreover, at the end of the table the grand total of time consumed in the shown OGS activity is presented.

Based on the analysis of work time and by comparing tables 1 and 2, it can be concluded that up to 52% of the OGS work can be offshored.

6.2.3 Option for Cost Reduced OGS

The outcome of this study is a new OGS methodology known as Shared OGS methodology. The idea is to build an offshore OGS team which will work in tandem and under the supervision of the onsite team. The offshore team will act as an extension of the onsite team. The following Figure 32 gives an overview of the shared OGS methodology:

Figure 32. Shared OGS framework.

As shown in Figure 32, the onsite team will be mostly involved in consulting work, whereas the offshore team will work on development and task execution. The first level analysis, analysis of work and project timelines will be provided by the onsite team. However, documentation, development and delivery will be handled by the offshore team. Furthermore, the OGS activities such as ticket handling and report generation will be shared efforts.

The implementation of the shared OGS methodology requires changes in the existing processes. However, it is very important that the changes are transpar-

ent to Telco and the current practices of collaboration with Telco will remain unchanged. Considering this, the following process model for the OGS activities is proposed for Telco.

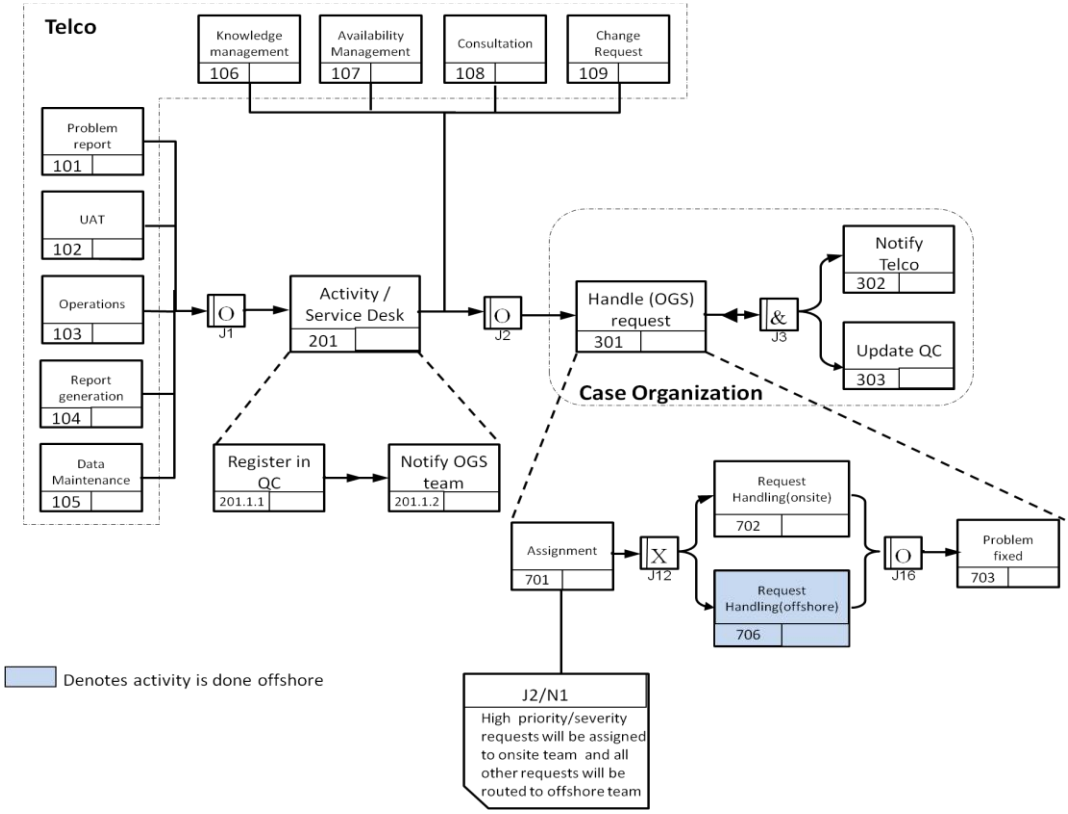


Figure 33. Proposed OGS methodology in Telco.

As shown in Figure 33, the process from Telco's point of view is identical. However, the task handling procedure shown in UOB#301 is changed. In order to make it more obvious, the process is further decomposed. In this process, the first activity is Assignment (UOB#701) where the onsite OGS team does the first level analysis and all the high priority/severity requests, i.e. severity 1 and severity 2 requests are handled by the onsite OGS team and hence assigned to them, and all other requests are assigned to the offshore OGS team, as shown by "XOR" junction J12. A note is introduced J2/N1 to UOB#701 in order to provide clear instructions. After the assignment, the task is handled onsite (UOB#702) or offshore (UOB#706). For representation purposes, all the activities performed by the offshore team are highlighted with sky blue colour. The "OR" junction J16 shows that after the request is handled by the onsite or the offshore OGS team, the requested task is changed to a problem fixed status (UOB#703). All the other activities remain the same as before.

6.2.4 Problem report (PR) modified

The problem report handling process should be modified in order to support the shared OGS methodology. Following Figure 34 depicts the proposed process diagram for PR.

