A Hybrid Framework Integrating BSC and GQM for Software Intensive Organizations

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2008

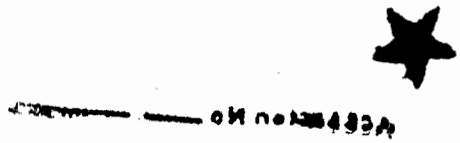
12/8/10

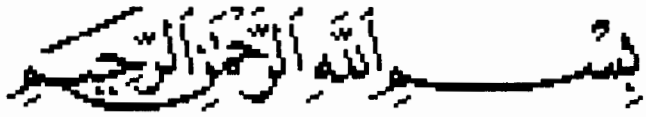
Performance standards

Task analysis

Organizational change

Management - Employee participation





In the name of ALMIGHTY ALLAH,
The most Beneficent, the most Merciful.

Department of Computer Science, International Islamic University, Islamabad.

30th August, 2008

Final Approval

It is certified that we have read the thesis, titled "**A Hybrid Framework Integrating BSC and GQM for Software Intensive Organizations**" submitted by **Muhammad Shamoon Azhar** under University Reg. No. **18-CS/MS(SE)/03**. It is our judgment that this thesis is of sufficient standard to warrant its acceptance by the International Islamic University, Islamabad, for the Degree of **MS Software Engineering**.

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Dedication

Dedicated to Almighty Allah and my parents who have supported me in all aspects throughout my life.

A dissertation submitted to the
Department of Computer Science,
International Islamic University, Islamabad
as a partial fulfillment of the requirements
for the award of the degree of
MS Software Engineering

Declaration

I hereby declare that this research project, neither as a whole nor as a part thereof has been copied out from any source. It is further declared that I have developed this thesis entirely on the basis of my personal efforts made under the sincere guidance of my supervisor. No portion of the work presented in this report has been submitted in support of any application for any other degree or qualification of this or any other university or institute of learning.

Muhammad Shamoon Azhar
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All praise to the Almighty Allah, the most Merciful, the most Gracious, without whose help and blessings, I would have been entirely unable to complete the project.

Thanks to my Parents who helped me during most difficult times of my life and it is due to their unexplainable care and love that I am at this position today.

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Project in Brief

Project Title:	A Hybrid Framework Integrating BSC and GQM for Software Intensive Organizations
Objective:	To design and implement an efficient technique for measuring and improving the performance of a software intensive organization towards its strategic goals.
Undertaken By:	**Muhammad Shamoon Azhar** (18-CS/MS(SE)/03)
Supervised By:	**Prof. Dr. Syed Affaq Hussain** Head, Department of Computer Science, Air University Islamabad.
Technologies Used:	C#, Access
System Used:	Pentium® IV
Operating System Used:	Win XP
Date Started:	19-02-07
Date Completed:	30-08-08

Abstract

The evaluation of the organizational performance has always been and still remains one of the primary objectives of many scholastic and business discussions. Increase in competition and decrease in time-to-market, as well as poor performance in terms of meeting cost and schedule commitments has raised the awareness of management's need to take control of this element which has increasingly become critical to the success of businesses. This thesis report presents a quantitative approach based on the goal-driven measurement paradigm and Balanced Scorecard methodology to capture and evaluate organization's performance. It also presents additional performance measures for IT organizations keeping in prime view their impact on the software process. The paper further highlights the application of this approach not only for performance measurement & process improvement but also at project level so that project management and strategic management systems are effectively aligned.

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1. Introduction

The assessment of the organizational performance has been and still remains one of the main topics of many academic and business discussions. Increasing competition and decreased time-to-market, as well as poor performance in terms of meeting cost, quality and schedule commitments, has raised the awareness of management to the need to take control of this component which has increasingly become critical to the success of their business. Until a few years ago, many companies had relegated the management of their software development process to their technical staff who were without proper professional management training.

Today's software development is still error prone. For instance, projects are completed too late, exceed their budgets, or require substantially more resources than planned. Often developers are working in an unstructured and stressful way, resulting in a poor or unknown level of product quality. These problems are often addressed as the *'software crisis'* [1], and by applying various software process improvement (SPI) approaches, organizations developing software try to resolve this crisis. [2]

1.1 Improvement areas of software development

The main improvement areas of software development are software products, software development processes and software quality. [1]

1.1.1 Software products

A software product is defined as the complete set of computer programs, procedures, and associated documentation and data, designated for delivery to a user [3].

Software products often struggle with quality problems. Due to the enormous size and complexity of many software products, software developers are often not capable of providing reliable information on the quality of their products. As a result, many high-tech software projects eventually turn out to be disastrous.

Furthermore, today's software should fulfill many implicit demands from a variety of users. Even if the software functions correctly, the functionality should also be logical for the users, clearly documented and supported by training of the users on how to use the software. Another problem for the software community is the fact that software is not a static product, but a product that needs to be adapted all the time because of a changing environment. Flexibility is, therefore, considered to be one of the most important

strengths of software. This flexibility is most apparent during the maintenance of software as the requirements of a software product often change over time, the product should be easily maintainable. Flexibility is, however, also the largest weakness of software, as this flexibility makes it possible to change a product so completely that its original architecture is put under a lot of pressure. Finally, software products tend to become larger and more complex every day the size of software in mobile phones, for example, increases 10 times every 1000 days [4]. Philips has noted that 70% of product development is spent nowadays on software development and has become the critical path in product development [5]. As a result of all these effects the quality of the product will often be at stake.

1.1.2 Software processes

Two major phases can be discerned in the software product life-cycle i.e. the development phase, and the exploitation phase. During development phase the product is initially created & during exploitation phase the product is used in practice and changes to the product are implemented in order to maintain the software. Software processes, therefore, refer to the development phase of a software product.

A software development process is defined as all activities necessary to translate user needs into a software product [6][3]. Pfleeger states that such a process consists of a Requirements Analysis and Definition phase, a System Design phase, a Program Design phase, a Program Implementation phase, a Unit Testing phase, an Integration Testing phase, a System Testing phase, a System Delivery phase, and finally, a Maintenance phase [7].

Software processes are considered to be the main area for quality improvement, because they contain the activities during which the product is actually created. The earlier quality problems are detected, the easier and cheaper they can be resolved. Three typical problems exist regarding software processes

- Software processes are often not defined;
- Software development is highly dependent on individual craftsmanship;
- Software development is difficult to manage.

Methods like the CMM focus on making software development manageable as a first step to continuous improvement [8]. Software processes are often not well-defined.

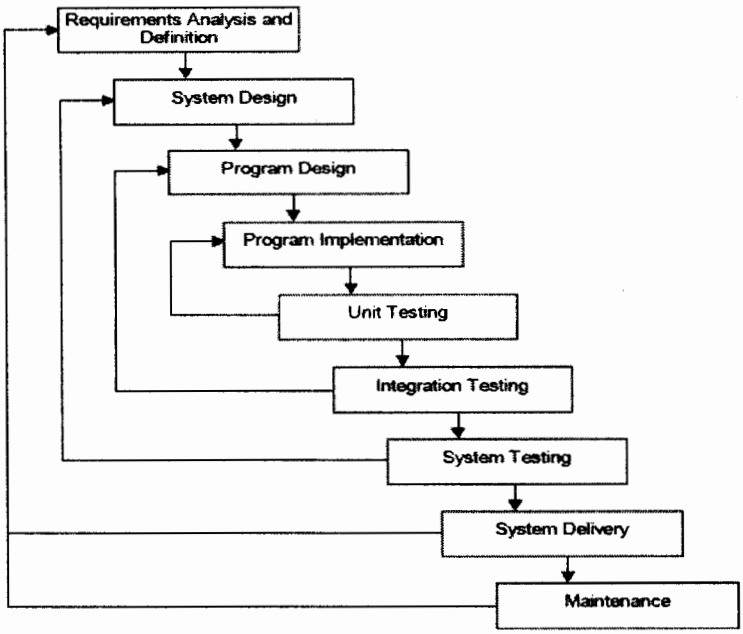

Figure 1.1 Phases within a software development process [7]

Although many methods are available, few are actually used in practice. Due to this lack of clearly defined processes, software development depends to a large extent on the individual skills and craftsmanship of the developers. Software development is still a very creative process [9], and individual developers maintain a significant influence on the end result [10]. The Software Engineering Institute (SEI) has defined a five level model to describe the 'maturity' of the way in which the organization addresses the importance of people the 'People-CMM (P-CMM)' [11]. Humphrey, also the originator of CMM, has described an approach for the individual improvement of software engineers the Personal Software Process (PSP) [12].

The dependence on individuals makes software development difficult to manage. It is often problematic to switch tasks between developers. Due to unclear or undocumented development processes it will be problematic to predict delivery times. A lot of research is still going on to enable organizations to improve their software development process, and, for instance, move to higher CMM levels [13].

1.1.3 Software quality

Software quality is defined as all characteristics of a product that bear on its ability to satisfy explicit and implicit needs of the user [14]. An example of such characteristics is

shown in Figure 1.2. Other subdivisions of quality in attributes have been described by, for example, Boehm, McCall and Cavano [15][16][17].

Quality is an important aspect of attracting customers. However, it is certainly not the only aspect. Other examples of important product characteristics would be price and delivery date. Also, the perception of quality will be different for many individuals. The software market itself is a typical example of a market where you may have a very successful product that is of poor quality, due to for example, missing functionality or software failures. Several problems exist regarding software quality that are all related to two basic problems

- It is difficult to specify software quality in measurable terms.
- It is difficult to select the most efficient and effective development process that produces a product with the specified level of quality.

These two basic problems are also related to each other. Quality involves many aspects and these aspects often require subjective judgments. An example of an aspect that is often subjectively measured is *usability*. An aspect such as *reliability* is probably more suitable for objective measurement. *Reliability* can, for example, be measured by means of particular failure rates. Even though a characteristic like reliability is also interpreted differently by different users, in practice most quality requirements for software are not made explicit during the definition phase of software development. In such a case, it will be quite difficult for developers to create quality. Most development methods only specify functional requirements, leaving the fulfilling of other quality characteristics to the experience, craftsmanship and personal interest of the developers. Even if quality is adequately specified, software quality is still difficult to build. Many software engineering methods, techniques, and tools, are used in the software industry, yet their effectiveness remains mostly unknown.

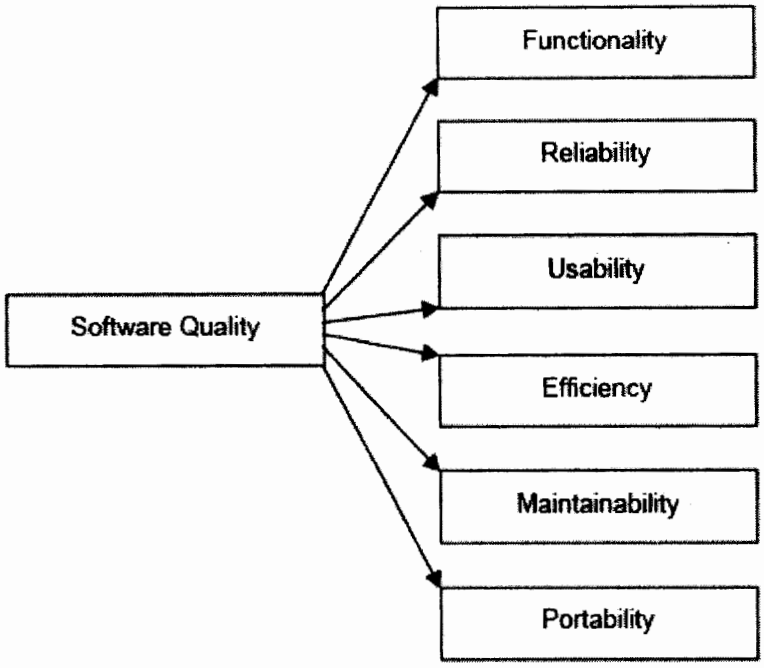

Figure 1.2 ISO 9126 software quality characteristics [4]

As a result, it is very difficult to select the most appropriate development process. Furthermore, during the development process, insufficient measurement is often applied in order to create the possibility to take corrective action. The quality of today's complex software systems should be achieved by combining experience and knowledge of many different disciplines. Integrating disciplines means cooperation of experts from particular disciplines, probably causing communication problems. Human failures then become more likely and can easily lead to lower product quality.

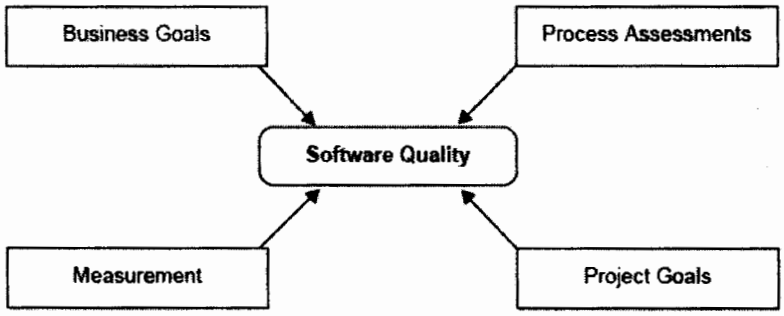

Figure 1.3 Identification of improvement goals [2]

1.2 Software process improvement goals

To improve their software development, organizations need a definition of clear improvement goals; otherwise the improvement activities will turn out to be as chaotic as the development process itself. These improvement goals should support business objectives in the best possible way. For example, it is not recommended to base improvements on a method that prescribes the installation of a software configuration management system, while most projects in the organization fail because of bad requirements management.

Improvement goals can be defined in different ways. First of all, corporate management can prescribe quality objectives, from which improvement goals can be derived. Secondly, organizations can conduct software process assessments, in order to identify main areas suitable for improvement. Based on the identification of such areas, improvement goals can again be defined. Finally, improvement goals may be defined with respect to particular project needs.

The four main areas to which software process improvement activities usually focus are the decrease of project costs, the decrease of project risk, the shortening of project cycle time, and the increase of product quality.

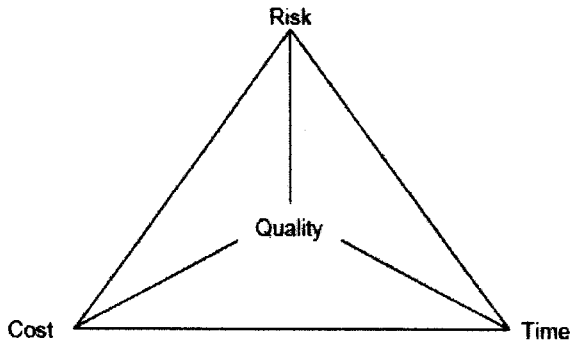

Figure 1.4 Process improvement focus [2]

1.2.1 Increase quality

If an organization intends to improve the quality of its products, improvement goals in the area of product quality attributes should be defined, and thus the need for clearly specified requirements on functionality, reliability or other quality attributes arises.

By focusing on quality increase as an improvement goal, the software development process will eventually need to be fully defined, as having a quality improvement goal without an established development process seems unfeasible. The responsibility for the product quality lies with the people that create the product. By adopting quality improvement goals in an organization, developers become aware of the need for high quality. Therefore, software process improvement supports the creation of a 'quality culture' within organizations very well.

When introducing quality increasing improvements in an organization it is possible that project teams will ask whether that is really necessary. They might state that they already develop high quality products. Therefore, make sure you can show that a quality increase is indeed necessary, probably not because it is bad, but because business almost always looks for higher quality. And, it is always possible to improve.

Improvement goals in the area of quality often start with some kind of software defect measurement or detection topic. Both product and process failures will then be registered in order to identify the areas in the development process that have the highest need for improvement. Also initial defect detection improvements will be the implementation of Fagan inspection or other review techniques. However, more subjective approaches on quality improvement, such as focusing on customer satisfaction or keeping documentation up-to-date, can also be defined within a quality improvement goal.

1.2.2 Shorten project cycle time

Shortening time-to-market is an improvement goal which is frequently heard of in practice. Marketing and competition requirements make market introduction one of the most stringent requirements for product development, especially in the embedded product area where cycle-time is currently most relevant. The project life-cycle or development time can be decreased by, for example, increasing productivity, parallel development, prototyping or reuse of already existing software. Productivity can be increased through, for example, specialization of software design. Parallel development will be encouraged through a modular design of the software.

Cycle-time reduction is often one of the reasons to define an improvement goal with respect to developer productivity. However, one should be careful choosing this approach.

Measuring individual performance is difficult and if not fully supported by the software developers, it might very well destroy the improvement initiative.

Software process improvement is an excellent method to evaluate whether new tools or techniques that are pushed into the market are really decreasing the development cycle.

Many 'silver bullet' stories are available on successful applications in organizations, though they never seem to fulfill all promises.

1.2.3 Decrease costs

Decreasing the costs of software development is primarily realized by decreasing the software development labor, and therefore cost reduction will mostly aim at executing software development processes more efficiently. A first step to this is identifying current effort and expenditure. Examples from practice in which costs are expressed are costs per source line, costs per function point, costs per life-cycle phase, or costs per product (subsystem).

Software measurement is an excellent tool to start improving on this type of data.

The focus will not only be on 'doing things better' but also on 'doing the right-things', because eliminating unnecessary activities will be one of the most interesting cost cutting activities.

Embedded software products, however, should be examined more carefully with respect to costs the cost of the product is not only related to the development cost of the software and to the development of the accompanying hardware. Often the product cost of an embedded system is largely determined by hardware, especially because eventually the production cost of hardware is higher than software, as production costs of software are negligible. Development of software is expensive and production is almost free.

Decrease of cost can also be established by reusing hardware designs, software components or documentation. Finally, an obvious reason to focus on cost reduction in an improvement program is the fact that corporate management will often be interested in financial figures.

1.2.4 Decrease risks

In order to decrease risks that are involved in executing a project, project management has to be able to manage risk factors that are relevant for specific projects. This can be

accomplished by identifying possible risk areas and applying measurements to those particular areas in order to track status and identify the need for corrective actions [18]. By increasing process maturity, the risks involved in executing the relevant process will decrease, because problem areas in the development process will be tackled by the software process improvement activities. Furthermore, explicit risk reduction makes projects more manageable, and is therefore a suitable and obvious way of improving software processes.

