DESIGN AND DEVELOPMENT OF A PERFORMANCE EVALUATION PROTOTYPE FOR IT ORGANIZATIONS IN THE CONTEXT OF OUTSOURCING

Thesis submitted by

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CERTIFICATE

I hereby certify that the thesis entitled **"Design and Development of a Performance Evaluation Prototype for IT Organizations in the Context of Outsourcing"** is based on the original work carried out by Mr. David Peter S. in the Department of Computer Science, Cochin University of Science and Technology, Cochin - 682 022, under my guidance and supervision with Dr. Sreela Sasi, Associate Professor, Department of Computer Science, Gannon University, Pennsylvania, USA, as co-guide.

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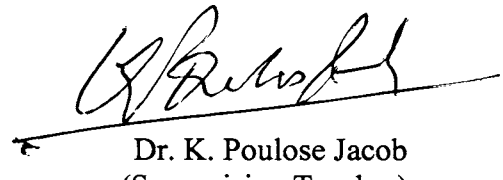

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CERTIFICATE

This is to certify that the thesis entitled "***DESIGN AND DEVELOPMENT OF A PERFORMANCE EVALUATION PROTOTYPE FOR IT ORGANIZATIONS IN THE CONTEXT OF OUTSOURCING***" is a bonafide record of the research work carried out by ***David Peter S.*** in the *Department of Computer Science, Cochin University of Science and Technology* under the supervision and guidance of Dr. Poulose K. Jacob and myself, and that no part there of has been presented for the award of any other degree.

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List of Abbreviations

BS	British Standards
BSC	Balanced Scorecard
CA	Competitive Advantage
CBA	Cost Benefit Analysis
CIO	Chief Information Officer
CMM	Capability Maturity Model
COBIT	Control Objectives for Information and related Technology
CSC	Computer Services Center
DFD	Data Flow Diagram
DU	Definitional Uncertainty
FACT	Fertilizers And Chemicals Travancore Ltd
IE	Information Economics
IRM	Information Resource Management
IRR	Internal Rate of Return
IS	Information Systems
ISACA	Information Security Audit and Control Association
ISO	International Standards Organization
IT	Information Technology
ITBSC	Information Technology Balanced Scorecard
ITIL	Information Technology Infrastructure Library
ITSMF	IT Service Management Foundation
MI	Management Information Support
NPV	Net Present Value
OLA	Operational Level Agreement
OR	Organizational Risk
PB	Pay Back
PES	Performance Evaluation System
PMS	Performance Measurement system
ROI	Return On Investment
SA	Strategic IT Architecture Alignment
SC	Service Catalogue
SLA	Service Level Agreement
SLM	Service Level Management
SM	Strategic Match
SORD	Structured Outsourcing Relationship Diagram
SP	Service Provider
TU	Technical Uncertainty
UC	Underpinning Contracts
UML	Unified Modeling Language
UP	Unified Process

Chapter 1

Introduction

Information Technology (IT) is the backbone of any enterprise - whether commercial or non-commercial. Without creating a good Information Technology infrastructure, no organization can be made functional. This shows that the success of an organization is dependant on the proper functioning of the IT infrastructure and it implies the need for good management of the IT in an organization. Moreover intense competition has forced the business organizations to improve its performance steadily. So if IT, which pervades into almost all organizational processes is not effective, then it can be detrimental to the future of the enterprise. Hence constant monitoring and improvement of the performance of the IT organization is crucial for the success of any enterprise.

In this chapter, after a brief discussion on IT organization and its management an overview of the performance evaluation of the IT organization is presented. It is followed by a discussion on the research question.

1.1 IT Organization

An IT organization can be considered as a body of individuals providing IT resources and services to the enterprise. It includes Data Processing Centres/Departments, IT Departments, Computing Centres, Information Resource Management Centres, or any other grouping that provides such services, existing in an enterprise (Ward, 1996).

In the sixties and seventies the attention was focussed on information systems (IS) that could handle massive databases. These information systems

were mostly batch-oriented and were supported by computing centres. All the activities were centralized and such centres were also known as Data Processing Centres. In the beginning of eighties through the passage of the Paper Reduction Act, in US, the concept of Information Resource Management (IRM) Centre with a Chief Information Officer (CIO) at the top was introduced (Trauth89). The eighties mark a tremendous growth in the use of Information Technology, mainly due to the introduction of Personal Computers and Local Area Networks. Also the geographical distribution of the enterprise led to a distributed IT infrastructure and that in turn necessitated a distributed IT organizational structure.

According to Earl et. al., (1996) there are basically three different governance structures possible for IT organizations – Centralized, Decentralized and Federal. In a centralized IT governance structure, IT is a unified function, reporting to the Corporate Management. There can be some local IT in the distributed corporate environment; but they are all under the strategic, tactical and operational control of the central IT organization. Whereas, in the decentralized IT Governance structure, IT is a distributed function. Each business unit may have its own IT under its control. Here the main advantage is that there will be quick decision-making and are more flexible to necessary changes. The major disadvantage is that it becomes difficult to have common standards throughout the enterprise and also benefits like economy of scale, critical mass skills, etc. are lost.

But the Federal IT governance structure combines the benefits of both; ie., centralized as well as decentralised IT governance structures. Here the IT function is co-ordinated by the central unit but the activities are divided between central and distributed units. Many different configurations of federal structure are possible with different patterns of resource and responsibility distribution.

Usually smaller firms are likely to adopt a centralized IT governance structure and large firms prefer to have a decentralised governance structure,

which is in line with the decentralized organizational structure of the enterprise. Firms of medium size can easily adopt a federal structure.

1.2 IT Service Management

By the late eighties it was realized by the business world that heavy investments in IT did not guarantee effectiveness in the provision of IT services. The proper management and control, derived from the technical characteristics of the information system components and from the specific user requirements and constraints, could provide availability, reliability, security, continuity, operational excellence etc. (Looijen, 1998).

Several IT service management models had evolved, since then. Information Technology Infrastructure Library (ITIL) developed by the Central Computer and Telecommunications Agency(CCTA), UK, Triple model of MCM developed by Prof. M. Looijen, TUDelft, The Netherlands, Control Objectives for Information and related Technology (COBIT) developed by the Information Security Audit and Control Association (ISACA), USA are some of the prominent ones. The public availability of ITIL books, the international support by a user platform – IT Service Management Foundation (ITSMF) and a range of commercial companies providing training and consultancy has made ITIL more popular all over the world.

Irrespective of the service management model adopted by the IT organization, the service level management (SLM) process plays a crucial role in controlling the quality of the provision of IT services. According to ITIL terminology, it is the process of defining, agreeing, documenting and managing the levels of certain IT services that are required and cost justified. A service level agreement (SLA) is a written agreement/contract between the user/customer and the service provider that documents the agreed service levels for a service (OGC, 2002). Most often, the important target set in it will relate to the service

availability and thus require incident resolution within agreed period. In addition, it may also contain performance requirements such as response time, throughput etc. as well as other requirements on security, reliability, etc. To ensure the quality of the services provided to the user/customer as mentioned in the SLAs, IT organization in turn, may have to enter into contracts/agreements with internal or external parties/agencies. The monitoring/maintenance of such agreements also come under the scope of the SLM (See fig 1.1).

For the effective implementation of the service level management, usually a service catalogue is prepared. The service catalogue is a repository containing the necessary details of all services provided by the IT organization. Based

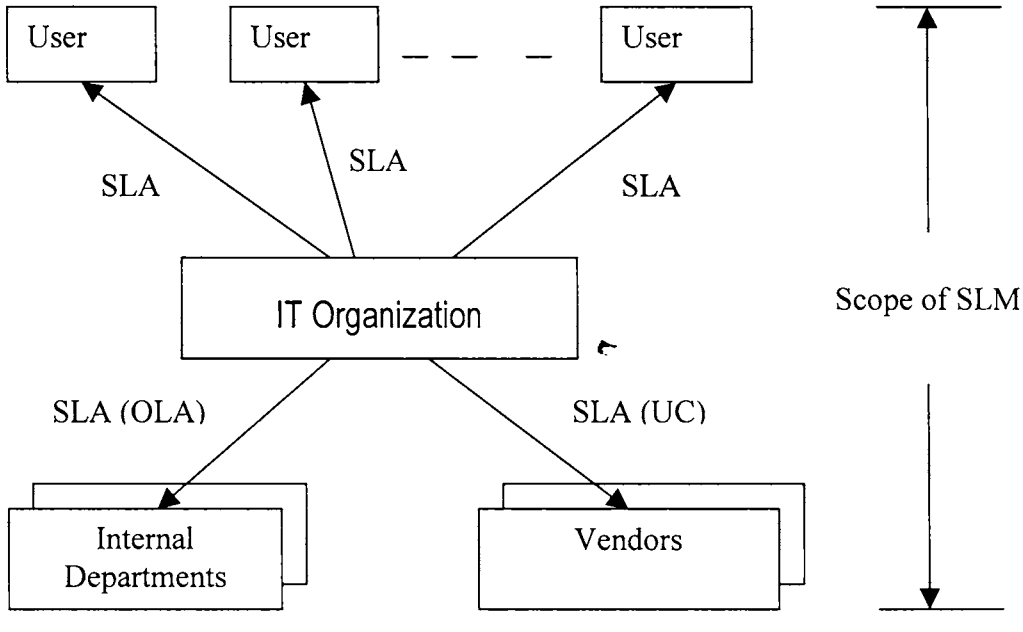


Fig. 1.1 Scope of Service level management

Note: According to ITIL terminology, the IT organization will have operational level agreements (OLA) with internal departments and underpinning contracts (UC) with external vendors. However, for all practical purposes such contracts/agreements are also referred to as SLAs in other literature, because the SLA forms the 'technical core' of such documents.

on the service catalogue, the customer can prepare a service level request (SLR), which depicts the service level he/she would like to have. The SLM then negotiates with the customer on an acceptable level of service, which later forms the service level agreement. The responsibility of SLM does not end here. It has to ensure that all the agreements are satisfactorily met. That means, it has to continuously monitor the performance, report to the management, and review the agreements periodically to ensure that the required service quality is maintained. This has to be done, not only with respect to the SLAs made with the customers, but also those made with the external vendors as well as the internal departments. In short the SLM process goes through a constant cycle of agreeing, monitoring, reporting and reviewing of IT services, to maintain and improve the IT service quality (Hendrix and Carr, 2002).

1.3 Outsourcing – the Current Trend

Outsourcing is the process of entrusting the responsibility of providing certain goods and services to an external party (service provider). It is not a new phenomenon in the IT sector. In the sixties the outsourcing focus was on the services and facilities management of the hardware. In the seventies the focus shifted to software development in the form of contract programming. The interest in outsourcing declined in the early eighties, but resurfaced again in the late eighties with a new vigour, in which the interest was in total outsourcing. The main segments of out-sourcing included onsite facilities management, network management, system integration, etc. In total outsourcing the vendors purchased the customers' IT infrastructure, and the IT personnel were also shifted from customer to the vendor (Lee, 2003). In such cases more than eighty percent of the Organization's IT budget will be consumed by the service providers. To site a few examples of companies that have outsourced significant portions of their IT functions include Kodak, British Petroleum, Continental Airlines, DuPont, Xerox, etc. (Lacity and Willcocks, 2000).

Another significant development was that in many cases even though the outsourcing was total, the contracts were made not with a single vendor but with different parties for different services. For example, the famous photo-imaging company M/s Eastman Kodak Co. outsourced its data centres to IBM Corporation, its communications to Digital Equipment Corporation and its micro Computer based networks to Businessland Inc., but retained the applications development (Gupta and Gupta, 1992). A survey conducted by Lacity and Willcocks (2000) among 79 organizations that engage in outsourcing, revealed that more than eighty percent of such organizations made contracts with multiple suppliers. This phenomenon is referred to multiparty outsourcing.

During the nineties, the outsourcing phenomenon experienced a lot of dynamism; ie., various forms of outsourcing emerged. Selective outsourcing, which is the most predominant form (Willcocks and Lacity, 2000) results when the organization decides to outsource selected IT functions to external providers while still spending twenty to eighty percent (typically sixty percent) of the IT budget on internal provision. Contracts, which call for the market to provide resources to be deployed under the buyer's management and control is referred to as insourcing. In such cases more than eighty percent of the IT budget will be consumed by internal IT organization (Willcocks et.al., 1995).

Selective outsourcing, which is characterized by short-term contracts and multiple suppliers dealing with infrastructure activities, tend to emerge as the most effective practice, followed by insourcing. Total outsourcing is normally opted by large organizations and the success rate also seems to be low. (Willcocks and Lacity, 2000).

1.4 Role of IT Organization in an Outsourcing Environment

As a consequence of outsourcing, the downsizing of IT organization will take place to some extend because certain in-house capabilities are no more required. But outsourcing introduces new risks There can be financial risks like hidden costs, escalation of costs etc., business risks like loss of internal competencies and technical risks like degradation of delivered services, etc. Now the IT organization has the added responsibility to mitigate these risks, mainly by monitoring the service provider and managing the relationships. This is all the more important in the case of total outsourcing.

According to Earl, (1996), outsourcing doesn't necessarily mean a change in the structure of the IT organization, even though the roles and responsibilities may change.

1.5 Performance Monitoring of IT Organizations

Then the question arise "By having an IT service management, can we be assured of the satisfactory performance of an IT organization?". One method to verify the quality of the management is to compare its performance against preset standards. Standards like ISO 9000 and ISO 9001 of the International Standards Organization, BS 15000 of the British Standards Institute etc. are well known quality standards, which can be used for this purpose. By having periodic auditing with respect to the above standards the quality of the IT management can be monitored.

But, the above exercise will only ensure that the processes are implemented properly. Again the question of effectiveness (i.e. are we delivering the right service/product?) remains unanswered. This necessitates the monitoring of performance in a different perspective.

Over the years efforts were made to adopt the traditional financial techniques like "Return On Investment" (ROI), "Net Present Value" (NPV), "Internal Rate of Return" (IRR), etc. for information system evaluation. The draw back of the above techniques was that they could not consider the intangible benefits.

Cost Benefit Analysis (CBA), which also considers the intangible benefits by assigning a monetary value for each element contributing to the costs and benefits, was introduced later. It was followed by SESAME, a variant of CBA, which derives the payback of the information system by computing what the cost would have been, if the same functionality had been delivered by non-computer based methods (Leycet, 2000).

It was generally felt that converting all the benefits into monetary terms were not always feasible. For example it is difficult to quantify the full benefit of a Decision Support System or a Knowledge Based System. As an alternative, a new approach called "Information Economics" was proposed, which take into consideration, the less tangible benefits like improved customer service, higher degree of competitiveness, etc. This method extends CBA with three additional processes. They are "value linking", "value acceleration" and "job enrichment" (Leycet, 2000). It also separates the benefits and risks into two domains – business domain and technological domain, and evaluates these domains separately.

Lastly the adoption of Balanced Scorecard (BSC), which was developed as a means to evaluate the corporate performance, seems to be more suitable (Martinsons, 2003; Grembergen and Bruggen, 1997). Basically it supplements the traditional financial measures with operational measures concerning customer satisfaction, internal processes and the ability to innovate. That is, it evaluates the performance of the IT organization from four different perspectives: the business (corporate) contribution, user orientation, operational excellence and future

orientation. Hence this framework could also be used to monitor and guide the efforts for performance improvement.

1.6 Relevance of the Work

Outsourcing has become an accepted means of driving efficiencies in the IT sector. It has outlived the five-year period, which is typical of a management fad. (Willcocks and Lacity, 2000). From the initial main focus on cost reduction IT outsourcing has become complementary to productivity and an alternate mode of managing IT. But this phenomenon had brought with it certain risks, which had led to unsuccessful outsourcing relationships. According to Willcocks et. al. (1995) one of the main reasons is the inadequate attention in setting up appropriate measurement system to monitor the performance of the functioning of the IT organization. Moreover, any organization venturing for quality certifications such as ISO, CMM, Six-sigma, etc, should be able to monitor its performance and strive for continuous performance improvement. Hence it would be worthwhile to look into the various aspects of performance evaluation of an IT organization in the context of outsourcing.

1.7 Research Question

As mentioned above, an IT organization in the context of outsourcing depicts a complex picture, as far as performance monitoring is considered. At the same time, performance monitoring is all the more important than before because we have to verify whether the goods and services provided by the external service provider are as per the service contract. This is in addition to the quest for continuous improvement. Above all, as the old saying goes "if it is not worth measuring, then it is not worth maintaining". Hence the main research objective can be stated as follows: "To help an IT organization in the context of outsourcing to realize its current standing, so that it can take corrective steps where ever necessary and strive for continuous improvement".

To achieve the above research objective the following research question is formulated:

"How can we effectively monitor the performance of an IT organization in the context of outsourcing?"

In order to answer the above main research question the following sub-questions are to be answered:

- *What are the complexities involved in managing/coordinating the activities of an IT organization in an outsourcing environment?*
- *What are the techniques available for resolving the above complexities?*
- *How can we meaningfully measure the performance of an IT organization?*
- *What are the meaningful performance indicators for measuring the performance of an IT organization in the context of outsourcing?*
- *How can we gather and analyze the performance data for providing meaningful and relevant information required for the effective management of the IT organization?*

An appropriate approach for doing research in order to answer the above questions is given in the next section.

1.8 Research Method

Method is a way of reaching a given end by a series of acts, which tend to secure it (Webster, 1956). The block diagram of the research method we had used for answering the above research question is given in figure 1.2.

The first step as seen from the diagram is to carry out a domain study to formulate the research objective and the research question. In this step we had conducted a preliminary literature study. The first chapter of this thesis is a by-product of this study and it explains the technical background and the relevance of the research question.

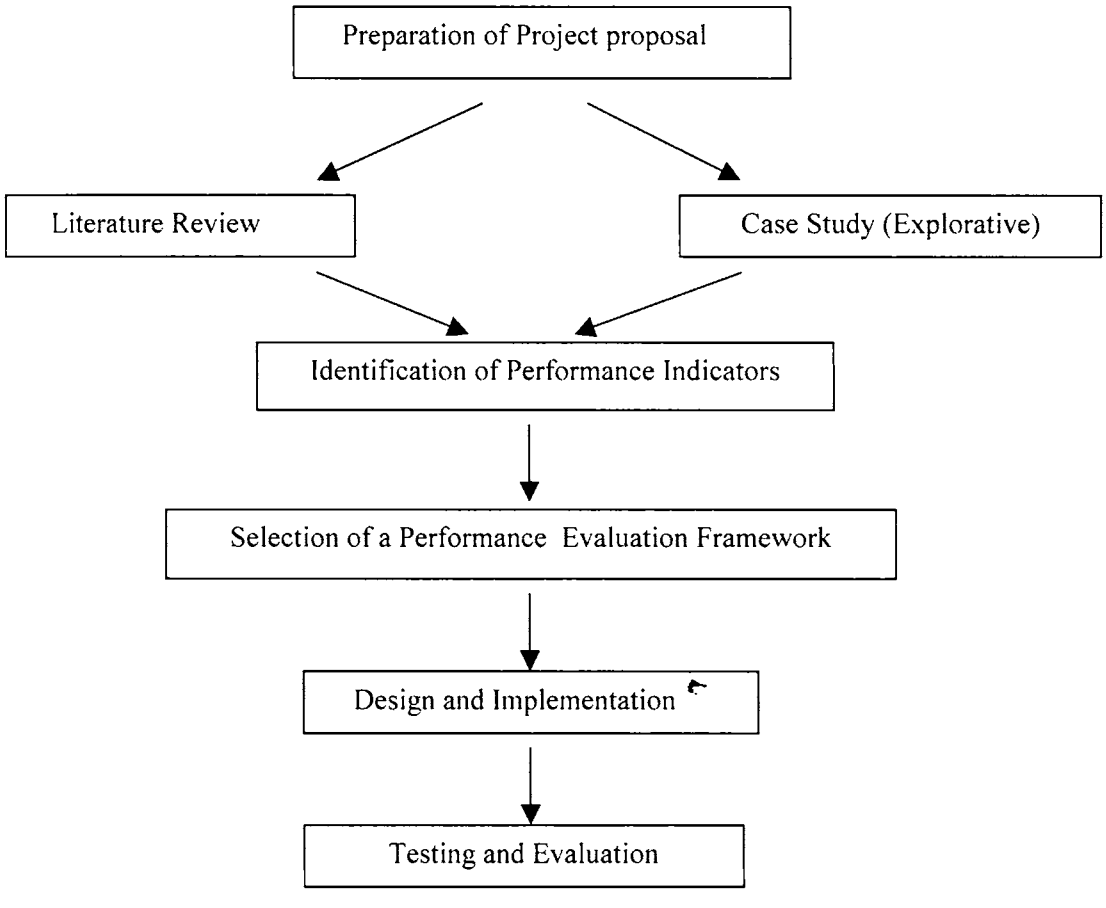


Figure 1.2 The block diagram of the research method

The next two steps, namely the literature review and the case study were carried out simultaneously, using the research instruments literature study and case study (explorative), respectively. In general, literature study was useful in finding the answers for all the five sub-questions, but for the first two, it was the

sole instrument used. The main objective of the case study was to gain first hand information required for the identification of performance indicators that are relevant for an IT organization in an outsourcing environment. The results of the first two questions, the case study and the specific literature study conducted for finding out the typical performance indicators that are used in the industry, helped us to identify meaningful performance indicators for developing the prototype.

The selection of an appropriate performance evaluation framework was also done, based on a literature study. A literature survey of the various frameworks used in the IT industry was made and an appropriate one, namely the IT balanced scorecard was selected in the next step.

A performance evaluation system was designed and developed based on the insights gained from the previous steps. The system so implemented was tested and evaluated at the case study organization and the feedback was analysed as the last step of the research.

1.9 Conclusion

In this chapter, after a brief discussion on IT organization and its management, an overview of the current status of the outsourcing phenomenon and performance evaluation of IT organizations are presented. With this as the background the research questions and the method adopted in this research were also presented in this chapter. The findings of the literature study carried out for answering the first sub-question of the main research question are discussed in the next chapter of this thesis.

Chapter 2

Outsourcing – Issues and Complexities

In earlier days IT organizations used to have a centralized governance structure, in order to reap the benefits like economies of scale, sharing of data, integration of application, optimal use of scarce resources, etc. Moreover, traditionally IT was used only for central administrative functions and less for the primary process. But when automation spread deep into all sectors of business activities and when business expanded with multi-business unit corporations operating internationally, various governance structures other than the centralised one emerged. They are decentralized, federal, internal bureau and business venture type of structures (Earl, et. al., 1996). Each of these governance structures has got its own merits and demerits and is opted by the business organization to suit its strategy.

As a consequence of outsourcing, the downsizing of the IT organization will take place, since specific in-house capabilities are no more required. As stated before, the extent of downsizing depends on the type and scope of outsourcing. Outsourcing introduces new risks. These can be financial risks such as hidden costs, escalation of costs etc., business risks such as loss of internal competencies, etc., and technical risks such as degradation of delivered services, etc. These risks become more acute if the service provider is from a different continent (offshore outsourcing), which is very common in the west. Also, as mentioned in section 1.3, often outsourcing contracts are made with multiple service providers (multiparty outsourcing). This introduces one more risk – the risk of coordinating the provision of the services by different vendors. So, though being downsized, IT organizations now have the added responsibility to mitigate these risks and also manage the relationships with the external service providers. This is, all the more important in the case of total outsourcing.

According to Earl et. al., (1996), outsourcing is an option available for all organizations, irrespective of the IT governance structure. It does not necessarily mean a change in the governance structure of the IT organization, even though the roles and responsibilities may change. But that is not the case always. For example, Lacity and Willcocks (1996) report that there are occasions in which business executives enter into IT outsourcing contracts, without even consulting the IT manager or the IT group; and the beneficiaries sometimes monitor such contracts themselves. In certain other cases, it is seen that the responsibility of the IT organization is limited to the maintenance of the service catalogue. That means, the new contractual and monitoring relationships that come into force in a multiparty outsourcing environment will necessitate changes in the structure of the IT organization and the way IT is governed.

From the above discussion it can be concluded that in a typical multiparty outsourcing environment the retained IT organization need to have the following IT capabilities:

i) Competencies required in managing and maintaining the core functionalities that are not outsourced. They are mostly strategic in nature – related to creating business value. Examples are the functionalities of a business architect, strategy manager, etc.

ii) Competencies required managing the service providers. Examples are the functionalities of a service level manager, contract manager, etc.

This implies that even though it is possible to downsize the IT organization, since many in-house capabilities are no longer required, new roles and responsibilities become necessary to monitor and manage the service providers. This is to ensure the anticipated benefits of outsourcing.

In this chapter we strive for a proper and better understanding of the complexities/issues in a multiparty outsourcing environment. According to our opinion this better understanding is the basis for being capable of managing and monitoring the overall performance of IT. WE do this by answering the first research sub-question which is repeated below.

What are the complexities involved in managing/coordinating the activities, in a multiparty outsourcing environment?

An analysis of the outsourcing environment in more detail was done to bring out the complexities in it.

2.1 Analysing the Complexities in an Outsourcing Environment

Even though in a typical outsourcing environment, the delivery of some or many of the IT services are provided by multiple external service providers, it is necessary to ensure that everyone in the business organization gets the information/IT services needed to perform his or her tasks. Usually the IT organisation is responsible to ensure that the level of the quality of the IT services is appropriate. This quality level is usually referred to as the minimum performance level. However in more federal or decentralised IT governance structures it can be difficult to pinpoint a single responsibility to ensure such a minimum performance level. Federal structures, for example, are based upon shared responsibilities. To ensure this minimum performance level for the products and services, many authorities within the organization "make" service level agreements with the service providers. And to define, achieve and maintain the provision of the agreed quality of service, service level management processes are set-up, within the organization.

We shall, first look into the complexities associated with service level agreements, service level management processes and then the service level

management organization. It shall then be followed by other complexities, which we consider intrinsic to the IT sector.

2.2 Complexities Associated with Contracts and SLAs

A service level agreement is a written agreement between a customer and a service provider that documents the agreed service levels for a service (OGC, 2002). Most often, the important targets set in a SLA will relate to the service availability and thus require incident resolution within agreed periods. In addition, it may also contain performance requirements such as response time, throughput, etc. and other requirements such as security, reliability, contingency, change control, service level monitoring and reporting, etc (Hiles, 1994). Mostly, SLAs are part of a contract in which all aspects of the agreement have been stated, such as financial terms and conditions, penalty clauses, etc. In practice there is no strict borderline showing what to include in the contract and what to include in the SLAs.