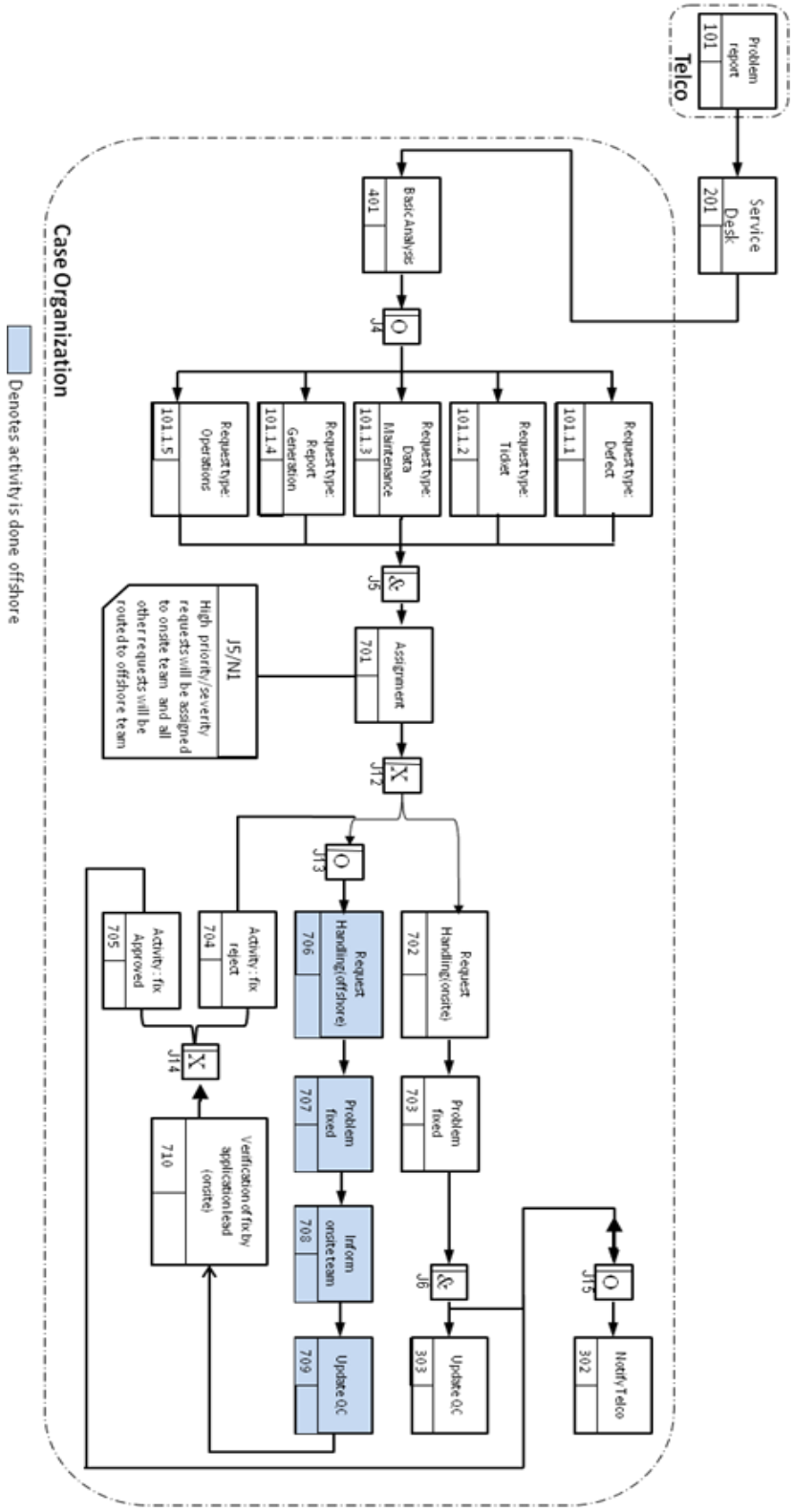


Figure 34. Problem report process modified.

As shown in Figure 34, the modification starts from the Assignment activity (UOB#701). The note J5/N1 is attached to UOB#701 instructing that all high priority requests should be assigned to the onsite OGS team and the remaining requests to the offshore OGS team. The ”XOR” junction J12 shows that either the request will be handled by the onsite OGS team or by offshore team. Further, “OR” junction J13 shows that offshore OGS team gets the requests from UOB#701 (new assignment) or if the fix provided by offshore OGS team is rejected by Onsite team (UOB#704). In the shared OGS methodology, there are two different flows to handle requests, one for the onsite OGS team and another for the offshore OGS team. After the requests are assigned to the onsite OGS team, requests are handled onsite(UOB#702) and after a requested task is finished successfully, the request is changed to Problem Fixed status (UOB#703). Further, the onsite OGS team updates QC (UOB#303) and notifies Telco (UOB#302). However, if the task is assigned to the offshore OGS team then the request is handled offshore (UOB#706), and after the completion of the task its status is changed to Problem fixed (UOB#707). Also, the offshore OGS team informs the respective onsite OGS team (UPB#708) and updates the QC with fix details (UOB#709). The activity of the offshore OGS team finishes at this stage and the onsite OGS team takes control. The onsite application lead verifies the fix is done (UOB#710) and if the fix is correct then he/she approves the fix (UOB#705) or rejects it (UOB#704). In case the fix is rejected it goes back to Junction J13 and undergoes further handling. However, if the fix is approved then the onsite OGS team notifies Telco accordingly (UOB# 302). In the Figure 34 there is a constraint precedence link between Junction J6, UOB#705 and “OR” junction J15, showing that without successfully handling the request, the OGS team cannot update QC or cannot notify customer.