1.3 Software process improvement approaches

There are two generic types of approach to Process Improvement [19][20][21]

1.3.1 Analytic models

These are *open, goal-oriented, measurement-based* and *bottom-up-driven.* Analytical models use quantitative evidence in determining where an improvement is needed and, later, whether or not the improvement initiative has been successful. The Plan-Do-Check-Act Cycle, by Shewhart & Deming, GQM technique [22], QIP [23] and AMI [24] can be categorized as analytic models. Some organizations create *ad hoc* measurement programs, just for their own processes.

1.3.2 Prescriptive models

These are *closed, staged, assessment-based* and *top-down-vision-driven.* Prescriptive models use a formal and prescriptive improvement model which includes a structured set of practices. A basic assumption with this type of approach is that the defined roadmaps of these prescriptive models have general validity. Approaches like CMM [8], SPICE [25] and BOOTSTRAP [26], Balanced Scorecard [34][35][36] can be categorized as prescriptive models.

1.4 Organizational Performance Improvement

The evaluation of organizational performance has been and still remains one of the hottest topics of many scholarly and business debates. But well known financial measures such as "Return on Investment" (ROI), "Internal Rate of Return" (IRR), "Net Present Value" (NPV), and the "Payback Time" (PB) have been demonstrated to be neither sufficient to adequately explain IT investment decisions nor for their assessment. For assessing IT investments, it is critical to understand how organizational and strategic goals are achieved. First step was to introduce more dimensions (perspectives) of analysis,

since the financial measures alone were not sufficient, representing just the tip of the iceberg, ignoring all the relations among the processes.

IT organizations often use Balanced Scorecard [34][35][36] and Goal-Driven measurement [22][23] as enterprise wide measures to reflect the relative health of their organization. These measures help guide an organization's overall performance and process improvement effort. Both methodologies are well known, but usually applied separately. The Balanced Scorecard encourages an organization to take an introspective look at its processes. From this an organization can set enterprise-strategic goals and develop a set of indicators and measurements for the desired outcomes and performance drivers. The Goal-Driven approach then follows a disciplined way for deriving required measures and indicators. This approach is intended to help an organization determine the best measures and associated indicators for its unique environment. Using this approach, an organization can systematically set goals for each of the perspectives of Balanced Scorecard and develop a set of strategic measures and indicators to determine and track the quality of outcomes and organizational performance.

Often business & technical sections of organizations are working in different directions towards achieving different goals. This thesis report investigates Balanced Scorecard & GQM techniques keeping in prime view the issue of alignment of project management & strategic management frameworks within matrix structured IT organizations in order to achieve better performance, software process improvement, and better measurement and feedback mechanism for the long term growth and stability of the organization.

2 Goal Question Metric Approach

GQM method was developed by V.Basili and D.Weis as an outcome of both practical experience and academic research [27]. By now, GQM has proven its quality in the problems of metrics selection and implementation. The basic principle behind the paradigm is that each organization or project has a set of goals. For each goal there is a set of questions that you might ask to help you understand whether you are achieving your goal. Many of questions are a complete set, and to the extent the metric data satisfactorily answers the questions, you can measure whether you are meeting goals. The relationships among goals, questions, and metrics are shown in Figure 2.1.

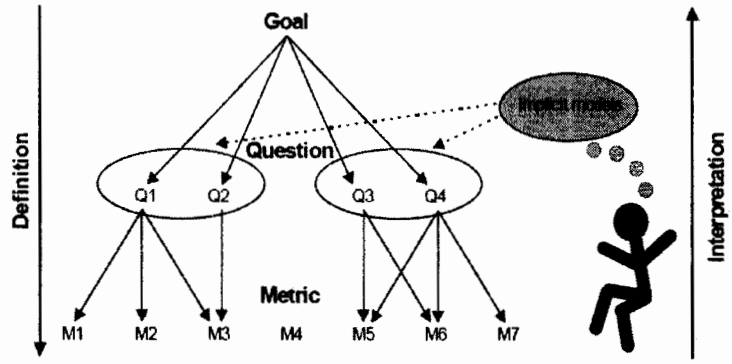

Figure 2.1 The GQM Paradigm [27]

2.1 Levels of GQM

The measurement model has three levels:

2.1.1 Conceptual Level (Goal)

A **goal** is defined for an object, for a variety of reasons, with respect to various models of quality, from various points of view, relative to a particular environment. The fundamental objects of measurement are products, processes and resources.

- **Product measures:** These measures generally refer to the volume of product produced. These include LOC, pages of documentation, numbers of screens, numbers of files, and so on.
- **Process measures:** These measures quantify the behavior of our process. These are generally objective, absolute, explicit, and dynamic. These measures also provide the elements for a host of useful derived measures. The categories of process measures are event counts, time measures, and so on.
- **Resource measures:** Resource measures apply to labor hours, the principal software development resource. The concerns are working hours, job categories, and task activities.

2.1.2 Operational Level (Question)

Questions are used to characterize the way the assessment/achievement of a specific goal is going to be performed based on some characterizing model. Questions try to characterize the object of measurement with respect to a selected quality issue and to determine its quality from the selected viewpoint. Questions must be answerable in a quantitative manner.

2.1.3 Quantitative Level (Metric)

A set of data is associated with every question in order to answer it in a quantitative way. The data can be [2]

- **Objective:** if data depend only on the object that is being measured and not on the viewpoint from which they are taken; e.g. number of versions of a document, staff hours spent on a task, size of a program.
- **Subjective:** if data depend on both the object that is being measured and the viewpoint from which they are taken; e.g., readability of a text, level of user satisfaction.

2.2 The measurement concept: the GQM paradigm

GQM represents a systematic approach for tailoring and integrating goals to models of the software processes, products and quality perspectives of interest, based upon the specific needs of the project and the organization [33]. The result of the application of the GQM method is the specification of a measurement program targeting a particular set of issues and a set of rules for the interpretation of the measurement data.

The principle behind the GQM method is that measurement should be goal-oriented. Therefore, in order to improve a process, organizations have to define their measurement goals based upon corporate goals and transform these goals into activities that can be measured during the execution of the project. GQM defines a certain goal, refines this goal into questions, and defines metrics that should provide the information to answer these questions. By answering the questions, the measured data defines the goals operationally, and can be analyzed to identify whether or not the goals are attained. Thus, GQM defines metrics from a top-down perspective and analyzes and interprets the measurement data bottom-up, as shown in Figure 2.3. The GQM model starts top-down with the definition of an explicit measurement goal. This goal is refined into several questions that break down the issue into its major components. Each question is then refined into metrics that should provide information to answer those questions. Measurement data is interpreted bottom-up. As the metrics were defined with an explicit goal in mind, the information provided by the metrics should be interpreted and analyzed with respect to this goal, to conclude whether or not it is attained. GQM trees of goals, questions and metrics should be built on knowledge of the experts in the organization: the developers. Therefore, knowledge acquisition techniques are also applied to capture the implicit models of the developers built during years of experience. Those implicit models give valuable input into the measurement program and will often be more important than the available explicit process models.

Over the years, GQM has evolved to include models of software processes and products, resulting in a model-based GQM approach [29], which defines metrics from two different perspectives, as shown in Figure 2.2:

- . Metrics definition by members of the project team, using GQM techniques.
- . Metrics definition based on models of software processes and products.

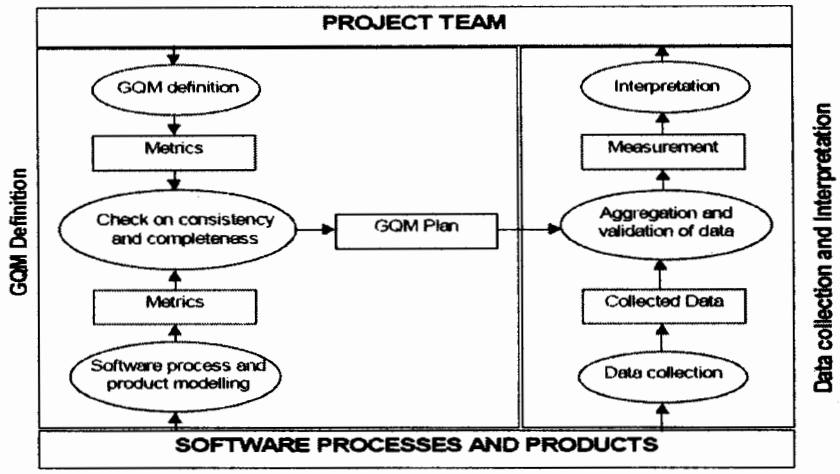

Figure 2.2 Metric Modeling from two perspectives [28]

By modeling both perspectives, two sets of metrics are identified that can be mutually checked for consistency and completeness. This will identify subjects that are missing, or badly defined. After the models of these two perspectives have been checked and enhanced, a GQM plan is developed. The GQM plan is the documented description of all the information that the measurement program is based on. This document represents the measurement goals, related questions and identified metrics. Based on the GQM plan, a measurement plan is developed that defines procedures for collecting data. When the plans are approved, measurement can start. Data are collected on the software development process and products, aggregated and validated. Finally, the measurement results are returned to the project members for analysis, interpretation and evaluation on the basis of the GQM plan [29]. Figure 2.2 illustrates that GQM modeling can be checked for consistency and completeness on the basis of software process and product models. The following activities are required [2]:

1. Check on the presence of all GQM based direct metrics in the software development process model.
2. Adjust the software development process model, adding the missing direct metrics.
3. Check the GQM definition on missing metrics that are defined in the software development process model and identify their relevance.
4. Adjust GQM definition, adding the missing direct (or indirect) metrics.
5. Decide on accepting the set of direct metrics.

The consistency and completeness check between the software development process models and GQM means that all metrics defined in a measurement program, also need to be defined in the software development process model. If a certain direct metric is not defined in the software development process model, however, as required in your GQM model, the software development process model should be enhanced, adding the specific metric. In this way GQM also supports improving your software development process models.

2.3 The GQM method phases

Software measurement should only be performed towards an explicitly stated purpose. This so-called 'goal-oriented measurement' [27] is especially used for improvement programs. The GQM method contains four phases [2]:

1. The ***Planning phase***, during which the project for measurement application is selected, defined, characterized, and planned, resulting a project plan.
2. The ***Definition phase***, during which the measurement program is defined (goal, questions, metrics and hypotheses are defined) and documented.
3. The ***Data collection phase***, during which the actual data collection takes place, resulting in collected data.
4. The ***Interpretation phase***, during which the collected data is processed with respect to the defined metrics into *measurement results* which provide *answers* to the defined questions, after which *goal attainment* can be evaluated.

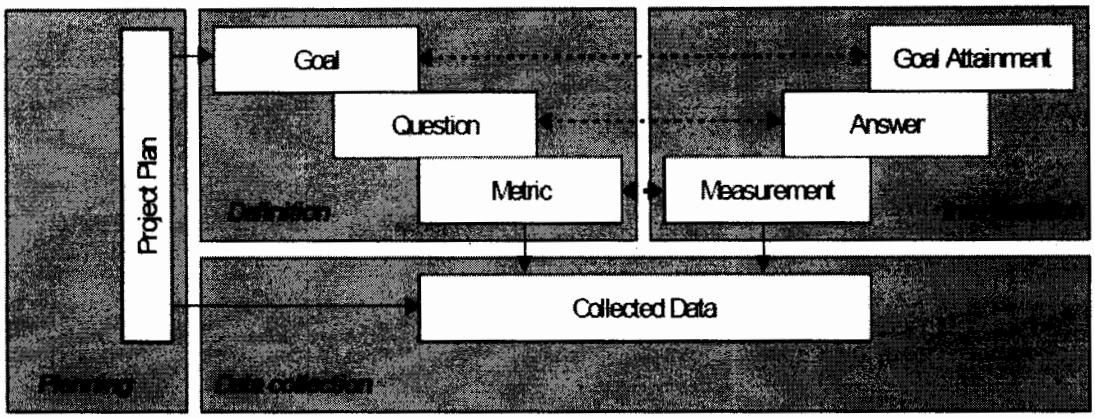

Figure 2.3 The four phases of GQM method [30]

The four phases of the GQM method are illustrated in Figure 2.3. The planning phase is performed to fulfill all basic requirements to make a GQM measurement program a success, including training, management involvement and project planning. During the definition phase all GQM deliverables are developed, mainly based on structured interviews or other knowledge acquisition techniques. The definition phase identifies a goal, all questions, related metrics and expectations (hypotheses) of the measurements. When all definition activities are completed, actual measurement can start. During this data collection phase the data collection forms are defined, filled-in and stored in a measurement database. Then the 'real work' can start: using the measurement data. During the interpretation phase, the measurements are used to answer the stated questions, and these answers are again used to see whether the stated goals have been attained.

Activities such as packaging measurement results to be used in other parts of the organization are not considered to be part of the GQM method, but of a wider perspective, such as a company wide improvement program.

2.4 The GQM method stepwise

2.4.1 GQM Planning Phase

The primary tasks of the planning phase are collecting all necessary information for a successful start, preparing and motivating members of an organization for this program.

A project plan contains documentation of procedures, schedules and objectives of a measurement program and basic information for promotion to and acceptance by management, and should be available after completing this phase [2].

The planning phase is performed to fulfill all the necessary requirements to make GQM measurement program a success, including training, management involvement and project planning.

The planning phase can be divided into four sub-phases

1. Establish GQM Team
2. Select Improvement Area
3. Select Application Project and Establish Project Team
4. Create Project Plan

2.4.2 GQM Definition Phase

The definition phase is the second phase of the GQM process, and concerns all activities that should be performed to formally define a measurement program. During this phase three documents are produced [2]:

- . GQM plan;
- . measurement plan;
- . analysis plan.

These three plans contain all pertinent information regarding the measurement program

GQM definition phase can be divided into 11 sub-phases:

1. Define measurement goals
2. Review or produce software process models
3. Conduct GQM interviews
4. Define questions and hypotheses
5. Review questions and hypotheses
6. Define metrics
7. Check metrics on consistency and completeness

8. Produce GQM plan
9. Produce measurement plan
10. Produce analysis plan
11. Review plans

2.4.3 GQM Data Collection Phase

When all the definition activities are completed the actual measurement can start. The success of every project depends on accurate measures. Sometimes the product measures can be obtained without human intervention- automatic and digitized analysis. But in the case of process and resource measurements that is usually not possible. Manual data collection could make some problems with high demands and rigorous procedures. However, this is usually the most common and the easiest way of collecting data although it sometimes takes a lot of effort to set in place the procedures for accurate measurements. The results of a data collection phase are filled-in forms stored in a measurement database. The whole procedure of data collection can be divided into several sub-phases and here are the detailed descriptions of the most important:

1. Hold & Trial Period
2. Metric Base

1. Hold and Trial Period

In order to avoid mistakes and to test the data collection procedures, tools and forms, before the actual data collection period a trial measurement period should be held. Now the 'kick-off session' should be organized, during which all people participating in the measurement program should approve all the plans, forms, tools and procedures.

2. Metric Base

Data collection forms should be filled in and then gathered by GQM team, who is responsible for checking correctness of the filled data. If any messages or mistakes occur they are supposed to be immediately corrected. A metrics base is the first part of

measurement support system (MSS) which plays an important role in a measurement program. The MSS supports all measurement activities [2]:

1. Collecting, storing and maintaining measurement data, which means registration of the data by a project team.
2. Storing measurement data, which means entering data into measurement database.
3. Maintaining measurement data.
4. Processing measurement data, which means for example, combining, sorting and dividing data to provide the required metrics.
5. Measurement data presentation in a suitable form, like tables and charts are.
6. Packaging measurement data, which means the storage of data for expected presentation in future.

During MSS development spreadsheet tools are used to store, maintain and process the collected measurement data and presentation tools for preparing presentation results.

2.4.4 GQM Interpretation phase

GQM Interpretation phase is the final and essential phase in the GQM method. During the interpretation phase, the collected data are used for answering the stated questions and in that way for identifying whether the goals are achieved. In other words, results of the measurements are discussed and conclusions made in terms of measurement results. If hypotheses and conclusions are consistent the goal has been achieved. The following tasks should be performed during this phase:

1. Feedback session
2. Measurement Results
3. Cost and benefit analysis

3 The Balanced Scorecard

Conventional performance measures are insufficient to gauge performance and guide organizations in today's rapidly changing, complex economic landscape. Organizations need to link performance measurement to strategy, and must measure performance in ways that both promote positive future results and reflect past performance.

Leaders in the organizations the world over encounter some tough questions:

- How do we communicate strategy through a complex, multi-faceted, decentralized global organization?
- Are we achieving our business strategies?
- How do we align our organization and minimize superfluous activities so that we're all working efficiently to the same ends?
- How do we measure the effectiveness of our strategy and its implementation?
- Do our business units align with these strategies?
- Are individual employees supporting these strategies?
- Are we making a profit while meeting customer needs?
- Are these the right strategies to position us for the future?
- How do we promote a culture of agility to respond to the rapidly changing business climate we face?

To answer these questions, most organizations typically used financial measures. The problem was that the financial measures were only a part of the overall equation.

The Balanced Scorecard [33][34][35] has been developed as a powerful way to implement strategy and continuously monitor strategic performance. Creating a *strategy focused organization* (the phrase coined by the founders of the Balanced Scorecard methodology) is a significant, challenging culture change for many organizations. Success in achieving this change requires:

- Consistent executive support and involvement.

- Education, communication, and visibility of the strategy and measurements of its effectiveness throughout the organization.
- Constant feedback loops so that strategy is an every-day consideration.
- Tools to enable non-technical users to understand the key drivers of the measures.
- Translation of the strategy to operational terms so that alignment to strategy and implementation of it occur at all levels of an organization.

The balanced scorecard is a new management concept which helps managers at all levels monitor results in their key areas. An article by Robert Kaplan and David Norton entitled *"The Balanced Scorecard - Measures that Drive Performance"* [34] in the Harvard Business Review in 1992 sparked interest in the method, and led to their business bestseller, *"The Balanced Scorecard: Translating Strategy into Action"*, published in 1996 [35]. Recognizing some of the weaknesses and vagueness of previous management approaches, the balanced scorecard approach provides a clear prescription as to what companies should measure in order to 'balance' the financial perspective.