SLAs can be defined at different levels of granularity. It can be a comprehensive one, made at top level, covering all the services to be provided by a particular vendor. Or it can be many separate ones, one for each service. This implies that there can be multiple SLAs made by the same organization with the same vendor. Different SLAs with the same service provider by different business units/departments/user groups are also not uncommon in practice. They are often caused by the existing IT governance structure. This implies that different people (actors) from the same organization are responsible for making and monitoring SLAs.

In a typical multiparty outsourcing environment, the details of the outsourcing contracts can vary from case to case. This means that for each contract the terms and conditions of service, availability requirements, performance levels, etc. can be different, depending upon the criticality of the

service. For example the availability of mainframe services may be ninety eight percent and the maximum down time can be two hours, whereas for desktops, they can be ninety percent and twenty four hours respectively. Keeping track of each and every clause of all these SLAs will become cumbersome in such a situation. This will add to the complexity in managing the multiparty outsourcing environment.

It is not uncommon in bigger organizations to have many SLAs and contracts made by the organization with multiple service providers. It is not uncommon to have a few hundreds or even thousands of SLAs/contracts being signed by an organization. Different people might have entered into these, at different times. Hence proper management and monitoring of these contracts has become cumbersome. Quite often it is seen that these contracts are automatically renewed, without even knowing the need or usefulness of such contracts.

2.3 Complexities Associated with Service Level Management Process

Service level management is the process, which controls the quality of the provision of IT services. According to ITIL terminology, it is the process of defining, agreeing, documenting and managing the levels of certain IT services that are required and cost justified (OGC, 2002). That means, the responsibility of SLM does not end with the creation of the SLA but, also should ensure that the services are provided as per the contract (Hendricks, 2002). SLM is also responsible for the continuous improvement of service levels in line with business processes, review of SLAs, resolution of major service issues and production, review and maintenance of service catalogue.

For the effective implementation of the service level management, usually a service catalogue (SC) is prepared. The SC is a repository containing the necessary details of all IT services required by the enterprise. It details all the IT services with the default level of quality and options available, in each case

(OGC, 2002). It is to be prepared in consultation with the users/clients. Often negotiations are to be made with the users on the performance level of the services required by them. Once the service catalogue is finalized, it forms the basis for the negotiation with the service providers and the subsequent formulation of the service level agreements/contracts.

To achieve and maintain the agreed quality of service, the management of the relationships with the service provider is very important. For the smooth sail of each relationship, there should be a well-defined governance structure (Kern and Willcocks, 2000). As seen in the previous paragraph, there can be multiple relationships with the same service provider. And in a multiparty outsourcing environment, there could be a number of such service providers. Such a scenario presents a complicated management of the relationships.

The fact, that the different stakeholders have conflicting interests, adds another dimension to the complexity of relationships. The management of the business organization is interested in getting the service at the lowest cost and the service provider tries to maximize the profit by diminishing the operational costs. Finally, the user expects the best quality service. As a result all the parties are forced to accept the minimum performance level as the basis, which may not be realized, unless it is monitored carefully.

Another issue related to management of relationships is the mistrust or misunderstanding caused by the cultural differences of the people belonging to the client and supplier organizations. People on both sides need to know each other's goals and objectives; especially the service provider. But often they have differing objectives. For a successful relationship, the people on the supplier side should have a high level of understanding of the client's business and should work towards achieving their goals and objectives (Kern and Willcocks, 2000). In practice this is not an easy task. With a large number of such service providers/suppliers, the issue becomes more acute.

When different services are sourced to different service providers, which are quite common in selective outsourcing, the co-ordination of the activities of various service providers is also very important. For example when there is a connectivity problem, it may be difficult to know, whether it is due to failure of networking hardware or an operating system problem or a transmission problem. The outsourcing agents for these three services may have to work together to identify the cause and resolve the issue. So the co-ordination of the activities of the different service providers and the maintenance of good relationships among them adds another dimension to the complexity.

The above illustration also points to the fact that in IT it is difficult to clearly demarcate the boundary of its services. This adds yet another dimension to the complexity in the service level management process.

In a multiparty outsourcing environment, objective measurement of the performance of individual service provider is another difficult task. This is because of the fact that the different services supported by different service providers are interdependent. For example, consider the case of e-mail services. The service may not be available due to the failure of hardware (server) at the customer side or it can be due to a virus attack in the network, or it can be due to a cable fault in the local network. As far as the customer is concerned the service is not available. And for the e-mail service provider the non-availability is not his fault. So in such cases, the measurement of the performance of the individual suppliers becomes difficult.

2.4 Complexities Associated with Service Level Management Organization

Earlier, the service level management process was contained in the IT organization. But currently, there are situations in which, it is spread over the entire organization. For example, outsourcing decisions are not always taken by

the IT managers. In a survey conducted by Lacity and Willcocks (1996), thirty percent of the outsourcing decisions were taken by the senior executives, without even consulting the IT organization. Similarly, the beneficiary also in certain cases, handles the monitoring of the service provision and the role of IT organization is limited to the maintenance of the service catalogue.

In such a situation, it becomes difficult to assess the overall performance of the IT in that enterprise. Different service providers providing different services submit their performance report to different monitoring authorities. To make an assessment of the overall performance, the data is to be collected from various locations (monitoring authorities) and compiled. This again raises a number of practical issues like who will do the compilation, how to gather the performance data, how to check the reliability of the data so collected, etc. Hence it becomes difficult to have an overall assessment of the performance in a multiparty outsourcing environment.

The distribution/decentralization of the monitoring and relationship management activities may cause difficulties in the maintenance of the service catalogue also. The service catalogue is to be reviewed and updated regularly on the basis of the changing user requirements and the assessment of the performance level of the services provided. So it becomes difficult to update the service catalogue, if the true performance data is not available.

The process of sub-contacting the tasks, by the service provider, with or without the knowledge of the outsourcing organization is also common. This causes additional burden to the relationship management, in terms of complicated communication structure and accountability issues. This is all the more crucial in the case of offshore outsourcing contracts. For instance, many IT services outsourced to Indian companies are being sub-contacted to countries such as Sudan, Iran and Bulgaria, which increases the security risk. The reason for this

could be shortage of labour or lack of proper infrastructure to cope up with the burst of business from the west (Hilley, 2004).

2.5 Complexities due to Intrinsic Characteristics of IT

There are certain characteristics, which are intrinsic of IT, which makes IT outsourcing different from other outsourcing activities. The fact that IT pervades, affects and even shapes most organizational process in some way makes it very critical and important part of the company (Kern, et. al., 2002). When different service providers provide different IT services or when different service providers provide services for different segments, the services of all the service providers are equally important for the smooth functioning of the business organization. So each service provider needs to understand the implications that IT has for the business organization. If any of them fail to do so, then the whole business is affected. The old saying "the strength of the chain depends on the weakest link is very much true in this situation".

Outsourcing software development to an offshore company brings risks to a firm's intellectual property. What if a supplier's development team uses an inadequate development methodology and opens an application to attack or deliberately inject a 'Trojan' or open a backdoor in the code (Hunter, 2003).

Flaws in the assessment of the service provider can also affect the delivery of services. Often it will be a matter of establishing technical compatibility rather than competence, because the firm suitable for one type of project may not have the skill base for another type of project. In certain cases the credibility of the staff is another important aspect to be assessed. Bradbury (2004) reports that when a security services company checked the staff of a potential offshore supplier for a western financial services customer, it found that at least three of them were members of a hackers group.

Complexity Category	Complexity descriptions
A. Complexities associated with contracts and SLAs	1. The boundary between SLA and service contract is not well defined 2. Difference in the granularity of SLAs 3. SLAs are made by different actors 4. Difference in the contents 5. Large number of SLAs
B. Complexities associated with SLM process	1. Difficulties in the management of multiple relationships with multiple service providers 2. Conflicting interests among different stake holders 3. Issues caused by cultural differences 4. Difficulties in the coordination of the relationships between service providers 5. Difficulties in measuring the performance objectively 6. Difficulties in demarcating the jurisdiction of different services
C. Complexities associated with SLM organization	1. Distribution of responsibilities over the entire organization 2. Difficulties in measuring the overall performance 3. Difficulties in maintaining the service catalogue 4. Issues related to sub-contracting
D. Complexities due to intrinsic characteristics of IT	1. IT services are different from other services 2. Difficulties in securing Intellectual Property 3. Inadequate assessment of the Service Provider 4. Difficulties in estimating the future value of IT 5. Difficulties in accommodating the business dynamism

Table – 2.1 Complexities in a multiparty outsourcing environment

The speed at which the IT capabilities continue to evolve makes it difficult to estimate the future IT needs (Lacity and Willcocks, 1996). The adoption of a new technology in one sector may necessitate changes in other sectors/services. For example, a change in the software platform can necessitate changes in the hardware platform and/or changes in the application software. So when different service providers are responsible for providing services in different sectors, all of them have to agree and cooperate, for adopting a new technology, which may be outside the contract.

Above all the dynamism in the business scenario, due to various reasons like diversification of products and services, mergers, acquisitions, downsizing, etc. will necessitate corresponding changes in the IT which supports the business. Accommodating these changes 'on the fly', in an outsourcing environment, is another complex reality, which is to be dealt with.

2.6 Conclusion

In short, we have identified nearly 20 different complexities, which can be categorized under four headings. They are summarised in table 2.1. In the next chapter we shall discuss the solutions available in the literature for dealing with these complexities.

Chapter 3

Understanding the Outsourcing Complexities

In the previous chapter we had identified several issues/complexities involved in managing an IT organization in the context of outsourcing. The next step is to identify the relevant research which has already contributed to describing, modelling and/or understanding the above complexities. This will support in identifying the areas which we need to study further for getting a proper understanding of the multiparty outsourcing environment. Hence in this chapter a summary of the literature survey conducted by the researcher to that effect is presented innitially. It is then followed by the presentation of two sets of modelling and description techniques usable for understanding the complex relationships in a multiparty outsourcing environment. The first set, which was developed by the researchers is presented in section 3.2 (Peter, et.al., 2004). The second technique for representing the relationships is based on Unified Modelling Language and is given in section 3.3 (Peter, et.al, 2006).

3.1 Understanding the Complexities

The summary of the complexities associated with the management of an IT organization in an outsourcing environment were classified into four categories and presented in Table 2.1. The literature review was also conducted in a similar fashion so that they deal with the complexities category wise. Hence we begin with the presentation of the summary of the relevant research that deals with the complexities associated with contracts and SLAs.

3.1.1 Understanding the Complexities Associated with Contracts and SLAs

In order to address the complexities associated with outsourcing contracts and SLAs we have looked for research carried out in the area of the content of contracts and SLAs. The main contributions we have looked for are related to:

- The typical content of a SLA
- The typical content of a contract
- The way SLAs and contracts are related
- The actors involved in contracts and SLAs
- The main processes as defined to monitor and manage the contracts and SLAs

Hiles(1994) defines SLA as an agreement between the provider of a service and its customer which quantifies the minimum quality of service that meets the business needs. As each situation is unique, it is difficult to be prescriptive, since the SLA content varies depending upon the type of SLA (OGC, 2002). However there are a number of common features that often occur within SLAs. According to Hiles (1994) a typical SLA should contain the following:

- Purpose of the SLA
- Service description
- Service hours and maintenance slots
- Service availability
- Performance
- Peak period service – variations
- Volumes, throughput and ouput deadlines
- Restrictions and standards
- Support service levels
- Security
- Contingency
- Change control

- Problem management and escalation
- Service level monitoring
- Service level reporting
- Service regimes and priorities
- SLA review meetings
- Duration, amendment and termination of SLA

In addition to the above, OGC suggests that it can contain the details of agreement regarding financial incentives or penalties based upon performance against service levels.

Usually, a service contract will cover business terms and commercial issues in addition to an SLA. The typical content of an outsourcing contract is given below (Lacity and Willcocks, 2000):

- Service level agreement
- Financial aspects
- Penalty clauses
- Confidentiality clauses
- Named contract managers
- Intellectual property right clauses
- Warranty clauses
- Liability and indemnity clauses
- Specified arrangements for adapting the contract
- Early termination provisions
- A force majeur clause

The generic SLA model developed by the IBM research group at Watson Research Centre, New York, (Ward et al., 2002) for the execution management of e-Business outsourcing contracts, is a good tool for the understanding and

monitoring of outsourcing contracts. It is very suitable to be used for general outsourcing contracts with a little modification, even though it was made to help the service provider to manage e-business outsourcing contracts. It can capture the principal elements of the outsourcing contract, such as the description of the service(s), functional requirements, duration of the service, terms and conditions of the service, service level monitoring and reporting specifications, problem escalation procedures, etc.

The above semantic elements and the relationships among them are then represented in UML as a structure diagram, which allows easy top to bottom reading. The relationships are labelled with unidirectional cardinality such as 'uses' and 'includes'. It is accompanied by a description of the semantic elements in a tabular form. The proposed relationship structure diagram is given in figure-3.1. The model also provides a systematic means of identifying and structuring necessary service level reporting modules. As such it is a very useful tool in providing assistance to deal with some of the complexities associated with SLAs, by providing a clear pictorial representation of individual outsourcing contracts. But it does not give an overall picture of the outsourcing scenario, in which different services are provided by multiple service providers.

In a survey conducted by Lacity and Willcocks (2000) in certain organizations that are involved in IT outsourcing, in UK an US, IT Managers and/or internal lawyers were responsible for negotiating and defining outsourcing contracts in most of the cases. Other stakeholder groups viz. external lawyers, external consultants, senior executives and suppliers and in certain cases even the board were involved in finalizing the outsourcing contract. But the above authors recommend that it should be done by a mix of people having technical skills and political power, for a successful outsourcing contract.

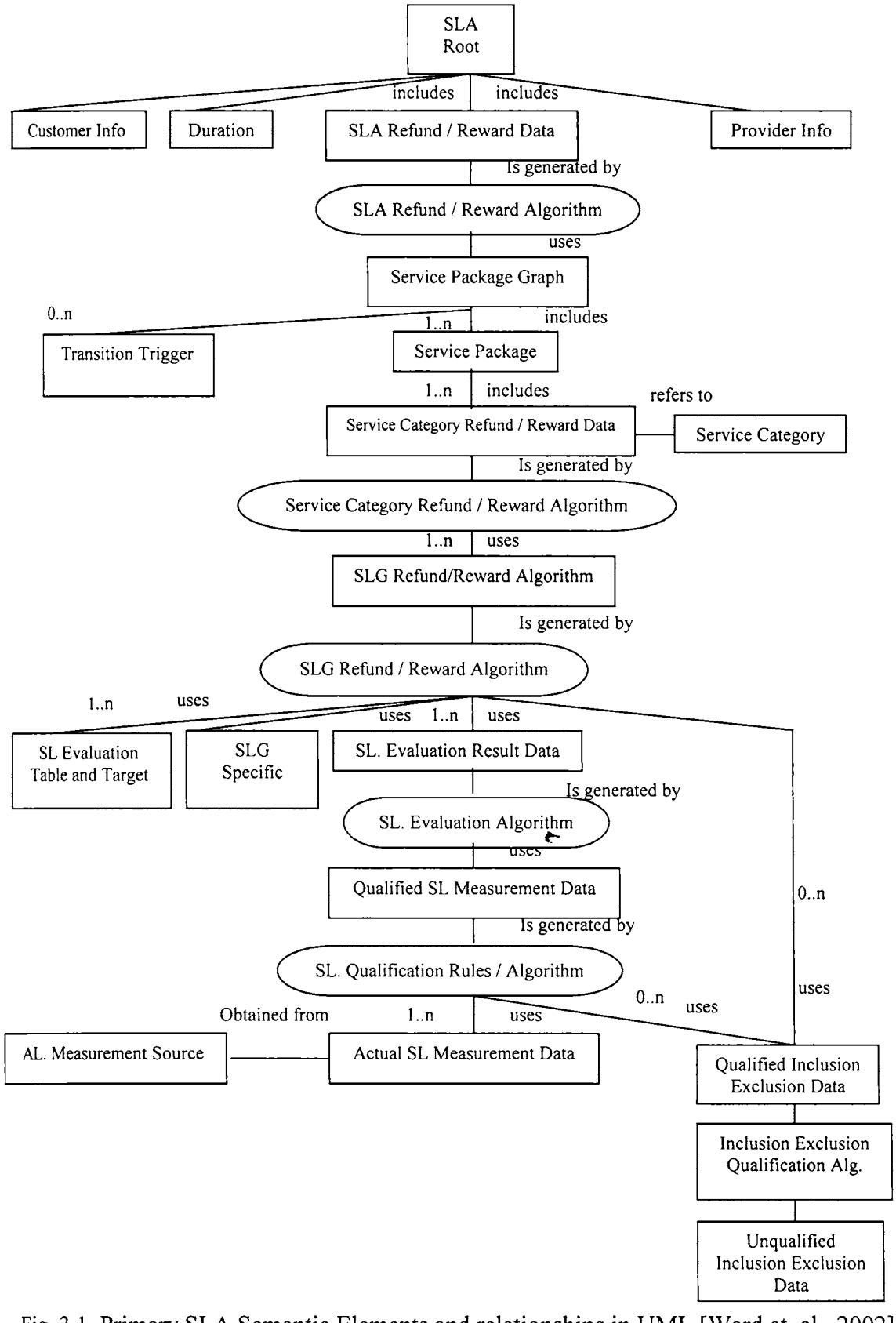


Fig. 3.1 Primary SLA Semantic Elements and relationships in UML [Ward et. al., 2002]

3.1.2 Understanding the Complexities Associated with Service Level Management Process

In order to address the complexities associated with service level management process, we have looked for research carried out in the area of management, coordination and performance. The main contributions we have looked for are related to:

- Coordinating workflows across multiple partners
- Defining services and its performance clearly
- Ways to align objectives between customers and suppliers (e.g. win-win)

Business organizations are quite complex with different customer groups, business units, people, resources and systems and they stretch over numerous different processes that interact in a seemingly chaotic manner. So graphical representations of business process models are an important means for grasping such inherent complexities (Alexopoulos and Theodoulidis, 2003). The testbed project, which develops methods, techniques and tools to handle change in business process, makes use of a graphical business process language called AMBER to represent the business processes and the relations visually (Luttighuis et. al. , 2001).

A brief description of the business process language AMBER and its graphical representation is given below. It recognizes three aspect domains:

- The actor domain, describing the resources deployed for carrying out business processes
- The behaviour domain, describing the activities happening in the business process
- The item domain, describing the items (forms, files, databases, etc.) handled in business processes

The basic concept in the actor domain is the actor, represented by octagon. It designates a function, role, organizational unit, person or system (used for) carrying out a business process. For actors containing other actors, a nested representation is used. Actors generally have interaction points represented by oval, which are physical or logical locations at which the actor may interact with its environment. Interaction relations connecting interaction points are represented using lines. Figure 3.2 shows a typical actor model.

The basic concept in the behavior domain is the action, which is represented by a circle. It models a unit of activity in the business processes. An action can happen when its enabling condition, represented by an arrow is satisfied. They can be composed using splits and joins represented by small diamonds and little rectangles respectively. Triggers are like actions, except that they are always immediately enabled and are represented using frayed

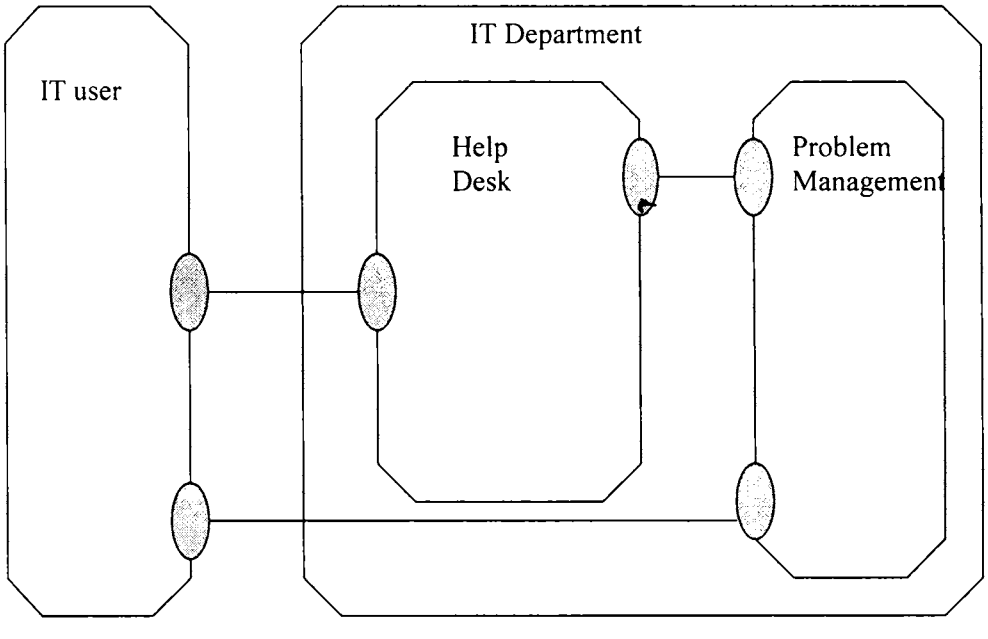


Fig. 3.2 An example of actor model

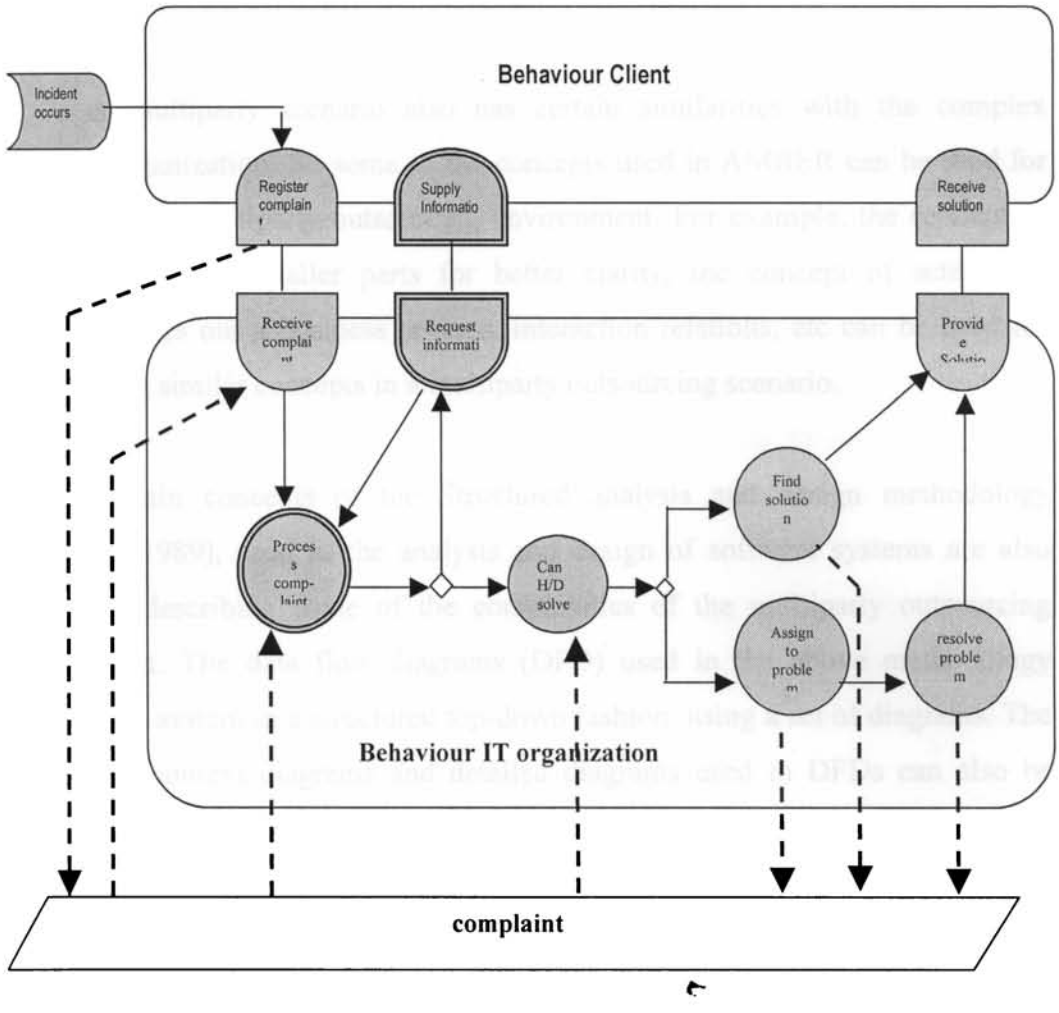


Figure 3.3 A typical behavior model coupled to an item

semicircles. Actions can be grouped in blocks represented by a rounded rectangle. When a block separates behavior inside actions, the action is divided into a number of interactions represented by semicircle. Interaction relations are represented by lines.

The item domain models the items, represented by rhomboids, on which the actions are performed by the actors. In the actor and behavior models, items can be included and coupled to the various elements using dotted lines. In the actor domain, items are coupled to interaction-point relations, whereas, in

behavior models, items are coupled to actions and interactions. figure 3.3 shows a typical behavior model coupled to an item.

A multiparty scenario also has certain similarities with the complex business organization. So some of the concepts used in AMBER can be used for describing the multiparty outsourcing environment. For example, the concept of decomposing into smaller parts for better clarity, the concept of actor who initiates/carries out a business process, interaction relations, etc can be used for representing similar concepts in a multiparty outsourcing scenario.

Certain concepts of the Structured analysis and design methodology (Yourdon, 1989), used in the analysis and design of software systems are also helpful in describing some of the complexities of the multiparty outsourcing environment. The data flow diagrams (DFD) used in the above methodology represents a system in a structured top-down fashion, using a set of diagrams. The concept of context diagrams and detailed diagrams used in DFDs can also be made applicable to describe the complex scenario in the multiparty outsourcing environment in a systematic manner.

Another Software Engineering tool, which can be made use of in understanding the isuues related to the coordination of workflows across multiple partners, is the Interaction diagram of UML; especially the Collaboration diagram (Booch et.al., 2001). The Collaboration diagram consists of objects which is also called collaborators and the links existing between them. Links can be used to send messages, through which the interaction takes place. Messages are shown as labelled arrows placed near the link and are prefixed with sequence numbers. Such diagrams can be adapted for depicting the interactions between the various actors in a multiparty outsourcing environment.