6.2.5 Change Request (CR) modified

The change request handling process should be modified in order to support the shared OGS methodology. Figure 35 depicts the proposed process diagram for CR.

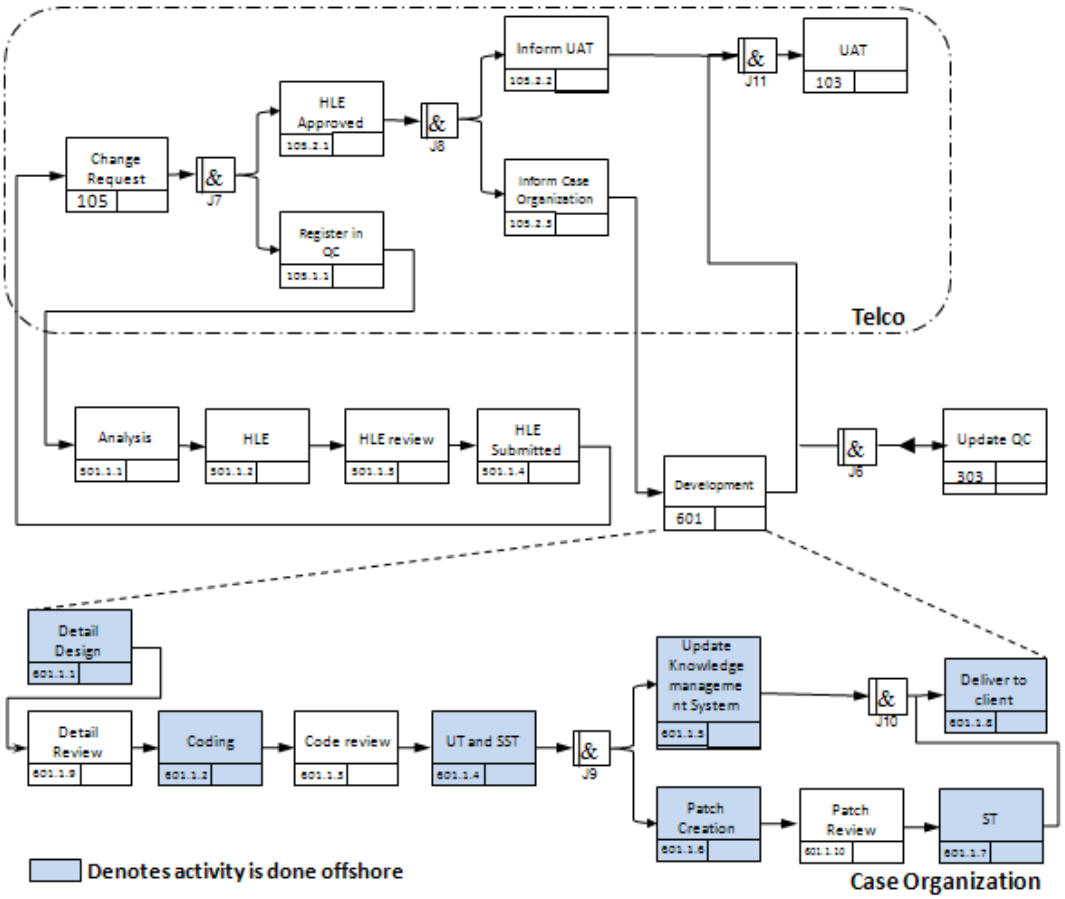


Figure 35. Change request process modified.

As shown in Figure 35, the modification is done for a development activity (UOB#601). The development activity is further decomposed in order to pin-point the modification needed in the process. Further, activities performed by the offshore team are marked with sky blue color. The development starts with the preparation of a detailed design (UOB#601.1.1), this activity will move offshore. After the detailed design is ready, it will be reviewed and approved by the onsite team (UOB#601.1.9). After the approval, coding (UOB#601.1.2) will be done offshore. Once the coding is finished, a code review (UOB#601.1.3) will be done by the onsite OGS team. After the code has been reviewed and approved, Unit testing (UT) and Sub system testing (SST) is done by the developer (UOB#601.1.4). The ”AND” junction J9 shows after the UT and SST is finished, the developer documents the changes and updates the Knowledge management system (601.1.5). Additionally, a patch is prepared (UOB#601.1.6), which is first reviewed and approved by the onsite OGS team (UOB#601.1.10) and then delivered for system testing (ST)(UOB#601.1.7). After the fix is passed ST, it is delivered to the client (UOB#601.1.8) along with the relevant documentation.