The Balanced Scorecard is a **management** system (not only a measurement system) that enables organizations to rapidly implement strategy by translating the vision and strategy into a set of operational objectives that can drive behavior, and therefore, performance. Strategy-driven performance measures provide the essential feedback mechanism required to dynamically adjust and refine the organization's strategy over time. When fully deployed, the balanced scorecard transforms strategic planning from an academic exercise into the nerve center of an enterprise.

Kaplan and Norton describe the innovation of the balanced scorecard as follows:

"The balanced scorecard retains traditional financial measures. But financial measures tell the story of past events, an adequate story for industrial age companies for which investments in long-term capabilities and customer relationships were not critical for success. These financial measures are inadequate, however, for guiding and evaluating the journey that information age companies must make to create future value through investment in customers, suppliers, employees, processes, technology, and innovation [36]."

3.1 Elements of Balanced Scorecard Perspectives

The Balanced Scorecard is an approach to describing and communicating strategies. It is also a way of selecting performance measures that will drive a unique organizational strategy. Dr. Norton describes the Balanced Scorecard as follows:

> "A balanced scorecard is a system of linked objectives, measures, targets and initiatives which collectively describe the strategy of an organization and how the strategy can be achieved. It can take something as complicated and frequently nebulous as strategy and translate it into something that is specific and can be understood."[37]

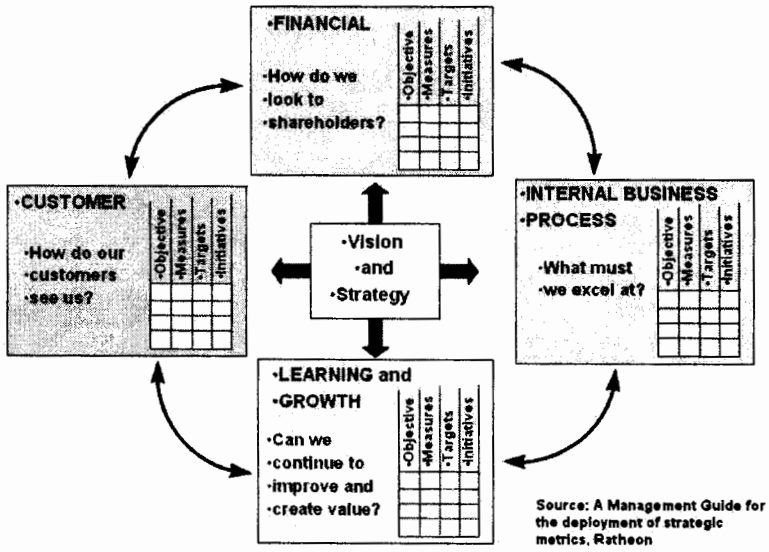

Figure 3.1 Balanced Scorecard [36]

3.1.1 Perspectives

Kaplan and Norton's Balanced Scorecard describes strategy and performance management from multiple perspectives [34]. The classic Balanced Scorecard has four perspectives:

Perspective	***Key Question***
Financial	*To succeed financially, how should we appear to our stakeholders?*

Customer	*To achieve our vision, how should we appear to our customers?*
Process	*To satisfy our customers and shareholders, at what business processes must we excel?*
Learning and Growth	*To achieve our vision, how will we sustain our ability to change and improve?*

Each perspective can be explained by a key question with which it is associated. The answers to each key question become the *objectives* associated with that perspective, and performance is then judged by the progress to achieving these objectives. There is an explicit causal relationship between the perspectives: good performance in the Learning and Growth objectives generally drives improvements in the Internal Business Process objectives, which should improve the organization in the eyes of the customer, which ultimately leads to improved financial results.

Though there are four basic perspectives proposed, it is important to understand that these perspectives reflect a unique organizational strategy. So the perspectives and key questions should be amended and supplemented as necessary to capture that strategy. For example, a non-profit or government organization would not have the same perspectives as a for-profit corporation.

1. The Learning and Growth Perspective

This perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In a knowledge-worker organization, *people* -- the only repository of knowledge -- are the main resource. In the current climate of rapid technological change, it is becoming necessary for knowledge workers to be in a continuous learning mode. Government agencies often find themselves unable to hire new technical workers, and at the same time there is a decline in training of existing employees. This is a leading indicator of 'brain drain' that must be reversed. Metrics can be put into place to guide managers in focusing training funds where they can help the

most. In any case, *learning and growth constitute the essential foundation for success of any knowledge-worker organization.*

Kaplan and Norton emphasize that 'learning' is more than 'training'; it also includes things like mentors and tutors within the organization, as well as that ease of communication among workers that allows them to readily get help on a problem when it is needed. It also includes technological tools; what the Baldrige criteria call "high performance work systems." [38] One of these, the Intranet, will be examined in detail later in this document.

2. The Business Process Perspective

This perspective refers to internal business processes. Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements (the mission). These metrics have to be carefully designed by those who know these processes most intimately; with our unique missions these are not something that can be developed by outside consultants.

In addition to the strategic management process, two kinds of business processes may be identified: a) mission-oriented processes, and b) support processes. Mission-oriented processes are the special functions of government offices, and many unique problems are encountered in these processes. The support processes are more repetitive in nature and hence easier to measure and benchmark using generic metrics.

3. The Customer Perspective

Recent management philosophy has shown an increasing realization of the importance of customer focus and customer satisfaction in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good.

In developing metrics for satisfaction, customers should be analyzed in terms of kinds of customers and the kinds of processes for which we are providing a product or service to those customer groups.

4. The Financial Perspective

Kaplan and Norton do not disregard the traditional need for financial data. Timely and accurate funding data will always be a priority, and managers will do whatever necessary to provide it. In fact, often there is more than enough handling and processing of financial data. With the implementation of a corporate database, it is hoped that more of the processing can be centralized and automated. But the point is that the current emphasis on financials leads to the "unbalanced" situation with regard to other perspectives.

There is perhaps a need to include additional financial-related data, such as risk assessment and cost-benefit data, in this category.

3.1.2 Objectives and Measures

Objectives are desired outcomes. The progress toward attaining an objective is gauged by one or more measures. As with perspectives, there are causal relationships between objectives. In fact, the causal relationship is defined by dependencies among objectives. So, it is critical to set measurable, strategically relevant, consistent, time-delineated objectives.

Measures are the indicators of how a business is performing relative to its strategic objectives. Measures, or metrics, are quantifiable performance statements. As such, they must be:

- Relevant to the objective and strategy.
- Placed in context of a target to be reached in an identified time frame.
- Capable of being trended.
- Owned by a designated person or group who has the ability to impact those measures.

An organization is likely to have a variety of types of measures. Some will be calculated from underlying data. Others will be aggregated index measures that assign different weights to multiple contributing measures. Some are frequently measured and others may only be measured on a quarterly or annual basis.

It is important to balance lagging indicators—which includes most financial measures—with leading indicators—areas where good performance will lead to improved results in the future.

It is also important to balance internal measures, such as cost reduction, injury incident rates, and training programs, with external measures like market share, supplier performance, and customer satisfaction.

3.1.3 Initiatives

An initiative is a change process or activity designed to achieve one or more objectives. The initiative is what will move a measure toward its target value. Initiatives may be large or small in scope. They generally are owned by a person or group, and are managed like projects.

3.1.4 Strategy Maps, Strategic Themes, and Matrices

Even a relatively simple scorecard can contain an overwhelming amount of information; therefore, several tools have been developed to help communicate large, complex quantities of information in simple, easily understood ways.

Strategy Maps

Mapping a strategy is an important way to evaluate and make visually explicit an organization's perspectives, objectives, and measures, and the causal linkages between them. Organizing objectives in each defined perspective, and mapping the strategic relationships among them, serves as a way to evaluate objectives to make sure they are consistent and comprehensive in delivering the strategy.

The strategy map is a visual way to communicate to different parts of the organization how they fit into the overall strategy. It facilitates cascading a balanced scorecard through an organization, because it can be created at different levels of an organization, and each level's map can be viewed for alignment with the overall strategy map.

Strategic Themes

The strategic theme is a grouping of similar objectives and their measures across perspectives. It helps make a complex strategy more understandable by organizing and categorizing objectives and measures. It also reduces the amount of information and number of causal linkages that need to be drawn on a strategy map. A complex organization might have several strategic themes, with objectives and measures designed to gauge the effectiveness of the organization in pursuing those themes.

Strategy Matrix

The strategy matrix is another useful visualization and summarization tool. It displays objectives, measures, targets, and initiatives in one table. The strategy matrix can point to areas where scorecard elements might be out of balance. For example, there may be a cluster of initiatives around one objective, while other objectives have no supporting initiatives. This can be useful when prioritizing spending for projects. Typically, the strategy matrix will reflect a strategic theme, so one matrix is prepared for each theme.

3.2 Purpose of the Balanced Scorecard

Kaplan and Norton cite the following benefits of using the balanced scorecard [37]:

- Clarify and update strategy
- Communicate strategy throughout the company
- Breaking down strategic measures to local levels so that unit managers, operators, and employees can see what's required at their level to roll into excellent performance overall i.e. align unit and individual goals with strategy
- Link strategic objectives to long term targets and annual budgets
- Identify and align strategic initiatives
- Conduct periodic performance reviews to learn about and improve strategy
- Focusing the whole organization on the few key things needed to create breakthrough performance

- Helping to integrate various corporate programs, such as quality, re-engineering, and customer service initiatives

The Balanced Scorecard concept is built upon the premise that what is measured is what motivates organizational stakeholders to act. Ultimately all of the organization's activities, resources, and initiatives should be aligned to the strategy. The Balanced Scorecard achieves this goal by explicitly defining the cause and effect relationships between objectives, measures, and initiatives across each perspective and down through all levels of the organization

3.3 Critical Success Factors for BSC Development

Extensive research and evaluation of hundreds of Balanced Scorecard implementations has been done by the Balanced Scorecard Collaborative (the consulting organization established by the founders of the Balanced Scorecard methodology) and various other practitioners. A consistent theme emerges from this body of knowledge: the Balanced Scorecard is a cultural change initiative. Successful organizations use the Balanced Scorecard to create a culture of continual focus on strategy formulation, measurement, and revision. They create what Kaplan and Norton call a strategy focused organization.

The key elements in creating this strategy focused organization are as follows:

1. **Mobilize change through executive leadership.** Building a strategy focused organization usually involves significant culture change. Organizational change is an evolutionary process. Consistent executive leadership, involvement, active sponsorship, and support are critical to maintaining momentum through the challenges that organizations inevitably encounter.

   The executive team must be in agreement on strategies and must drive the scorecard process for it to be successful. Often executives are too busy to be intimately involved in the process, so a cross-functional team is formed. This can be successful if:

   - The executive team has first participated in facilitated sessions at which the fundamental mission, vision, and strategic themes are established.

- The team has the ear of the leadership and can readily escalate issues to executives for resolution.
- Executives continue to communicate their support for, and involvement in, the Balanced Scorecard initiative.

2. **Make strategy a continual process.** A strategic focus is not maintained if strategy formulation becomes a one-time activity. Feedback loops are needed to constantly focus attention on and reevaluate the strategy and the measures. To support strategy evaluation, tools for reporting and analysis should be deployed to enable analysis of the factors influencing the measures. The budget process also is often linked to strategy, and in some cases the Balanced Scorecard replaces traditional budget formulation as a way to allocate funds.
3. **Make strategy everyone's job.** This is done through strategic education and awareness and by cascading the scorecard down through the organization, so that business units, departments—or even individuals—create their own scorecards. The linkages to strategy are explicitly defined at all levels. This helps departments and individuals understand and find new ways to support the strategy of the organization. It also helps ensure that employees at all levels are being measured and compensated in ways that support that strategy.
4. **Align the organization to the strategy.** This involves evaluating current organizational structures, lines of reporting, and policies and procedures to ensure that they are consistent with the strategy. It can include re-alignment of business units or re-defining the roles of different support units to make sure that each part of the organization is lined up to best support the strategy.
5. **Translate the strategy into operational terms.** Tools like the strategy maps, cascaded scorecards, and strategy grids are used to integrate strategy with the operational tasks that employees perform daily. This ensures that tasks are done in ways that support the strategies.

3.4 Common Pitfalls

When Kaplan and Norton's second book, *The Strategy Focused Organization [37]* was published, the *Harvard Business Review* hailed the Balanced Scorecard as one of the most significant contributions to management practice in the last 75 years. However, despite its well-publicized successes, the majority of organizations that adopt a scorecard fail to reap the rewards they expect. In researching these disappointments, some common themes stand out:

1. **Measures that do not focus on strategy**

A common problem is that an organization will adopt some new non-financial measures, but fail to align the measures adequately with strategy. According to Dr. Norton,

> "The biggest mistake that organizations make is thinking that the scorecard is just about measures. Quite often they will develop a list of financial and non-financial measures and believe they have a scorecard. This, I believe, is dangerous [37]."

For example, in one case a bank's IT department had identified measures and benchmarks for being a world class IT department. According to those measures, they had done very well. However, the measures used by the IT department were not tied in with the overall business strategy and therefore discouraged the IT department from meeting the strategic business needs.

2. **Failure to communicate and educate**

A scorecard is only effective if it is clearly understood throughout an organization. Frequently, scorecards will be developed at the executive level, but not communicated or cascaded down through an organization. Without effective communication throughout the organization, a balanced scorecard will not spur lasting change and performance improvement.

3. **Measures tied to compensation too soon**

It is generally a good idea to tie compensation to the Balanced Scorecard. However, several factors suggest it can be a mistake to do that too early in the lifecycle of the scorecard.

- Rarely is an initial scorecard left unrevised. So, if an organization ties compensation to measures that are not in fact driving desired behavior, a powerful motivator has been instituted that will drive an unwise action.
- Data may be incomplete or inaccurate, so measures may not be correct. If employees' paychecks are adversely impacted, serious morale problems and invalidation of the scorecard inevitably result.
- It may take time to determine realistic targets, and penalizing people for failing to achieve an unreachable target will surely have a negative impact on morale and eventually profits.

4. No accountability

Accountability and high visibility are needed to help drive change. This means that each measure, objective, data source, and initiative must have an owner. Without this level of detailed implementation, a perfectly constructed scorecard will not achieve success, because nobody will be held accountable for performance.

5. Employees not empowered

While accountability may provide strong motivation for improving performance, employees must also have the authority, responsibility and tools necessary to impact relevant measures. Otherwise they will resist involvement and ownership. Resources must be made available, and initiatives funded, to achieve success. Employees are likely to need new information tools to help them understand the drivers of measures for which they are responsible so they can take action. These tools can include systems for analysis and early warning indicators, exception reports and collaboration.

6. Too many initiatives

Large, decentralized organizations usually find that crossover and duplication among initiatives can be identified. Cross-matching scorecard objectives with current and

planned initiatives can be an important way to focus and align a company. This method will identify cases where objectives are supported inappropriately. Rather than relying on budgeting for strategic funding, this process eliminates waste, speeds scorecard implementation, and helps an organization prioritize their initiatives to better support their strategy.

4 Related Work & Problem Definition

4.1 Related Work

4.1.1 Aligning Software process Improvement with business goals

According to Lugi Buglione & Alain Abran software process improvement (SPI) is not just a goal in itself [19]. ISO defines process improvement as an "action takes to change an organization's processes so that they meet the organization's business needs and achieve its business goals more effectively" [72]. SPI as a result is a means to bring about improved business results by continuously improving the performance of software processes. While it is projected that improving the software processes will result in enhanced business results, measures are considered necessary to verify, in business terms, the return on their investments in process improvement.

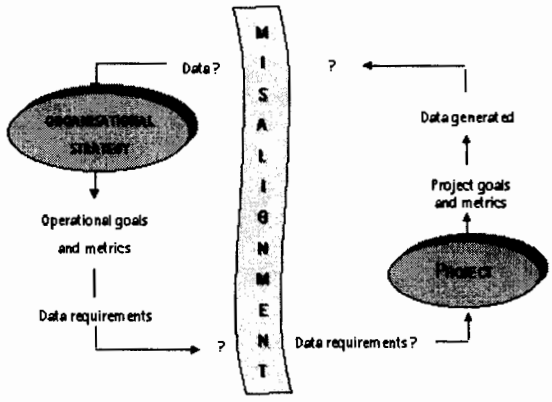

Figure 4.1 Organizational and project level strategy misalignment [48]

The value supplemented by aligning internal process activities with business objectives has been established as an important factor in maintaining business excellence. One of the best-known examples is Porter's Value Chain [73], which necessitates the need to classify those activities that directly add value to both internal and external customers. Whether the business strategy is to serve customers on time or to make sure that they receive the appropriate product for their requirements, internal processes need to mirror the strategy selected. If the processes have been effectively aligned with the organization's objectives, anyone external to the organization should be able to identify the company's strategy merely by observing its processes. European Software Institute

defines SIO as organizations whose main objective is software development and selling, or departments of software organizations that develop software as integrating part of its final products, or organizations that develop software for internal use in order to achieve better business results, or whose software department can be qualified as an independent organizational unit. However, how does the manager of a Software Intensive Organization (SIO) identify and define the critical and value-added activities that support the business strategy?

The principles of the strategic management system developed by Kaplan and Norton address two critical issues [19]:

- the alignment of the processes with the strategic business goals, and
- the identification and application of measures to comprehensively manage the performance of a business unit.

When organizational and project-level strategies are not aligned (Figure 4.1), an SIO can suffer negative consequences, such as [19]:

- a corporate strategy which is unknown or not used in the development of project goals and measures;
- data collection at the project level which does not support organizational goals;
- financial indicators tending to drive corporate decision-making;
- measurement carried out mechanically with no clear purpose;
- measurement carried out in isolation from other projects.

Two interesting ways to adapt the Balanced Scorecard have been proposed for the IT domain: the Balanced IT Scorecard (BITS) [40] [41] [42], proposed by the European Software Institute (ESI), which provides a new version of the four original perspectives (financial, customer, internal process, infrastructure and innovation) and the BSC of Advanced Information Services Inc. [43] [44], which considers the "employee" element as a distinct perspective, thereby expanding the analysis to five elements (financial, customer, employee, internal business process, learning and growth). Information from the employee perspective is obtained by surveying employees and asking each person to prioritise the KPA of the P-CMM. The strategic objective of this perspective is to "consistently meet or exceed employee expectations for training, compensation, communication, work environment, performance management, and career development.