Most of the outsourcing literature deals with different types of relationships and tries to explain how to outsource, when to outsource and what to

outsource (Mckeen and Smith, 2001). But recently few researchers have shown interest in the post contract management; especially in the management of external relationships in IT outsourcing. Some of the findings of the study/research in this area are however useful in understanding certain complexities associated with the SLM process. These studies are discussed below in more detail.

Beulen and Ribbers (2002) used an IT outsourcing partnership model, which provides the conceptual framework for conducting a case study on IT outsourcing relationships. The model is composed of the following elements: outsourcing company, IT supplier, relationship, experience, power distance and individualism as shown in figure 3.4. It identifies the most important elements related to the relationship as business improvement (goals), contract structure (SLAs) and the contractual obligations (commitment). Lee (2003)used a casual model based on social exchange theory, in which he studied the effect of

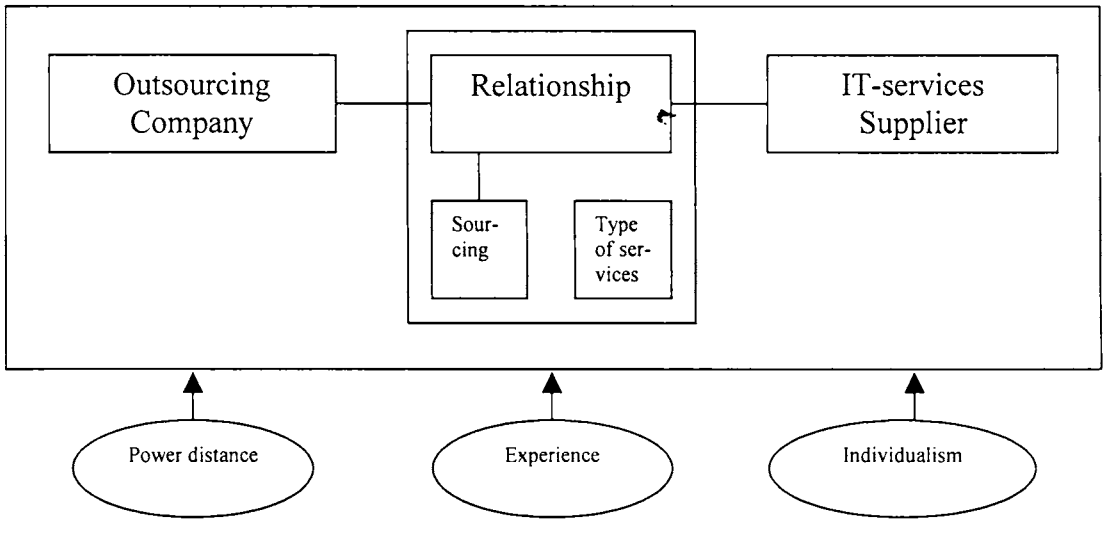


Figure 3.4 The IT Outsourcing Partnership model [Beulen and Ribbers, 2002]

three attitudinal variables, namely, mutual benefits, commitment and predisposition, to study their effect on outsourcing success and concluded that mutual benefit had the greatest impact on the outsourcing success.

A win-win solution for both the client and the supplier occurs, when they are able to look beyond the buyer-supplier type arrangements to a closer relationship that operates within the spirit of the contract (Kern and Willcocks, 2000). A conceptual model, as shown in figure 3.5 for studying the intricacies

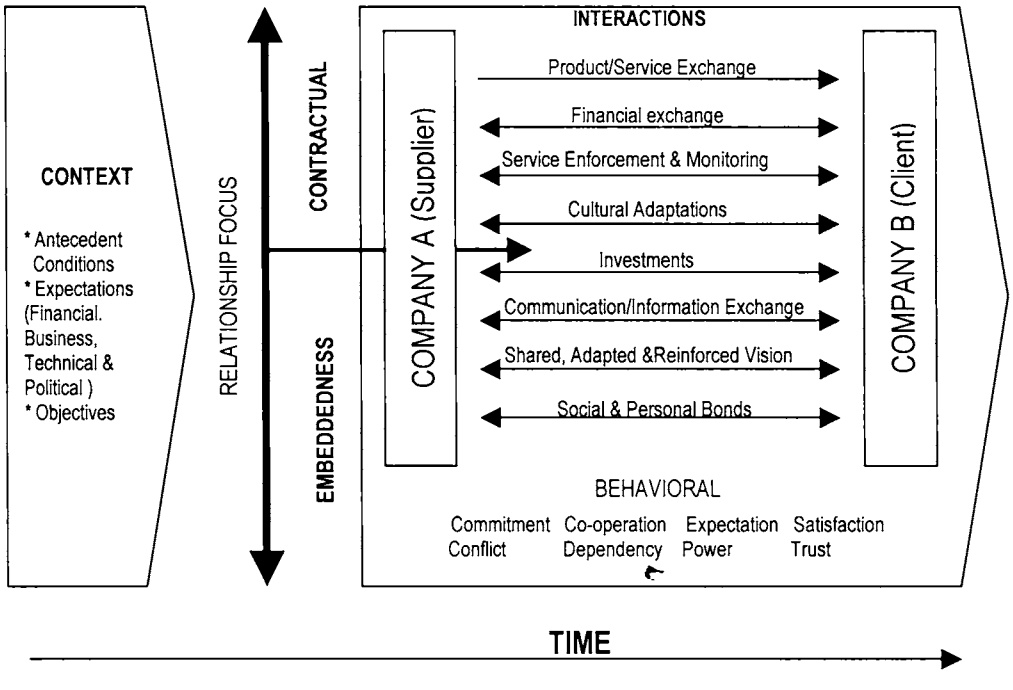


Figure 3.5 Conceptual model of Client-Supplier Relationship [Kern and Willcocks, 2000]

of the outsourcing relationships based on social exchange theory and social contract theory was used by Kern and Willcocks (2000). It takes into consideration the contextual dimension, which includes the contract and the management infrastructure, the behavioural dimension and the interactions. This model was used in an exploratory study, which revealed the need for having user

satisfaction, cultural convergences, good communication characterised by openness, commitment and honesty, etc in maintaining good relationship and in turn on the success of the contract.

Another solution to the issues related to the management of external relationships was brought out by Mckeen and Smith (2001), by obtaining a practitioners understanding of the issue and their strategies for managing the relationships. Using a focus group of practitioners from a variety of industries, they had sought to tap into the group's insights to balance the theoretical perspective. Four distinct external relationships emerge; they are performance contract, commodity contract, strategic partner and prferred partner. Even though contractual relationships are more common now, the focus group members expect to see the growth in the number and types of partnerships with external suppliers. A set of guidelines for managing external relationships was extracted from the group which represented a significant experimental base. The following are the strategies recommended by them:

- Asses the level of intimacy and trust between the client and the service provider
- Make relationship management part of your IS resourcing strategy
- Make contract management a core IS competency
- Consolidate the external relationships (by reducing the number of service providers)
- Establish the terms of reference for consulting partners
- Beware of the negative effects
- Build a 'preferred list of partners'

The conclusion is that the management of external relationships is to be made a core competency and that a well-focussed strategy, if formulated and adhered to, should guide IS organizations in establishing productive external relationships.

An automated system for the measurement, monitoring and verification of SLAs in a federated environment is proposed by Bhoj et al. (2001). A federated system is defined as a system composed of components with different administrative entities, cooperating to provide a service. The frame work of the above automated system is shown below in figure 3.6. The service model includes a description of the service components. It does the following:

i) identifies the components that enable a service

ii) expresses the interdependencies that exist among the different elements of the service and

iii) identifies the measurements that are available from each component.

The contract repository contains a set of contracts/SLAs which the organization has with its providers and/or customers. The SLA manager is the engine responsible for directing the verification task. It has the knowledge of how to evaluate an incoming verification request. This would involve interfacing with the contract repository to get the details of the contract, interfacing with the local resources and the local system and service management modules to collect information needed to verify the contract. If evaluation of a contract has dependencies on other external contracts, then it uses the contract verification interface provided by the external domains to collect the required data. Customizable plug-ins allow SLA Manager to communicate with a variety of systems to extract information about the domain. The contract evaluation and notification handlers use this abstract view to compare the service behaviour to preset thresholds and conditions specified in the contracts for compliance.

Such an automated system will be a great relief for the Service Level Manager in measuring and monitoring the performance aspects of the various SLAs and contracts.

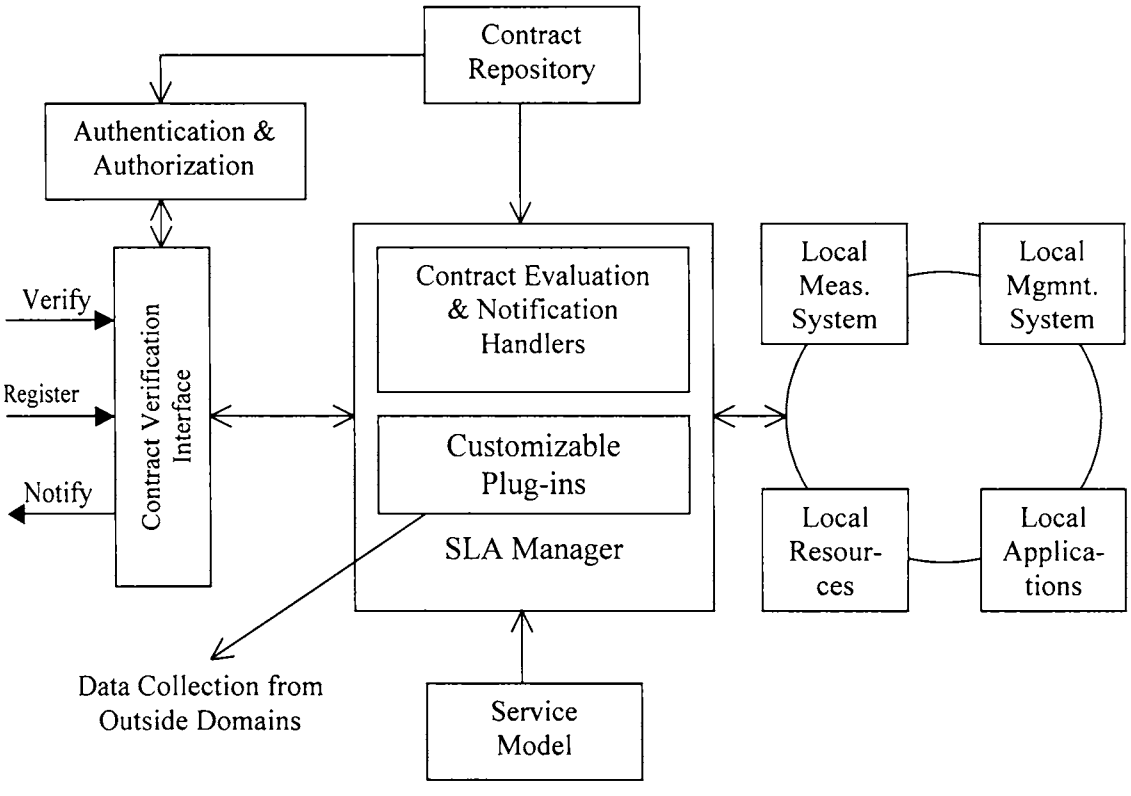


Figure 3.6 Contract Verification Framework [Bhoj, et al. 2001]

3.1.3 Understanding the Complexities Associated with SLM Organization

According to ITIL (OGC,2002), the SLM process must be owned by the service level manager who heads the SLM organization.The role of the service level manager is to implement and maintain the SLM process to the level required by the parent organization. The key responsibilities of the service level manager include the following:

- formulates, agrees and maintains an appropriate SLM Structure for the Organization.

- Creates and maintains a catalogue of existing services, offered by the IT organization
- Negotiates and agrees with both the customer and the IT service provider for any proposed new/developing services.
- Conducts annual review of the entire service level process and negotiates, agrees and controls any amendments necessary.

This implies that, even when the responsibilities of SLM are spread over the entire organization, the service level manager has to ensure the coordination. He should also be able to maintain the service catalogue.

An automated tool proposed by Bhoj et al. (2001), which is described in the above section, can trim down the difficulties in measuring the overall performance of the IT organization to some extent.

3.1.4 Dealing with the Complexities Associated with the Intrinsic Characteristics if IT

Considering the important role played by IT in supporting the business, several terms like 'outsourcing partnership', 'strategic partnership', 'strategic alliance', 'strategic relationship', etc. have been cointed by scholars and practitioners to define the outsourcing relationship. But the realization of such a relationship is not that easy, because it takes time to develop that level of confidence and trust between the two parties. It again points to the need for having an effective management of the outsourcing relationship, to attain this level of client-supplier integration as a win-win situation, where both parties benefit in their ways from the relationship (Kern and Willcocks, 2002).

The importance of the assessment of the service providers for the success of the outsourcing contracts were realized by the industry as early as the beginning of nineties. As reviewed by Lee and Kim (1997), numerous studies in

the specific areas of outsourcing such as bidding, contract management, package selection, etc., have already taken place. Combining the results of the above studies Lee and Kim (1997) had developed a rational model for outsourcing decision making. The model is given in figure 3.7.

First of all, a company decides to outsource or not, by considering its internal IT environment and the external service provider's environment. In this step, it studies the risks and benefits of outsourcing in detail. Then the outsourcing strategy is selected by selecting the factors such as type of outsourcing – total/selective, duration of the contract, number of service providers, etc. In the next step an appropriate set of service providers are selected and proposals invited from them. These proposals are then evaluated and the most suitable one is selected. Contract negotiation, in which the dynamics of the outsourcing relationships are defined is taken up next. The service provider then implements the outsourced services. To ensure effective and successful outsourcing, a contract management process is also set up. It takes care of the contract administration, liason with users, monitoring of the service level/quality, etc. The feedback from the above process is analysed to review any of the earlier decision or even for the termination/renewal of the contract, if necessary.

The complexities related to the future value of IT and business dynamism can be alleviated to some extent by having flexibility in the contracts. That means a contract must balance the flexibility needed to remain technologically competitive, yet be detailed enough to include specific performance criteria and to allow for managing the costs specified in the contract (Harris et. al., 1998). The flexibility can be incorporated by several methods such as price flexibility (through indexing or open pricing), renegotiation flexibility, shorter contract duration, incentive contracts (performance incentives), etc

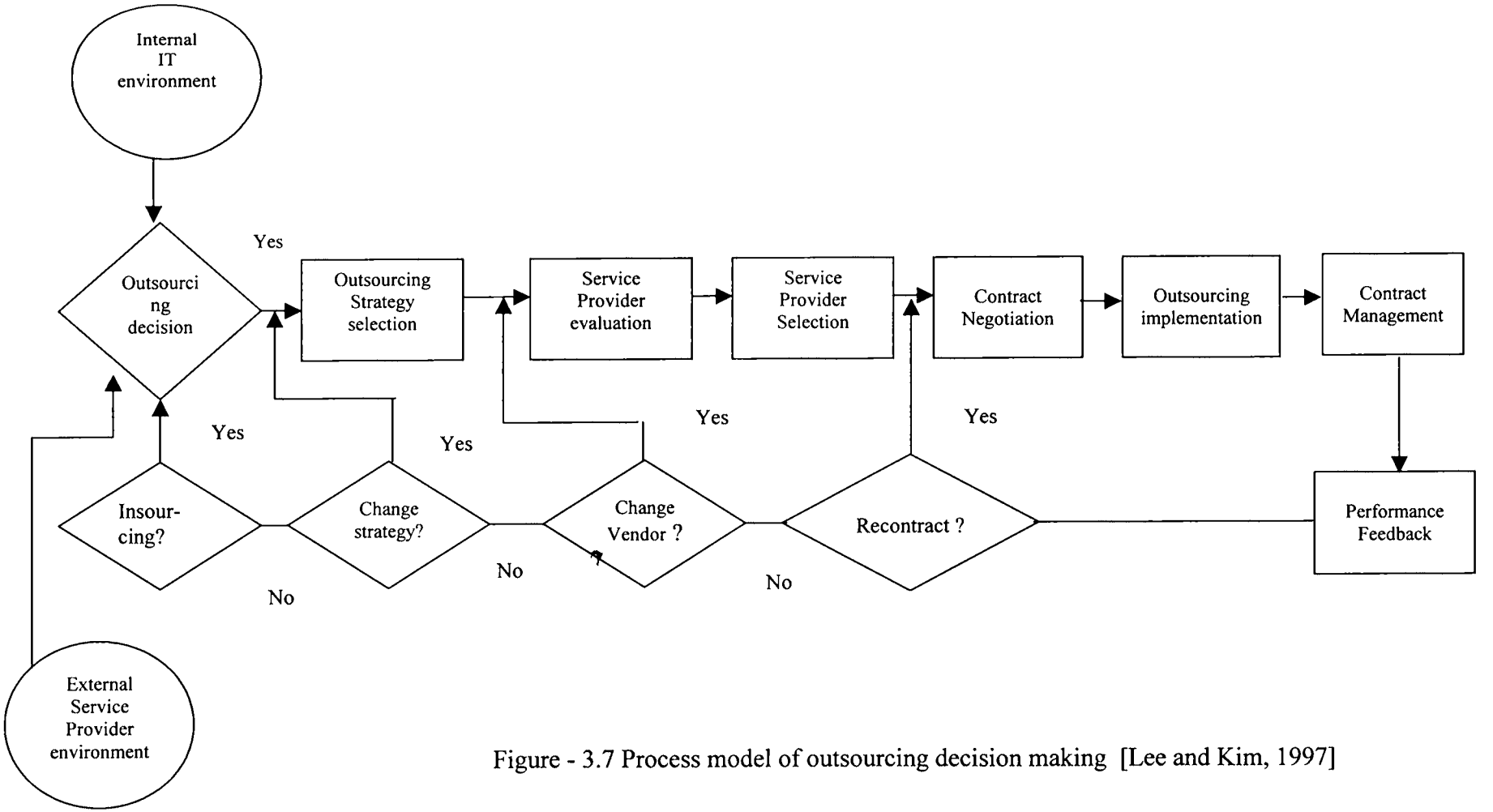


Figure - 3.7 Process model of outsourcing decision making [Lee and Kim, 1997]

3.1.5 Need for Further Work

The complexities involved in understanding and managing a multi-party sourcing environment were discussed in table-2.1. The mapping of the main remedial concepts identified to the complexitites identified above is shown in table-3.1. The adequacy of the existing models in capturing the complexities was explored and it was found that there exists a need for a model to capture the complex relationships at an abstract level. Hence in the next section we present two sets of modelling and description techniques usable for understanding the complex relationships in a multiparty outsourcing environment. The first set, which was developed by the researchers is presented in section 3.2. The second technique for representing the relationships is based on Unified Modelling Language and is given in section 3.3.

Complexity Category	Complexity descriptions	Remedial Concepts identified in the literature
A. Complexities associated with contracts and SLAs	1. The boundary between SLA and service contract is not well defined 2. Difference in the granularity of SLAs 3. Difference in the contents (terms and conditions) 4. Large number of SLAs 5. SLAs are made by different actors	1. Recommendations/Suggestions regarding the content of SLAs and contract is available 2. Graphical representation of the SLAs/Contracts will enhance the understanding and monitoring 3. Contractual relationships to be enacted by a mix of people having technical skills and political power
B. Complexities associated with SLM process	1. Difficulties in the management of multiple relationships with multiple service providers 2. Conflicting interests among different stake holders 3. Issues caused by cultural differences 4. Difficulties in the coordination of the relationships between service providers 5. Difficulties in measuring the performance objectively 6. Difficulties in demarcating the jurisdiction of different services	1. Business process models dealing with multiple parties can be adopted to describe the relationship with multiple service providers 2. Establishment of a Relationship Management infrastructure to deal with cultural convergence, good communication, ensuring mutual benefits and commitments, user satisfaction etc.
C. Complexities associated with SLM organization	1. Distribution of responsibilities over the entire organization 2. Difficulties in measuring the overall performance 3. Difficulties in maintaining the service catalogue 4. Issues related to sub-contracting	1. The responsibility of SLM should be vested on Service Level Manager 2. Automated systems can be used for gathering performance data directly from the source, processing it and distributing them to the different stake holders
D. Complexities due to intrinsic characteristics of IT	1. IT services are different from other services 2. Difficulties in estimating the future value of IT 3. Difficulties in accommodating the business dynamism	1. Effective management of outsourcing relationship leads to a win-win situation for both parties 2. By incorporating flexibility in contracts can handle future value and business dynamism

Table – 3.1 Complexities and remedial concepts found in literature

3.2 SORD - A Graphical Tool for Modeling the Multiparty Outsourcing Scenario.

The old proverb "A picture is worth thousand words" is always valid. The textual representation of a complex concept will only add to the complexity of understanding it. Whereas, a simple graphical representation with abstract symbols, will make it easy to understand. The visual appearance of a named symbol will reveal itself clearly. Similarly the lines/arrows show the relationship naturally. Hence a graphical representation technique is chosen for modelling the organizational structure and relationships of the IT organization in a multiparty outsourcing environment.

This graphical tool for modeling the multiparty outsourcing scenario based on the concepts derived from Test-bed Studio and Data flow diagram is named SORD - Structured Outsourcing Relationship Diagrams.The tool is explained in the following section with an illustrative example. We also made a separation between concepts that are preferably visualised and those concepts that are better seen as attributes to other concepts. The second category can be represented using a formal language.

3.2.1 General Design Considerations

In addition to the main objective of having a graphical representation of the complex multiparty outsourcing environment, another equally important objective was to have a simple and easy to use technique to capture the various outsourcing relationships in a systematic fashion. The following design considerations (Luttighuis, 2001; Jalote, 1996) were taken into account while designing the graphical representations.

1. *Simplicity*: Since the diagrams are to be used by non-technical persons at the managerial level, the diagrams must be easy to understand. The use of

simple geometrical shapes such as circles, rectangles, etc. are recommended.

2. *Low cardinality of symbols*: As the number of symbols used increases, the understandability of the diagram decreases. So the number of different symbols used should also be kept a minimum; say between five to seven.
3. *Easy to construct*: It should be possible to draw the diagram without any specialized tools. In other words it should be possible to draw freehand.
4. *Unambiguous*: There should be a simple, well defined meaning for every symbol used. Otherwise the main objective of drawing the diagram, i.e., to clearly understand the complex environment, is thwarted.
5. *A set of diagrams*: If we try to grasp all the complexities in one diagram, it may become difficult to understand. Hence it should be possible to represent it as a series of simple diagrams, which are easy to understand.
6. *A divide and conquer approach*: As a sequel of the above criteria, the series of diagrams should be developed in a systematic top-down approach, so that it would be more easy for a third person to traverse through them and understand it.
7. *Completeness*: It should be possible to represent all contractual/sourcing and monitoring relationships of the IT outsourcing environment, in the set of diagrams so constructed.

3.2.2 Modeling Concepts

As seen from the discussion above, the two key concepts in managing the multiparty outsourcing environment are the *contract* and the *service level agreement*. These establish the contractual relationship between the organization and the external service provider. For the establishment of a service contract or an SLA, the *service catalogue* acts as the supporting document. But, in certain cases it can be other contractual documents like a high-level rate contract, which contains the rates and the terms and conditions of service or even another SLA/contract. The SLA can however also be used for managing relationships

between internal customers and the internal IT organization and between different service providers.

Now we introduce the concept of *actor* – the entity which establishes or monitors a contract/SLA. The entity which provides goods or services can also be considered as an actor. Usually the establishment, as well as the monitoring, of the contract/SLA is made by the IT organization; but that need not be the case always. In practice it can be seen that, sometimes the actor who monitors the contract/SLA is different from the actor who has made the contract/SLA. For example, in a certain organization, the contract/SLA was made by the business executive and the monitoring carried out by the IT department. That means, we need to distinguish the monitoring relationship from the contractual relationship

The above example also indicates the necessity for identifying two special types of actors – a business actor who establishes the contract and an IT actor who monitors the performance of the outsourcing agent based on the contract. The IT actor need not be the IT organization always. But, quite often, both the business actor as well as the IT actor can be the same – IT organization. But it is worth mentioning that in practice, an actor can be a business entity or a person/position who is responsible for establishing or monitoring a relationship.

Hence the following concepts are chosen for modeling the complexity of the multiparty outsourcing environment:

1. The establishment of a contractual relationship with a supplier by means of contractual documents, such as Service Level Agreements, Service Contracts, etc. This is done by the business actor.
2. The monitoring of the performance of the services provided by the supplier. i.e., the monitoring relationship – maintained/monitored by the IT actor.
3. The supporting document which forms the basis for the establishment of the relationship. Usually it is the service catalogue. But it could also

be other contractual documents like a high-level rate contract or even another SLA/contract.

It may be noted that, in practice, the business actor is usually responsible for the financial and legal aspects of the contract.

3.2.3 Notations Used

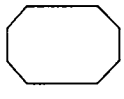
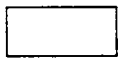
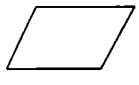
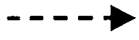
Symbol	Description
	An octagon represents an Actor, who is responsible for the creation and/or monitoring of the contractual relationship; i.e., it can be a business actor or an IT actor.
	A rectangle represents a vendor/sourcing agent or a customer/business entity.
	A Parallelogram represents a supporting document like service catalogue, a policy statement, or a contract, based on which a service level agreement is made.
	Line segments are used to represent the organizational relationships. It could be used for showing the hierarchical relationship (organizational structure) of a Business Organization or a vendor/service provider organization.
	A solid line arrow represents the outsourcing/contractual relationship. It originates from the business actor, which is responsible for establishing the contract and managing it.
	A broken line arrow represents the monitoring relationship. It originates from the IT actor.
	A broken line is used to represent the coupling of the document to the actor who uses it. Normally it is the one which is responsible for entering into a service level agreement. i.e., the IT organization.

Table 3.2 Notations used in SORD

For the effective representation of the complexities of a multi party outsourcing environment, seven concepts were chosen; namely, business/IT actor, business entity, supporting document, organizational relationship, contractual relationship, monitoring relationship and the coupling of a supporting document to the Actor who establishes the contract. Accordingly seven simple graphical symbols were chosen for their representation as described in table 3.2.