7 DISCUSSION AND CONCLUSIONS

This study first focused on an analysis of the existing OGS activities. Then data related to the OGS activities was collected from the OGS team members and based on the information thus collected, a detailed OGS activity map was prepared. Afterwards, three brainstorming sessions were conducted with a forum of technical experts and representatives of the management. The forum validated the OGS activity map and came up with a list of criteria to decide which activities can be offshored. Improvement areas were further identified by comparing the existing OGS team structure with the new proposed structure which consists of a balanced mixture of onsite and offshore team members, working in tandem, led by Group Leaders or Experts working onsite. Finally, the information collected was used to find the gaps in the operations and to modify the existing business processes in such a way as to support the proposed shared OGS model in order, to reduce the total cost of ownership for the OGS activities. While the process map analysis helped identify technical and implementation aspects, the discussions with the experts helped identify the business challenges. Further, the trend reports generated very useful information and can be used for various other purposes such as *Resource Planning & Assignment,* support planning and feasibility studies, work reduction plans, automation and so on.

7.1 Critical Issues

Based on the brainstorming sessions, data analysis and process analysis conducted in the previous sections, various critical issues, conclusions and recommendations are made. They have to do with the following aspects:

- Cross-cultural communication
- Communication
- Level of service to Telco
- Well defined and consistent work flows
- Authority and responsibilities
- Task handover

It is important to grasp and respect the cultural disparity of the teams to be offshored. The communication gap between the teams is usually due to differences in the communication styles. Moreover, clear and effective communication is the most important success factors for building efficient team. Therefore, it is critical

to prepare a team communication plan to provide guidelines on how to keep all the team members informed. Additionally, one key to success is to communicate frequently, discuss openly and build trust between the team members. The off-shoring should be carried out in such a way that it is transparent to Telco, and the service should remain at the same level as before or it should be enhanced. Work procedures should be well defined to avoid misunderstandings about how work should be performed. Furthermore, it should be well documented and communicated to the team so that it can be followed across onsite and offshore teams. The roles and responsibilities should be well defined and communicated to both onsite and offshore teams. This can be achieved by using the concept of "RACI" matrix to determine who is **R**esponsible, **A**ccountable, **C**onsulted, or **I**nformed for each deliverable or process step. When an organization works in work sharing methodology and the same activity is shared between sites or onsite and offshore teams, the task handover often poses problems. To avoid such a situation, processes should be well defined and followed strictly. The process should clearly specify the task handover deliverable detailing to whom it should be delivered, when it should be delivered and so on.

In conclusion of this study, the following observations can be made.

1. Data collected and presented in the Task Summary report was validated by the forum in the brainstorming sessions. Therefore, a reliable ground to take decisions was established.

2. In order to remain competitive, and to reduce total cost of ownership for the OGS activities, some of the OGS activities should be offshored.

3. It is critical to have a strong coordination between the onsite and the off-shore teams.

4. This study established the following four primary criteria that should be used to find which OGS activity should be kept onsite.

    - Customer facing - Activities which require frequent meetings with Telco personnel.
    - Technical reasons - Activities which are critical for the business of the CO or to Telco.
    - Managerial reasons - Activities which requires strong coordination and monitoring.

- Strategic or political reasons – Certain activities the management wants to keep onsite for business reasons.

5. Up to 52% of the current OGS work can be offshored.

7.2 Recommendations

Based on current best practises within the industry and the experience gained during this study, the researcher has made the following recommendations.

1. The offshore team should be treated as an extension of the onsite team. This means the work will be assigned by the onsite team project leaders and the offshore team members will report directly to the onsite project leader.

2. This recommendation is an extension of recommendation #1: Project management and task assignment should be carried out by the onsite management and the managers at the offshore site will act as facilitator and HR manager.

3. The offshore team members should visit onsite a few times a year in order to meet the onsite team and to enhance their knowledge, and to get hands on experience working closely with the customer.

4. The onsite team members should visit the offshore centre a few times a year to meet the offshore team in order understand their problems and also to do some knowledge transfer sessions.

5. The task should be offshored to India development centre (CO already has two development centres in India) as part of the development activity is already carried out from India (not part of OGS activities) and knowledge about the product and customization done for Telco is already readily available.

6. In order to reduce risk and to ensure a smooth transition, the OGS activities should be moved to offshore centre one by one and slowly.

7. Onsite coordinators should be appointed. An onsite coordinator is a dedicated resource for coordinating the work and communication between sites or onsite and offshore teams. Additionally, it should be made sure

that this person is the single point of contact for any clarifications needed by the offshore team. In general, there is a time gap and different working hours between the onsite and offshore teams and therefore, the availability of this resource beyond the regular work hours is important and may bring desired benefits to the organization by reducing the turnaround time for the offshore team.

8. Conducting joint standup meetings between the offshore and onsite teams would be very useful. The offshore gets important visibility into the issues and can feel that they are part of one unified team, instead of working in silos. This makes the overall project and progress more visible to both offshore and onsite team members. This will also help in building the offshore team's ownership towards the product.