Particular attention is paid here to the first of these. The ESI has adapted and extended the principles of the Balanced Scorecard to provide a well-defined approach to quantitatively managing SPI programmes in SIOs. The technology is specifically oriented towards SIOs which are aimed at introducing a quantitative management system to monitor business performance and to support the decision-making process with quantitative evidence. It provides an easy-to-use and widely applicable method for quantitatively managing SPI programmes and validating their effect on organizational business goals. More specifically, BITS supports:

(a) the identification and prioritization of software process improvement needs derived from the organization's business goals;

(b) the agreement and communication of the business strategy among the SIO's manager, sponsor and software engineers, thereby strengthening the required commitment from all parties;

(c) the identification of the critical set of factors affecting the achievement of the SIO's business goals;

(d) the selection of the minimum set of indicators to monitor the performance of the software processes.

The four distinct perspectives, derived from the original scorecard, are:

- **Financial Perspective**: How do our software processes and SPI add value to the company?
- **Customer Perspective**: How do we know that our customers (internal or external) are delighted?
- **Process Perspective**: Are our software development processes performing at levels sufficient to meet customer expectations?
- **Infrastructure & Innovation Perspective**: Are people, process, technology and organizational infrastructure issues being addressed to implement a sustainable improvement program?

A new, fifth perspective has recently been added, the **People Perspective**. In fact, personnel are the "prime material" (do you mean "raw material"?) of software development. The knowledge and experience of people represent a most important asset

and should not be relegated to the infrastructure level. Competence, satisfaction and retention are the three drivers to reaching higher productivity levels [42].

Edberg proposes a different view on how to adapt a BSC approach for IS measurement. In this case, the original four perspectives are translated in new four ones: project, product, process and performance. But the focus is limited to a single part of the organization [39].

4.1.2 A comparison of the Balanced Scorecard and GQM

Lugi Buglione & Alain Abran have compared to quantitative approaches recommended for developing and supporting software process improvement, that is, Goal Question metric (GQM) and the Balanced Scorecard (BSC) framework in their paper "Balanced Scorecard and GQM: what are the differences?". Their criterion for comparison between two above mentioned approaches was based on object of measurement, nature of the tool & strategy. According to them both tender the opportunity to implement a quantitative analysis of software projects, that's why they are often misinterpreted as either interchangeable or, on the contrary, mutually exclusive. After summarizing the key aspects of both approaches three main characteristics are proposed as a basis of comparison: measurement object, nature of approach and strategy.

GQM	*BSC*	*COMMENTS*
Goal	*Goal*	*GQM goals are referred to a project, while BSC goals are referred to a certain particular perspective and a certain particular tier in the organizational pyramid (hierarchy).*
Question	*Driver*	*The BSC Drivers can be compared to GQM Questions since they represent the way to express how a goal can be achieved*
Metric	*Indicator*	*The BSC (lead) indicators can be compared to the GQM Metrics, since they reflect the control mechanisms and values used to verify the (indirect) achievement of goals (through the selection and use of a particular driver)*

Table 4. 1Comparison of GQM and BSC structures [19]

Goal # x

Analyse (*object*) for the purpose of (*purpose*) with respect to (*quality focus*) from the viewpoint(s) of (*viewpoint*) in the following context (*environment*)
List of the "Question & Metric" elements deployed with a comment on results achieved: Q1 ..... Q1.1 ..... M1.1 ..... M1.2 .....

Figure 4.2 GQM Plan example [19]

There is, of course, a clear parallel between the decomposition of the GQM goals in question and the solution of questions through the list of measures, and the decomposition of BSC goals into drivers, which can be achieved through a quantitative control on the performance indicators. However, the higher-level strategic view is missing from the GQM technique. Thus, interpreting GQM as a substitute for the BSC would be a mistake [19].

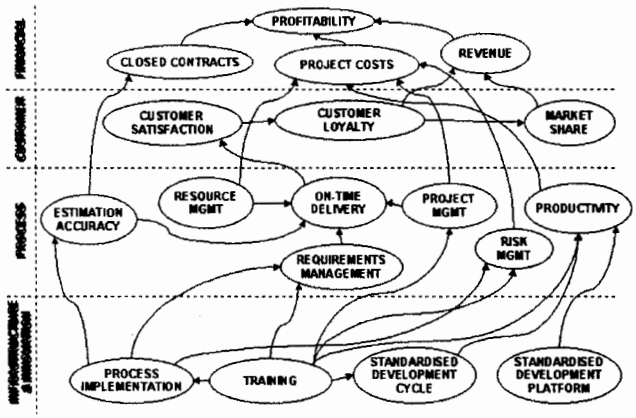

Figure 4.3 ESI BITS strategic map [42] © ESI 2000

Now the question arises that which technique is richer than the other. The question of the richness of GQM was investigated by Offen & Jeffery [45], who proposed a framework called **M^{3}P** (Model, Measure, Manage Paradigm) to extend QIP/GQM to remedy the "*lack of well-defined links between the numerical data and the surrounding development and business contexts.*" To do so, M^{3}P proposes a three-tier stakeholder hierarchy (Figure 4.4); the business, process and project measures (using three distinct GQM decompositions) must be taken into account, and linked and aligned from operational to strategic issues.

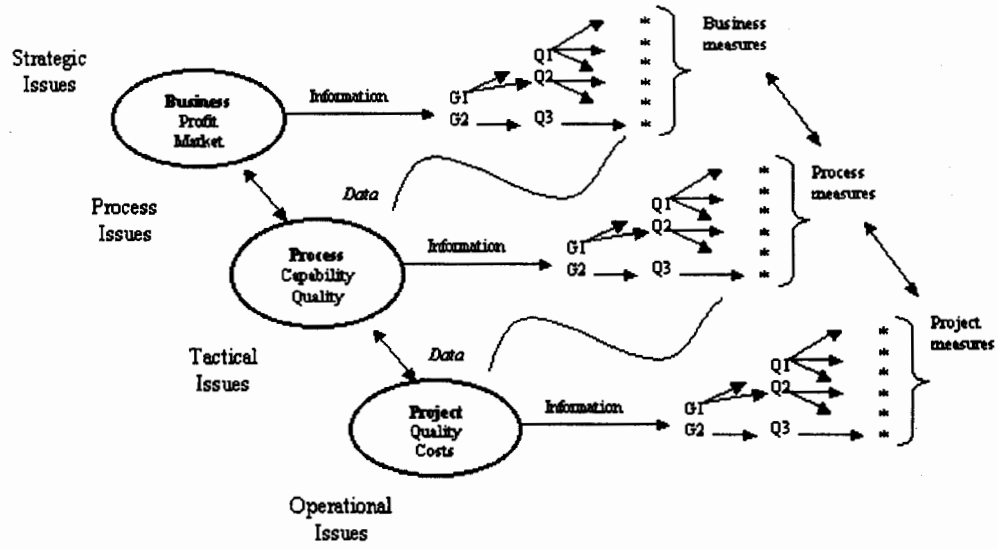

Figure 4.4 – The M³P meta-model stakeholder hierarchy [44]

Similarly for the opposite case: the correspondence between the structures of the GQM and GDI (Goal-Driver-Indicator) structures can facilitate the deployment and alignment of different scorecards, one for each organizational level, as recommended in some studies, GAO [46] and Pollard [54] for instance. This mechanism, also known as the *multi-level balanced scorecard*, can be designed using either a top-down or a bottom-up approach to avoid a potential misalignment across multiple levels of issues. As suggested in [48], the definition of each BSC goal could be reinforced by the elements proposed in GQM (purpose, issue, object and viewpoint). Multilevel Balanced scorecards can solve the problem but the authors have not provided any additional metrics to incorporate multilevel balanced score-carding technique into existing BSC paradigm.

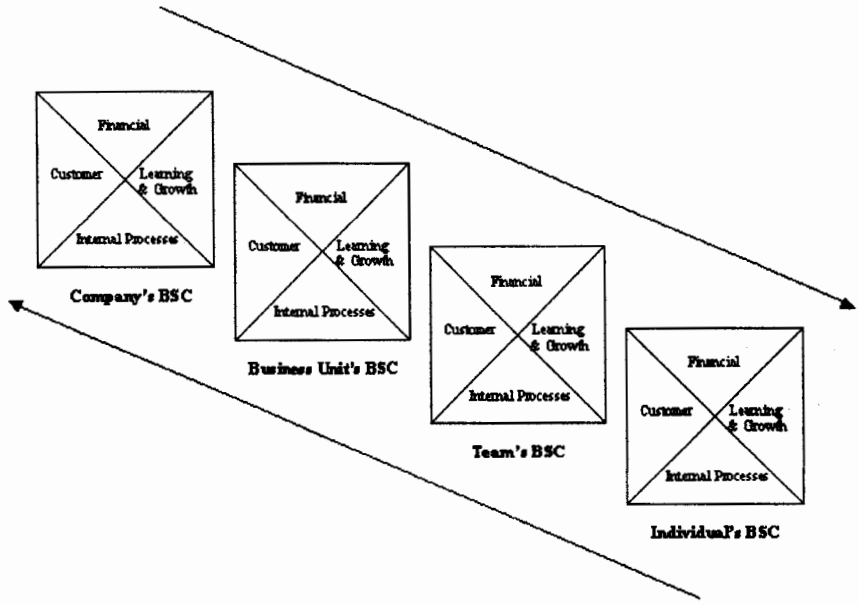

Figure 4.5* Multi-level BSC with four tiers *[POLL]

Becker and Bostelman [48] have tried to integrate the best of BSC and GQM, and have proposed a common measurement framework where the integration of BSC and GQM allows for a more detailed focus on the organizational measurement, facilitating the alignment between the strategic and project levels. It must be noted that this solution takes into account a refinement in defining high-level goals aligned with the organization's strategy for achieving the vision, but with just a single-level deployment at a time. Moreover, the solution does not provide any way to measure project's performance against organizational strategic goals.

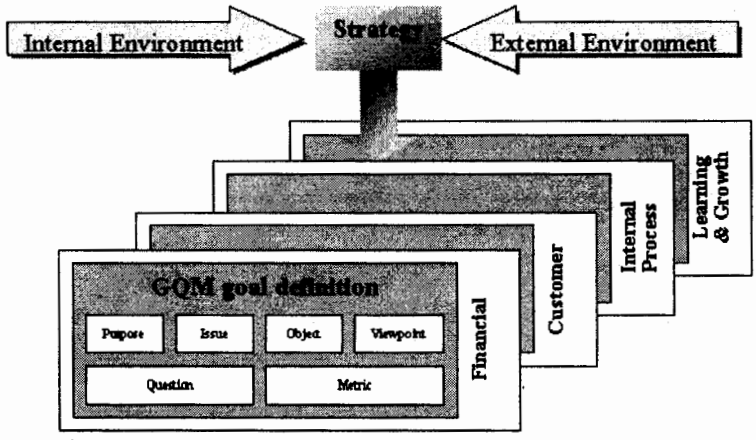

Figure 4.6 The integration of GQM and BSC [BECK99]

As it can be seen, GQM is indeed a flexible technique which can be used in multiple contexts, while the BSC-type framework provides a more comprehensive context of interpretations. More specifically, the added value in the BSC approach resides in its development of a causal relationship chain among the business goals of the various perspectives, allowing for the alignment of business and operative goals for achieving success.

4.1.3 Weighting the measures for effective performance measurement

Kaplan & Norton [36] put forward that balanced scorecard ought to imitate four types of measures (1) financial & non financial; (2) external i.e. financial & customer, and internal i.e. critical business processes, innovation, and learning & growth; (3) inputs/drivers and outcomes/results; and (4) objective, easily quantifiable measures and more subjective, judgmental measures.

The above mentioned work renders little or no direction in some cases on how to make tradeoff among the significant measures when evaluating the performance of a metric based organization, they speculate that the balanced scorecard renders biased reward systems "easier and supplementary justifiable to administer ... and also a lesser amount vulnerable" [36].

Extending the in informativeness criterion to a multi-measure system, analytical management accounting research demonstrates that non-zero weights should be attached to all performance measures that: (1) are sensitive to a manager's actions; (2) can be measured with some precision; (3) are not perfectly correlated with other measures in the system; and (4) lead to outcomes desirable to the owners of the firm [63][64]. This research further demonstrates that the relative weights placed on the performance measures will depend on their relative sensitivity, precision, and congruency. Although no prescriptions concerning the exact weights to be employed on these performance measures are made, the general conclusion derived from this literature is that weights of zero are inappropriate[70][71].

Analytical investigation [56][57] on the use of subjectivity in performance assessment and compensation focuses on the resolution of subjective bonus stuff, the drawbacks of subjective performance assessment [58][59], and the factors influencing the qualified weights placed on subjective versus objective performance measures in incentive

contracts [60]. Most of this research does not scrutinize how different types of performance measures or different forms of subjectivity should be incorporated. An exception is Murphy & Oyer's (2001) model [60], which suggests that the relative weights on the subjective measures will be higher in privately held companies, larger companies with more top managers, less autonomous business units, companies with substantial growth opportunities, and companies where accounting profits and shareholders returns are less highly correlated.

A related case study of automobile dealerships by Gibbs [61] finds that subjectivity (defined as the presence of any subjective bonus payment or as "discretionary bonus" as a present of total compensation) is positively related to departmental interdependencies, financial losses, the manager's tenure, and the achievability of formula based bonuses. While these two empirical studies provide insight into who uses subjectivity in compensation contracts, they provide little insight into how subjectivity is applied or performance is evaluated when multiple types of performance measures are incorporated into bonus contract.

Other studies tackle the relative importance placed on the various types of measures highlighted by Kaplan & Norton (1996)[36]. These studies inspect how human information processing capabilities and decision strategies influence the types of information individuals use when assessing performance. The behavioral experiments put forward that issues such as information overload and cognitive biases can play a significant role in the relative weights placed on different types of balanced scorecard measures[67][68]. In particular, evaluators normally place greater or exclusive stress on certain types of measures. Although many of these models say little about the specific types of performance measures that should be included in compensation contracts, several studies extend these papers to investigate the role of non financial measures [64][65]. These models suggest that financial measures unaccompanied are unlikely to be the most efficient means to motivate employees, and demand straight how incentives based upon non financial measures can improve contracting by incorporating information on agent's action that is not fully captured in contemporaneous financial results. A number of cross-sectional pragmatic studies draw upon in formativeness theories when examining the relative weights placed on individual, non-financial or subjective

performance measures [60][69][70][71]. The effects of noise on performance measures choice are examined using the variance in objective, financial measures. In these tests, the weight placed on financial measures is predicted to decrease in their noisiness, while the weight on other types of measures is predicted to increase. The weight placed on these measures is expected to be higher when the in formativeness proxies are greater.

A significant limitation of the analyses is the deficient in of data on non financial or subjective performance dimensions forcing researchers to use indirect proxies for the measure's in formativeness. Consistent with the non-financial performance measure and balanced scorecard literatures, I assumed that current financial measures are potentially incomplete, and that other indicators of future financial performance can provide incremental information on the manager's actions [36][37][64][65].

It is assumed that measures that are more predictive of future performance provide greater information on the congruence between the agent's actions and the outcomes desired by the principal. In an agency setting, the coefficients (or weights) associated with the non-financial performance measures in a structural model linking non-financial measures to future financial results, i.e., the "business model" and the coefficients (or weights) used which complicates our hypothesis development and subsequent empirical tests. The lack of direct correspondence between the weights in the business model and compensation model only arises in models that do not allow for private information by the agent [74].

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4.2 Problem Statement

Both GQM and Balanced Scorecard methodologies use organizational goals; however, as it is obvious from the related work that the overall organizational focus is missing in GQM technique. However, the use of Balanced Scorecard forces an introspection of the organization against a standard way of investigating the fitness of an organization and organizing the purpose of eventual measures and indicators. The GQM then follows as a disciplined way to derive the specific measures and indicators needed. So, a hybrid technique needs to be developed by using both by using best of the both mechanisms to achieve better results. Many approaches and extensions to the existing BSC framework have been presented, but there is a lack of any comprehensive and practical systematic approach that can produce instantly measurable results. As related work reflects that often technical and business sectors of IT organizations work in opposition, towards different goals and objectives, due to dissimilar considerations but there is no case study provided to elaborate that whether this problem actually exists or not. In this research venture I have tried to find whether this problem actually exists in the organizations or not and if it exists then strategic and project management systems need to be aligned with overall organizational strategy to ensure long term growth and stability, and competitiveness.

As per previous discussion classical text and current research address and emphasizes the issue of aligning software process improvement with business goals and is an issue which has become a hot topic in many business and scholarly discussions.

Balance Scorecard has been proposed for software companies with modifications in the original framework, but there are no weaknesses presented in the implementations of original BSC framework in software industry and the need for its alteration. Susan Brock at. al. [6] has written that the Balanced Scorecard in its application to projects, in its present form, does not contain a sufficient theoretical knowledge base applicable to projects. Specifically the four Balanced Scorecard perspectives do not adequately reflect the relevant project management focus areas. Many researchers have written the inadequacy of BSC for Software Projects but they did not demonstrate the application of original BSC on software project.

I have designed and implemented the original framework of Balanced Scorecard on software projects in software intensive organization, and have analyzed the results that either the BSC is successfully managing the performance of software projects as well as the overall organizational performance or there is a need for some alteration in its framework.

4.3 Research Methodology

The best way to investigate about the inadequacy of original framework of BSC for potential misalignment between strategic and project management frameworks in an organization was through a case study in a scientific way rather than relying on common wisdom/argument I applied Balanced Scorecard on software development projects in Software Development Organization in order to measure organizational performance as well as the performance of software project. As BSC follows the vision, mission and strategies of the company, so, firstly the BSC at corporate level was designed. Because the company had more than one projects so BSC at project level was designed by cascading it with company level of BSC. Then, in final, I was able to construct and implement the BSC at project level by cascading it with the higher levels of BSCs.

All the information and the data about the company and projects was provided by the Project Managers of the concerning projects. The performance data of the project against four perspective of the BSC was collected on the performa designed to collect data. The performance data was calculated by the corresponding Project Manager.

In the end the performance data was analyzed to analyze whether there exists a potential misalignment between strategic and project management systems.