3.2.4 Organization of the Diagrams

For the proper representation and understanding of the complex multiparty outsourcing environment with all the different types of Service Level Agreements, two sets of diagrams are envisaged. The first set contains organizational diagrams. The hierarchical organizational structure of the Business Organization, as well as the vendor organization / outsourcing agent can be represented using these diagrams. The granularity depends on the actual situation. The organizational diagram should properly represent all the actors, business actors as well as IT actors.

The other set consists of the outsourcing/contractual relationship diagrams. This set starts with a high-level context diagram, which basically shows the overview of the situation encompassing the Business organization and all the vendors/sourcing agents. The business organization is shown as a single entity on the left hand side and the vendors on the right hand side with separate arrows, representing the contractual relationships, connecting each of the vendors with the business organization. In this diagram, the arrows need not be named, because each arrow here may represent a number of SLAs/contracts. Lower level diagrams called detailed diagrams supplement this context diagram.

The detailed diagrams are used to show the actual contractual/sourcing and monitoring relationships. A minimum of one diagram per business actor, which has made one or more contracts or SLAs, needs to be drawn. In one diagram it is

better to limit the number of SLAs to 7±2, since it is difficult for human beings to comprehend more than 7 objects at a time. So depending upon the number of SLAs more that one relationship diagrams can be drawn for the same business actor. In detailed diagrams, both the contractual relationships as well as monitoring relationships are to be shown separately. Even if the IT actor and the business actor are the same, the relationship needs to be shown separately by having the solid arrow and the broken line arrow originating from the same octagon. Moreover, it may be noted that, the same IT actor need not monitor all the contracts established by the same business actor. Similarly, the vice-versa.

For systematically drawing all the detailed diagrams, it is suggested that, initially one has to traverse the hierarchical organizational structure diagram in a breadth-first manner, to identify all the business actors and then, the SLAs or contracts established by each of them.

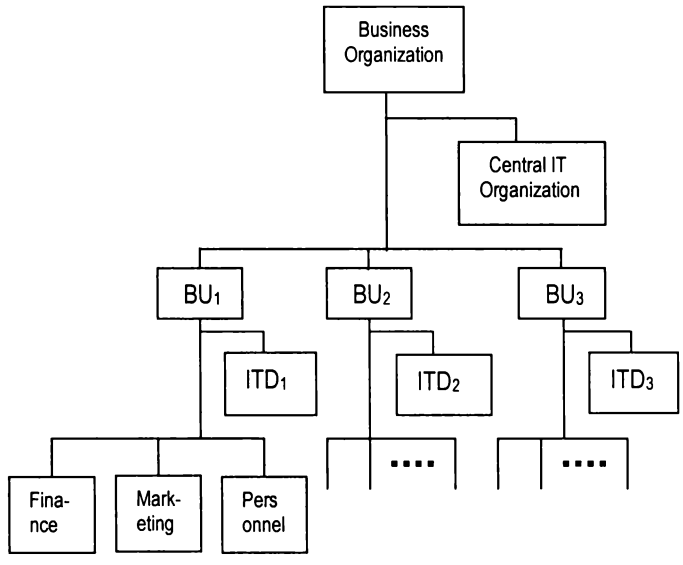
It is mandatory that the octagons, rectangles, parallelograms and the arrows are named appropriately in the detailed diagrams. For octagons, rectangles and parallelograms the names should be given inside the symbol. Short codes can be given as names for the arrows, both solid arrows as well as broken line arrows, in which case it should be described properly at the bottom portion of the diagram. Same name should be used for the solid line arrow as well as the broken line arrow, which represents the contractual and monitoring relationships respectively, of the same SLA/contract.

3.2.5 An Illustrative Example

Consider the case of an IT organization that supports a decentralized Business Organization with three independent Business Units. The Business Units are having their own IT Departments. However the major policy decisions with regard to IT are taken by the Central IT organization. Such a scenario is depicted in the organizational diagram shown in figure 3.8.

Suppose the central IT organization has made contracts with four different vendors regarding the terms and conditions of service and the rates at which, the various services they can offer. For this, the Central IT organization makes use of a service catalogue, which is maintained by it. Based on this contract, the business units can enter into specific SLAs for the services they need with any of the above four vendors. The context diagram for this scenario is shown in fig 3.9 and the detailed diagram of the Central IT organization is given in figure 3.10.

More than one vendor, at the same or a different rate and on the same or different service conditions may offer the same service. The Business unit has got the freedom to choose any of the above four vendors, for each of the service it needs. Say, for example, the Business Director of the Business Unit–1 in fig. 3.8, make SLAs with the above vendors in the following manner. For hardware support (PCs and servers) they have identified vendor-1. Vendor–2 has been identified for networking and communications support and Vendor–4 for applications development. . The monitoring of the performance of the IT services delivered by these vendors is carried out by the IT Department-1 of the Business Unit-1. Figure 3.11 shows the detailed diagram of the contractual/sourcing relationships as well as the monitoring relationships maintained by the Business Unit-1.



BU_n – Business Unit n
ITD_n – IT Department n

Figure 3.8 Hierarchical Organizational Structure Diagram

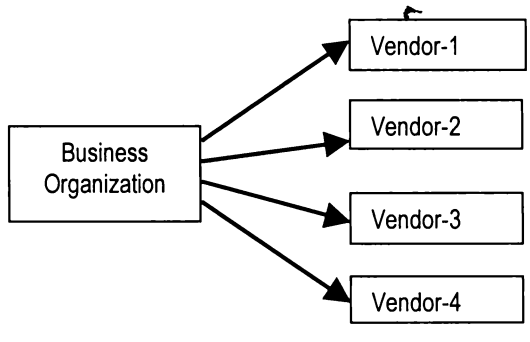
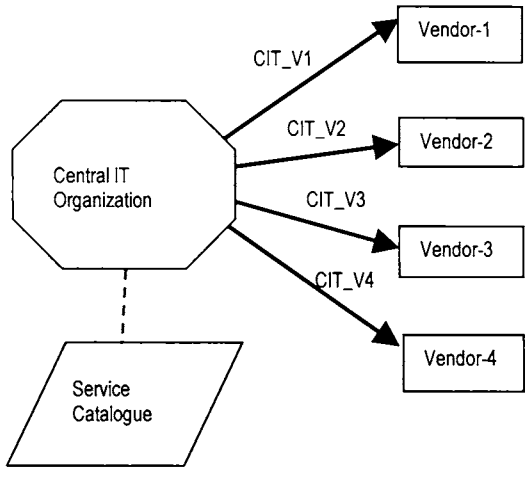


Figure 3.9 Context Diagram



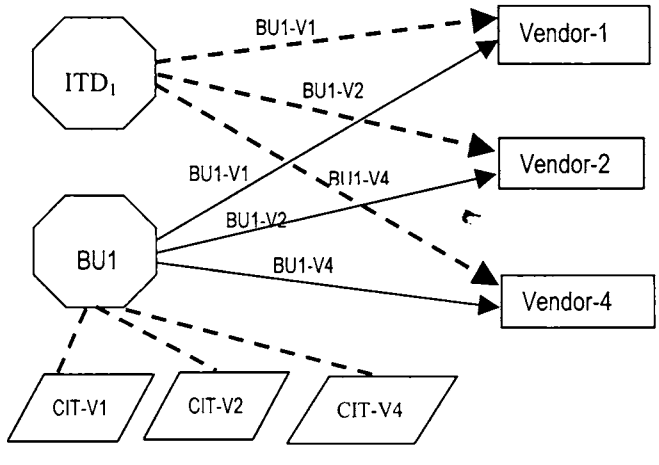
CIT-V1: Service contract between Central IT organization and Vendor-1

CIT-V2: Service contract between Central IT organization and Vendor-2

CIT-V3: Service contract between Central IT organization and Vendor-3

CIT-V4: Service contract between Central IT organization and Vendor-4

Figure 3.10 Detailed Diagram of Central IT organization



BU-1: Business Unit-1 ITD1 : IT Department-1

BU1-V1: SLA between IT Department-1 and Vendor-1

BU1-V2: SLA between IT Department-1 and Vendor-2

BU1-V4: SLA between IT Department-1 and Vendor-4

Fig. 3.11-Detailed relationship diagram showing the various contractual/monitoring relationships maintained by the Business Unit-1

3.2.6 Discussion

A graphical tool for modeling the multiparty outsourcing scenario, based on the concepts derived from Testbed Studio and Dataflow diagrams was presented and explained using a simple illustration. The tool when supplemented by a modeling technique such as 'Generic SLA Semantic Model' can be used for managing the multiparty outsourcing environment more effectively.

Here we have considered the SLAs/contracts made by the enterprise with the outsourcing agents or vendors. It can also be easily extended to represent the relationships that results, when SLAs are made by the IT organization with the other departments or clients, which are internal to the enterprise. Such a comprehensive approach to manage the internal as well as the external SLAs will elevate the performance of the IT organization to higher levels.

3.3 Graphical Modeling of a Multiparty Outsourcing Scenario using UML

A visual representation of the multiparty outsourcing scenario showing the organizational structure, relationships, interactions, etc, can be demonstrated using Unified Modeling Language (UML) diagrams such as object diagrams, instance diagrams and collaboration diagrams.

3.3.1 Organization of the Diagrams

For the proper representation and understanding of the complex multiparty outsourcing environment with all the different types of service sevel agreements, three sets of diagrams are envisaged. The first set contains organizational diagrams. The hierarchical organizational structure of the business organization, as well as the organization which provides the service are represented using these

diagrams. In UML it can be depicted using an object diagram with aggregation relationships.

The second set consists of outsourcing/contractual relationship diagrams using 'context diagrams' and 'detailed diagrams'. The context diagram basically shows the overview of the relationships maintained by the business organization with the service providers. The detailed diagram is used to show the actual contractual and monitoring relationships. Both the contractual relationships as well as monitoring relationships are shown separately. When represented in UML using instance diagrams, ordinary links are used to denote contractual relationships and links with navigational symbols are used to show monitoring relationships. As seen in the previous discussion, the monitoring need not be done by the entity which has established the contract. For systematically drawing all the detailed diagrams, it is suggested that, initially one has to traverse the hierarchical organizational structure diagram in a breadth-first manner, to identify all the entities which are responsible for the establishment of the SLAs or contracts.

The third set consists of a number of interaction diagrams which shows the sequence of activities that takes place in executing a task. It also shows the various entities involved in the accomplishment of the task. This can be very well depicted by means of collaboration diagrams in UML.

The same example given in section 3.2.5 for the illustration of SORD is used in the next sub-section for demonstrating graphical modelling of a multiparty outsourcing scenario using UML.

3.3.2 An Illustrative Example

Consider the case of an IT organization that supports a decentralized business organization with three independent business units. The business units are having their own IT departments. However the major policy decisions with regard to IT are taken by the Central IT organization. The organizational diagram is shown in figure 3.12.

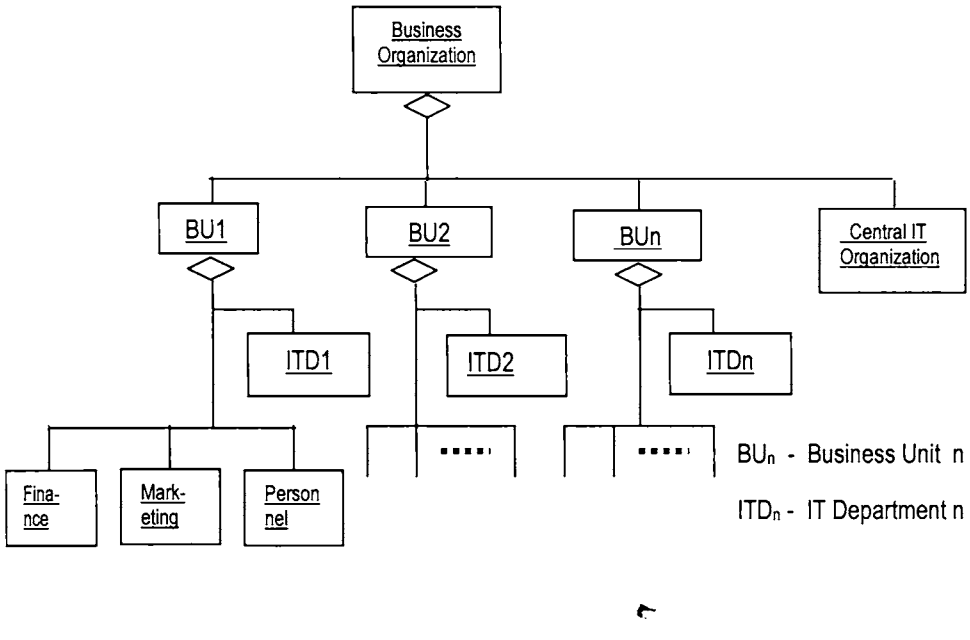


Figure 3.12 Hierarchical Organizational Structure Diagram

Suppose the central IT organization has made contracts with four different service providers regarding the terms and conditions of service and the rates at which the various services they offer. The Central IT organization maintains a Service Catalogue for this purpose. Based on these contracts, the business units can enter into specific SLAs for the services they need with any of the above four service providers. The context diagram for this scenario is shown in Fig. 3.13 and the detailed diagram of the Central IT organization is given in Fig. 3.14. CIT-SP1, CIT-SP2, CIT-SP3 AND CIT-SP4 are the Contractual Relationships

between the Central IT organization with ServiceProvider1, ServiceProvider2, ServicProvider3 and ServiceProvider4 respectively.

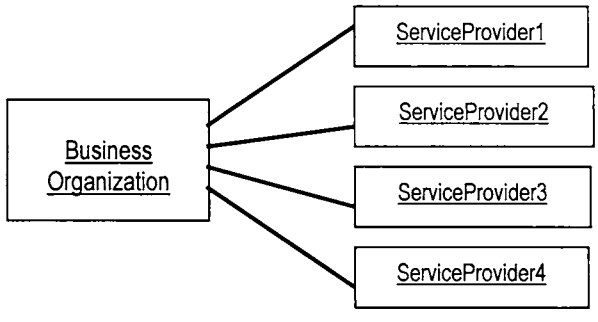


Figure 3.13. Context Diagram

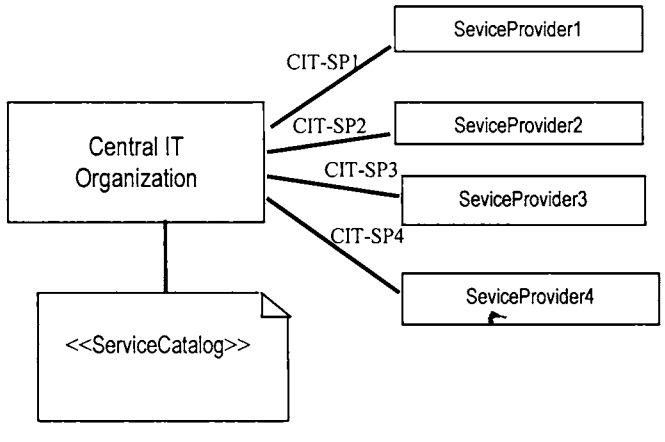


Figure 3.14 Detailed Diagram of Central IT organization

More than one service provider, at the same or a different rate, may offer the same service. The business unit has got the freedom to choose any of the above four service providers, for each of the service it needs. Say, for example, the Business Director of the business unit BU1 in Fig. 3.12, makes SLAs in the following manner: For hardware support (PCs and servers) they have identified Service provider1. Service provider2 has been identified for networking and communications support and Service provider4 for applications development. The

monitoring of the performance of the IT services delivered by Service provider2 and Service provider4 are carried out by the IT department (ITD1) of BU1. The monitoring of services offered by ServiceProvider1 is taken care of by the respective departments, namely Finance, Marketing and Personnel.

Fig.3.15 shows the detailed diagram of the contractual/outsourcing relationships as well as the monitoring relationships maintained by the business unit BU1. BU1-SP1, BU1-SP2, BU1-SP4 are the contractual relationships of BU1 with ServiceProvider1, ServiceProvider2 and ServiceProvider4 respectively. Fin-SP1, Mar-SP1 and Per-SP1 are the monitoring relationships of Finance Department, Marketing Department and Personnel Departmentt. respectively, with the Service provider SP1. ITD1-SP2 and ITD1-SP4 are the monitoring relationships of the ITD1 with ServiceProvider2 and ServiceProvider4 respectively.

Now, let us assume that in this selective outsourcing environment, the helpdesk and change management are retained by the respective IT department of the business units. The incident resolution process in BU1 can be represented by the collaboration diagram shown in Fig. 3.16. The diagram shows the entities involved in the process and also the actions along with the sequence number. The diagram is quite simple and self explanatory.

3.3.3 Discussion

An attempt was made to model the multiparty outsourcing scenario using UML and the same was explained using a simple illustration.This graphical model identifies all the entities and artifacts involved in managing a multiparty outsourcing environment. For each contract/SLA, it clearly shows the entity which has established it as well as the entity which monitors it. It also gives the details of the interactions for all major tasks. Some of the complexities that

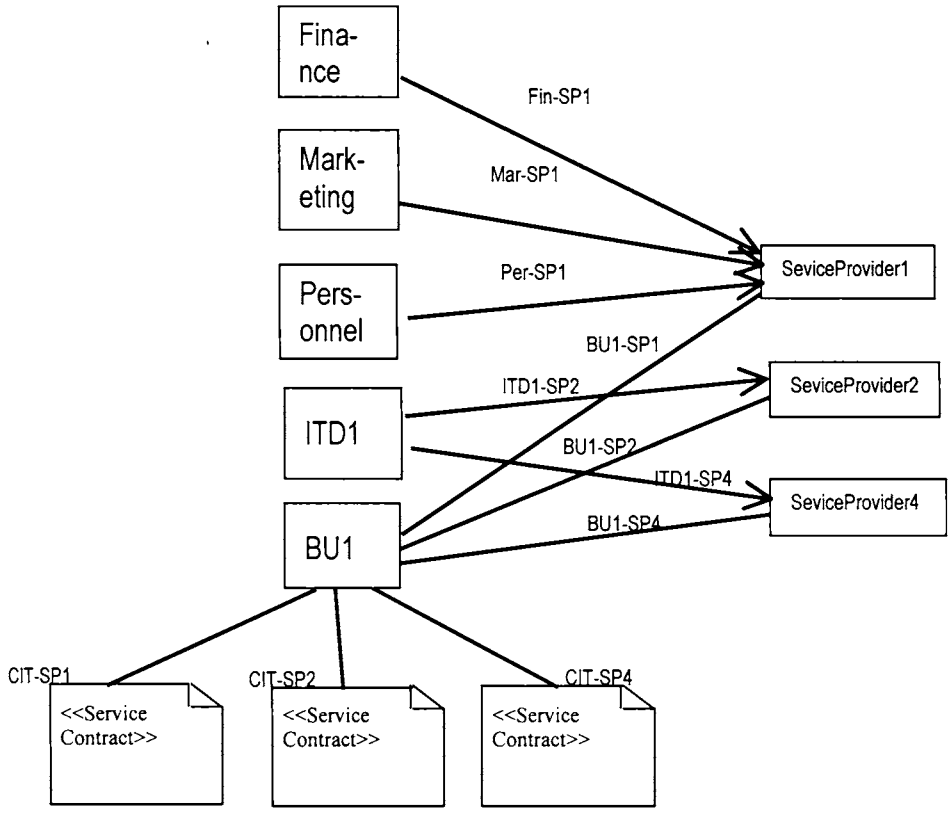


Figure 3.15 Detailed relationship diagram showing the various contractual/monitoring relationships maintained by the Business Unit-1

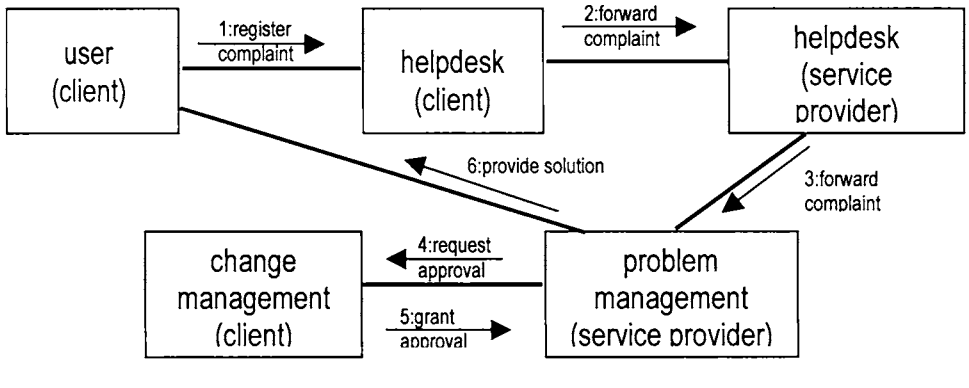


Fig. 3.16 - Incident resolution process in BU1

often come across in a multiparty outsourcing environment are analyzed using this model. For example, the complexities due to large number of SLAs, involvement of different entities in each SLA/contract, distribution of the SLM process over the entire organization, etc. are understood by this modelling technique.

3.4 Conclusion

The adequacy of the existing literature in addressing the complexities was explored and the findings were presented in Table-3.1. It was found that there exists a need for a graphical tool to model the multiparty outsourcing scenario visually. Two schemes for addressing the same were presented. The first one, named SORD, for modeling the multiparty outsourcing scenario, based on the concepts derived from Business process models and software engineering tools was presented and explained using a simple illustration. The second one was an attempt to model the multiparty outsourcing scenario using UML. It was also explained using a simple illustration. This model can assist in alleviating some of the complexities involved in understanding as well as monitoring an IT organization in a multiparty outsourcing environment.

But there are still a few more complexities which are not yet addressed. Difficulties in measuring the overall performance is one of the most important among them. This aspect will be discussed in more detail in the next chapter.

Chapter 4

Performance Evaluation – a Review

It is not uncommon that around twenty percent of the total expenditure of a business organization is spent on IT resources (Kueng, 2002). The management therefore opts to make sure that it is effectively utilized. The operational excellence of IT resources that is essential for the success of the business organization cannot be ensured by just making heavy investments. So in order to know whether the targets are achieved it is necessary to evaluate the performance of the IT organization objectively.

Also, now a days, most businesses are exposed to intense competition and therefore companies are forced to improve their performance steadily. One cannot improve unless he knows where he stands. Moreover performance measurement is mandatory for obtaining quality certifications such as ISO 9000, CMM level 4 and higher, BS 15000, etc. (Jarvis and Crandall, 1997).

In addition to the objective of knowing the status of the performance of the organization, performance measurements are required to take necessary steps to improve the performance. An effective performance measurement system produces information that delivers the following benefits (GAO/AIMD, 1998):

- Provides early warning indicator of problems
- Provides input to resource allocation and planning
- Provides data necessary to check the effectiveness of corrective actions
- Provides feedback to employees, customers, and other stakeholders, about the quality, quantity, cost and timeliness of products and services.

In short it can be said that performance evaluation helps to define what is important to an organization, how success is perceived by it and how it structures its improvement efforts.

At the same time a number of issues can cause obstacles for performance evaluation. (Mah, 2002) To mention a few:

- Measurement fear
- Perceived lack of time due to dead lines
- Lack of management education
- Invalid approaches
- Poor record keeping
- No established protocols etc.

Here performance evaluation is considered as an extra overhead or misperceived as a necessary evil as opposed to the view as a strategic tool. Hence it would be worthwhile to have a review of the present performance evaluation scenario.

In this chapter after discussing the definitions of various terms related to performance evaluation, a review of the different performance evaluation frame works is presented. It is then followed by an overview of the performance evaluation process. Finally a step-by-step procedure for setting up a performance evaluation system (PES) using the Information Technology Balanced Scorecard (ITBSC) is also presented. In this document the term performance evaluation and performance measurement are used as synonyms.

4.1 Fundamentals of Performance Evaluation

About 150 years ago Lord Kelvin, an Irish mathematician and physicist said "when you can measure what you are speaking about and express it in

numbers, you know something about it, but when you cannot measure it or when you cannot express it in numbers, your knowledge is of meager and unsatisfactory kind". So successful organizations rely heavily on performance measures to operationalize its goals and objectives, track progress and learn from mistakes. This basis of performance evaluation is quantitative measurement of the quality of the performance. The definitions of some of the terms related to performance evaluation is given below.

A *measure* is a number that assign a relative value to an aspect (Russac, 2002). For example, customer satisfaction can be expressed as a number (index) in a ten-point scale, effort can be expressed in man-hours, etc. The combination of two or more measures by which a product or process is objectively evaluated is called a *metric*. Cost efficiency calculated as cost per function point (i.e., the quotient of total cost divided by total number of function points) is an example of a metric. Defect removal efficiency which is computed as the quotient of the total number of defects found prior to delivery divided by the total number of defects discovered before and after delivery, is another example for metric.

A simple definition for performance indicator is given in ITIL (OGC, 2001) as a measurable quantity against which specific performance criteria can be set while drawing SLA. Here the scope is limited to SLAs. A more general definition for performance indicator can be as follows: A *performance indicator* is a measure or metric designed to quantify the extend to which the performance objectives are achieved on an ongoing basis (Neely et. al., 1995; ITGI, 2000) A customer satisfaction index, availability of mainframe services in percentage, etc., are examples of performance indicators.

Performance measurement is defined as the process of quantifying the efficiency and effectiveness of actions (Neely et. al., 1995). A *Performance measurement framework* is defined as a set of performance indicators used to quantify both the efficiency and effectiveness of actions. In the section that

follows we shall look into some of the commonly used performance evaluation frameworks, used in the IT environment.

4.2 Performance Evaluation Frameworks – a Review

As reviewed by Bourne and Neely (2003), before 1980 performance measurement in IT organizations was based mostly on traditional financial methods. Techniques like Return on Investment (ROI), Net Present Value (NPV), Internal Rate of Return (IRR), Pay Back (PB), etc., which were used to evaluate business investments were adapted and used for the performance evaluation of Information Systems in the seventies and eighties.

Cost Benefit Analysis (CBA), which consider both tangible and intangible benefits was introduced later. It assigns a monetary value for each element contributing to the costs and benefits. It was followed by SESAME, a variant of CBA, which derives the payback of the information system by computing what the cost would have been, if the same functionality had been delivered by non-computer based methods (Leycet, 2000).