9. The researcher recommends using tools such as WebEx, voice conference and instant messenger (IM) to communicate with the team. The usage of the video conferencing feature in WebEx (a free but less commonly used service) is also advocated. Knowing and seeing the counterparts improves the dynamics of the team and promotes the camaraderie among the team members.

10. Well defined processes and methodologies should be developed and communicated to both the onsite and offshore teams.

7.3 Final Remarks

As discussed in the beginning of the study, there are various BPM techniques to model a process. However, this study has chosen Rich Pictures and IDEF3 techniques to model the processes involved in providing OGS. The Rich Pictures seem extremely suitable for capturing the thoughts generated during the brainstorming sessions, and IDEF3 seems good for showing various OGS processes. However, the capabilities of IDEF3 have not been fully utilized in this study as the scope is limited. In practice when a more detailed analysis is needed, the processes can be decomposed further using the IDEF3 methodology. Furthermore, this technique facilitates expressing the same process in more than one way, and different teams can easily communicate about a part of the process by referring the UOB number. Finally, the process maps drawn in this study are at a high level with the objective of capturing only those details that help identify the critical issues outlined at the beginning of the

project. More issues are expected to turn up as the implementation work progresses. In other words, IDEF3 suited this study while a few other modelling techniques may suit as well.

The processes are modelled at a high level in this study, each UOB in the process model drawn can be magnified into many UOBs, and some of the UOBs in the process model are a combination of dozens of UOBs. Hence, the issues are also identified at a high level design of the system. Further, magnification of the processes may reveal more issues that are likely to be more technical in nature.

To conclude, the study covered many functional and technical aspects that may pose a challenge in connection with the CO making a transition and offshoring some of its activities.
Also, this study should be considered unbiased as many different methods were used to confirm its validity. For instance, the hours reported by the OGS team members, in Task summary sheet is checked against the working hours reported by the OGS team members in the official working hour system. Additionally the Task summary sheet was presented in the first brainstorming session with a notion to judge its accuracy. Further, both the experts' views and the analysis of the business process models were used to identify any critical issues. Each process model was drawn based on the documentation belonging to the case organisation. The correctness of the process models were also endorsed by the management and the technical experts involved in the day to day operation of OGS. Additionally, the researcher has eight years of working experience in the telecommunications billing domain and has had access to the internal documents of the CO. Thus the analysis carried out and conclusions made in this study should be considered reliable and hence provide a solid ground for future work.

REFERENCES

Aguilar-Savén, R.S. (2004) Business process modelling: Review and framework In: *International Journal of Production Economics*. Volume 90 (2004).129-149. Available at http://www.sciencedirect.com (Last accessed on 1st January, 2010.)

Al-Ahmari, A.M.A. & Ridgway, K. (1999) An integrated modelling method to support manufacturing systems analysis and design In: *Computers in Industry*. Volume 38. 225-238.

Aron, R. and Singh, V. J. (2005) Getting Offshoring Right In: *Harvard Business Review.*

Bakehouse, G. et al. (2007) Rich Pictures In Soft Systems Methodology. *Student Accountant*, pp66-71. Available at http://www.oxfordinstitute.org/pubs/students/publications/student_accountant/archive/Bakehouse0107.pdf Last accessed on 1st Mar 2010.

Checkland, P.B. (1981) Systems Thinking, Systems Practice. New York: John Wiley &Sons. Republished 1999 with 30-year retrospective.

Checkland, P.B. (2001) Soft Systems Methodology, in J. Rosenhead and J. Mingers (eds), *Rational Analysis for a Problematic World Revisite.* Chichester, England: Wiley.

Coghlan, D. and Brannick, T. (2005) *Doing Action Research in Your Own Organization*. London: Sage Publications.

Davenport, H. T. (1993) *Process Innovation: Reengineering work through information technology*. Boston: Harvard Business School Press.

Denscombe, M. (2000) *The Good Research Guide: for small-scale social research projects.* Buckingham: Open University Press.

Friel, G. P. and Blinn, M.T. (1989) Automated IDEF3 and IDEF4 Systems Design Specification Document. *Technical repor*. NASA Johnson Space Center. Knowledge Based System Inc. Available at http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19910023489_1991023489.pdf (Last accessed on 10th Mar 2010).

Gantin, J. (2006) Assessment of IT Value Delivery at a Large Nordic Bank. Available at http://www.ee.kth.se/php/modules/publications/reports/2006/XR-EE-ICS_2006_017.pdf (Last accessed on 20th Mar 2010).

Gantt, H. L. (1916) Work, Wages and Profit In: *The Engineering Magazine*. New York, republished as Work, Wages and Profits, Easton, Pennsylvania: Hive Publishing Company.

Hammer, M. and Champy, J. (1993) *Reengineering the Corporation: A Manifesto for Business Revolution*. New York: Harper Business.

Hubbard, W. D. (2009) *The Failure of Risk Management: Why It's Broken and How to Fix It*. New Jersey: John Wiley & Sons. Available at http://books.google.fi (Last accessed on 10th Mar 2010).