5 Case Study

5.1 Limitations of case study

Prior to taking into consideration the case study it is necessary that certain limitations be mentioned. The BSC was not previously implemented in the company in which the case study was conducted.

The data concerning project performance against the defined objective in Projects was provided by the corresponding project managers, there can be a potential for biased data capture.

During the project interaction remained to Project Manager only. The managerial activities performed by the Project Manager were his own decision to improve the performance toward the objectives.

5.2 Introduction about Company – ESOLPAK

Electronic Solutions Pakistan (Pvt.) Ltd. (ESOLPK) is a leading software services and product development company, headquartered in Islamabad, Pakistan. ESOLPK has established an impressive list of clients ranging from large enterprises to many mid-tier and start up companies. They adopt a client focus strategy, bringing high value to their clients by providing high quality cost effective solutions through state-of-the-art project management capabilities. ESOLPK is an established organization, well positioned to deliver quality services to Asian, European and North American markets. They focus on building long term, 'value based' relationship with clients and alliance partners. They are an ISO 9001:2000 company compliant with CMMi processes and procedures. Their documentation follows IEEE standards. Several in house methodologies and best practices have been developed to provide quality services to our clients. ESOLPK has successfully completed over 150 projects, varying from tens of man hours to tens of man months. They specialize in Decision Support Systems, Management Information System, Business Intelligence Systems, e-Business, e-Government, Retail, Healthcare, Resource Management, Supply Chain, Defense and military related software.

As being an offshore software company, they have experienced phenomenal growth exceeding industry standards due to dedicated work force, quality standards, excellent

customer relationships and forward-looking vision and exceptional leadership of ESOLPAK's founding CEO, Mr. Ahsan Ahmad.

To provide fast and most reliable integrated computer services on turn key basis utilizing state-of-the-art solutions to meet the challenges of dynamically growing present and future business requirements of the customer ESOLPAK strives for client's enchantment and relationship based on integrity and mutual trust. ESOLPAK aims to gain sustainable competitive advantages by creating teamwork environment. Further, ESOLPAK is committed to provide superior training and technical environment for personal and professional growth to provide highest quality products/services.

ESOLPK takes pride in providing High-Value Quality Focused Software Solutions. The company brings its clients' the winning impetus by employing the latest software development tools, the modern software development platforms, the latest project management techniques and up-to-date software engineering practices.

Followings are the broad classifications:

1- Business Applications

ESOLPK's core service is to build application and database solutions on behalf of clients in a variety of industries. Its focus in application development has been in the following broad technical classifications: Web design, Web and database applications e-Commerce applications and transaction engines Software re-engineering and reverse engineering Component based development Mission critical applications

ESOLPK's expertise in developing these types of applications are rooted in the fact that they have skills in the core technologies such as XML, .NET, Java, Oracle and C++.

2- Enterprise Applications

ESOLPK offers a complete range of enterprise level business applications, enabling an organization to automate its business functions. ESOLPK's suite of business applications help the organization well equipped for handling the challenges offered in today's competitive market. Our applications provide timely and detailed information analysis so that the management can take decision in a proactive manner. The Enterprise applications offered by ESOLPK are listed below: Decision Support Systems Enterprise Resource

Planning System Customer Relationship Management Knowledge Capture Content Management & Development Human Resource Management Financial Management Supply Chain Management System

3- Businesses Process Outsourcing

ESOLPK is a provider of top notch offshore customer contact solutions, their customized solutions primarily entail inbound and outbound telemarketing and business process outsourcing. At ESOLPK they truly believe that they are a natural extension to their valued clients operations. By bridging the gap they provide dramatic cost savings and also provide quantifiable quality and performance enhancements. Their vision is to be the model of success for business process outsourcing in offshore markets.

5.3 Vision & Mission Statement Statements

Corporate Vision

To make people and businesses realize their true potential by carving out best solutions.

Mission Statement

Ensure excellence and competitiveness to clients in the changing horizon of business world by providing innovative solutions, to make a win-win result for all the stakeholders.

5.4 Strategic Objectives

- Strengthening ties with the clients.
- Understanding and meeting the needs of the clients.
- Ensuring satisfaction of both internal and external clients.
- Innovating in everything they do. Investing in latest hardware and software technologies.
- Promoting a culture of trust, mutual respect and competence.
- Fostering open communication.

- Prioritizing training of employees.
- Promoting team spirit and professional values.
- Continually improving processes to get better quality. Above all striving to achieve corporate excellence.

5.5 Balanced Scorecard at Corporate Level

The BSC's strategic objectives were developed using the "Balanced Scorecard Approach." The Balanced Scorecard Approach says the success of an organization is dependent upon balancing various aspects of the organization to achieve overall success. Manager must look at the organization from four basic perspectives:-

- **The Financial Stakeholder Perspective** – What must we do to satisfy our financial stakeholders? Their key financial stakeholders are their clients, Pakistani public, taxpayers, and those in government concerned with the impact of their actions and services. Their stakeholders are interested in the value they bring to the nation through our business.
- **The Customer Perspective** – What must we do to satisfy and retain current customers and attract new customers? Customers in this context are primarily the end –user of our products or services.

- **Internal Business Perspective** –What core internal business processes drive the results we want to achieve under the customer perspective and the financial stakeholder perspective? For these processes, what level of performance they must achieve?

- **Learning and Growth Perspective** –What must we do to develop people and technology to support our internal business processes and improve our capabilities so that we can continue to add value for our customers and our financial stakeholders?

Keeping in view above-mentioned questions strategic goals were translated into goals across four perspectives to achieve the organizations' vision and mission. These goals against four perspective of balanced scorecard are as:-

5.5.1 Financial Perspective

- Be financially sustainable in the service of our mission.
- Making decisions in the best long-term interests of our financial shareholders.

5.5.2. Customer Perspective

- Build and maintain the good long-term relationships with our customers.
- Provide reliable integrated services to our customers.
- Deliver creative and effective customized solutions to payers.
- Provide innovative and high quality of products/services.

5.5.3 Internal Business Process Perspective

- Follow the defined processes model.
- Uphold the proper defined procedures.
- Optimize the mix of our workforce and teamwork environment to achieve competitive advantage.

5.5.4 Learning and Growth Perspective

- Provide proper education and training for high quality of services/product.
- Improve business practices & efficiencies acting with integrity, high ethical standards and motivation.
- Building an environment that encourages open communication, participation, honesty and candor.

Corporate Balanced Scorecard

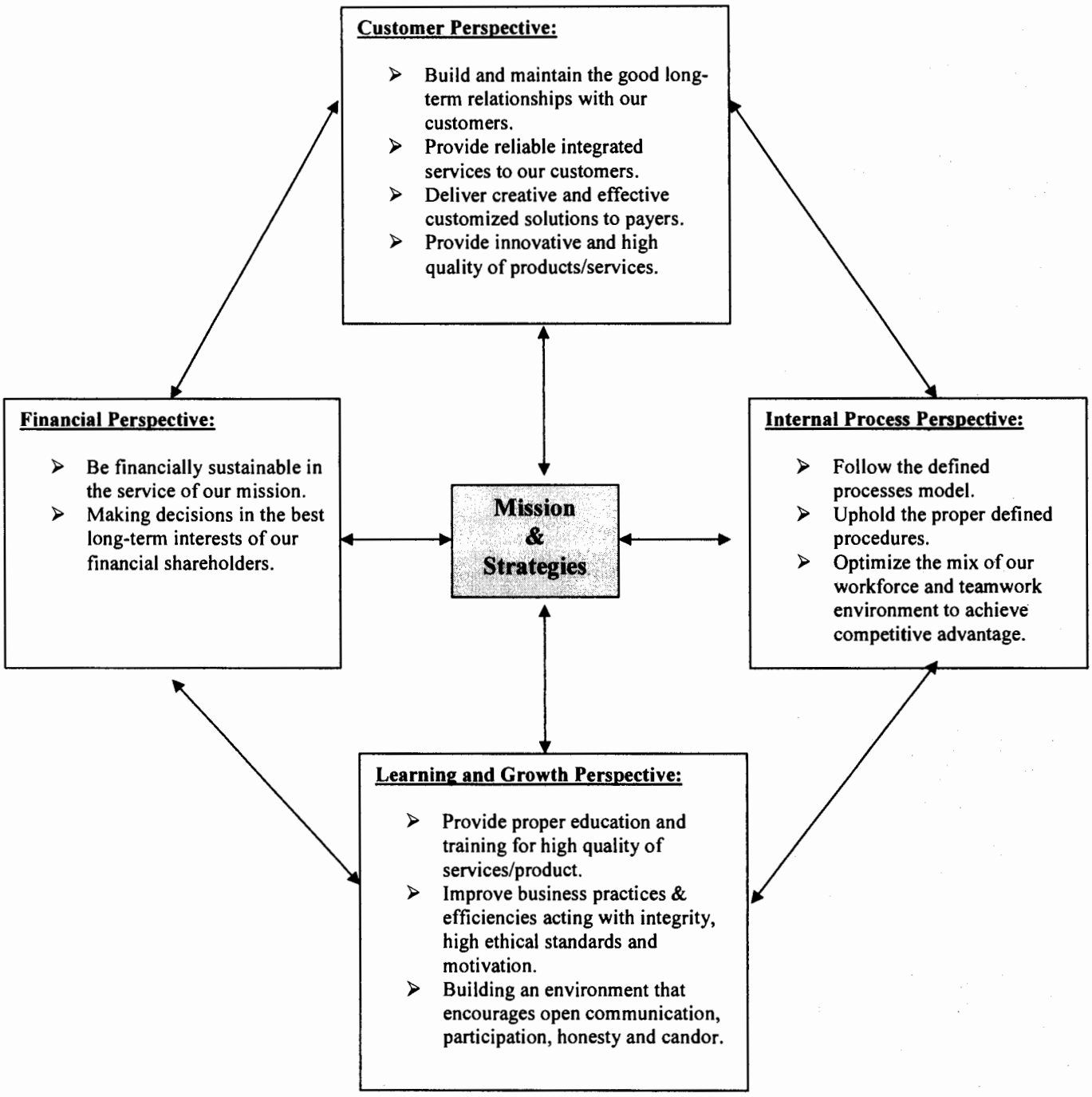

Figure 5.1 Corporate BSC

5.6 BSC at Software Development Unit

If we look at ESOLPAK, the company has four Sub Business Units:-

i. Consultancy Unit
ii. Software Development Unit
iii. Networking Unit
iv. Manpower Training Unit

My main concern was to implement the BSC at Software Development Project. So, BSC at Software Development Unit level was constructed by cascading it with the BSC at corporate level so that the organizational strategic goals should be aligned.

Strategic objectives across four perspective of Software Development Unit are as under which are cascaded with the corporate level strategic objectives:

5.6.1. Financial Perspective

- Making clear and sound business decisions.
- Planning and managing well.
- Optimum utilization of recourses.
- Efficient in prediction capabilities.
- Introducing variety of products.
- Attract and maintain the valued customers.

5.6.2. Customer Perspective

- Fully satisfy customer requirements and aggressively resolve problems in the light of present and future needs to deliver best value services.
- Delivering what we promise.
- Achieving customer satisfaction.
- Deliver services consistent in value & quality.
- Strong orientation to service and the customer.

5.6.3. Internal Business Process Perspective

- Follow the defined/standard rules and regulations.
- Anticipating, shaping and effectively responding to relevant external forces and events.

- Being responsive to the needs of customers
- Being reliable, dependable and trustworthy.
- Manage business risk.
- Communicating clearly, consistently, and openly with everyone we deal with.
- Use performance metrics to drive best business practices and achieve high quality results.

5.6.4 Learning & Growth Perspective

- Emphasizing the positives, celebrating successes and strengths, and constantly striving to improve our performance.
- Be a great place to work where motivated, prepared staff, shares goals, care deeply about their work, and support one another and the people they serve.
- Recognize and reward exemplary performances
- Reduce cost and improve quality through leadership and teamwork.
- Contribute to human services research and innovation.
- Employee Satisfaction.
- Train and develop our employees

BSC at Project Level

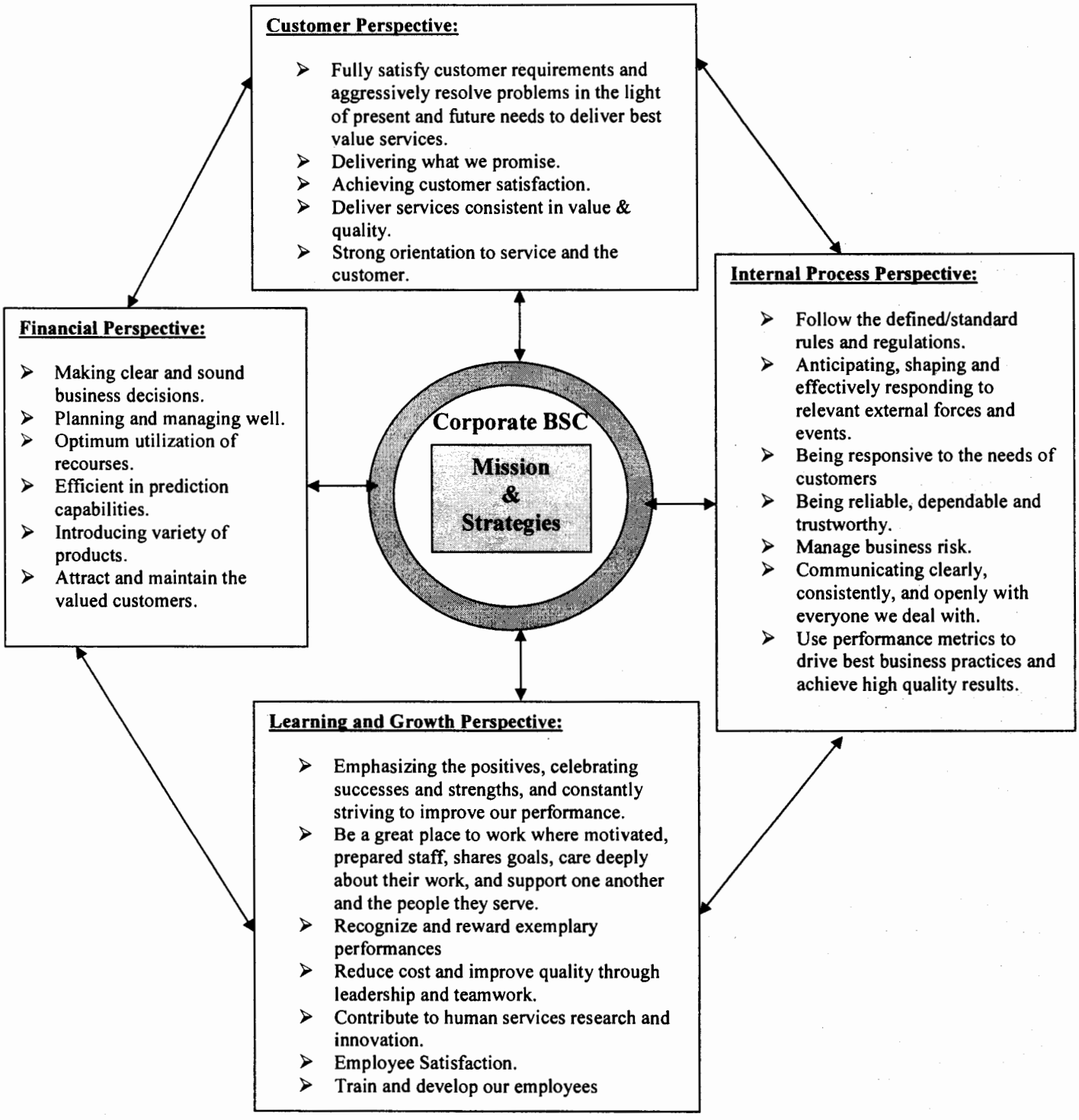

Figure 5.2 Software Development Unit BSC

5.7 Implementation of BSC at Project Level

5.7.1 Introduction to Software Projects

A number of project are going on in the company like DR SIR, PharmaSoft, E-HMS, DR SIR & E-Cars. For our case study two projects DR SIR & E-Cars were selected.

DR SIR is a due diligence tool kit for healthcare industry. DR SIR is a software suite designed to optimize the performance of complex unit operations of hospitals. It does this by using state-of-the-art technologies to improve overall hospital productivity.

E-Cars is a complete web-based trading system, developed in latest .NET technology. The system comprises of online automobile trading, financial, HR, inventory, logistics, dealers & affiliates management, sale/purchase, workshop management system and many more features.

5.7.2 BSC at Software Project Level

The project level's strategic objectives are developed using the Balanced Scorecard approach and cascaded with strategic objectives of BSC at Software Development Unit of ESOLPAK. Performance measures against each strategic objective is defined which support the accomplishment of respective strategic objective.