These traditional metrics were found to have serious shortcomings when used to measure the service performance of IT organizations. Subsequently it became quite apparent that there is a need for alternative measures of IT performance. One such alternative measure that recently has become quite popular is service quality (Kang and Bradley, 2002). It was first originated in the field of marketing. It proposes that there is a need for organizations to understand and measure customer expectations (Parasuraman et al., 1985). The organization must listen continuously to their customers in order to improve the level of service quality they provide and subsequently improve their overall organizational performance.

A model named SERVQUAL was developed in 1988. It gives an indication of the performance, by calculating the difference between customer's perception and expectation of the service, along five dimensions of service – tangibility, reliability, responsiveness, empathy and assurance (Kang and Bradley, 2002). Suitable questions are to be formulated for assessing the ideal level of service, feasible level of service and actual level of service. The ideal level of service is the level of service IT customers would like to receive in order to meet their requirements and the acceptable level of service is the minimum feasible level of service IT customers are willing to receive, given the constraints of personnel, technology and organizational limitations. The answers to the above questions are collected in a seven-point response format for each of the three levels of service. The findings are tabulated for each service and the gaps between ideal and feasible levels, actual and feasible levels, etc., are calculated. Necessary steps are to be taken to reduce the above gaps in a systematic manner.

A more powerful performance evaluation framework called Information Economics (IE) was developed by Parker and Benson (1998), during the same time, specifically for assessing IT investments. (Information economics should not be confused with the economics of information systems). It is based on the concept of value (positive factor) and risks (negative factor) in IT investments. Typically it identifies ten factors, which are grouped under two domains – the business domain and technology domain. (The business domain uses IT while the technology domain provides IT services to the business domain).

The business domain factors include the following:

- Return on Investment (ROI – value factor)
- Strategic Match (SM – value factor)
- Competitive Advantage (CA – value factor)
- Management Information Support (MI – value factor)
- Legislative Implementation (LI – value factor)
- Organizational Risk (OR – risk factor)

The technology domain factors include:

- Strategic IT Architecture Alignment (SA – value factor)
- Definitional Uncertainty Risk (DU – risk factor)
- Technical Uncertainty Risk (TU – risk factor)
- Information System Infrastructure risk (IR – risk factor)

Depending on the business priorities, the organization can assign weights between one and ten to each factor. Each factor is then evaluated according to specific criteria, and assigns a score of one to five. The sum of the value scores multiplied by the corresponding factor weights constitutes the value of the IT and the sum of the product of the risk scores and their corresponding factor weights constitute the risk to the organization. This value and risk are the representation of the performance of the IT organization. The factor weights, scores, their products and the appropriate summation showing the net vale and net risk, constitute the Information Scorecard (Moreton, 2003). The format of a sample IE scorecard is shown in figure 4.1.

	Business Domain						Technology Domain				Project Score	
Factor	ROI	SM	CA	MI	LI	OR	SA	DU	TU	IR	Value	Risk
Score												
Weight												

Figure 4.1 Format of an Information Economics Scorecard

The Balanced Scorecard (BSC), developed by Kaplan and Norton (1992) of the Harvard Business School, supplements the traditional financial measures with operational measures concerning customer satisfaction, internal processes and the ability to innovate. This general BSC framework designed for business organizations can be easily translated to the more specific needs of the evaluation of the IT organization (Grembergen and Bruggen, 1997). In this case, the four perspectives are user orientation, corporate contribution, operational excellence and future orientation. The User orientation perspective represents the user evaluation of the IT. The operational excellence perspective represents the IT processes employed to develop and deliver the applications. The future orientation perspective represents the human and technology resources needed by IT to deliver its services in this competitive environment. The corporate contribution perspective captures the business value of the IT (Grembergen, 2000).

There are many more performance evaluations frame works that are used by the business organizations. Among them the performance pyramid and the performance prism are noteworthy.

The performance pyramid is a hierarchical set of building blocks starting with "Vision" at the top and ending with specific operating issues and individual performance measures at the bottom. It can be viewed from each of the three sides and provide relevant information to the three main stakeholder groups, namely customers, shareholders and employees (Kippenburger, 1996).

The performance prism is also a three dimensional model for performance evaluation, developed by Andy Neely and Cris Adams (2000). The five facets of this triangular prism represent the following. The top and bottom facets are the stakeholder satisfaction and stakeholder contribution respectively. The three side facets are strategies, processes and capabilities. The Performance Prism starts with stakeholders. They believe that the organizations aspiring to be successful in the long run, should have an exceptionally clear picture of who their stakeholders are

and what they want. After identifying them, strategies required to satisfy these wants and needs are developed. Then the processes needed to achieve these strategies are identified. Subsequently the capabilities (people, practices, technology, infrastructure, etc.) needed to operate and enhance these processes are identified. Finally, what the organization needs from the stakeholders to develop and maintain these capabilities are also identified. Appropriate performance indicators are selected to evaluate performance along these five perspectives.

Among the three frame works that are popular in the IT field, namely SERVQUAL, Information Economics and the IT Balanced Scorecard (ITBSC), the last one seems to be more apt. It is more comprehensive and elaborate, since it considers all the four perspectives that are relevant for IT organizations. Moreover according to many researchers (Kueng, 2002; Martinsons, et. al., 1999) the most acclaimed model that has been proposed so far, for performance evaluation in IT organizations is the ITBSC. We also support this opinion and hence have chosen the ITBSC as the underlying model for the performance evaluation tool that is to be developed for evaluating the performance of IT organizations in the outsourcing environment. Hence a more detailed discussion on IT Balanced Scorecard is given in the next section.

4.3 ITBSC – The New Generation Performance Evaluation Framework for IT Organizations

In this section the general balanced scorecard from which the ITBSC is derived is discussed initially. It is then followed by a discussion on ITBSC, which is an adaptation of BSC to suit the requirements of an IT organization. Finally the benefits of using it in the IT sector are also presented in this section.

Robert Kaplan of Harvard University and David Norton an American Management Consultant, have proposed the balanced scorecard (BSC) as a means to evaluate corporate performance from four different perspectives. They are:

(i) the financial perspectives

(ii) the internal business process perspective

(iii) the customer perspective

(iv) the learning and growth perspective.

This was presented in a series of articles published in Harvard Business Review (Kaplan and Norton, 1992, 1993, 1996a) They have argued that the traditional financial accounting methods like ROI, payback period, etc., offer a narrow and incomplete picture of business performance and the reliance on such data hinders the creation of future business value. As a result, they suggested that financial metrics must be supplemented with additional ones that reflect customer satisfaction, internal business processes and the ability to learn and grow. Their BSC is designed to complement financial metrics/measures of the past performance with metrics/measures of the drivers of future performance (Kaplan and Norton, 1996a).

The name itself reflects an intent to keep score of a set of items that maintain a balance – balance between short-term and long-term objectives, balance between financial and non-financial measures, balance between lagging and leading indicators and balance between internal and external performance perspectives. Management attention to such a broad set of performance indicators should not only help to ensure good short term financial results, but also to guide the business as it seeks to achieve its strategic goals (Martinsons, 1999).

Future oriented, process-based metrics are seen as a key element in a strategic management system that drives performance improvement and enables the top management team to make well informed decisions that prepare their

organization for the future (Rainer and Watson, 1995). Such a management system should include the following major elements:

(a) Vision – an image of what the organization should look like and do in the future
(b) Mission – that gives a sense of purpose to their organization
(c) Strategic objectives – that are required to achieve the mission in each perspective.
(d) Performance indicators - using which the objectives can be measured.

A fully operational BSC can also become a strategic management tool. The following steps are appropriate to implement effectively the BSC as a strategic management system (Kaplan and Norton, 1996b):

- Classify and translate the vision and strategy into specific action programmes.
- Link strategic objectives to team and individual goals.
- Link strategic objectives to resources allocation
- Review performance data on a periodic basis and adjust the strategy as appropriate.

Ever since the launch of BSC for measuring performance in business organizations in 1996, attempts were made for adapting it for measuring the performance in IT organizations. The adaptation was not that difficult and many success stories were reported (Grembergen, 1997; Martinsons et. al., 1999; Shakelton, 2002; Hu and Huang, 2005). Moreover the adoption of the ITBSC by the US General Accounting Office (GAO/AIMD, 1998) and the recommendations of the IT Governance Institute, USA, gave a boost to its popularity in the West.

Considering the nature of the IT organization as an internal service provider, the nomenclature and meaning assigned by the IT Governance Institute for the different perspectives in ITBSC is as follows:

- Business Contribution – How does the management view the IT organization?
- User Orientation – How do users view the IT organization?
- Operational Excellence – How effective and efficient are the IT processes?
- Future Orientation – How well is the IT positioned to meet future needs?

The framework of a sample IT balanced scorecard, for a typical IT organization is given in Table 4.1 (Grembergen, 2000)

The IT balanced scorecard can, not only be used as a performance measurement tool and as a strategic management tool, but also as an IT- business alignment tool (Hu and Huang, 2005). The BSC offers two unique benefits for aligning the BSC of the business organization and its IT organization. First, business and IT management can use the same 'performance evaluation' language. Second, IT can be managed using an integrated planning and evaluation cycle as the other business processes.

To summarize, the BSC developed by Kaplan and Norton measures the performance along four perspectives; namely the financial perspective, the internal business process perspective, the customer perspective, and the learning and growth perspective. For each perspective a clear mission and strategic objectives are identified. Performance metrics suitable for evaluating the strategic objectives are selected for implementation. The performance information collected should be used to adjust the strategy as appropriate. Above all, in addition to its function as a performance evaluation tool the BSC can function as a strategic management tool and an IT business alignment tool. Now, in the next

section we shall see the practical aspects of implementing a performance evaluation system.

User orientation	**Business contribution**
How do users view the IT department	How does management view the IT department
Mission	**Mission**
To be the preferred supplier of information system	To obtain a reasonable business contribution of IT investments
Strategies	**Strategies**
• Preferred supplier of applications • Preferred supplier of operations • Partnership with users • User satisfaction	• Control of IT expenses • Business value of IT projects • Provide new business capabilities
Operational excellence	**Future orientation**
How effective and efficient are the IT process?	How well is positioned to meet future needs?
Mission	**Mission**
To deliver effective and efficient IT applications and services	To develop opportunities to answer future challenges
Strategies	**Strategies**
• Efficient and effective developments • Efficient and effective operations	• Training and education of IT staff • Expertise of IT Staff • Research into merging technologies • Age of application portfolio

Table 4.1 A sample framework for an ITBSC [Grembergen, 2000]

4.4 Implementation and Use of Performance Measurement Systems

Performance measurement frameworks may have answered the question "what types of measures should a company use?" but they do not provide specific advice to a company implementing a performance measurement system (Bourne and Neely, 2003). For this a separate management process is needed and there are a number of different approaches available in the literature. But the successful development and implementation of a performance measurement system is not an easy task. According to Bourne et al. it usually takes three to five years for the performance measurement system to stabilize; i.e. to derive the full benefit.

As shown in figure 4.2 a typical Performance Measurement System (PMS) has a life cycle with five stages, namely, definition of performance indicators, data collection, storing and analyzing data, disseminating results and improving performance (Kueng, 2002).

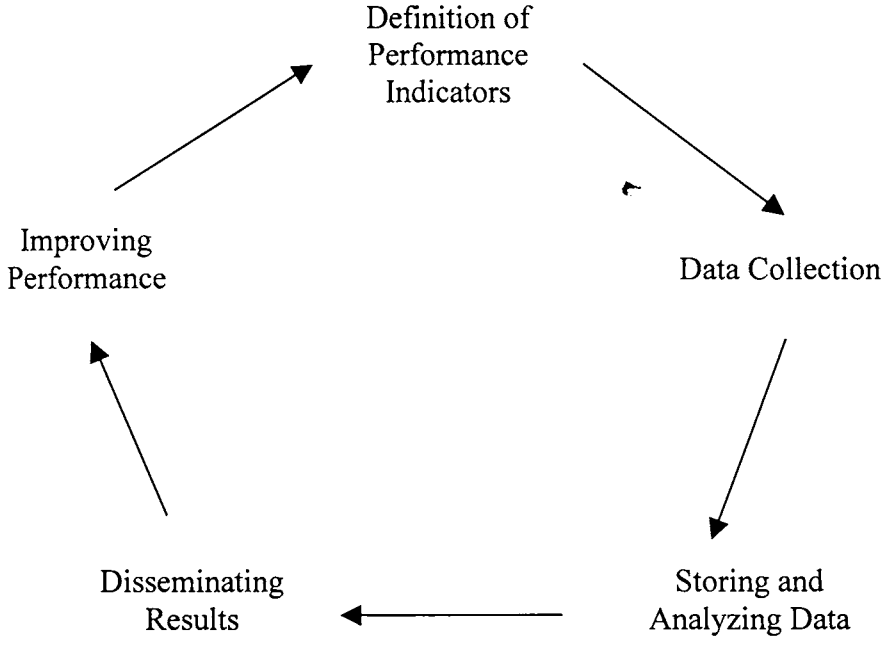


Figure 4.2 - Life cycle of a performance measurement system

A discussion on the first three stages is given in the next sub-section entitled 'Implementation of a performance evaluation system' and the last two stages, namely, disseminating results and improving performance is covered in the sub-section "Distribution and use of performance measurement results".

4.4.1 Implementation of a Performance Measurement System

After the selection of an appropriate performance measurement framework, a good implementation process starts with the definition of the corporate vision and strategy, by systematically identifying both, customer and stakeholder needs (Bourn et. al., 2000; Rantanen et. al., 2003). This is followed by the definition or clarification of corporate goals, objectives and success factors. The next step is to fix the relevant performance dimensions (which is more or less fixed, depending upon the framework chosen), followed by the relevant performance indicators (measures) for each dimension. The total number of indicators is usually restricted to a manageable limit, with an upper bound of twenty (Rantanen et. al., 2003).

The implementation of the performance measurement system is the next stage. It comprises of simple processes like data collection, collation, sorting and storing (Bourne et. al., 2000). All these tasks are mechanistic in nature requiring either new manual procedures to be implemented or computer programs to be written to provide the information automatically. Although manual methods can be used for individual investigations, performance measurement systems requiring regular reporting are best when automated. This is because the manual collection of data has the following drawbacks: (i) data acquisition process is costly (ii) people who have to report performance data may be tempted to 'improve' the requested data and (iii) if the employees are interrupted in their normal work to collect performance relevant data, their motivation to deliver accurate data is lowered (Kueng, 2002).

Level	Description
1	Performance relevant data is locally extracted from the various operational IT systems, electronically or manually and forwarded to the requester.
2	Performance relevant data is extracted locally. Some data is collected from operational IT systems – some data is collected from local data warehouses
3	Most performance-relevant data are fed into local data warehouses. To assess performance these data warehouses can be accessed.
4	The various IT systems are integrated. Performance relevant data can be collected centrally.

Table 4.2 Level of technical integration for data collection [Kueng,2002]

Intranet and internet facilities can be used to collect data that are normally available on the operational IT systems. In many cases data for each measure needs to be collected from various independent IT systems, depending on the level of integration of IT in the organization. Kueng (2002) also categorizes the performance measurement systems into four levels based on the degree of IT integration as shown in the table 4.2

Also the data collected manually, if any, for example, customer satisfaction information collected manually, through a survey based on questionnaire, should also be entered into the IT system for performance measurement. In short, it is recommended to make available all the performance data in a central database. Such a central database should contain financial as well as non-financial data. Moreover it should store performance data that stem from operational IT systems the company has in place, as well as the data that is usually

not stored in a structured way such as customer complaints or customer surveys (Kueng, 2002).

In a decentralized IT organization, where each business unit maintain their own IT set-up, care needs to be taken on the semantics, while integrating the performance data. This is because, the requirements as well as the standards for each unit, or even each service may differ. For example, ninety percent availability may be 'good' for one unit, but for another unit only ninety-nine percent can be considered as 'good'. Similarly, for the same unit, seventy percent availability may be satisfactory for network connectivity, but for the desktops ninety five percent might be required. So the data in the central performance database should be a true reflection of the performance situation.

Once the data is available in the electronic format, the analysis can be done using standard software packages to provide the necessary statistical information/trends/gaps, and the performance measure can be expressed meaningfully. For effectiveness, it should be presented in a meaningful format, preferably in the graphical form like line-graph/bar charts/ pie charts etc. Appropriate scales with distinct levels (say level-0 for lowest and level-5 for highest) or green/amber/red indicators can also be used to depict the result of performance analysis.

4.4.2 Distribution and Use of Performance Measurement Results

The performance results are to be provided to all stakeholders; ie. not only to the management and employees, but also to the customers, suppliers, investors etc. But the kind and volume should be tailored to the recipient's needs. Moreover it has to be disseminated systematically and rapidly.

The dissemination of performance results are often made through reports – monthly/quarterly/annual. Oral communication of the results is also not

uncommon. The use of web-based technologies offer a great potential in the systematic dissemination of the performance results. An effective scheme for the above could be as follows (Kueng, 2002):

- The performance results with a low degree of confidentiality (e.g. turn-over) is communicated to all employees (stake holders) via e-mail. i.e. push operation.
- Information with higher degree of confidentiality and low interest is provided via intranet. The use of intranet enables the use to query the database and offers the staff an opportunity to browse through the data, that is of particular interest to him. This reduces the risk of information overloading. This is the pull operation.
- Confidential data, destined for the top management of the company, is stored in separate IT system that is not accessible to the rest of the work force. Top management gets access to the confidential data after a secure identification.

The performance improvement is the ultimate rationale of the performance measurement systems. It gives the necessary feedback to take the corrective measures/ improvements, which are to be practiced at all management levels; i.e. at operational, tactical and strategic levels.

The performance measurement system can provide a feedback mechanism to control the IT organization, if implemented properly. The success of this feedback mechanism depends on providing meaningful data to the decision makers and the effective utilization of that information. But in practice, very few organizations are able to utilize this potential of PMS. This aspect shall be further discussed in chapter seven.

Now, in the next section we shall see how to implement an ITBSC, framing it as a performance evaluation tool for an IT organization.

4.5 Implementing an ITBSC – a Step by Step Procedure

A ten-step procedure for implementing an ITBSC in an organization, as suggested by Sara Shakelton (2002) is discussed briefly:

Step – 1 Create the organizations vision and mission.

To set up a balanced scorecard the vision of the organization is to be laid out by looking at current plans and deciding where the company wants to be in five years. This is to be followed by laying out the mission statement for each of the four perspectives.

Step – 2 Layout the organization's strategy.

The strategy to be followed for achieving each mission is to be identified next. These objectives are to be clear, achievable and measurable.

Step – 3 Find metrics that will determine whether you have reached your goal.

The managers are to identify meaningful and concise metrics/measures. This should be based on the identification of the processes that are essential in achieving the vision/mission of the organization.

Step – 4 Balance your metrics

There is no room in the scorecard for independent and isolated measures/metrics. Make sure that they are not contradicting with each other. Also try to see that there exists same type of cause and effect relationship among them.

Step – 5 Outline the formula for your metrics.

The majority of the measures/metrics may be simple and can be obtained directly. However it is to be stated without any ambiguity.

Step – 6 Ensure that your measures/metrics use valid data.

The old saying " if you put garbage in, you will get garbage out" is to be borne in mind when you feed data into the performance evaluation system. This implies that invalid data will generate invalid results, which will result in the loss of confidence in the system.

Step – 7 Assign an owner to each performance indicator.

Assign to a specific person, the responsibility of gathering the data, analyzing the results and reviewing the measure/metrics pertaining to each performance indicator.

Step – 8. Implement the system.

Communication is essential in implementing the scorecard. First of all the employees need to be empowered. They should know the organization's vision and strategies. Each one should also know their specific role and responsibility in achieving the goals.

Step – 9. Analysing the results

After implementation, the results that are obtained from the system are to be analyzed to know where you are in relation to where you want to be. Technologies such as gap analyses, self-diagnosis, benchmarking, etc. can be used for the same. Similarly the results can be used as feedbacks to the employees so that they in turn can take corrective actions at their end.

Step – 10. Keep your metrics/measures in tune with your organization's progress.

The balanced scorecard represents the organization's knowledge of its past and current achievements and its directions for the future. As you build experience with the scorecard you will be able to carve it into a meaningful tool. But it has value only where it is used. Some suggestions for the effective use of the ITBSC are (i) Make the scorecard a reference

point at management meetings (ii) Keep regular communication with employees. (iii) Use it for updating strategies and in turn updating the system with new measures/metrics, etc.

An effective performance evaluation system can be put in place in an IT organization by systematically implementing the above mentioned steps.

4.6 Conclusion

In this chapter we have reviewed the performance evaluation frame works that are used for evaluating the performance of IT organizations, after a brief discussion on the fundamentals of performance measurement. Considering the nature of the IT organization as an internal service provider, three performance evaluation frame works were found suitable for measuring the performance of IT organizations. They are (i) SERVQUAL (ii) Information Economics and (iii) IT Balanced Scorecard. They are explained briefly in section 4.2. Among the three, the ITBSC was found to be the more suitable for measuring the performance of IT organizations, since it considers measures/metrics form four different perspectives. Hence a more detailed discussion on the general balanced scorecard followed by a discussion on ITBSC are presented. Finally, a ten-step procedure for implementing an ITBSC in an IT organization is also presented. With this background we attempt to identify the measures/metrics required for developing an ITBSC for an IT organization in an outsourcing environment, in the next chapter.

Chapter 5

Identification of Performance Indicators

The saying "what gets measured gets done" illustrates the importance of the right things to be measured and inappropriate things to be left out. If an organization does not measure what it values, it will end up valuing what can be measured. The choice of indicators will have a major impact on the operation and direction of the organization. Hence the knowledge of the factors driving behaviour and influencing performance is crucial in performance evaluation (Audit commission, 2000).

The main objective of this chapter is to identify the meaningful performance indicators for evaluating an IT organization in the context of outsourcing. No published work on this aspect was found available. Hence the information available in the literature to guide the above process is discussed first. Then the highlights of a case study conducted to identify meaningful performance indicators that can be used in the outsourcing environment is presented. Finally, the performance indicators selected for developing the prototype of the performance evaluation system for the case study organization is also presented.

5.1 A Literature Review on the Selection of Performance Indicators For Building an ITBSC

If performance evaluation framework is considered as the heart of a performance evaluation system, then performance indicators are the lifeblood, without which the system is lifeless. Also if the blood gets contaminated, then the being will eventually die. Similarly, if the performance indicators are not appropriate the performance information produced by the performance evaluation system will be irrelevant and the system becomes defunct.

The general technique for drawing up meaningful performance indicators from the organization's mission and strategy was discussed in the previous chapter (section 4.4). Additional general guidelines available in the literature are presented in the following sub-section and those specific to the four different perspectives are discussed in sub-section 5.1.2.

5.1.1 General guidelines

According to Martinsons (1999) all the performance indicators included in the ITBSC should meet the following three elementary criteria.

(i) Quantifiable – even if it is a quality factor it should be possible to express it in some numeric quantity. For example user friendliness expressed as an index in a ten-point scale.

(ii) Easy to understand - The system is to be used or operated by different categories of people. So there should not be any room for ambiguity.

(iii) Easy to collect and analyse data – i.e., the data collection and analysis is to be cost effective. The PES should not become a burden for the organization.

The *Executive Guide* of the US General Accounting office (GAO/AIMD, 1998) suggests the following characteristics for satisfactory performance indicators.

(i) Effectiveness – illustrating the extent to which the set of objectives are achieved.

(ii) Efficiency – relates to the resource inputs to the organization's output.

(iii) Relevant – it should have a logical relationship to the objectives and strategies.

(iv) Free from bias – it should be possible to gather data and report the results impartially (leaving no room for incorporating individual biases).

Kaplan and Norton (1996b) stress the importance of adhering to three principles in order to develop a balanced scorecard, so that it will not be a set of isolated or conflicting strategies and metrics.

(i) Build in cause – and – effect relationship

(ii) Include sufficient performance drivers

(iii) Provide a linkage to financial measures.

If cause and effect relationships are not adequately reflected in the BSC, then it means that company's vision and mission are not satisfactorily translated into strategies. These cause and effect relationships can involve several or all forms of the BSC perspectives. For example better staff skills (learning and growth perspective) will reduce the frequency of bugs in the applications (internal business process) (Martinsons, 1999).

An appropriate mix of outcome measures and performance drivers is needed for a well built balanced scorecard. Outcome measures like programmer's productivity without performance drivers like IT staff education do not communicate how the outcomes are to be achieved and performance drivers without outcome measures may fail to reveal whether the operational improvements or investments made has produced the desired benefits (Gremburgen and Bruggen, 1997).

The BSC must retain a strong emphasis on financial outcomes. "A failure to convert improved operational performance into improved financial performance should send executives back to the drawing board to rethink the company's, strategy or its implementation plans" (Kaplan and Norton, 1996b). This means that measurements alone will not do any good unless it is used and acted upon by the management.

To summarize the findings, the following are the desirable features of an acceptable set of performance indicators.

(i) Quantifiable

(ii) Easy to understand

(iii) Easy to collect and analyse

(iv) Show effectiveness

(v) Reveal efficiency

(vi) Relevant

(vii) Free from bias

(viii) Built-in cause – effect relationship

(ix) Good mix of performance drivers and outcome measures

(x) Provide a linkage to financial measures

5.1.2 Guidelines for the Selection of Performance Indicators Under Each Perspective

(i) Corporate contribution

The traditional financial perspectives such as ROI, CBA, etc. encompass the control of the IT Budget and the benefits arising from the sale of IT related products and services to third parties. Other popular financial metrics are the IT budget expressed as either a percentage of total expense or as a percentage of sales turnover (Martinsons, 1999).

Bench marking to other organizations in the industry may provide useful insights (Mittelstadt, 1992). However, differences that are identified should be interpreted with care, since they may be due to organization specific factors. A critical attitude towards these figures is necessary even if a number or a percentage is at the same level as the industry average.

Value is a much broader concept than benefits, and IT projects can generate business values in many ways. For example the implementation of a

menu driven customer database may reduce the amount of IT specialist support needed and hence generate a modest amount of direct benefits. However, the real value of such an application will be reflected in marketing and sales performance. Sales people would be able to integrate the database into their activities and improve the productivity of the sales process and consequently raise revenue levels and/or profits margins.