ITIL & ITSM World, *The Itil and ITSM Directory*, http://www.itil-itsm-world.com/ (Last accessed on 10th March, 2010.).

Knowledge Based Systems, Inc. *IDEF3 Process Description Capture Method*. http://www.idef.com/IDEF3.html (Last accessed 1st mar 2010).

Kolb, D. A. (1984) *Experiential Learning: Experience as the Source of Learning and Development.* Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Lee, A. (2007) *Information Systems Action Research. An Applied View of Emerging Concepts. Ed.*, Koch N. New York: Springer.

Marttinen, P. G. (2006) *Activity preparation*. Available at http://en.wikipedia.org/wiki/File:Activity_preperation.svg (Last accessed on 5th Jan 2010).

Mayer, J. R. et. al. (1995) Knowledge Based Systems, Inc. Idef3 process description capture method report. Available at http://www.idef.com/pdf/Idef3_fn.pdf (Last accessed 3rd Mar 2010).

Mercury*, ITIL best practices: Maximizing the business value of IT - Part 2*. (2005)

Available at www.mercury.com (Last accessed on 1st March, 2010).

Mind Tools Ltd., *Brainstorming Generating many radical, creative ideas* Available at http://www.mindtools.com/brainstm.html (Last accessed on 20th Mar 2010).

Mukherjee, S. (2008) *Business Process Outsourcing and India*. Published by Oxford management Publishing. Available at: http://www.oxmp.co.uk/item_det.php?id=167&searchkey=&res=&ext=&item=case&page=2 (Last accessed on 5th Jan 2010).

OGC, Office of Government Commerce, *OGC* (2009). Available at http://www.ogc.gov.uk/index.asp?id=2261 (Last accessed on 10th March, 2010).

Osborn, A.F. (1963) *Applied imagination: Principles and procedures of creative problem solving* (Third Revised Edition). New York: Charles Scribner's Sons.

Overby, S. (2007) *ABC: An Introduction to Outsourcing*. Available at www.CIO.com (Last accessed on 15th Mar 2010).

Potter, R. *Team Quest and ITIL Version 2. Available at* http://www.teamquest.com/pdfs/whitepaper/itil.pdf (Last accessed on 10th March, 2010).

Project Scope and Commitments, Case Organisation's internal document.

Schön, D. (1983). *The Reflective Practitioner: How Professionals Think in Action*. NY: Basic Books.

Su, C.J. (2008) Business Processes Re-design Using Accountability Paradigm with IDEF Modeling and Simulation In: *Journal of Quality*. Volume 15 (6). 425-239.

University of North Carolina at Chapel Hill and Kimberly Abels, *Brainstorming*. Available at http://www.unc.edu/depts/wcweb/handouts/brainstorming.html#3 (Last accessed on 20th Mar 2010).

Vakola, M. et al. (2000): The CONDOR business process re-engineering meth-odology In: *Managerial Auditing Journal*, Volume 15 (1/2), 42-46.

Waltham, M. (2006) Elie Cohen CEO Siemes Business Services Franceand and CSE In *Annual Meeting.*

Yin, R. K. (2003). Case study Research: *Design and Methods*. 3rd ed. London, England: Sage Publication Inc.

APPENDICES

Appendix 1: Definitions

Term	Definition/Description
Availability Management	Availability Management is the practice of identifying levels of IT Service availability for use in Service Level Reviews with Customers. All areas of a service must be measurable and defined within the Service Level Agreement (SLA) (Source: http://www.itil-itsm-world.com/itil-9.htm , last accessed on 20th Mar 2010).
Average Revenue Per User (ARPU)	Average revenue per user (sometimes average revenue per unit) usually abbreviated to ARPU is a measure used primarily by consumer communications and networking companies, defined as the total revenue divided by the number of subscribers. (Source: http://en.wikipedia.org/wiki/Average_Revenue_Per_User , last accessed on 20th Mar 2010).
Change management	Change management is a structured approach to transitioning individuals, teams, and organizations from a current state to a desired future state. Change management (or change control) is the process during which the changes of a system are implemented in a controlled manner by following a pre-defined framework/model with, to some extent, reasonable modifications (Wardale, D. 2009). In project management, change management refers to a project management process where changes to a project are formally introduced and approved (Filicetti, J. 2007).
Change Request (CR)	A customer's request to change/add functionality after the scope of a version is closed and the specs documents are signed by the customer (also known as RFC – Request for Change) (Source: AGQM Methodology Group).
Data Maintenance	The process of adding, deleting, changing and updating the existing/corrupt data in the system is known as Data Maintenance.
Defect	An incorrect system behavior (that is, failure or non-compliance with the specifications). A client or Amdocs team member may report a defect. Synonyms: bug, SERF, problem. (Source: AGQM Methodology Group).
Letter of engagement (LOE)	An engagement letter defines the legal relationship (or engagement) between a professional firm (e.g., law, investment banking, consulting, advisory or accountancy firm) and its client(s). This letter states the terms and conditions of the engagement, principally addressing the scope of the engagement and the terms of compensation for the firm. (source: http://en.wikipedia.org/wiki/Engagement_Letter, last accessed on 20th Mar 2010).
Knowledge Management	Knowledge management (KM) comprises a range of strategies and practices used in an organization to identify, create, represent, distribute, and enable adoption of insights and experiences. Such insights and experiences comprise knowledge, either embodied in individuals or embedded in organizational processes or practice. (Source : http://en.wikipedia.org/wiki/Knowledge_management, last accessed on 20th Mar 2010).