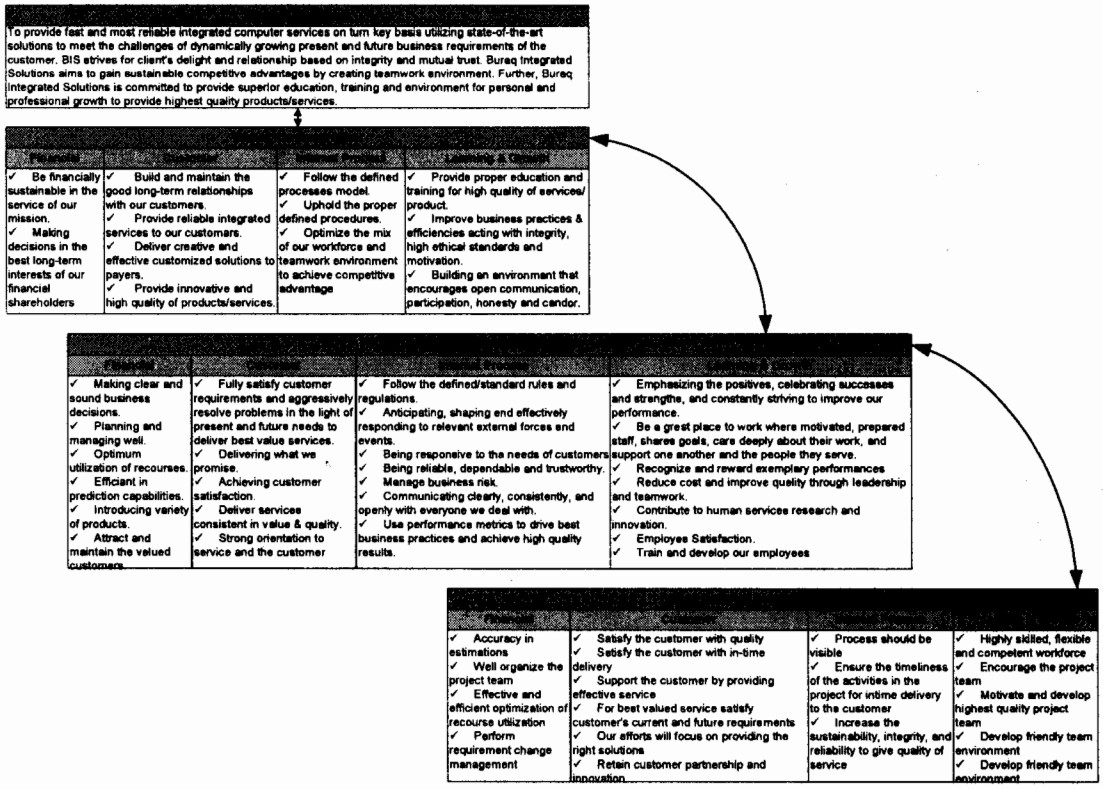

Figure5.3: BSC at all levels of ESOLPAK

5.7.2.1 Financial Perspective

The objectives and their performance measures of financial perspective are following:

F1		% accuracy in the cost estimation
		% accuracy in the time estimation
		% accuracy in the effort estimation
F2		Production of the project team
		Project team collaboration
F3		% recourse utilization allocated to project
		Effectiveness of expenditures
F4		% changes performed by change management procedure

5.7.2.2 Customer Perspective

The objectives and their performance measures of customer perspective are defined as following:

C1		How much customer is satisfied with quality
C2		How much customer is satisfied with in-time delivery

C3		Response time to customer request
		Level of communication with customer
C4		Current requirement entertained
		Future requirements entertained
C5		Level of focus on demanded solution
C6		Reviews performed with customers
		Project briefings to customer
		Progress visible to customer

5.7.2.3 Internal Business Process Perspective

The objectives and their performance measures of internal process perspective are shown below:

P1		Processes documented
		Plan each process before execution
P2		Number of activities reviews that were completed during the period
		More effort performed on critical activities
		Manage unplanned/vacant working days

P3	[redacted]	Expert reviews
		Test performed
		Defects rectified

5.7.2.4 Learning and Growth Perspective:

The objectives and their performance measures of learning and growth perspective are following:

L1	[redacted]	Training in the relevant technologies
		Training about the domain field
L2		Level of appreciation
		Level of rewards
L3		Salary Satisfaction
		Work distribution
		Facilities provided
L4		Level of coordination among the team
		Level of supporting among the team

5.8 Data Collection

Two types of information were collected from the Project Managers of E-Cars & DR SIR project. One type of information is based on the performance measurement data and the other information is the list of managerial activities performed by the project manager to improve the performance in the light of achievement of the strategic objectives defined against the four perspectives of the Project BSC.

A quantitative data collection technique was adopted to collect the performance data against each performance measure defined in E-Cars & DR SIR project BSC. It was decided to measure the performance after every three weeks period. Each performance measure was assigned a target value in percentage, which remained fixed through out the project against all the chunks of performance duration. So during the each performance duration the Project Manager had to achieve the same target. Most of the measures were also taken in the percentage.

List of managerial activities performed by the Project Manager to improve the performance towards the defined targets were also collected in list format along with the performance measurement data.

The performance data with the lists of managerial activities were collected on the defined performa (Appendix-A) which contains all the strategic objectives, their performance measures and targets.

5.9 Mathematical formulation of metrics

Let δ is the overall organizational performance, η_z is the performance of the project z, ξ is the perspective's performance, λ is the goal's fulfillment, ζ is the sub-goals's fulfillment, φ is the question's fulfillment, ξ_j is the performance of perspective i, λ_j is the fulfillment of goal j, ζ_k is the fulfillment of sub-goal k, φ_l is the fulfillment of question l, κ_m is the answer to the question by employee m where total number employees is r, $w_{\xi i}$ is the relative weight of perspective i, $w_{\lambda j}$ is the relative weight of goal j, $w_{\zeta k}$ is the relative weight of sub-goal k & $w_{\varphi l}$ is the relative weight of question l.

If there are n perspectives, then

$$\delta = \sum_{i=1}^{n} \xi_i w_{\xi i} \leq 1 \quad where \quad \sum_{i=1}^{n} w_{\xi i} = 1$$

.....i

$$\xi_i = \sum_{i=1}^{n} \lambda_j w_{\lambda j} \leq 1 \quad where \quad \sum_{j=1}^{o} w_{\lambda j} = 1$$

.....ii

$$\lambda_j = \sum_{k=1}^{p} \zeta_k w_{\zeta j} \leq 1 \ where \ \sum_{k=1}^{p} w_{\zeta j} = 1$$

.....iii

$$\zeta_k = \sum_{l=1}^{q} \phi_l w_{\phi l} \leq 1 \ where \ \sum_{l=1}^{q} w_{\phi l} = 1$$

.....iv

$$\phi_l = \sum_{m=1}^{r} \kappa_m / r \leq 1$$

.....v

From i,ii,iii,iv,v we have

$$\delta = \sum_{i=1}^{n} \sum_{j=1}^{o} \sum_{k=1}^{p} \sum_{l=1}^{q} \sum_{m=1}^{r} \kappa_m / r \, w_{\phi l} w_{\zeta j} w_{\lambda j} w_{\xi i} \leq 1 \text{ for all values of } K.$$

&

$$\eta_z = \sum_{i=1}^{n}\sum_{j=1}^{o}\sum_{k=1}^{p}\sum_{l=1}^{q}\sum_{m=1}^{r} \kappa_m / r\, w_{\phi i}\, w_{\zeta j}\, w_{\lambda j}\, w_{\xi i} \leq 1 \text{ for all values of } K \text{ that belong to project z.}$$

5.10 Data Analysis

For estimating the overall performance of the projects through BSC (Appendix-B), weightage was assigned to its four perspectives as well as each objective and Measure in BSC as proposed by the CEO. On the basis of metrics defined above the performance of each performance measure was calculated, after that the performance of each objective was calculated and on the basis of that the performance level of ach perspective in the relative project was calculated.

Appendix-C shows the mapping of project management nine areas with the activities performed by the project manager to improve the performance of project toward the objectives defined in four perspective of the project balanced scorecard. Mapping table shows the level of usage of each management area during the project to improve the performance against BSC approach. Level of usage of PM Areas has been categorized in four usage level i.e. Poor Use (1% to 25%), Partial Use (26% to 50%), Moderate Use (51% to 75%) and Highly Use (76% to 100%).

The objective "*Processes should be visible*" (P1) of Internal Process Perspective was measured by the measurement "*% Processes documented*" and "*% plan each process before its execution*". To improve the processes visible some managerial activities have been performed like to document all the processes and activities needed to identify, define. To become the each process visible it was identified, combine, unify and coordinate with other processes before its execution. The objective "*Changes should be managed*" (F5) was measured by measurement "% Changes performed by change management procedure". To improve the performance toward this objective (F5) some managerial activities like reviewing all changes requests, approving changes and controlling changes were exercised. These managerial activities are related to the Integration Management area of PMBoK (2004) and used in this project integrated with BSC at a Partial level of usage (Appendix-C).

The objective "Our effort will focus on providing the right solutions" (C5) of Customer Perspective was measured by the measurement "Level of focus on demanded solution". Our efforts towards right solution has been retained and improved by defining the scope definition and scope controlling that have given the vision about the work that were actually required to do and that not to do. Another objective *"Changes should be managed"* (F5) of Financial Perspective was measured by the measurement "% changes performed by defined procedure". To improve the performance toward this object (F5) some managerial activities like scope defining, scope controlling were also exercised. These managerial activities are belonging to the Scope Management area of PMBoK (2004) and used in this project integrated with BSC at a Partial Level of usage (Appendix-C).

The objective *"accuracy in estimation"* (F1) of Financial Perspective was measured by the measurements of *"% accuracy in the time estimation"*. Time estimation has a great financial impact. For improvement in accuracy in the time estimation, some managerial activities have been performed like *defining the activities* those could be estimated and need to be performed to produce the various project deliverables, *estimating the duration* of the defined activities, and *estimating the recourses* required for their completion. To improve the performance toward the objective *"Ensure the timelines of the activities in the project for in-time delivery to the customer"* (P2) of Internal Process Perspective, some managerial activities have been performed like *sequencing the defined activities* and noted down their dependencies to avoid from any deadlock, and estimated the type and quantity of resources for each activity completion so that there might not be any delay in-time delivery. To improve the in-time delivery, *activities were reviewed* those have to complete during the period, and for those defined activities the *schedule was controlled* so that there should not be any unprocessed change in the performance of any activity. These all managerial activities performed to improve the performance toward the achievement of the objectives (F1, P2) are related to the Time Management area of PMBoK (2004) and used in this project integrated with BSC at a Highly Level of usage (Appendix-C).

The objective "*accuracy in estimation*" (F1) of Financial Perspective was measured by the measurement "accuracy in the cost estimation". To improve the performance toward this objective some managerial activities have been performed like defining the activities those needed to be performed to produce the various project deliverables, developing an approximation of the cost of the resources needed to complete project activities. Another objective "to ensure project resources are allocated in a cost-effective way" (F4) was measured by the measurement "level of effectiveness of expenditures". The effectiveness of expenses is improved by the activities of estimating influencing values of expenditure, by controlling the factor that create cost variations and controlling change to the project budget. These managerial activities performed to improve the performance toward the achievement of the objectives (F1, F4) are related to Cost Management area of PMBoK (2004) and used in this project integrated with BSC at a Moderate Level of usage (Appendix-C).

Objective "*satisfy the customer with quality*" (C1) of Customer Perspective was measured by the measurement "how much customer is satisfied with quality". To satisfy the customer with quality of service is improved with the reviewing the milestones in the presence of customers. In doing so the quality is improved with customer satisfaction and got the customer verification. Another objective "*increase the sustainability integrity and reliability to give quality of service*" (P3) was measured by the measurement "expert reviews", "test performed" and "defect rectified". To improve in the performance toward this objectives (P3) some managerial activities have been performed like identifying the quality standards, applying the planned systematic quality activities of testing, reviewing and debugging, and monitoring the results to determine whether they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance. These all activities performed to improve the performance toward the achievement of the objective (C1, P3) are related to Quality Management are of PMBoK (2004) and used in this project integrated with BSC at a Highly Level of usage (Appendix-C).

The objective "*well organize the project team*" (F2) was measured by the measurement "production of the project team" and "*project team collaboration*". To improve the performance towards this objective (F2) some management activities has been exercised

like identifying and documenting roles, responsibilities, reporting relationships, arranging the recourses needed to complete the project. Another objective "*encourage the project team*" (L2) was measured by measurement of "*level of appreciation*" and "*level of rewards*". Performance has been improved toward the team encouragement by some activities providing the feedback, resolving the issues, appreciating on achievements, rewarding in the recognition of effective services. The objective "*highly skilled flexible and competitive work force*" (L1) was measured by the measurement "*training in the relevant technologies*" and "training about the domain field". Another objective "*motivate and develop highest quality project team*" (L3) was measured by the measurement of "*salary satisfaction*", "*work distribution*" and "facilities provided". And the objective "*develop friendly team environment*" (L4) was measured by the measurement "*level of coordination among the team*", "*level of supporting among the team*". It has been observed that the performance towards these objectives (L1,L3,L4) has been improved by improving the competency of team member by providing the training in required technologies and domain field, encouraging by providing the competitive salaries packages and other facilities, and improving the interaction among the team members by providing corporate environment. These managerial activities which performed to improve the performance towards the objectives (F2, L2, L1, L3, L4) are related to the HR management of PMBoK and used in this project integrated with BSC at a Highly Level of usage (Appendix-C).

Objective "*support the customer providing the effective services*" (C3) was measured by the measurement "*response time to the customer request*" and "*level of communication with customer*". To improve the performance toward this objectives, some managerial activities has been performed like making needed information available to the customer in a timely manner, making the effective communication with customer to satisfy the customer requirement and to resolve the issues faced by the customer. Another objective "*develop friendly team environment*" (L4) was measured by the measurements of "*level of coordination among the team*" and "*level of supporting among the team*". Improvement toward the friendly team environment is observed by increasing the communication among team to satisfy the requirements and to resolve the issues faced by team members. All these activities are related to communication management knowledge

area of PMBoK and used in this project integrated with BSC at a Moderate Level of usage (Appendix-C).

The objective "*insure the timeliness of the activity in the project for in-time delivery to the customer*" (P2) was measured by the measurements "number of activities reviews that were completed during the period", "more effort perform on critical activities", "manage unplanned/vacant working days". To improve the performance toward this objective, some managerial activities like deification of activities that might be required more efforts to complete with in there estimated time, identification critical activities by critical path those needed to be completed with in defined time period, and also identifying the unplanned working days. All these activities are related to Risk Management area of PMBoK and used in this project integrated with BSC at a Partial Level of usage (Appendix-C).

The results analysis shows that the performance of the projects has been improved towards its objectives defined in BSC framework through the activities some of which are managerial activities also related to the project management area of PMBoK. It has also been observed that majority of project management knowledge area are used in some extend depending on the nature of project and its defined objectives. As we know that BSC framework has not sufficient theoretical knowledge of project management areas but the analysis prove that BSC is not making any hurdle to utilize the managerial activities of project management areas to manage and improve the performance. Then it was leaned that the BSC in its original form has successfully measure the performance of a software project because all the improvement activities defined in four perspectives are reflecting the relevant project management focus areas, the areas defined in the PMBoK. So there is no need to alter the original framework of BSC for software project to give it the theoretical knowledge about the project management. The result that shows that there is a clear difference between the performance of both projects which leads to potential misalignment between the project management frameworks and strategic management frameworks. So strategic and project management frameworks need to be aligned in order to get long term growth and stability.

6 Conclusion & Future Work

6.1 Conclusion

In this research venture I have been able to formulate a strategy for a discrete quantified framework which enables us to make the process of consultation regarding highly variant and diverse methodologies like goal driven measurement and BSC unnecessary in terms of not only software process management but also regarding organizational processes. The idea has been enhanced one step forward by making the methodology incorporate additional performance measures for Information System development organizations etc and Measurement framework providing Organizational performance measurement, Project's performance measurement & software process assessment. This approach also enables the project's performance to be measured against organization's strategic objectives thereby aligning project management with strategic management, quantifying those aspects which can not be measured quantitatively by incorporating their fulfillment with their relative importance.

The thesis highlights the application of said approach not only for performance measurement & process improvement but also at project level so that project management and strategic management systems are effectively aligned.

6.2 Future Work

Various weights are measuring schemes for different organizations and private organizations and further improvement can be made in the paradigm by mapping the objectives and goals of CMMI with the proposed approach and the performance measures of CMMI can also be quantified and evaluated on the same criterion. If any such mapping can be implemented then the measurement of organizational processes for various levels of CMMI can also be quantified giving organizations a quantitative view of the qualitative processes.

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Appendix – A

(Data Gathering Performa)

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 11-08-2007 to 25-08-2007

F1		% accuracy in the cost estimation	90	70	Deep analysis of the Project. Defining the activities. Defining the resources need for each activity. Estimating the cost of each activity. Estimating the activities duration. Estimating total man-hours for each activity. Analysis with previous project's cost.
		% accuracy in the time estimation	80	60	
		% accuracy in the effort estimation	80	70	
F2		Production of the project team	100	50	Acquiring quality of team member. Balancing the cross functional team. Identifying roles of team memebers. Arranging the recourses needed. Defining the reporting relationships. Defining the workflow. Minimizing the communication gape.
		Project team collaboration	80	40	
F3		% recourse utilization allocated to project	100	50	Deciding team's requirements for the project. Resource usage planning. Resource utilization scheduling. Defining expenditure management process. Estimating influencing values of expenditure.
		Effectiveness of expenditures	100	60	
F4		% changes performed by change management procedure	100	50	Reviewing all changes requests. Approving changes. Scope defining.
C1		How much customer is satisfied with quality	100	60	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2		How much customer is satisfied with in-time delivery	80	40	Documenting the progress Inform the customer about progress Immediate reply with customer services
C3		Response time to customer request	80	60	Insuring needed information available to the customer. Effective communication. Quick responsing to the customer.
		Level of communication with customer	80	80	

C4		Current requirement entertained	100	60	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	30	
C5		Level of focus on demanded solution	100	80	Defining the scope. Strictly follow the contract.
C6		Reviews performed with customers	60	50	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	70	
		Progress visible to customer	80	70	
P1		Processes documented	90	80	Idenfying the Processes. Defining the Processes. Documenting the Processes. Identifing the processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	50	
P2		Number of activities reviews that were completed during the period	80	50	Sequencing the activities. Observing dependencies. Estimatint the type and quantity of resources. Identifying the activities which required more efforts. Identification critical activities by critical path.
		More effort performed on critical activities	100	50	
		Manage unplanned/vacant working days	100	60	
P3		Expert reviews	80	70	Identifying the quality standards. Applying the systematic quality activities of testing, Define QA standards. Following the predefined QA standards.
		Test performed	80	40	
		Defects rectified	100	80	
L1		Training in the relevant technologies	100	50	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Training about the domain field	50	50	
L2		Level of appreciation	80	40	Providing the feedback. Resolving the issues. Appreciating on achievements. Rewarding in the recognition of effective services.
		Level of rewards	60	20	

L3	[illegible]	Salary Satisfaction	60	20	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Work distribution	60	20	Providing attractive facilities. Providing corporate environment.
		Facilities provided	60	30	Divide the work load.
L4	[illegible]	Level of coordination among the team	100	40	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	50	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 26-08-2007 to 08-09-2007