A new concept called business value complementarity has been devised by Barua and his colleagues (1996), using a business value modelling approach. It is argued that IT is complementary with organizational characteristics and process and therefore IT investments will not produce significant contributions if they are undertaken in isolation.

Not withstanding such benefits, value also implies risk. IT benefits have traditionally been measured by quite simple financial measures. However these types of financial measures limit themselves to financial benefits rather than the broader concept of business values. But Information Economics (IE) has sought to address this deficiency. The IE method as seen in the previous chapter is a scoring technique whereby value and risk categories are attributed a numerical score.

The significance of the IE method lies in the fact that the scores are assigned by all parties involved. End users score risks and value in the business domain while IT specialists score IT related categories. In this way the business contribution of the projects can be assessed jointly. So, it is worth mentioning that the IE is clearly useful in determining the corporate contribution of the IT project or the IT organization as a whole. However they fail to account for the other perspectives. Moreover as a metric it is quite expensive computationally and cumbersome to evaluate. Hence it is not uncommon to use the traditional metrics mentioned earlier in many performance evaluation systems.

(ii) Customer orientation

In contrast to the large potential market for the products and services of most organizations, an IT organization has limited or few opportunities to attract new customers. In such circumstances the satisfaction of existing customers will be much more important than building up market share or acquiring new customers. Hence it will be important to monitor the satisfaction of customers/users on a regular basis. Also we need to establish and maintain relationships with the community of current and potential users in order to understand and anticipate their needs (Martinsons, 1999).

From the end-user's perspective the value of IT will be based largely on the extend to which it helps them to do their jobs more efficiently and effectively. For example, managers will rely on IS outputs to monitor and control both internal and external business environment, and help them make better decisions. Hence a broad cross section of end-users (ideally all users) should be surveyed periodically using quantitative methods such as user satisfaction index, user friendliness index of the application, Index of user involvement in generating new applications, etc. In addition, semi-structured interviews are recommended in order to gain deeper in sights.

Indices resulting from surveys are very important; but they must be treated with care. It is useful to distinguish between objective and subjective measures. The indices resulting from surveys are subjective measures, as opposed to many other measures that are objective measures. For example system usage data, financial data, etc. are objective measures. The weightage for each of them may differ, based on what the management wants to do with the information produced. (Hamilton and Cheruvany, 1981).

(iii) Operational excellence

The IT organization should aim to deliver high quality services to its users at the lowest possible cost. This can only be achieved by managing its process in an efficient manner. Hence it is to be assessed by measuring and evaluating the basic processes, performed by it; namely (a) supply and support of hardware and software (b) development of new IT applications (c) operation and maintenance of current IT applications (d) help desk and problem management (e) user education etc. (Martinsons, 1999)

The measurement and evaluation of the development and maintenance activities should yield useful data about the productivity of different resources. Managers can be informed about the performance of specific people and technologies and compare the productivity of internal staff with that of contractors. This could enable them to take decisions on whether to outsource or not (Lee and Kim, 1997).

Once outsourcing is adopted it opens up a new set of processes to the measured. For example, the compliance of SLAs, effectiveness of relationship management process, etc., are some of the important aspects to be evaluated.

(iv) Future Orientation

In addition to managing current performance, there is also a need to measure and evaluate readiness of the IT organization to meet future challenges. The future orientation perspective is concerned with the following:

a) Continually improving the skill set of IT specialists in order to prepare them for potential changes and challenges in the future
b) Regularly updating the applications portfolio
c) Putting effort into researching emerging technologies and their potential values to the organization

The ability to deliver quality services and to lead new technology assimilation efforts will depend on the preparations that are made today and tomorrow. IT managers must assess future trends and anticipate them. Unanticipated circumstances can probably be dealt with external support. However the preferred course of action is to train and develop internal people so that when specific expertise is needed, it can be found in-house. Moreover innovation and learning efforts can raise competence levels that in turn will improve the over all performance of the IT organization in the future (Martinsons, 1999).

Considering the above aspects one may select/identify meaningful performance indicators for the four perspectives of the IT balanced scorecard. It should be noted that a set of IT performance measures that work for one organization might not completely work for another organization (GAO/AMID, 1998). The performance measures/metrics differ on what is valid most in terms of IT performance. To illustrate, IT goals and objectives which stress cost savings would have more measures related to efficiency verses effectiveness. IT goals and objectives stressing customer satisfactions and other service oriented goals might have fewer efficiency measures.

However there are many sets of sample measures/metrics that can be used as performance indicators in a typical IT organization (Salle, 2004; Grembregen, 2000; Martinsons, 1999; Grembregen, and Bruggen, 1997). A compilation of the same by the researcher is given below, perspective wise:

a) Measures for corporate contribution.
   - Percentage above or within budget
   - Allocation of the different budget items
   - IT budget as a percentage of turnover
   - IT expenses per staff member
   - Financial benefits stemming from selling products and services

- Financial evaluation based on ROI, NPV, PB etc.
- Business evaluation based on Information Economics
- Percentage of development capacity engaged in strategic projects
- Relationship between new developments/infrastructure and investments/ replacement investments.

b) Measures for the user orientation

- Percentage of requests managed by IT
- Percentage of applications delivered by IT
- Percentage of in-house applications
- Index of user involvement in generating new strategic applications
- Frequency of IT steering committee meetings
- Index of user friendliness of applications
- Index of user satisfaction
- Index of availability of applications and systems

c) Measures of operational excellence

- Percentage of unavailability of network
- Percentage of unavailability of mainframe
- Percentage of jobs done within set time
- Percentage of solutions within SLA
- Percentage of users already received training
- Satisfaction index of IT staff
- Percentage of IT staff that can access groupware facilities

d) Measures for future orientation

- Number of educational days per person
- Educational budget as a percentage of total IT budget
- Number of years of IT experience per staff member

- Age pyramid of the IT staff
- Number of applications younger than 5 years
- Percentage of budget spent on IT research.

One of the objectives of this study was to understand the current standing of an IT organization in an outsourcing environment. To understand its current standing we have to measure its performance. So, in order to understand the relevant performance indicators required for the meaningful measurement of the performance of an IT organization in an outsourcing environment, we decided to conduct a case study. The excerpts of the case study and the findings are discussed in the next section

5.2 The Case study

To gather first hand information regarding the issues involved in evaluating the efficiency and effectiveness of the functioning of an IT organization in an outsourcing environment, especially in the Indian context, a case study was conducted. The highlights of the study including the findings are given below.

5.2.1 The Methodology

The objective of this case study research was to study "how we can evaluate the performance of IT organizations in an outsourcing environment?". The case study method is most appropriate when a "how" or "why" question is asked about a contemporary set of events over which the investigator has little or no control (Yin, 2003). Moreover case study is regarded a viable IS research strategy when studying state of the art IS questions in a natural setting, and when investigating an area where little or no previous research has been performed (Benbasat, et. al., 1987).

We have engaged in a single case research to investigate how to evaluate the performance of the IT organization in the context of outsourcing. Single case studies are often considered inferior to multiple case studies with respect to generalization. However when selected with care, a limited number of case studies or even a single case study may be very successful in terms of theory formulation and testing (Yin, 2003).

We investigated the case at the IT organization of a major fertilizer company in Kerala. We prepared a case study proposal outlining the objectives and scope of our study. A copy of the same is appended herewith as Appendix A1. With the approval of the management, we carried out the investigation. We used tools such as interviews, inspection of documents and physical observation of activities for data collection. A copy of the interview questionnaire is included in the Appendix A2. After analysis and evaluation, the findings are presented in the form of a short report (Cooper and Schindler, 2003). A copy of the same is also included in this thesis an Appendix A3. The highlights of the findings, pertaining to performance evaluation is presented below.

5.2.2 The Case organization

The Fertilizer and Chemicals Travancore Limited (FACT), India's first large-scale fertilizer company was set up at Kalamassery, Kerala in 1943. The company's main business is the manufacture and marketing of Fertilizers and Caprolactum. It serves all the four states in south India and is an ISO certified company. The Computer Services Centre (CSC) headed by a Chief Manager (Computer Services) was established in 1965 to meet the growing need for management information systems and engineering applications. There are eleven divisions in FACT, which are geographically distributed over the Ernakulam district. CSC is one among the eleven divisions. The four *Area offices* and sixteen *Regional offices* pertaining to marketing are spread all over south India. All the above mentioned offices are all connected by the FACTNET. The Online

Integrated Information Systems (OIIS), which runs on oracle 8i optimises business process of the enterprise and provide information for decision-making. It also integrates the Production MIS, Financial Accounting System, Materials Management System, Payroll System, Human Resources Management System, etc. CSC is keeping the management abreast of the fast paced technological changes in the field of Information Technology.

The CSC adopted outsourcing as a cost saving measure since 1998. At present the IT support needed at the Area/Regional Marketing offices are provided by Sprint technologies. The hardware (PC) and networking is taken care of by HCL Infosystems and the SUN Servers are taken care of by ACCEL-ICIM. The outsourcing agreement is usually made for two years and is renewable after a review. There is no continuous monitoring of performance. But, major violation of contract terms are closely monitored.

5.2.3 Findings and Discussions

Case studies are conducted with wider scope, rather than just concentrating on the issue that is being investigated (Yin, 2003). This is because of the fact that many relevant pieces of information are uncovered when a comprehensive study is conducted. Hence data relating to SLAs, service level management, relationship management and performance evaluation are collected and analysed. The major findings are discussed below:

(i) Factors affecting the success of outsourcing contracts

The outsourcing contracts are in general successful at CSC. The main reason attributed for the success is the stringent selection procedure. A pre-qualified vendor list is prepared after assessing their credit worthiness, track record, client base, reputation, etc. and quotations/proposals are invited only from the vendors in this list. The second reason associated for the success is

the well-drafted service level agreement, which is elaborate and comprehensive. Finally, in the delivery of the goods and services the proper understanding of the customer organization and the commitment plays an important role in the success.

(ii) Conflict Resolution

Most often conflicts may occur when there is ambiguity or lack of clarity in the service level agreement. This may necessitate the escalation of complaints. But if there exists a good relationship between the vender and the customer in the outsourcing environment the need for escalation rarely occur. So the frequent escalation of complaints is an indicator of unsatisfactory relationship. At CSC they are having good relationship with all their vendors and the need for escalation of complaints rarely occur. But still they have a well-defined complaint escalation procedure involving pre-designated people at different levels in both supplier as well as vendor organizations. This is documented in their SLA.

(iii) Measures and Metrics for Performance Evaluation

All the interviewees in one voice said that the satisfaction of the end user is the best yardstick in measuring the performance of an IT organization. But to know the performance of the outsourced functionalities, the violation of SLAs can be considered as a meaningful measure. At CSC whenever there is a deviation/violation of SLA, damages are computed in terms of money (according to the Liquidated Damage Clause of the SLA). And the money is recovered from the performance bank guarantee. Here again there must be a distinction between minor and major deviation. The classification is based on the severity of the damage caused.

From the findings above it can be deduced that the following aspects are very much relevant in measuring the performance of an organization in the outsourcing environment:

(a) User satisfaction

(b) Prompt delivery of services

(c) Good relationship

Hence the above aspects can be developed into meaningful strategies. Appropriate measures/metrics relevant in each case can also be identified from the above discussion. Table 5.1 presents the strategies and metrics/ measures so identified.

Strategies	Metrics/Measures
Better User satisfaction	Index of user satisfaction
	Index of user friendliness of applications
Prompt delivery of services	Minor deviation from SLAs
	Major deviation from SLAs
Good relationship management	Index of the level of understanding of the organization's business
	Percentage of complaints escalated

Table 5.1 Meaningful metrics identified from the case study

5.2.4 Summary

The case study was successful in meeting the objective, which was to identify performance indicators that are relevant in measuring the effectiveness of outsourcing. The performance indicators identified are tabulated in table – 5.1. It is to be supplemented by other relevant indicators for knowing the status of the overall performance. This is discussed in the next section.

5.3 Selection of Performance Indicators

In this section we briefly discuss the process of identifying the meaningful performance indicators that we had used in the development of the prototype of the performance evaluation system for CSC. It was based on the general guide lines discussed in section 5.1 and the specific understanding that we gained from the case study. As highlighted in the concluding paragraph of section 5.1 all the performance indicators that we selected for our prototype PES, may not be relevant for all organizations, which had outsourced its functions. But in general, the most of them will be useful, we believe.

We begin our discussion with a statement of general guidelines (or say constraints) used in the selection of performance indicators. These guidelines are:

(i) The set should contain a manageable number of indicators say 12-16.

(ii) The data should be readily available and easy to collect

(iii) In general, the overhead of operating the system should be minimal.

(iv) The performance indicators should reflect the vision, mission, strategy, and priorities of the organization.

After many rounds of discussion and deliberations with the management of FACT and the officers of CSC (IT organization at FACT) the vision, mission, and strategies were formulated as follows:

Vision: to provide cost effective, state-of-the-art IT products and services to support the organization's business. i.e., manufacturing and marketing of FACT's products

Mission and strategy: The three-layer structure consisting of Mission, strategy and indicators/metrics/measures (Kaplan and Norton, 1996a) for each of the perspective is shown in table 5.2.

Perspective	Mission	Strategy	Performance Indicators (Metrics/Measures)
Corporate contribution	To have a better control over IT expenditure	Control of IT expenses	Percentage over or under IT budget
			Percentage deviation in operational costs from previous year
User Orientation	To satisfy every genuine requirement of the users	User friendliness of applications	Index of user friendliness of applications
		User satisfaction	Index of user satisfaction
Operational Excellence	Efficiently deliver IT products and services	Efficient Computer Operations	Percentage unavailability of mainframe and network
			Percentage unavailability of desktops and peripherals
		Prompt delivery of services	Minor deviation from SLAs
			Major deviation from SLAs
		Good relationship management	Level of understanding of organization's business
			Percentage of complaints escalated
Future Orientation	To equip the organization to meet the challenges in the competitive environment	Educate IT personnel	Number of educational days per person
		Experienced IT staff	Average number of years of IT experience per staff member
		Research into emerging technologies	Percentage of budget spent on research and development

Table 5.2 Mission, Strategies and Performance Indicators selected for CSC, FACT

The next step is to define the performance indicators selected. As part of the definition, the formulae for computing the performance indicators are to be found out first. In the case of CSC, the performance indicators selected were simple and straightforward. Some of them are simple measures that can be directly used without any modification or computation. For example, the number of cases of minor deviation from SLAs can be directly obtained from the helpdesk. In other cases also, the performance indicators/metrics can be calculated

from simple measures using elementary arithmetic operations. The details of the formulae used for each performance indicator is given in table 5.3.

Performance Indicators (Metrics/Measures)	**Formulae**
Percentage over or under IT budget	(YTD IT Expense - YTD IT Budget) *100 / YTD IT Budget
Percentage deviation in operational costs from previous year	(YTD Operational costs (current) – YTD Operational costs (prev. year))*100 / YTD Operational costs (prev. year)
Index of user friendliness of applications	Index (1...10)
Index of user satisfaction	Index (1...10)
Percentage Unavailability of mainframe and network	Total downtime *100 / (Total up time + Total downtime)
Percentage Unavailability of desktops and peripherals	Total downtime *100 / (Total up time + Total downtime)
Minor deviation from SLAs	No. of cases
Major deviation from SLAs	No. of cases
Level of understanding of organization's business	Index (1..10)
Percentage of complaints escalated	Number of complaints escalated* 100 / Total number of complaints received
Number of educational days per person	Sum of the training days of each person during that month / Number of persons
average number of years of IT experience per staff member	Sum of the IT experience of each person / Number of persons
Percentage of budget spent on research and development	YTD Amount spent on research *100 / YTD IT budget

Table 5.3 Formulae for computing performance indicators

The second part of the metric definition deals with the identification of the limits. For each of the metric there are two thresholds. The first one is the critical limit below which the performance is considered to be unacceptable. The value above the critical limit is considered acceptable. The second threshold is the satisfactory

limit above which we can say that the performance is good. So if the performance value is in between the critical limit and the satisfactory limit, then we can say that the performance is acceptable but not up to our expectation. This concept is pictorially shown in figure 5.1.

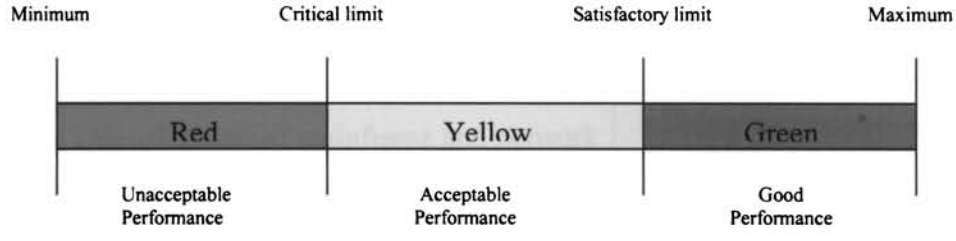


Figure 5.1 – The performance status bar showing the limits/ranges

As seen in figure 5.1, for the purpose of visual representation of the performance status we need to identify the minimum and maximum value. These are cut off points below which or above which, as this case may be, does not have any significance. For example, the satisfactory limit for the performance indicator "percentage of IT budget spent on R&D" is fixed on 10%. This means that any value greater than 10% is 'good'. But we fix the maximum value to be 20%. This means that even if the actual value goes above 20% then it may be indicated as 20%. This is because any value higher than 20% does not contribute further to our understanding that the performance status is good. The various limits like critical value, satisfactory value, maximum value and minimum value for each performance indicator is given in table 5.4.

Performance indicators (Metric/Measures)	**Limits** (min-cri-satis-max)
Percentage over or under IT budget	100 – 20 – 5 – (-100)
Percentage deviation in operational costs from previous year	50 – 0 – (-10) – (-50)
Index of user friendliness of applications	1 – 4 – 7 - 10
Index of user satisfaction	1 – 5 – 8 - 10
Percentage Unavailability of mainframe and network	10 – 3 – 1 – 0
Percentage Unavailability of desktops and peripherals	20 – 10 – 3 - 0
Minor deviation from SLAs	25 – 10 – 3 – 0
Major deviation from SLAs	5 – 2 – 1 – 0
Level of understanding of organization's business	1 – 6 – 8 - 10
Percentage of complaints escalated	10 – 5 – 2 – 0
Number of educational days per person	0 – 5 – 10 – 50
Average number of years of IT experience per staff member	0 – 1 – 2 - 5
Percentage of budget spent on research and development	0 – 3 – 10 - 20

Table 5.4 - Limits of the performance indicators

Another aspect, which is to be identified, is the priority to be given to each of the above performance indicator/perspective so that the overall performance status of the organization could be found out. Priority is expressed as the weightage assigned to the performance indicators. Under each perspective the weights are assigned to the different performance indicators under that perspective in such a way that they sum up to one hundred. Finally the weights are

assigned to the different perspectives so that they also sum up to one hundred. Now, the performance status of the organization as a whole can be found out. The weights assigned to the performance indicators as well as the different perspectives are given below in table-5.5.

Perspective		**Performance indicators**	
Name	Wt.	Name	**Wt.**
Corporate contribution	20	Percentage over or under IT budget	40
		Percentage deviation in operational costs from previous year	60
User Orientation	25	Index of user friendliness of applications	50
		Index of user satisfaction	50
Operational Excellence	35	Percentage Unavailability of mainframe and network	25
		Percentage Unavailability of desktops and peripherals	10
		Minor deviation from SLAs	10
		Major deviation from SLAs	25
		Level of understanding of organization's business	15
		Percentage of complaints escalated	15
Future Orientation	20	Number of educational days per person	30
		Average number of years of IT experience per staff member	40
		Percentage of budget spent on research and development	30

Table 5.5 - Weights for each perspective and each performance indicator

5.4 Conclusion

In this chapter, the guidelines for the selection of the performance indicators under the four different perspectives are discussed initially. A compilation of commonly used performance indicators found in the literature was also presented. It is then followed by the excerpts of the case study conducted at the IT department of FACT, Cochin, to identify relevant performance indicators in an outsourcing environment. The important aspects to be considered for measuring the performance in an outsourcing environment was brought out from the case study. Based on this information meaningful measures/metrics that are potential candidates for becoming performance indicators in measuring the effectiveness of outsourcing are identified and is presented in table 5.1. Finally, the meaningful performance indicators and their attributes that we used for the development of the prototype for the performance evaluation of CSC were identified and presented in tables 5.2 through 5.5. In the next chapter the implementation details of the prototype is discussed.

Chapter 6

Design and Development of the Prototype

In the software engineering domain, an application development tries to answer the questions 'what to do', 'how to do' and 'with what skills'. In response to these questions software engineers have come up with several software development process models. Unified Process (UP) is one such model, which supports application development using object-oriented approach.The various artifacts produced by this process model are represented by the graphical modelling language called Unified Modeling Language (UML).

In this chapter we present an overview of the analysis, design and development of the prototype of a performance evaluation system. It is based on the ITBSC framework and the set of performance indicators that was identified in the last chapter. After a brief introduction to the unified process model and UML, we present the analysis and design models of the prototype we developed. Finally, an overview of the implementation details is also presented. The complete system documentation is given in Appendix-B.

6.1 The Software Development Methodology

During the development of any type of software product, adherence to a suitable process model has become mandatory. Adoption of a suitable life cycle model is a prime necessity for the successful completion of the project. It also encourages the team members to perform various development activities in a systematic and disciplined manner.

The software process model selected in this work is the unified process model proposed by Ivar Jacobson, Grady Booch and James Rumbaugh (Jacobson

et. al., 1999). As mentioned above, this process model can be used to build systems according to the object-oriented approach of software development. In this approach the main building block of a software system is the object or the class. Every object has an identity (for distinguishing it from other objects), state (some data associated with it) and behavior (things it can perform). One of the primary advantages of object-oriented approach is the increased productivity of the software development team. The reasons can be attributed to reuse of code and design, ease of testing and maintenance and better code and design understandability.

The unified process consists of four phases. They are inception, elaboration, construction and transition. In the inception phase, by interacting with the end users the fundamental business requirements are identified. The business requirements are described through a set of use cases. The elaboration phase encompasses the customer communication and modeling activities. This phase focuses on the creation of analysis and design models with an emphasis on class definitions and architectural representations. The construction phase focuses on the refinement and translation of the design model into implemented software components. The transition phase focuses on the transfer of the software from the developer to the end user for beta testing and acceptance (Pressman, 2005).

The unified process is an iterative process. An iterative approach advocates increasing understanding of the problem through successive refinements and incremental growth of an effective solution over multiple iterations. This ensures the flexibility to accommodate new requirements or factual changes in business objectives. It also allows to identify and resolve risks sooner rather than later.

Each iteration concludes with a product release. It consists of a body of source code embodied in components that can be compiled and executed, manuals and associated deliverables. The associated deliverables include the architecture and visual models developed by the UML.

6.1.1 Unified Modelling Language – an overview

UML is a standard language for writing software blueprints. The UML may be used to visualize, specify, construct, and document the artifacts of a software-intensive system (Booch, et. al., 1999). It is primarily a graphical modelling language. The UML is appropriate for modelling systems ranging from enterprise information systems to hard real time embedded systems. It is a very expressive language addressing all the views needed to develop and then deploy such systems. The UML is process independent although optimally it should be used in a process that is use case driven, architecture-centric, iterative and incremental. UML was developed to standardize the large number of object-oriented modeling notations that existed and were used extensively in the early 1990s. UML was adopted by Object Management Group as *de facto* standard in 1997 (Booch et. al., 1999).

UML can be used to construct nine different types of diagrams to capture different views of a system. They are:

(a) *Use case diagram* that shows a set of use cases and actors and their relationships.

(b) *Class diagram* that shows a set of classes, interfaces and collaborations and their relationships.

(c) *Object diagram* that shows a set of objects and their relationships.

(d) *Collaboration diagram* which is an interaction diagram that emphasizes the structural organization of the objects that send and receive messages.

(e) *Sequence diagram* which is an interaction diagram that emphasises the time-ordering of messages.

(f) *Statechart diagram* that shows a state machine consisting of states, transitions, events and activities.

(g) *Activity Diagram* which is a special kind of statechart diagram that shows the flow from activity to activity within a system.

(h) *Component diagram* that shows the organization and dependencies among a set of components.

(i) *Deployment diagram* that shows the configuration of run-time processing nodes and the components that live on them.

UML can be used to construct the five views (User view, Structural view, Behavioral view, Implementation view, Environmental view) of a system.

- Users' view: It defines the functionalities that are made available by the system to its users. The users view can be considered as the central view and all other views are expected to conform to this view. In UML it can be realized by use case diagram.
- Structural view: It defines the kinds of objects (classes) important to the understanding of the working of a system and to its implementation. It captures the relationships among the classes (objects). Class diagrams and object diagrams can realize the structural view.
- Behavioural view: It models how the objects interact with each other to realize the system behavior. This model captures the time-dependent behavior of the system. Sequence diagrams, collaboration diagrams, statechart diagrams and activity diagrams can realize the behavioural view.
- Implementation view: This view models the important components of the system and their dependencies. Component diagrams can realize the implementation view.
- Environmental view: This view models how the different components are implemented on different pieces of hardware. Deployment diagrams can realize the environmental view.

However it is not mandatory to construct all views of a system in a modeling effort. The types of models to be constructed depend on the problem at hand. For a simple system, the use case model, class diagram and one of the

interaction diagrams may be sufficient. For a system which is implemented on large number of hardware components, a deployment diagram may also be necessary.

6.2 System Modelling using UML

The problem statement and the different models of the prototype of the performance evaluation system developed by us are discussed briefly in the next section. The system documentation containing the detailed description of these models is given in Appendix – B.

6.2.1 Problem Statement

The prototype should evaluate the performance of an IT organization using the ITBSC framework. There will be three categories of users. They are the administrators, managers and the data entry operators.

The administrator keeps a database of metrics and measures that are used in the performance computation. The administrator should create an organization structure, which includes various business departments/divisions and IT organization(s). The administrator can maintain the organization structure by adding or deleting departments.

The managers of the corresponding departments will identify and update the department level metric information and the vendor information. They are the users of the performance results generated by the system. The data entry operators update the measure values for departments in a periodic manner, say monthly.

For security purposes and for distinguishing the various user privileges, the user will be provided a login ID and Password by the administrator to access the database. The system is to display the performance status of the organization using various techniques such as bar charts, performance dials, etc.