Term	Definition/Description
Release Management	Release management defines the mechanisms of building and releasing software, and is included as a component of the Service Support Set in ITIL. The practice of Release Management continues to evolve while being applied to complex distributed software services. The goal of release management is to protect the live production environment. Release management controls the release of new configuration items into that environment. The process is more than creating a new version or update of a program. When a new release is needed there are various steps to follow. Gathering the requirements and gathering the dependencies with the existing components must be checked out in advance. After that a new version can be built, tested and the release can be prepared. Finally, the release that is brought to the operations environment consists of a software file ready to be installed, complete with manuals. The company itself also saves the design and testing documents. A release rollback plan is also available on standby to safeguard against surprises during the release, or non-acceptance by the end users. (Source: http://en.wikipedia.org/wiki/Release_management, last accessed on 20th Mar 2010)
Return On Investment (ROI)	Financial ratio that expresses the total yearly profit in relation to the invested capital (of an individual investment or total investments in a firm).
Risk Management	Risk is defined in ISO 31000 as the effect of uncertainty on objectives (whether positive or negative). Risk management can therefore be considered the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities (Source: Douglas, H. 2009).
System Test (ST)	System test of software is testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of black box testing, and as such, should require no knowledge of the inner design of the code or logic.
Ticket	A ticket is a token, containing information of the Incidents/problem.
Ticket Handling	Process of analysing the incidence reported, solving/answering the ticket is known as ticket handling.
Unit Test (UT)	In traditional programming, a unit test will usually include testing of a single program or a group of related programs that together implement the basic functionality of a system (Source: AGQM Methodology Group).
User Acceptance Test (UAT)	User Acceptance Test is the testing done by client, in order to check if system works as per the requirements, and does not contain defects in excess of permissible level. Once software passed UAT it is delivered to production.

Table 3 – Definitions

IDEF3 Definitions

Source: Mayer et al. (1995: p 228-224) Knowledge Based System.

Term	Definition
Activation	A collection of instances of some or all of the UOBs in the process represented by the schematic whose temporal and logical properties satisfy the temporal and logical conditions specified in the schematic.
Constraints	Most generally, a statement which must (or equivalently, must not) hold in a system. Most often, constraints express logical properties of, or connections between, domain objects that must be maintained if the system is to function as intended. Constraints are distinguished conditions known to hold between the objects in a process or between the processes themselves.
Decomposition	One of possibly many contextualized descriptions of one UOB in terms of other UOBs. Schematics providing a more detailed view or different perspective of a process with a clearly defined viewpoint.
Description	A recording of facts or beliefs about something within the realm of a domain expert's knowledge or experience.
IDEF	Acronym for Integration Definition. Also used to refer to a family of mutually-supportive methods for enterprise integration, including in particular IDEFØ, IDEF1, IDEF1X, IDEF3, IDEF4, and IDEF5.
IDEFØ	Integration Definition (IDEF) method for Function Modeling.
IDEF3	Integration Definition (IDEF) method for Process Description Capture.
Junction	An element of the IDEF3 Schematic Language providing a mechanism to graphically display logical branching.
Link	A syntactic element of the IDEF3 Schematic Language used to connect other IDEF3 syntactic elements. Links denote significant relationships among UOBs, Object States, and Objects. Examples of the types of relations that can be highlighted by IDEF3 links include temporal, logical, causal, natural, and conventional.
Constrained Precedence	A specialization of precedence links that adds further constraints over and above the activation semantics of simple precedence.
Process	A real-world event or state of affairs involving one or more individuals over some (possibly instantaneous) interval of time. Typically, a process involves some sort of change in the properties of one or more of the individuals in the process. Sometimes referred to as process instance.
Unit of Behavior (UOB)	A term used in IDEF3 to describe types of "happenings". Concepts such as function, process, scenario, activity, operation, decision, action, event, procedure, and so forth each represent "happenings" involving some circumscribed behavior. The term UOB is used to encapsulate concepts such as these.
UOB Box	A syntactic element of the IDEF3 Schematic Language used to represent a real-world process.
Viewpoint	The perspective taken while examining or describing a system or process. Role-specific and objective viewpoints are captured using IDEF3's UOB decomposition mechanism.

Table 4 – IDEF3 Definitions

Appendix 2: IDEF3 MODEL DIAGRAM NOTATIONS

This appendix briefly describes different notations used in the IDEF3 process schematic model diagrams in this study. The basic syntactic elements of the IDEF3 process description language are shown in Figure 36 below.