F1		% accuracy in the cost estimation	90	70	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	60	
		% accuracy in the effort estimation	80	70	
F2		Production of the project team	100	55	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	40	
F3		% recourse utilization allocated to project	100	60	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	60	
F4		% changes performed by change management procedure	100	70	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1		How much customer is satisfied with quality	100	60	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2		How much customer is satisfied with in-time delivery	80	40	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3		Response time to customer request	80	60	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	80	
C4		Current requirement entertained	100	60	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	30	
C5		Level of focus on demanded solution	100	70	Controlling the scope. Strictly follow the contract.
C6		Reviews performed with customers	60	40	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	60	
		Progress visible to customer	80	70	
P1		Processes documented	90	85	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	50	
P2		Number of activities reviews that were completed during the period	80	50	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	60	
		Manage unplanned/vacant working days	100	60	
P3		Expert reviews	80	70	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	50	
		Defects rectified	100	80	
L1		Training in the relevant technologies	100	60	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Training about the domain field	60	55	

L2		Level of appreciation	80	40	Providing the feedback. Resolving the issues.
		Level of rewards	60	20	Appreciating on achievements. Rewarding in the recognition of effective services.
L3		Salary Satisfaction	60	30	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Work distribution	80	20	Providing attractive facilities. Providing corporate environment.
		Facilities provided	60	35	Divide the work load.
L4		Level of coordination among the team	100	40	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	60	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 09-09-2007 to 22-09-2007

F1		% accuracy in the cost estimation	90	60	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	50	
		% accuracy in the effort estimation	80	70	
F2		Production of the project team	100	70	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	60	
F3		% recourse utilization allocated to project	100	70	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	70	
F4		% changes performed by change management procedure	100	80	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1		How much customer is satisfied with quality	100	50	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2		How much customer is satisfied with in-time delivery	80	50	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3	Support the customer by providing effective service	Response time to customer request	80	50	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	70	
C4	For best valued service satisfy customer's current and future requirements	Current requirement entertained	100	70	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	40	
C5	Our efforts will focused on providing the right solutions	Level of focus on demanded solution	100	60	Controlling the scope. Strictly follow the contract.
C6	Retain customer partnership and innovation	Reviews performed with customers	60	20	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	40	
		Progress visible to customer	80	40	
P1	Process should be visible	Processes documented	90	50	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	60	
P2	Ensure the timely completion of the project for timely delivery to the customer	Number of activities reviews that were completed during the period	80	60	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	70	
		Manage unplanned/vacant working days	100	65	
P3	Increase the sustainability, integrity and reliability to the quality of service	Expert reviews	80	50	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	60	
		Defects rectified	100	60	

L1	Highly skilled, flexible and competent workforce	Training in the relevant technologies	100	70	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Training about the domain field	60	30	
L2	Encourage the project team	Level of appreciation	80	50	Providing the feedback. Resolving the issues. Appreciating on achievements. Rewarding in the recognition of effective services.
		Level of rewards	60	40	
L3	Motivate and develop higher quality project team	Salary Satisfaction	60	40	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment. Divide the work load.
		Work distribution	60	30	
		Facilities provided	60	40	
L4	Effective internal communication	Level of coordination among the team	100	50	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	70	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 23-09-2007 to 06-10-2007

F1		% accuracy in the cost estimation	90	70	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	60	
		% accuracy in the effort estimation	80	70	
F2		Production of the project team	100	50	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	40	
F3		% recourse utilization allocated to project	100	50	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	60	
F4		% changes performed by change management procedure	100	50	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1		How much customer is satisfied with quality	100	60	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2		How much customer is satisfied with in-time delivery	80	40	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3	[redacted]	Response time to customer request	80	60	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	80	
C4	[redacted]	Current requirement entertained	100	60	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	30	
C5	[redacted]	Level of focus on demanded solution	100	80	Controlling the scope. Strictly follow the contract.
C6	[redacted]	Reviews performed with customers	60	50	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	70	
		Progress visible to customer	80	70	
P1	[redacted]	Processes documented	90	80	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	50	
P2	[redacted]	Number of activities reviews that were completed during the period	80	50	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	50	
		Manage unplanned/vacant working days	100	60	
P3	[redacted]	Expert reviews	80	70	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	40	
		Defects rectified	100	80	

L1	Highly skilled, flexible and competent workforce	Training in the relevant technologies	100	50	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Training about the domain field	60	50	Providing attractive facilities. Providing corporate environment.
L2	Motivate the project team	Level of appreciation	80	40	Providing the feedback. Resolving the issues.
		Level of rewards	60	20	Appreciating on achievements. Rewarding in the recognition of effective services.
L3	Motivate and develop skilled quality project team	Salary Satisfaction	60	20	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Work distribution	60	20	Providing attractive facilities. Providing corporate environment.
		Facilities provided	60	30	Divide the work load.
L4	Develop friendly team environment	Level of coordination among the team	100	40	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	50	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 07-10-2007 to 20-10-2007

F1	Accuracy in estimations	% accuracy in the cost estimation	90	70	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	70	
		% accuracy in the effort estimation	80	80	
F2	Well organize the project team	Production of the project team	100	70	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	70	
F3	Effective and efficient optimization of recourse utilization	% recourse utilization allocated to project	100	80	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	80	
F4	Efficient requirement change management	% changes performed by change management procedure	100	90	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1	Satisfy the customer with quality	How much customer is satisfied with quality	100	60	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2	Satisfy the customer with in-time delivery	How much customer is satisfied with in-time delivery	80	60	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3	Support the customer by providing effective service	Response time to customer request	80	50	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	60	
C4	Get best valued service satisfy customer's current and future requirements	Current requirement entertained	100	80	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	40	
C5	Our efforts will focus on providing the right solutions	Level of focus on demanded solution	100	60	Controlling the scope. Strictly follow the contract.
C6	Retain customer partnership and add value	Reviews performed with customers	60	25	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	50	
		Progress visible to customer	80	55	
P1	Improve the rate of visibility	Processes documented	90	60	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	70	
P2	Ensure the timeliness of the activities in the project for timely delivery to the customer	Number of activities reviews that were completed during the period	80	70	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	80	
		Manage unplanned/vacant working days	100	70	
P3	Increase the dependability, integrity and reliability to give quality of service	Expert reviews	80	65	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	60	
		Defects rectified	100	70	

L1	Highly skilled, flexible and competent workforce	Training in the relevant technologies	100	90	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Training about the domain field	60	40	
L2	Encourage the project team	Level of appreciation	80	60	Providing the feedback. Resolving the issues. Appreciating on achievements. Rewarding in the recognition of effective services.
		Level of rewards	60	45	
L3	Motivate and develop the developing project team	Salary Satisfaction	60	50	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment. Divide the work load.
		Work distribution	60	40	
		Facilities provided	60	50	
L4	Develop friendly team environment	Level of coordination among the team	100	60	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	80	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 21-10-2007 to 03-11-2007

F1		% accuracy in the cost estimation	90	80	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	70	
		% accuracy in the effort estimation	80	80	
F2		Production of the project team	100	80	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	75	
F3		% recourse utilization allocated to project	100	85	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	80	
F4		% changes performed by change management procedure	100	100	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1		How much customer is satisfied with quality	100	70	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2		How much customer is satisfied with in-time delivery	80	65	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3	[redacted]	Response time to customer request	80	60	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	60	
C4	[redacted]	Current requirement entertained	100	90	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	50	
C5	[redacted]	Level of focus on demanded solution	100	70	Controlling the scope. Strictly follow the contract.
C6	[redacted]	Reviews performed with customers	60	30	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	55	
		Progress visible to customer	80	60	
P1	[redacted]	Processes documented	90	70	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	80	
P2	[redacted]	Number of activities reviews that were completed during the period	80	75	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	85	
		Manage unplanned/vacant working days	100	70	
P3	[redacted]	Expert reviews	80	70	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	70	
		Defects rectified	100	80	

L1	Highly skilled, flexible and intelligent workforce	Training in the relevant technologies	100	95	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Training about the domain field	60	50	Providing attractive facilities. Providing corporate environment.
L2	Encourage the project team	Level of appreciation	80	60	Providing the feedback. Resolving the issues.
		Level of rewards	60	50	Appreciating on achievements. Rewarding in the recognition of effective services.
L3	Motivate and develop highest quality project team	Salary Satisfaction	60	50	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Work distribution	60	45	Providing attractive facilities. Providing corporate environment.
		Facilities provided	60	60	Divide the work load.
L4	Develop friendly team environment	Level of coordination among the team	100	70	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	80	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 04-11-2007 to 17-11-2007

F1	Accuracy in estimation	% accuracy in the cost estimation	90	80	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	70	
		% accuracy in the effort estimation	80	80	
F2	Well organize the project team	Production of the project team	100	90	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	75	
F3	Effective and efficient optimization of recourse utilization	% recourse utilization allocated to project	100	90	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	90	
F4	Perform requirement change management	% changes performed by change management procedure	100	100	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1	Satisfy the customer with quality	How much customer is satisfied with quality	100	80	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2	Satisfy the customer with in-time delivery	How much customer is satisfied with in-time delivery	80	70	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3	[redacted]	Response time to customer request	80	70	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	70	
C4	[redacted]	Current requirement entertained	100	90	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement.
		Future requirements entertained	60	50	Trying to understant the future requirements. Find out the solution for future requirements.
C5	[redacted]	Level of focus on demanded solution	100	80	Controlling the scope. Strictly follow the contract.
C6	[redacted]	Reviews performed with customers	60	40	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	60	
		Progress visible to customer	80	70	
P1	[redacted]	Processes documented	90	80	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	80	
P2	[redacted]	Number of activities reviews that were completed during the period	80	80	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	90	
		Manage unplanned/vacant working days	100	80	
P3	[redacted]	Expert reviews	80	80	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	80	
		Defects rectified	100	90	

L1	Highly skilled, flexible and competent workforce	Training in the relevant technologies	100	95	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Training about the domain field	60	55	Providing attractive facilities. Providing corporate environment.
L2	Encourage the project team	Level of appreciation	80	70	Providing the feedback. Resolving the issues.
		Level of rewards	60	50	Appreciating on achievements. Rewarding in the recognition of effective services.
L3	Motivate and develop highest quality project teams	Salary Satisfaction	60	55	Providing the training in technologies and domain. Providing the competitive salaries packages.
		Work distribution	60	50	Providing attractive facilities.
		Facilities provided	60	60	Providing corporate environment. Divide the work load.
L4	Develop friendly team environment	Level of coordination among the team	100	80	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	85	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Performance Measurement of Project through Balanced Scorecard, and managerial activies performed during the period from 18-11-2007 to 30-11-2007

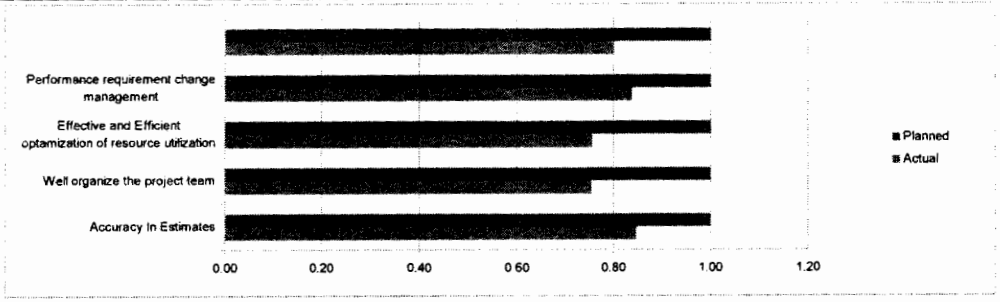
F1	Accuracy in estimations	% accuracy in the cost estimation	90	80	Reviewing the activities. Defining the new activities. Identifying resources needed for each activity. Estimating the activities duration. Estimating the cost of each activity. Estimating total man-hours for each activity. Analysis with previous estimation.
		% accuracy in the time estimation	80	70	
		% accuracy in the effort estimation	80	80	
F2	Well organize the project team	Production of the project team	100	90	Reviewing the acquired team members. Reviewing the roles of team memebers. Identifiying the recourses needed. Reviewing the reporting relationships. Reviewing the workflow. Minimizing the communication gape. Rearranging the recourses needed. Performing effective team work.
		Project team collaboration	80	75	
F3	Effective and efficient optimization of recourse utilization	% recourse utilization allocated to project	100	90	Reviewing resource usage planning. Reviewing resource utilization scheduling. Tracking the project resources utilization. Recuding the unnecessary idle time of resources. Reviewing expenditure management process. Estimating influencing values of expenditure. Controlling the factor that create cost variations. Controlling change to the project budget. Accountability analysing.
		Effectiveness of expenditures	100	95	
F4	Perform optimum change management	% changes performed by change management procedure	100	100	Reviewing all changes requests. Approving changes. Controlling changes. Scope controlling .
C1	Satisfy the customer with quality	How much customer is satisfied with quality	100	90	Interviewing with customer. Presenting project prototype to the customer. Reviewing with customers. Getting customer verification.
C2	Satisfy the customer with in-time delivery	How much customer is satisfied with in-time delivery	80	75	Documenting the progress Inform the customer about progress Immediate reply with customer services

C3	[redacted]	Response time to customer request	80	70	Insuring needed information available to the customer. Effective communication. Resolving the issues faced by the customer. Quick responsing to the customer.
		Level of communication with customer	80	80	
C4	[redacted]	Current requirement entertained	100	100	Documenting current and future requirements Reviewing current and future requirements Use prototype method to get complete current requirements. Agreement on the current requirement. Trying to understant the future requirements. Find out the solution for future requirements.
		Future requirements entertained	60	50	
C5	[redacted]	Level of focus on demanded solution	100	90	Controlling the scope. Strictly follow the contract.
C6	[redacted]	Reviews performed with customers	60	50	Reviewing in the presence of customer Inform the progress to the customer Frequient meetings with customer. Customizing according to customer.
		Project briefings to customer	80	70	
		Progress visible to customer	80	80	
P1	[redacted]	Processes documented	90	80	Reviewing the Processes. Documenting the Processes. Combining the processes. Unifing the processes.
		Plan each process before execution	100	90	
P2	[redacted]	Number of activities reviews that were completed during the period	80	80	Reviewing the sequence of activities. Reviewing the dependencies of activities. Estimatint the type and quantity of resources. Reviewing the activities. Controlling the schedule of activities. Identifying the activities which required more efforts. Identification critical activities by critical path. Identifying the unplanned working days.
		More effort performed on critical activities	100	90	
		Manage unplanned/vacant working days	100	90	
P3	[redacted]	Expert reviews	80	80	Identifying the quality standards. Applying the systematic quality activities of testing, reviewing and debugging, and monitoring. Define QA standards. Following the predefined QA standards.
		Test performed	80	80	
		Defects rectified	100	100	

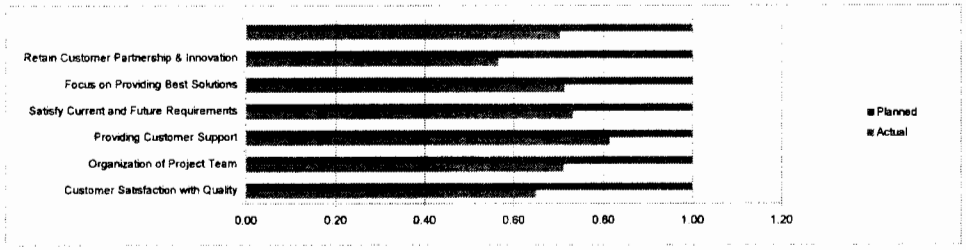
L1	Highly skilled, flexible and competent workforce	Training in the relevant technologies	100	95	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Training about the domain field	60	55	
L2	Encourage the project team	Level of appreciation	80	75	Providing the feedback. Resolving the issues. Appreciating on achievements. Rewarding in the recognition of effective services.
		Level of rewards	60	55	
L3	Motivate and develop higher quality project team	Salary Satisfaction	60	55	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment. Divide the work load.
		Work distribution	60	50	
		Facilities provided	60	60	
L4	Develop friendly team environment	Level of coordination among the team	100	80	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.
		Level of supporting among the team	100	90	Providing the training in technologies and domain. Providing the competitive salaries packages. Providing attractive facilities. Providing corporate environment.