6.2.2 Use Case Model

Figure 6.1 depicts the use case model of the IT Balanced Scorecard system. It describes the various use cases of the system and the various actors interacting with each use case. The detailed specifications of each use case are given in Appendix - B.

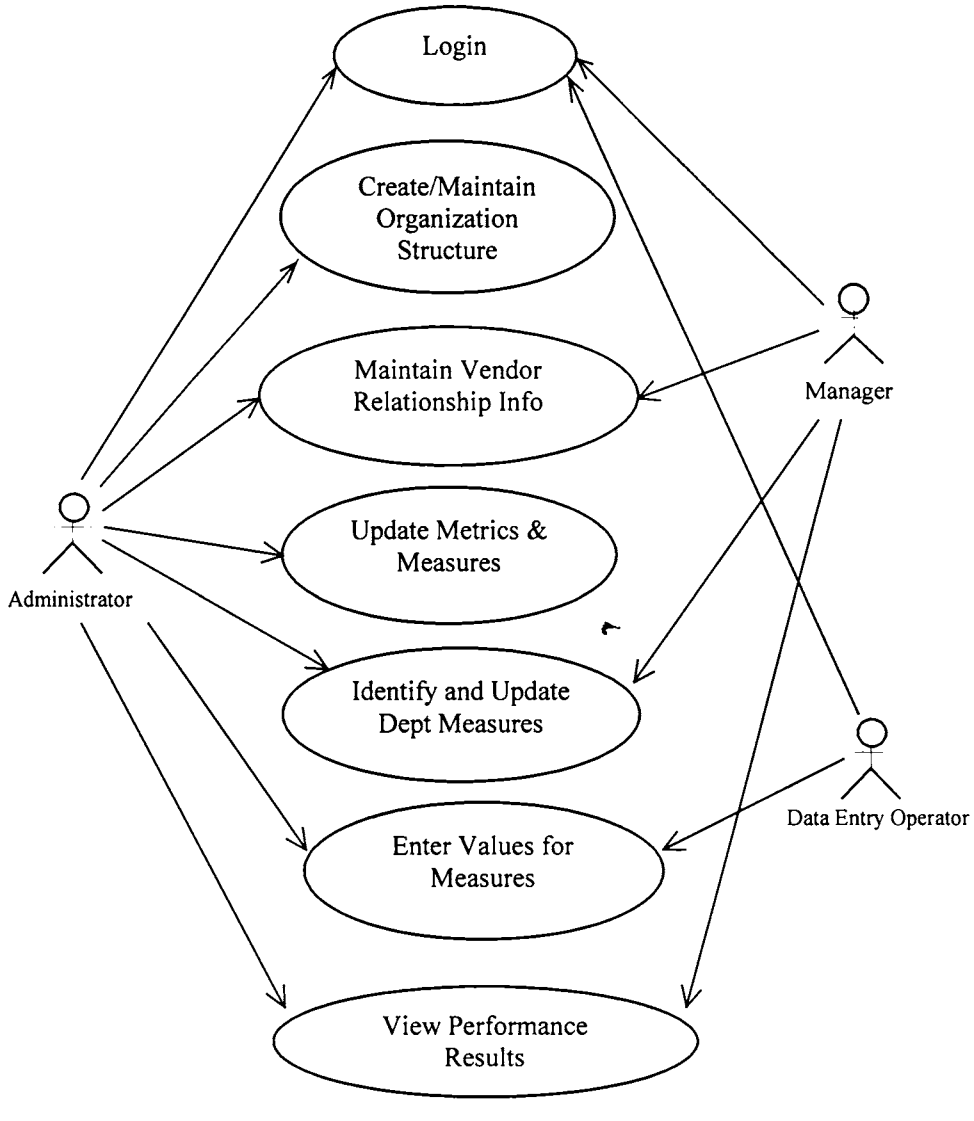


Figure 6.1 The Use Case Model of the System

6.2.3 Structural Model

The structural model of the prototype is represented using a high level class diagram. It shows the set of classes, interfaces and collaborations and their relationships that are important to the system. The class diagram of the IT Balanced Scorecard system is given in figure 6.2.

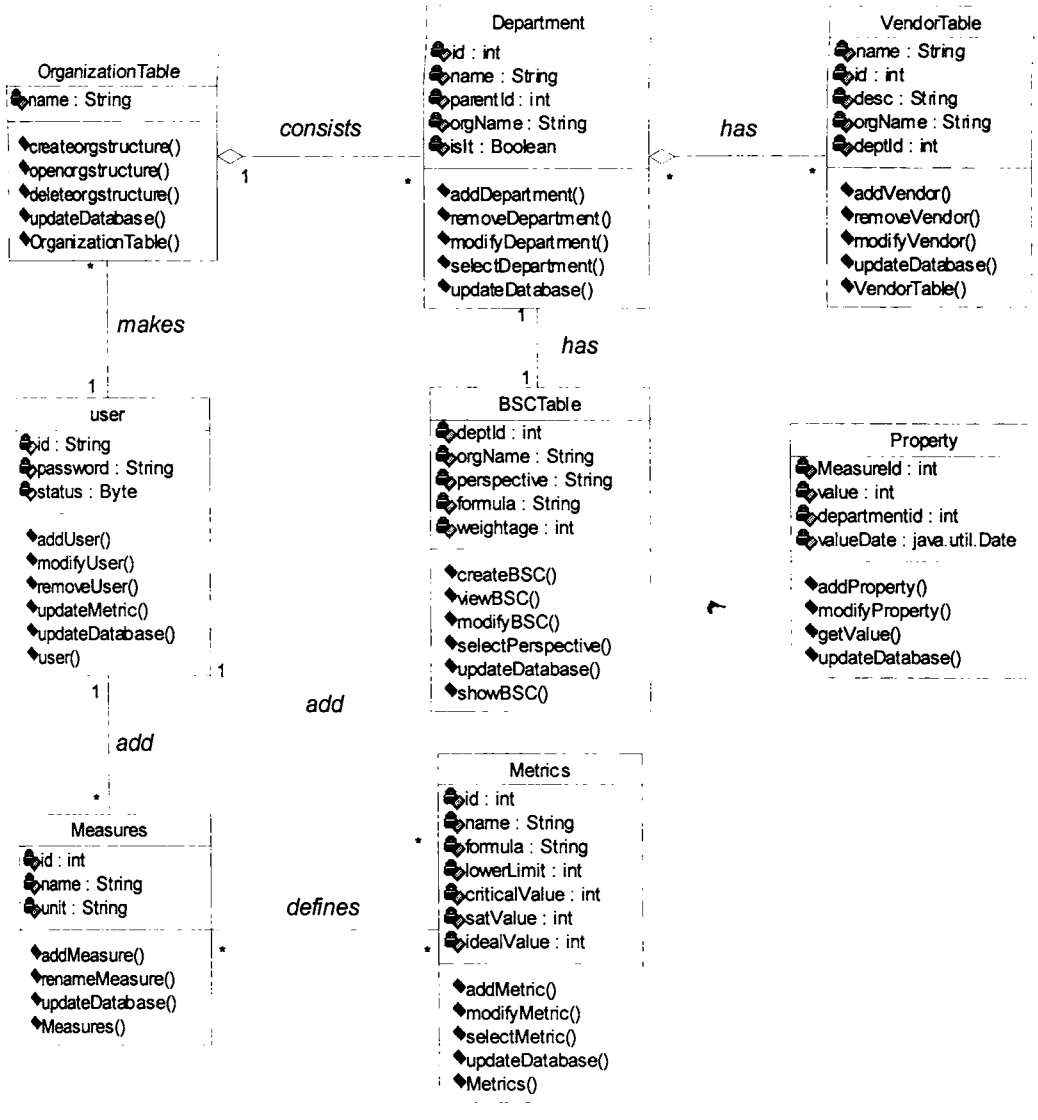


Figure 6.2 Class diagram

6.2.4 Behavioral Model

It depicts the time dependent behavior of the system. The behavioral diagrams can be used to visualize, specify, construct and document the dynamic aspects of a system. UML diagrams that are used to represent the behavior of a system are sequence diagram, collaboration diagram, state-chart diagram and activity diagram. Sequence diagram is an interaction diagram that emphasizes the time ordering of messages sent between the collaborating objects in a use case. Collaboration diagram is an interaction diagram that emphasizes the structural organization of the objects that send and receive messages. State chart diagram shows a state machine, which specifies the sequences of states an object goes through during its lifetime in response to events, together with its response to those events. Activity diagram represents the flow of control from activity to activity in the various use cases identified.

All these different types of behavioral diagrams are not required for every problem. The appropriate diagrams are selected, according to the nature and type of the problem (Mall, 2004). For the prototype development, we had used activity diagrams and sequence diagrams. The activity diagram corresponding to the use case "Update Metrics and Measures" is given in the figure 6.3 and the sequence diagram for the same is given in figure 6.4. The detailed behavioral model of the system is included in the system documentation, which is given in Appendix – B.

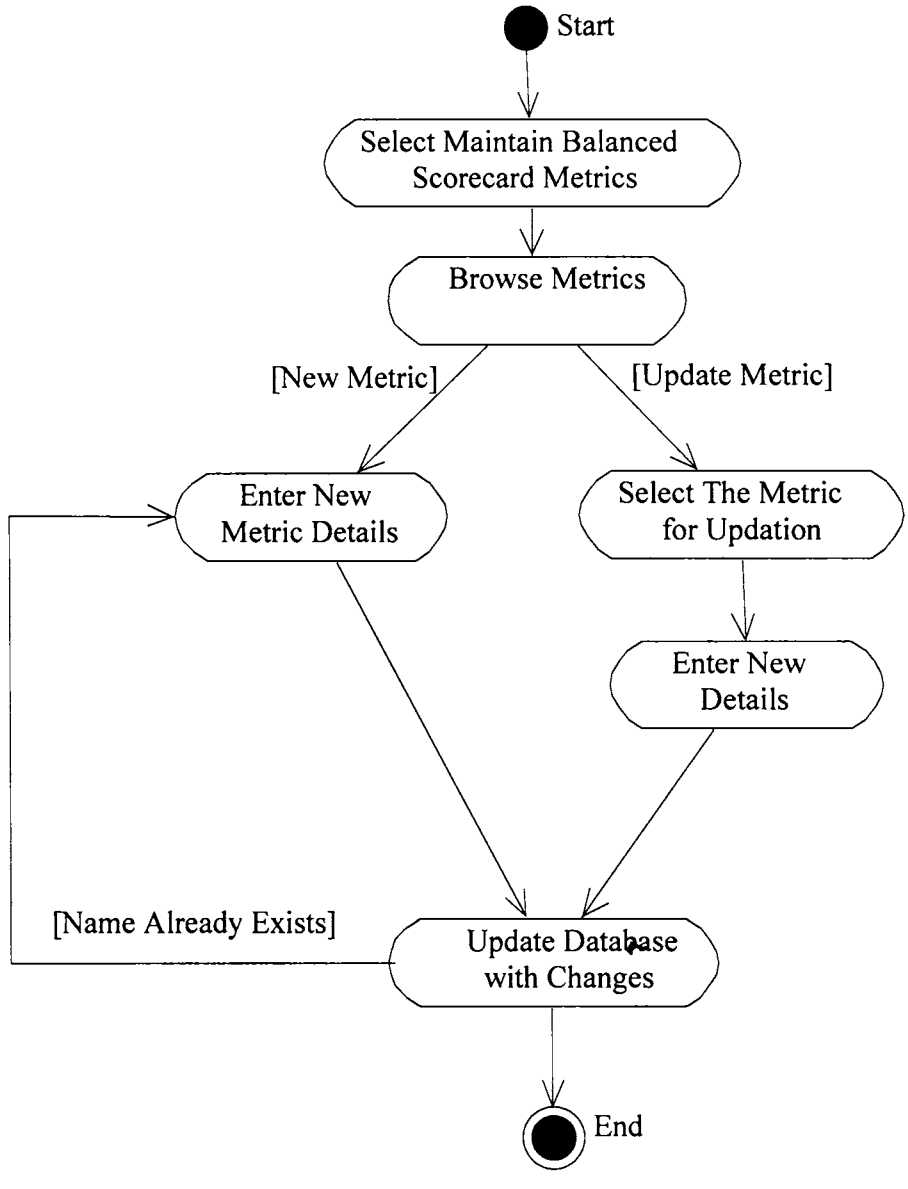


Figure 6.3 Activity Diagram for the use case 'Update Metrics & Measures'

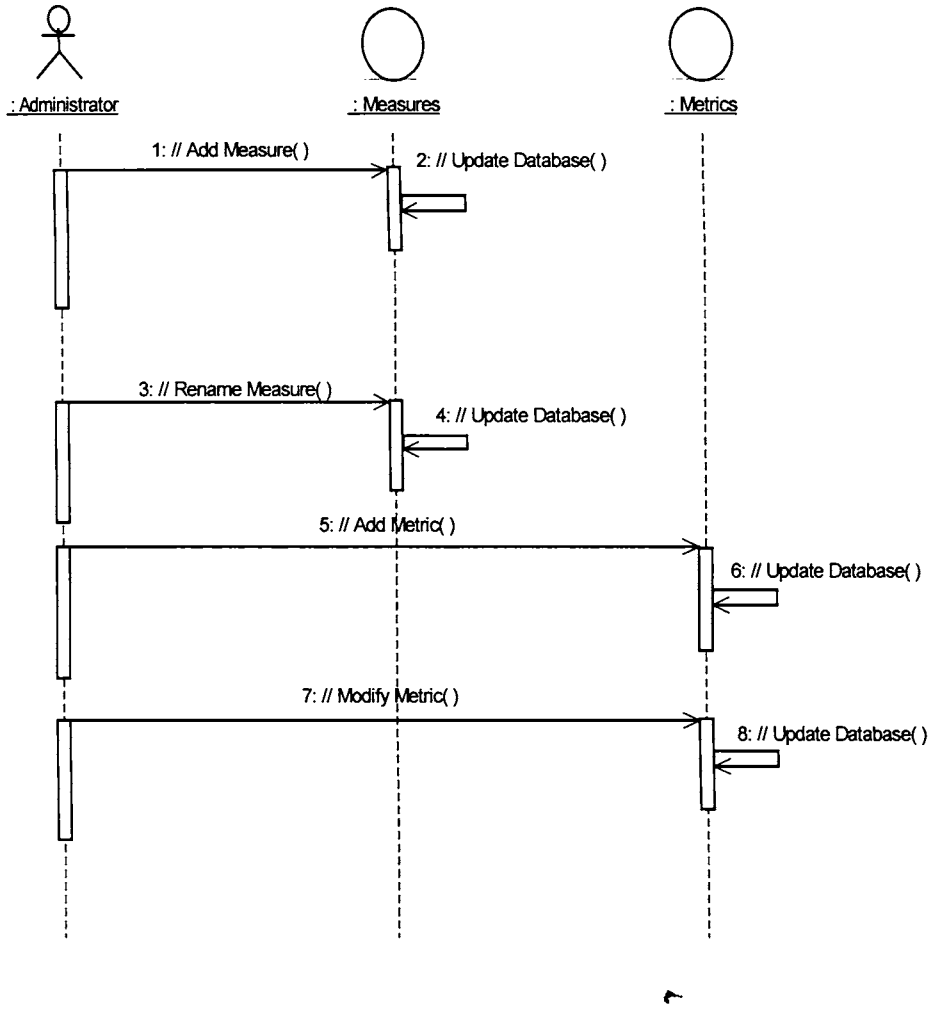


Figure 6.4 Sequence Diagram for the use case 'Update Metrics & Measures'

6.2.5 Deployment Model

Deployment diagram shows the configuration of run-time processing nodes and the components that live on them. This model primarily depicts the distribution, delivery, and installation of the parts that make up the physical system. Active components are bordered with thick lines. For the prototype we

have developed, the two main components are prototypeappln.jar and the itbsc database. The prototypeappln.jar is the executable version of the software. Since the prototype named ITBSC system was implemented as a single user system, there was only one processing node. Hence both the above-mentioned components were deployed on it as shown in figure 6.5.

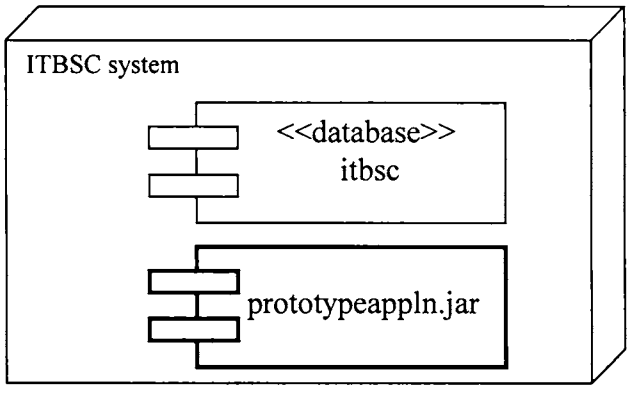


Figure 6.5 Deployment Diagram of the system

6.3 Platform Used

The system was implemented on a PC with Pentium 4 (HT) 2.8 GHz processor, 256MB RAM and 40 GB Hard Disk. The operating system used was Windows 2000 Professional Edition.

The coding was done in Java programming language (Naughton,1999). The J2SDK1.4.1 development environment was used for building the application. Microsoft Access was used to store the data required for the Balance Scorecard. JDBC:ODBC driver was used for database connectivity.

6.4 Conclusion

The analysis, design and implementation details of the prototype of the performance evaluation system we developed are briefly described in this chapter. We had followed the object-oriented approach using UML for system development. The software was developed in Java and the database was implemented in MS Access. A discussion on the testing and evaluation follows in the next chapter.

Chapter 7

Testing and Evaluation

According to Gause and Weinberg (1989), ninety percent of product development efforts fail. It is not that they do not produce a product. In most cases they do produce it. Either the users do not like it or they do not want to use it. Hence testing the usability and/or measuring the user satisfaction are very much important. This is all the more true in our case, since the main objective is to study the effectiveness of a performance evaluation system in improving the performance of the IT organization.

In this chapter we initially discuss the testing that we have carried out during the development process. This type of testing is called error-based testing. It consists of the functional testing (black box testing) and structural testing (glass box testing or white box testing). It is followed by a brief description of the usability testing and user satisfaction measurement that we have conducted. Finally the evaluation of the prototype with reference to the research objective (i.e., assessing the suitability of the performance evaluation prototype in improving the performance of an IT organization) is presented.

7.1 Error-based Testing

Testing is the Process of executing a program with the intent of finding errors (Myers, 1979). The general approach for testing is as follows:

- Construct test cases
- Describe the expected output.
- Perform the test (i.e., execute the software with the test cases)
- Compare the outcome with the expected output
- If they do not match debug the code

It is worth mentioning that test data is to be prepared from the specification and not from the features it supports. We have used both black box testing and glass box testing at appropriate stages. Glass box testing is more useful in error-based testing when you want to test the logic to guarantee proper functioning of the system. For example, testing all the paths of an object's method. This is a low level testing. Black box testing is more useful in high level testing such as testing components and its integration. It is also very much useful in the scenario-based testing which will be described in the next sub-section.

We have used both bottom-up and top-down approaches. Bottom-up approach starts with the details of the system and proceeds to higher level by a progressive aggregation of details until they collectively fit the requirements of the system (Bahrami, 1999). This approach is more appropriate for testing the individual objects of the system. Here we start with the methods and classes that do not call or rely on others. Then we progress to the next level up to test those methods and classes that use only the bottom level ones that are already tested. Next, we test combinations of the bottom two layers. We then proceed until the entire program is tested. The top-down strategy is useful in testing the user interfaces especially the interface navigation. It is also useful to test the subsystems at the integration stage.

Since the prototype was only an experimental one, we did not prepare elaborate test plans nor document the results for the error-based testing. (Otherwise, it would be too expensive with respect to time and other resources.) So the level of error-based testing we conducted was the minimum that was required to ensure the satisfactory working of the prototype.

7.2 Usability Testing

Both functionality and usability are two sides of the same coin, and are essential for the development of high quality software (Gause and Weinberg, 1989) Error-based testing deals mostly with the functionality of the system and usability testing deals with the usability of the system. It deals with the ease of use and degree of satisfaction that the users have with the system.

The International Standards Organization (ISO) defines usability as the effectiveness, efficiency and satisfaction with which specified set of users achieve a specific set of tasks in a particular environment. This definition implies that to measure usability, we have to be clear about (i) the tasks (ii) the users and (iii) the methods for measuring usability.

The tasks can be easily identified from the use cases. So each of the use cases identified earlier can become a potential test case. The users for each use case can also be identified easily from the use case diagrams. A simple survey based user satisfaction test can be conduced for quantifying the usability.

For the prototype we have developed, the usability test was conducted in two steps. Initially, the usability test cases were executed in the presence of appropriate user groups. In addition to administrators, we had only two more user groups namely, the data entry operators and the managers. Then the user satisfaction test, based on a survey instrument was conducted. The details of the above tests are discussed in the following sub-sections.

7.2.1 Execution of Usability Test Cases

A complete set containing the description and outputs of the usability test cases are given in Appendix – C. However as an example the details of the

usability test case generated for the use case "Enter values for measures" is given in Figure 7.1

User case: Enter values for measures

User groups: (i) Data entry operators and (ii) Administrator

Activity: Inputting the performance data for a particular month

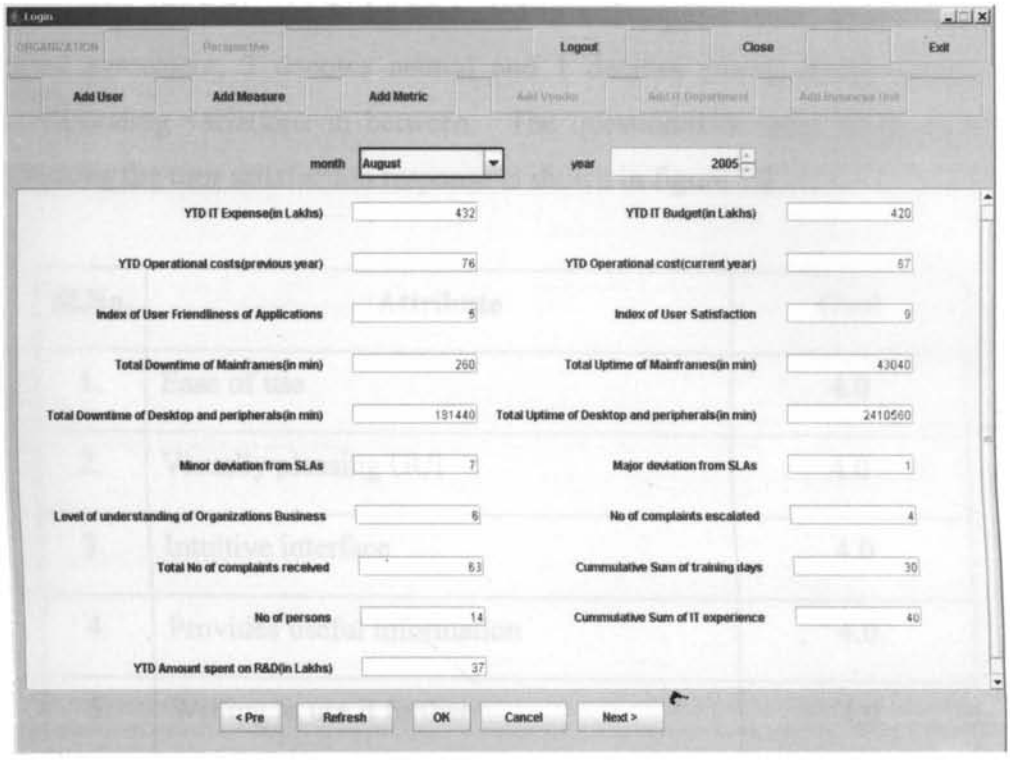


Figure 7.1 Screen shot showing the output of the execution of a usability test case

7.2.2 Measurement of User Satisfaction

User satisfaction testing is the process of quantifying the usability test with some measurable attributes of the test such as ease of use, functionality, etc. Usability can be assessed by comparing the actual values obtained in the tests, against the pre-defined goals (Bahrami, 1999).

For the performance evaluation prototype that we developed we defined the attributes and goals as given in table 7.1 The attributes were chosen in consultation with the users from among the commonly used attributes found in literature (Wang, 2003; Bahrami, 1999).

The attributes are to be evaluated in a five-point scale, where 5 denotes strong agreement, 3 denotes neutral and 1 denotes strong disagreement with corresponding variations in between. The questionnaire form so prepared for collecting the user satisfaction response is shown in figure 7.2.