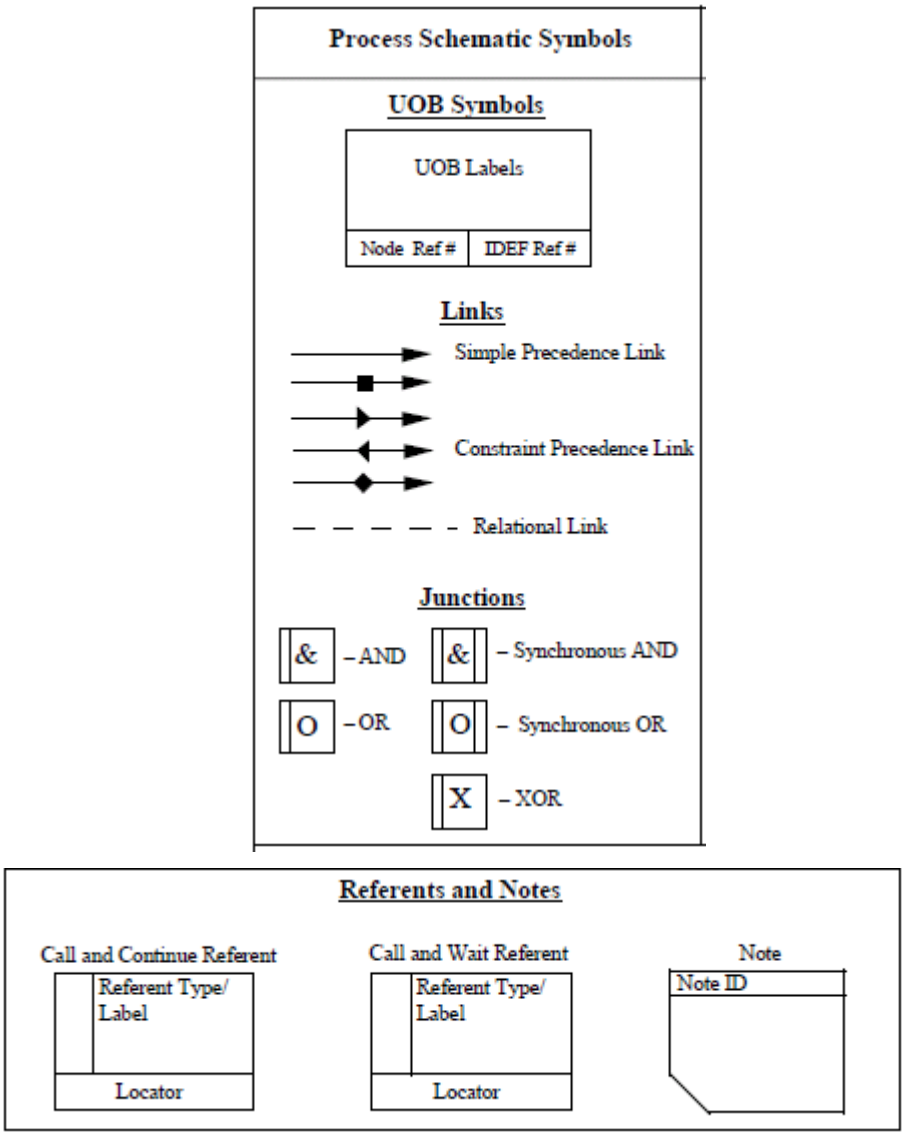


Figure 36. Symbols used for IDEF3 process description schematics (Mayer et al. 1995: 36).

An IDEF3 model diagram is composed of mainly three entities: UOBs (Unit of Behaviour), Links and Junctions. This section first describes each of the basic elements of an IDEF3 model followed by an example using the basic elements.

Units of behavior:

A UOB (and hence the meaning of a UOB box) is presented as a rectangle with a label at the centre and a node number at the bottom left-hand corner. The label describes the unit function performed at this UOB, and the node number or reference number is a number uniquely identifying a UOB. The IDEF reference number is optional and is placed at the bottom right-hand corner, and it may refer to the UOB of an existing IDEF0 model.

Links:

Links are the glue that connects the UOB boxes to form representations of dynamic processes. Links are used primarily to denote significant relationships among UOBs.=Links draw attention to important relations between UOBs in a process (Mayer et al. 1995: 25). As shown in Figure 36, there are six types of links in IDEF3, which can be categorised as simple precedence links, constrained precedence links or relational links. This study has used simple precedence and constrained precedence links.

Junctions:

Junctions in IDEF3 provide a mechanism to specify the logic of process branching. Additionally, junctions simplify the capture of timing and sequencing relationships between multiple process paths (Mayer et al. 1995: 30). Further, each junction has unique junction number which associate with a decision process that decides the next UOB in a process flow. In general a junction can be fan-in or a fan-out junction. A junction where more than one branches provide input is a fan-in junction. Similarly, a junction where more than one branches provide output is a fan-out junction. There are five junction types as shown in Figure 38 namely *AND*, *OR*, *XOR*, *Synchronous AND* & *Synchronous OR* junctions.

The real power of IDEF3 lies in its ability to represent simple and complex processes where multiple parallel and alternative threads are woven together into a single complex system. The key to such complex representations lies in the proper use of junctions, in particular, finding the right combinations of junctions to represent the process in question (Mayer et al. 1995: 34).