Sl.No.	Attribute	Goal
1.	Ease of use	4.0
2.	Visually pleasing GUI	4.0
3.	Intuitive interface	4.0
4.	Provides useful information	4.0
5.	Willing to use it further	4.0

Table 7.1 List of attributes for measuring user satisfaction

There were only two user groups, namely, data entry operators and managers in addition to the administrator. The same test was administered for the user group consisting of eight managers and one data entry operator. The summary of the results is shown in table 7.2. It is graphically depicted in figure.7.3

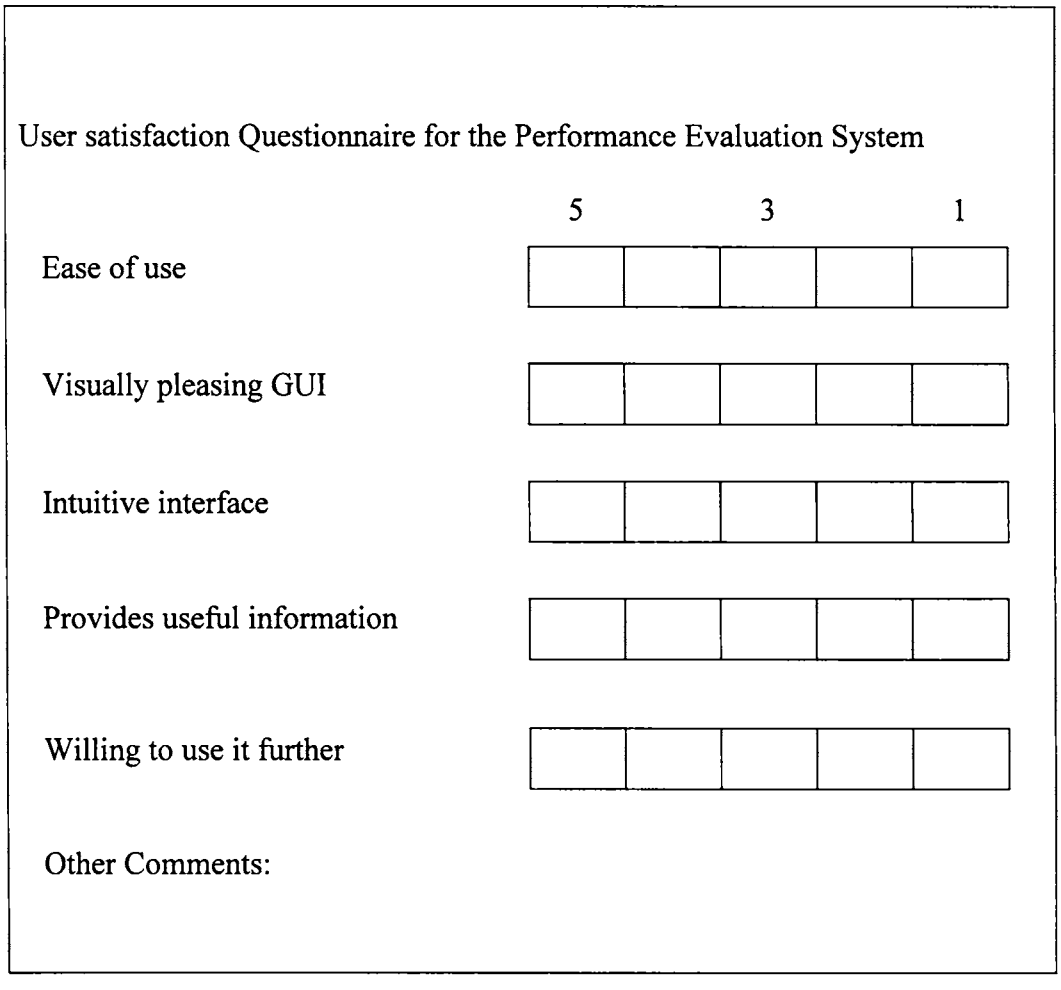


Figure 7.2 Format for user satisfaction test

Sl.no.	Attribute	Average value	Goal	Mini-mum	Maxi-mum
1	Ease of use	4.33	4.0	3.5	5.0
2	Visually pleasing GUI	4.11	4.0	3.0	5.0
3	Intuitive interface	3.44	4.0	3.0	4.0
4	Useful information	4.44	4.0	3.0	5.0
5	Willing to use it	4.55	4.0	4.0	5.0

Table 7.2 – Summary of the results of the satisfaction test

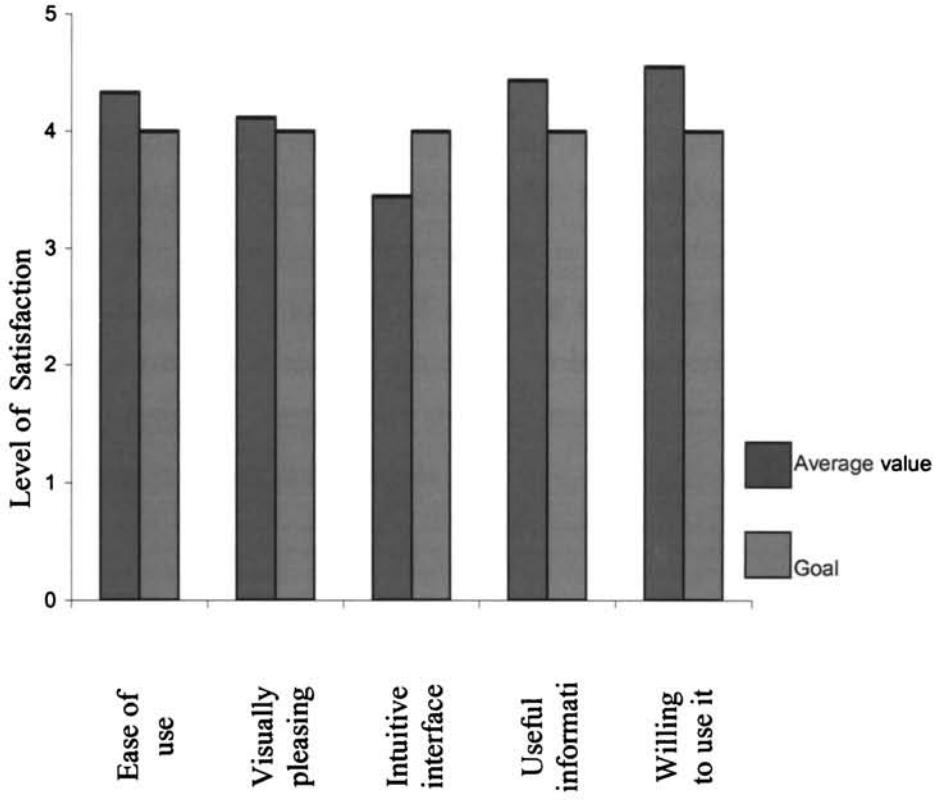


Figure 7.3 Graphical representation of the result of the user satisfaction test

The result shows that the performance of the prototype is satisfactory in all attributes except intuitive interface. This shows that manoeuvring through the interfaces is slightly difficult and it needs to be made more user friendly.

7.3 Evaluation of the Prototype

In the previous two sections we have discussed the details of the error-based testing and usability testing carried out on the prototype developed. In this section we evaluate the system based on the main objective of our research work. As mentioned in section 1.7, the main research objective was to help an IT organization to realize its current standing in the outsourcing environment so that

it can take corrective steps wherever necessary and strive for continuous improvement.

The performance evaluation system for an IT organization, in general, should be capable of providing meaningful information to all levels of management. The performance improvement is the ultimate rationale of the performance measurement systems. It gives the necessary feedback to take the corrective/improvement measures, which are to be practiced at all management levels; i.e. at operational, tactical and strategic management levels. Such a typical feedback system is shown in figure 7.4.

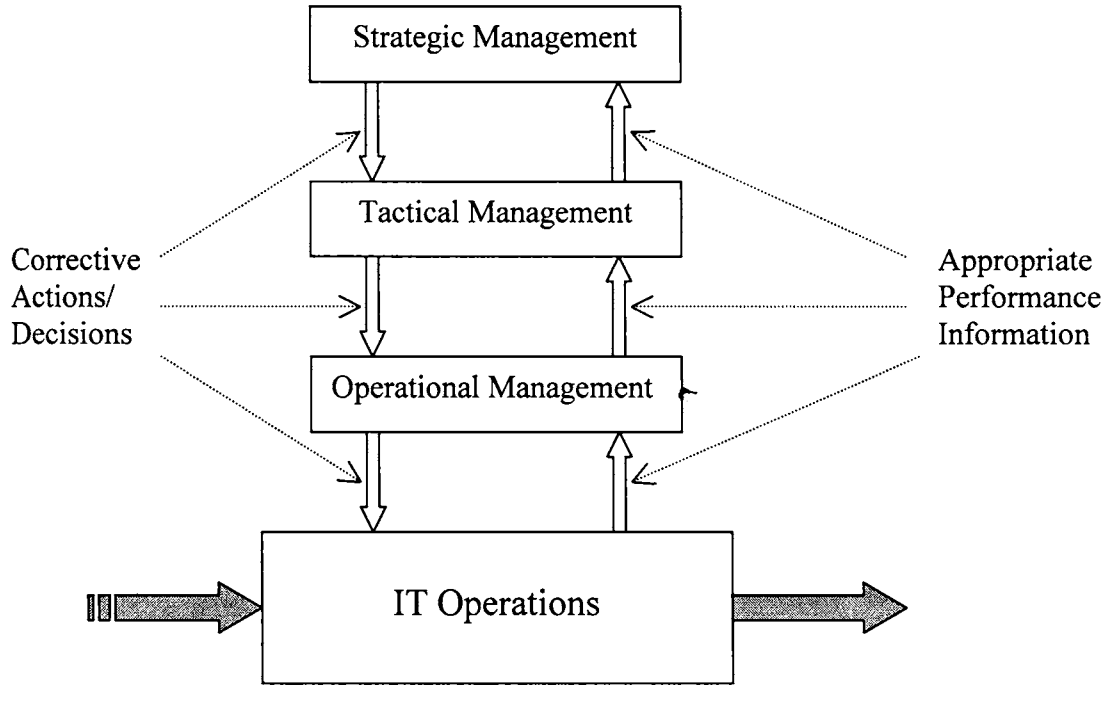


Fig. 7.4 The use of performance information at the various management levels

The operational management that deals with the day-today operation, uses the performance information to correct the procedures, actions, etc. For example, it may be more efficient and cost effective, if the helpdesk is open for one more hour at the close of the day. The tactical management may use performance

information for making changes in policy as well as for planning and budgeting. For example, the fine-tuning of the organizational structure of the IT department or replacement of the services of one particular vendor by another one could be a corrective action at this level. Similarly the strategic management could use it for long term planning or other strategic decision-making like change in the outsourcing policy, cancelling a contract, etc.

The prototype that we developed was capable of providing performance information for all the three levels of management. The different ways in which the performance results are displayed by the system are shown in figures 7.5 through 7.9.

Figure 7.5 shows the performance of the IT organization at the organizational level. The fill-colour of the box representing the IT organization shows whether its overall performance is satisfactory (green), caution (yellow) or alarming (red). In figure 7.6 the performance of the IT organization with respect to the four views of the IT Balanced Scorecard is displayed.

Figure 7.7 is a sample screen shot showing the performance at the metric level. In this diagram the performance of each metric coming under the selected perspective is shown. Here in this figure the selected perspective is future orientation. The fill colour of the box pertaining to that metric shows the performance status of it. Figure 7.8 shows the performance of the metric "percentage of complaints escalated" over a period of one year as a bar chart. Figure 7.9 shows the current status of the selected metric as a dial chart.

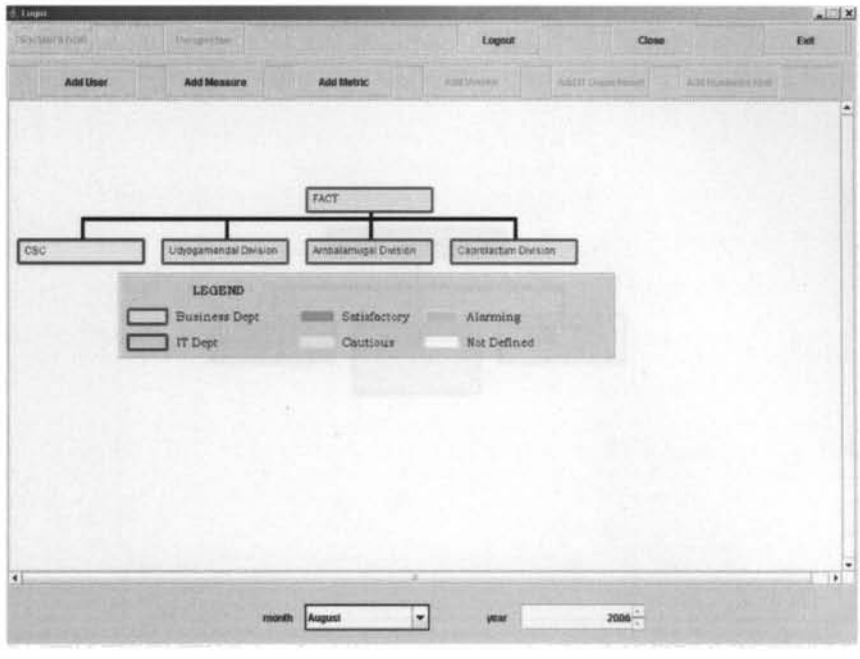


Figure 7.5 Screen shot showing the performance at the Organizational level

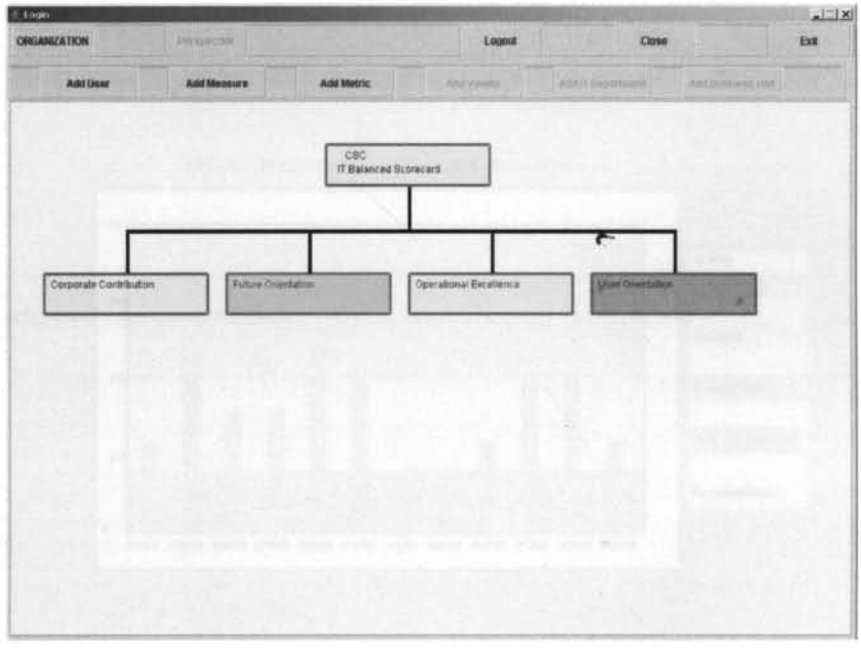


Figure 7.6 Screen shot showing the performance as IT Balance Scorecard

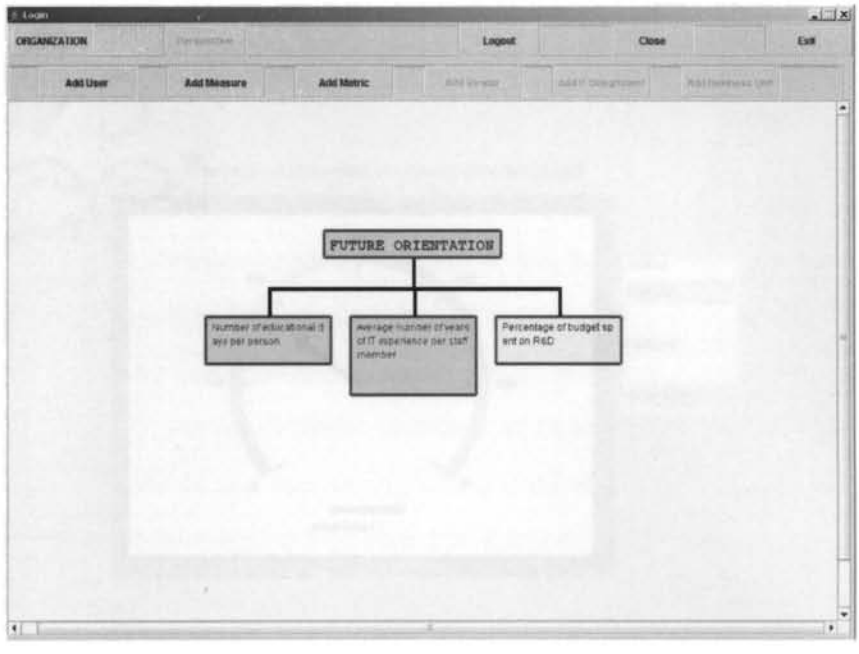


Figure 7.7 Screen shot showing the performance at the metrics level

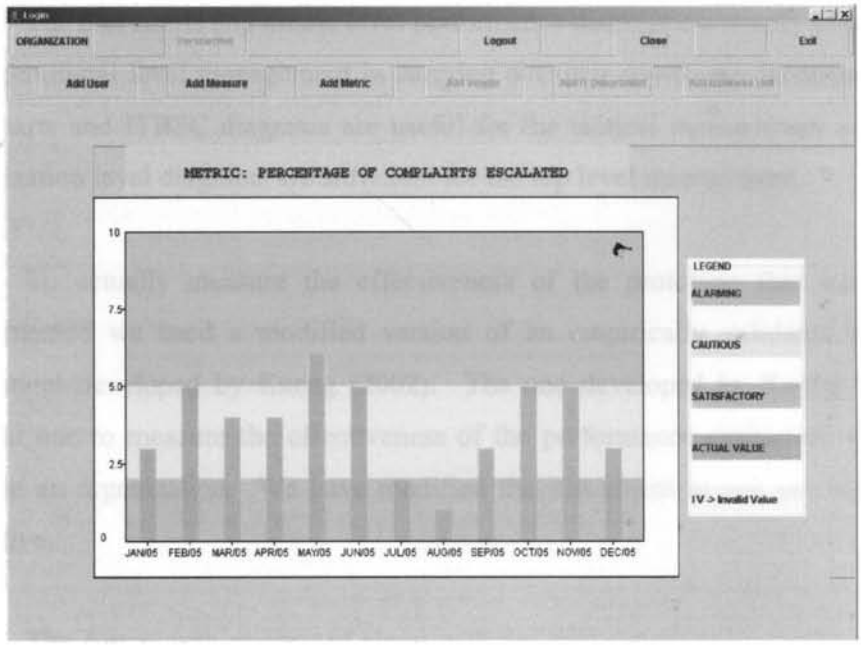


Figure 7.8 Bar chart showing the performance of a metric over a period

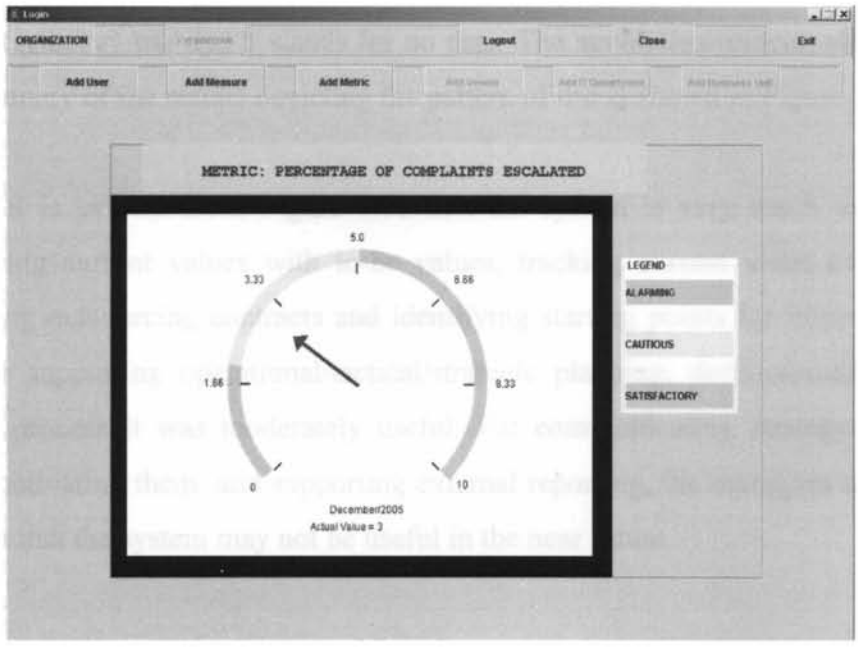


Figure 7.9 Dial chart showing the performance of a metric

The dial charts and metric level performance displays are mostly useful for the operational level management in carrying out their day-to-day business. The bar charts and ITBSC diagrams are useful for the tactical management and the organization level diagrams are sufficient for the top level management.

To actually measure the effectiveness of the prototype that we have implemented we used a modified version of an empirically validated survey instrument developed by Kueng (2002). The one developed by Kueng was a general one to measure the effectiveness of the performance evaluation system used in an organization. We have modified the instrument to suit our research objective.

The survey was conducted along with the user satisfaction test for all the eight managers who participated in the usability list. Each of the questions was to be evaluated on a five-point scale, as in the case of user satisfaction test. Here 5

stands for heavy use and 1 stands for no use. The survey instrument, along with the summary of the results depicting the pattern of use is shown in Figure 7.10.

It is evident from Figure 7.10 that the system is very much useful for comparing current values with to-be values, tracking current value over time, managing outsourcing contracts and identifying starting points for improvement. But for supporting operational/tactical/strategic planning, decision-making and budget process it was moderately useful. For communicating strategy/plans to staff, motivating them, and supporting external reporting, the managers are of the opinion that the system may not be useful in the near future.

Sl. No	**Use of the Performance Measurement system**	**Little use < 2.5**	**Moder-ate use 2.5 - 3.5**	**Heavy use > 3.5**
1.	Comparing current values with to be values			o
2.	Tracking current value over time			o
3.	Managing outsourcing contracts			o
4.	Identify starting points for improvement			o
5.	Support operational planning/decision making		o	
6.	Support tactical planning/decision making		o	
7.	Support strategic planning/decision making		o	
8.	Support budget process		o	
9.	Communicating strategy/plans to staff	o		
10.	Motivating staff	o		
11.	Supporting external reporting	o		

Fig. 7.10 – The survey instrument and the result (pattern of use)

7.4 Conclusion

In this chapter we have presented the details of testing and evaluation carried out on the prototype of the performance evaluation system. In the unified process, coding and testing starts in the elaboration phase itself. A detailed and thorough error-based testing was not conducted for the prototype, since it would be very expensive. However a systematic testing was carried out for component level testing and integration testing. It was a judicial blend of back box testing and glass box testing. It also made use of both bottom-up and top-down testing strategies.

After completing error-based testing the usability testing was carried out. Initially the usability test cases were prepared from the use cases. It is then executed before the selected user groups. After the execution of the test cases, the measurement of the user satisfaction was carried out. This was done by collecting the users' response using an appropriate questionnaire prepared for the purpose. The results were analysed and discussed.

Finally the evaluation of the prototype with respect to the main research objective was discussed. The survey instrument as well as the summary of the results were presented in figure. 7.10. The results seem to be promising. But there are certain useful modifications that can be incorporated, which will be discussed in the next chapter.

Chapter 8

Epilogue

An IT organization is responsible for the proper delivery of IT goods and services to the business organization. In order to discharge this duty effectively, IT service management processes are set up. But this cannot guarantee the satisfactory performance of the IT organization. Hence it is necessary to measure the performance to know where they stand. This quantitative measurement of the quality of performance is not an easy task, that too in the context of outsourcing.

So the main research question for this research was "How can we effectively monitor the performance of an IT Organization in the context of outsourcing?". In order to answer this research question, five sub-questions were formulated and elaborated in chapter one.

For answering the first three sub-questions, we had used literature study as the main research instrument. However to handle certain complexities that are not addressed in the literature, we had proposed a diagramming tool. For dealing with the fourth sub question, we had resorted to a case study in addition to literature study. The case study was conducted at an IT organization in a major fertilizer company in South India. The information so gathered was used to develop a performance evaluation prototype with which we had tried to answer the last sub-question. The results obtained from the validation testing indicate that the research was successful in meeting the objective.

The research findings related to the five sub-questions were discussed separately in five chapters starting with the second chapter in this thesis. A summary of the findings and suggestions for future work are given in the succeeding sections.

8.1 Research Findings

The issues and complexities involved in managing the IT organization in an outsourcing environment are many and the reasons for them are also diverse. Hence we have tried to identify as many as twenty complexities and had categorized them under four headings. They are (i) complexities associated with contracts and SLAs (ii) complexities associated with SLM process (iii) complexities associated with SLM organization and (iv) complexities due to intrinsic characteristics of IT. They are summarized in table 2.1.

A literature survey was conducted to find out the solutions available in the literature for tackling these issues. The findings are mapped to the complexities that we have identified in table 2.1 and are presented in table 3.1. In this study we realized that there is a need for a model to capture the multiple and complex relationships at an abstract level. Hence we had proposed two modelling techniques. The first one named SORD was based on the notations developed by the researchers (Peter, 2004) and the second one was based on UML. Both of them were equally good in capturing the complex relationships that existed in an outsourcing environment. But the second one has the advantage of being an internationally accepted modelling language.

To answer the third sub-question we made an elaborate study on the existing performance evaluation frame works that are used in the business environment and found that following three can be used for measuring the performance of an IT organization. They are:

(i) SERVQVAL
(ii) Information Economics
(iii) IT Balanced Scorecard

This is based on the fact that an IT organization is not a pure business organization, but an internal service provider. Among the three the ITBSC was

found to be more suitable than others, since it considers metrics/indicators from four different perspectives. Hence we had selected the ITBSC as the performance evaluation framework for the implementation of the prototype.

For the identification of meaningful performance indicators, we had conducted a case study in addition to literature survey. This was necessary because to the best our knowledge, no research has been carried out in finding out meaningful metrics/indicators to measure the performance of an IT organization in an outsourcing environment. Our earlier study in identifying the complexities had helped us in conducting an effective case study and come up with meaningful metrics/indicators. The metrics so identified were presented in table 6.2. The formula for calculating the metrics and the attributes such as the limits and priorities were presented in table 6.3 and table 6.4 respectively.

The last sub-question was dealt with by developing a prototype based on the outcome of the research conducted for answering the previous two sub-questions. That is, by implementing and validating the ITBSC using the performance indicators identified above. The prototype was implemented as a single user system on Java platform with MS Access DBMS. On evaluation we have found that the information produced by the system was useful for all the three levels of management namely, strategic, tactical and operational management.

8.2 Suggestions for Further Work

In this study, the metrics related to outsourcing were considered in general. For example, the metrics related to the relationship management were assessed by contract managers and the average value was used. But for large organizations having multiple vendors, it may be required to assess the metrics related to outsourcing separately, so that it would be possible to evaluate the contribution of each vendor. Then the combined performance can be calculated appropriately. It

would be interesting to make a study on the issues related to this aspect, in order to have a better control over the outsourcing scenario.

Another important fact pointed out by some of the participants in the user satisfaction test was the need to measure the quality of the inter-relationship among the service providers. For example, if two rival organizations are to provide two different but related services, their rivalry may affect the overall performance of the functioning of the IT organization. Hence this would be another interesting area to pursue research.

8.3 Conclusion

Using the three research instruments namely literature review, case study and the development of the prototype, we were able to answer the main research question. We had demonstrated that it is possible to measure the quality of the performance of an IT organization in an outsourcing environment effectively. This will enable the organization to strive for continuous performance improvement by taking appropriate corrective steps wherever and whenever necessary.

The prototype was developed as a stand-alone system. This can be further extended into a web-based multi-user system and deployed over the company-wide intranet, so that different stakeholders can view/use the performance information anywhere, anytime.

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