Appendix-B
(Performance Measurement of the Projects)

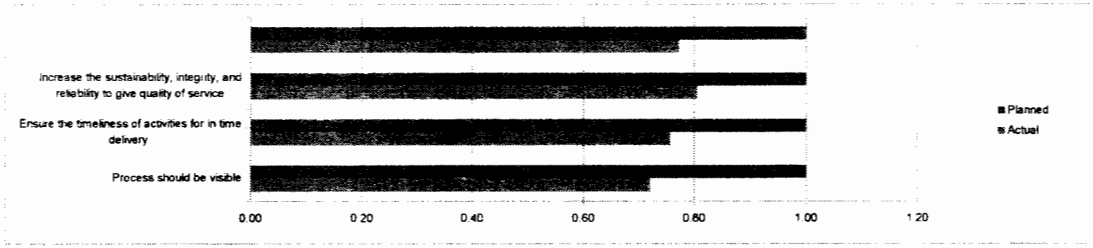
Financial Perspective (.25)			Financial Perspective					Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	26-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
F1	Accuracy In Estimates	0.32	% Accuracy in cost estimation	0.34	90	72	68	63	69	67	81	78	82	72.50	0.81
			% Accuracy in the time Estimation	0.33	80	63	66	51	53	67	69	71	70	63.75	0.80
			% Accuracy in effort estimation	0.33	80	67	71	72	69	80	81	78	82	75.00	0.94
															0.85
F2	Well organize the project team	0.16	Production of the project team	0.50	100	49	56	68	72	72	78	90	90	71.86	0.72
			Project Team Collaboration	0.50	80	40	42	58	69	71	74	75	76	63.13	0.79
															0.75
F3	Effective and Efficient optamization of resource utilization	0.32	% resource utilization allocated to project	0.50	100	49	61	65	75	78	87	89	91	74.38	0.74
			Effectiveness of expenditures	0.50	100	57	63	68	80	82	83	87	95	76.66	0.77
															0.76
F4	Performance requirement change management	0.20	% changes performed by change management procedure	1.00	100	58	68	77	83	90	94	100	100	83.75	0.84
															0.84
															0.80



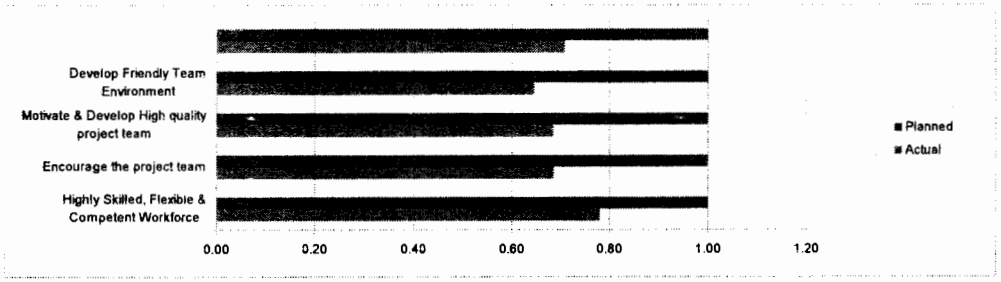
Customer Perspective (30%)								Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	26-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
C1	Satisfy the customer with quality	0.20	How much the customer is satisfied with the quality	1.00	100	56	63	54	50	57	68	82	90	65.00	0.65
															0.65
C2	Well organize the project team	0.17	How much the customer is satisfied with in time delivery	1.00	80	42	40	48	55	59	65	71	75	56.88	0.71
															0.71
C3	Support the customer by providing effective service	0.20	Response time to the customer request	0.50	80	57	60	56	52	50	58	67	70	58.75	0.73
			Level of communication with the customer	0.50	80	78	80	72	69	61	60	70	80	71.25	0.89
															0.81
C4	For best valued services satisfy customer's current and future requirements	0.19	Current requirements entertained	0.50	100	56	59	72	71	79	91	90	100	77.50	0.78
			Future requirements entertained	0.50	60	28	33	42	37	39	48	52	51	41.25	0.69
															0.73
C5	Our efforts will focus on providing best solutions	0.17	Level of focus on demanded solution	1.00	100	61	69	59	60	61	67	83	90	71.25	0.71
															0.71
C6	Retain customer partnership and innovation	0.13	Reviews performed with the customers	0.33	10	5	3	4	3	3	3	4	3	3.50	0.35
			Project breifings to the customer	0.33	10	7	6	4	4	5	6	6	7	5.63	0.56
			Progress visible to the customer	0.34	80	68	67	42	53	55	63	70	77	61.88	0.77
															0.68
															0.70



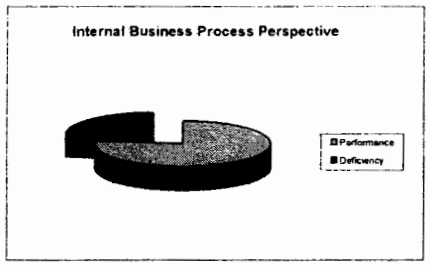
Internal Business Process (30%)							Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	25-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
P1	Process should be visible	0.23	Process Documented	0.43	90	80	83	52	53	57	66	82	80	69.38	0.77
			Plan each process before execution	0.57	100	50	50	60	65	70	80	80	90	68.13	0.68
															0.72
P2	Ensure the timeliness of activities for in time delivery	0.27	Number of activities/reviews that were completed during the period	0.25	80	51	58	69	72	75	79	77	54	66.88	0.84
			More effort performed on critical activities	0.50	100	49	59	71	72	83	84	88	89	74.38	0.74
			Managed unplanned/vacant working days	0.25	100	57	59	68	66	69	72	81	88	70.00	0.70
															0.76
P3	Increase the sustainability, integrity, and reliability to give quality of service	0.50	Expert Reviews	0.33	80	69	71	52	59	66	71	78	79	68.13	0.85
			Tests Performed	0.33	80	43	49	57	61	62	71	78	79	62.50	0.78
			Defects Rectified	0.34	100	79	83	61	62	70	83	88	99	78.13	0.78
															0.80
															0.77

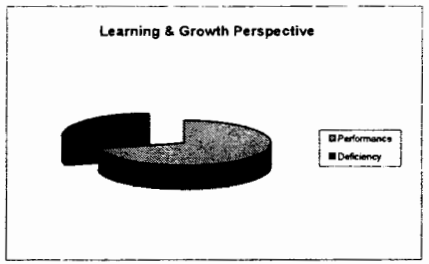


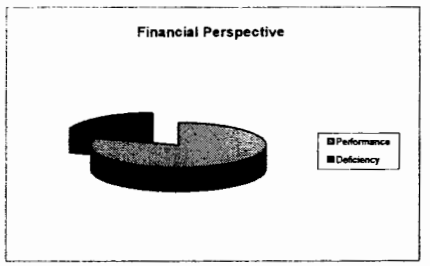
Learning & Growth (15%)								Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	25-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
L1	Highly Skilled, Flexible & Competent Workforce	0.33	Traning in the relevent branches	0.60	100	51	59	67	83	88	95	97	95	79.38	0.79
			Training about the domain field	0.40	60	48	55	32	33	37	51	54	55	45.63	0.76
															0.78
L2	Encourage the project team	0.20	Level of appreciation	0.66	80	40	40	50	50	60	60	70	75	55.63	0.70
			Level of rewards	0.34	60	17	23	37	41	45	51	52	55	40.13	0.67
															0.69
L3	Motivate & Develop High quality project team	0.27	Salary Satisfaction	0.25	60	20	30	40	40	50	50	55	56	42.63	0.71
			Work Distribution	0.50	60	19	21	27	41	42	45	48	52	36.88	0.61
			Facilities Provided	0.25	60	31	34	38	50	52	59	59	62	48.13	0.80
															0.69
L4	Develop Friendly Team Environment	0.20	Level of coordination among the team	0.67	100	38	41	51	58	61	72	80	80	60.13	0.60
			Level of support among the team	0.33	100	50	60	70	75	80	80	85	90	73.75	0.74
															0.66
															0.71

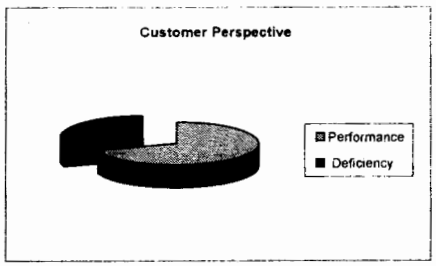


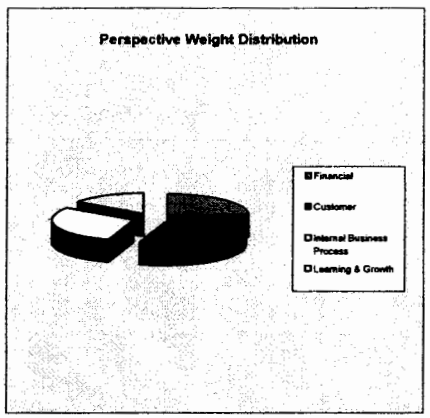
Balanced Scorecard						
	Perspective	Weight	Performance	Deficiency	Actual	Ideal
P1	Financial	0.25	0.80	0.20	0.20	1.00
P2	Customer	0.30	0.70	0.30	0.21	1.00
P3	Internal Business Process	0.30	0.77	0.23	0.23	1.00
P4	Learning & Growth	0.15	0.71	0.29	0.11	1.00
			0.75	0.26	0.75	1.00

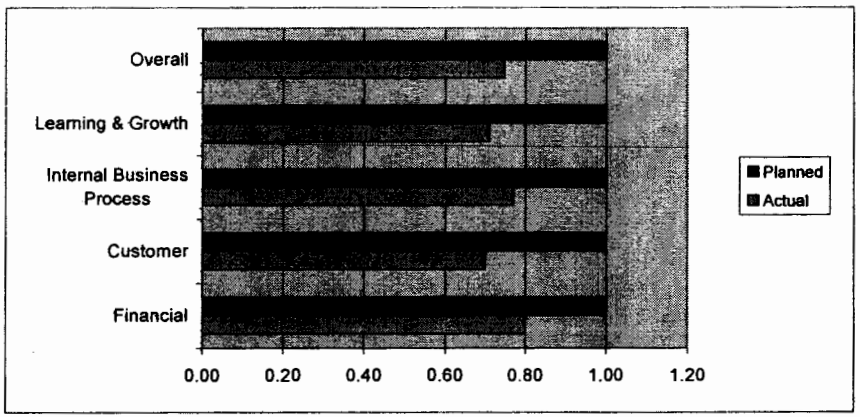


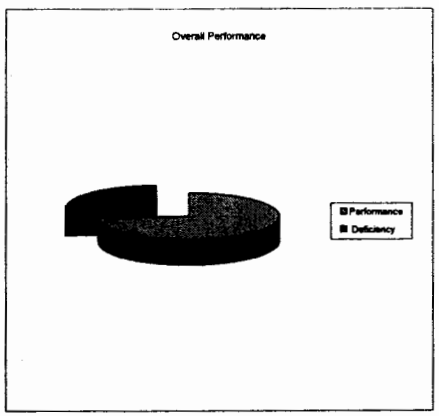






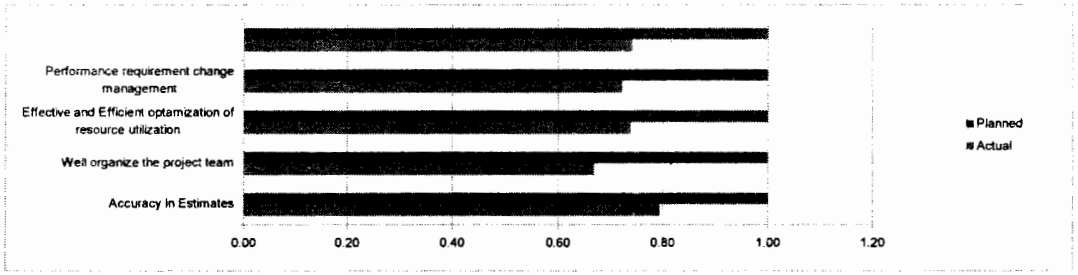




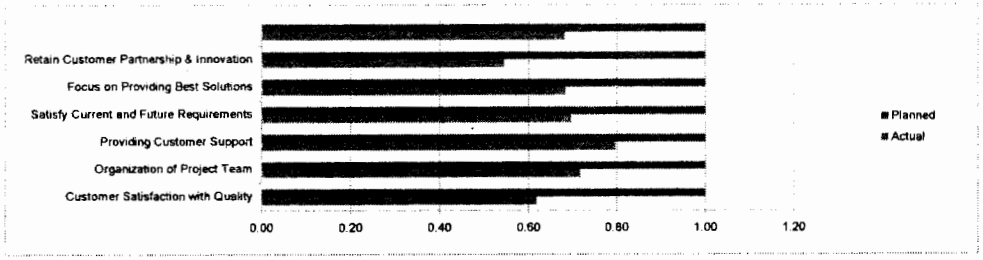


	Weight		Objectives	Weight	Performance Measures	Weight	Targets	Measures	Performance
Financial	0.25	F1	Accuracy In Estimates	0.32	% Accuracy in cost estimation	0.34	90	72.50	0.81
					% Accuracy in the time Estimation	0.33	80	63.75	0.80
					% Accuracy in effort estimation	0.33	80	75.00	0.94
									0.85
		F2	Well organize the project team	0.16	Production of the project team	0.50	100	71.88	0.72
					Project Team Collaboration	0.50	80	63.13	0.79
									0.75
		F3	Effective and Efficient optamization of resource utilization	0.32	% resource utilization allocated to project	0.50	100	74.38	0.74
					Effectiveness of expenditures	0.50	100	76.88	0.77
									0.76
		F4	Performance requirement change management	0.20	% changes performed by change management procedure	1.00	100	83.75	0.84
									0.84
									0.80
Customer	0.30	C1	Satisfy the customer with quality	0.20	How much the customer is satisfied with the quality	1.00	100	65.00	0.65
									0.65
		C2	Well organize the project team	0.17	How much the customer is satisfied with in time delivery	1.00	80	56.88	0.71
									0.71
		C3	Support the customer by providing effective service	0.20	Response time to the customer request	0.50	80	58.75	0.73
					Level of communication with the customer	0.50	80	71.25	0.89
									0.81
		C4	For best valued services satisfy customer's current and future requirements	0.13	Current requirements entertained	0.50	100	77.50	0.78
					Future requirements entertained	0.50	60	41.25	0.69
									0.73
		C5	Our efforts will focus on providing best solutions	0.17	Level of focus on demanded solution	1.00	100	71.25	0.71
									0.71
		C6	Retain customer partnership and innovation	0.13	Reviews performed with the customers	0.33	10	3.50	0.35
					Project breifings to the customer	0.33	10	5.63	0.56
					Progress visible to the customer	0.34	80	61.88	0.77
									0.56
									0.70
Internal Business Process	0.30	P1	Process should be visible	0.23	Process Documented	0.43	90	69.38	0.77
					Plan each process before execution	0.57	100	68.13	0.68
									0.72
		P2	Ensure the timeliness of activities for in time delivery	0.27	Number of activities/reviews that were completed during the period	0.25	80	66.88	0.84
					More effort performed on critical activities	0.50	100	74.38	0.74
					Managed unplanned/vacant working days	0.25	100	70.00	0.70
									0.75
		P3	Increase the sustainability, integrity, and reliability to give quality of service	0.50	Expert Reviews	0.33	80	68.13	0.85
					Tests Performed	0.33	80	62.50	0.78
					Defects Rectified	0.34	100	78.13	0.78
									0.80
									0.77
		L1	Highly Skilled, Flexible & Competent Workforce	0.33	Traning in the relevent branches	0.60	100	79.38	0.79
					Training about the domain field	0.40	60	45.63	0.76
									0.78
		L2	Encourage the project team	0.33	Level of appreciation	0.66	80	55.63	0.70
					Level of rewards	0.34	60	40.13	0.67
									0.69
		L3	Motivate & Develop High quality project team	0.21	Salary Satisfaction	0.25	60	42.63	0.71
					Work Distribution	0.50	60	36.88	0.61
					Facilities Provided	0.25	60	48.13	0.80
									0.69
		L4	Develop Friendly Team Environment	0.33	Level of coordination among the team	0.67	100	60.13	0.60
					Level of support among the team	0.33	100	73.75	0.74
									0.67
									0.75

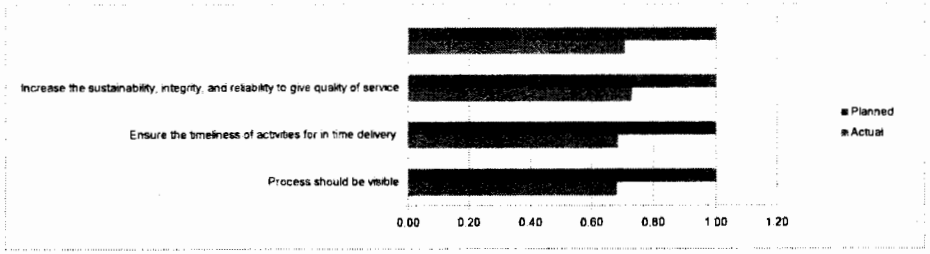
Financial Perspective (.25)							Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	25-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
F1	Accuracy In Estimates	0.32	% Accuracy in cost estimation	0.34	90	67	67	68	64	65	71	69	77	68.50	0.76
			% Accuracy in the time Estimation	0.33	80	65	61	65	67	67	61	62	60	63.50	0.79
			% Accuracy in effort estimation	0.33	80	55	59	63	62	71	69	74	77	66.25	0.83
															0.79
F2	Well organize the project team	0.16	Production of the project team	0.50	100	41	47	47	58	56	62	67	74	56.50	0.57
			Project Team Collaboration	0.50	80	49	51	52	57	63	69	71	83	61.88	0.77
															0.67
F3	Effective and Efficient optamization of resource utilization	0.32	% resource utilization allocated to project	0.50	100	69	63	70	73	62	79	89	91	74.50	0.75
			Effectiveness of expenditures	0.50	100	59	63	66	73	77	78	82	89	73.38	0.73
															0.74
F4	Performance requirement change management	0.20	% changes performed by change management procedure	1.00	100	61	61	66	69	67	83	82	89	72.25	0.72
															0.72
															0.74



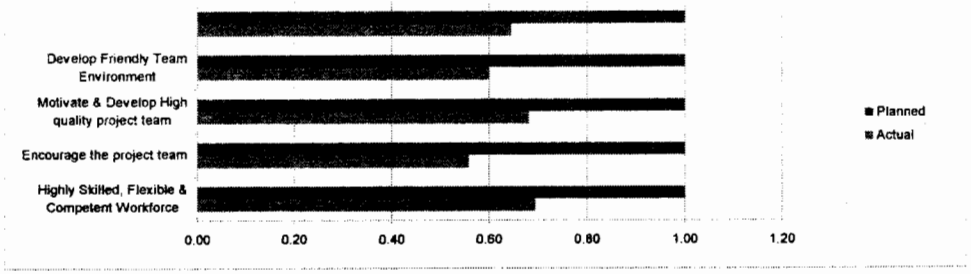
Customer Perspective (30%)							Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	25-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
C1	Satisfy the customer with quality	0.30	How much the customer is satisfied with the quality	1.00	100	59	64	52	48	53	59	77	82	61.75	0.62
															0.62
C2	Well organize the project team	0.17	How much the customer is satisfied with in time delivery	1.00	80	43	43	49	57	55	67	69	76	57.38	0.72
															0.72
C3	Support the customer by providing effective service	0.20	Response time to the customer request	0.50	80	48	53	56	57	49	57	63	71	56.75	0.71
			Level of communication with the customer	0.50	80	81	73	74	67	62	59	68	81	70.63	0.88
															0.80
C4	For best valued services satisfy customer's current and future requirements	0.13	Current requirements entertained	0.50	100	43	57	73	68	77	93	88	95	74.25	0.74
			Future requirements entertained	0.50	60	23	27	37	41	33	42	57	53	39.13	0.65
															0.70
C5	Our efforts will focus on providing best solutions	0.17	Level of focus on demanded solution	1.00	100	57	69	52	58	77	66	81	87	68.38	0.68
															0.68
C6	Retain customer partnership and innovation	0.13	Reviews performed with the customers	0.33	10	6	4	2	2	3	3	3	3	3.25	0.33
			Project breifings to the customer	0.33	10	5	6	5	3	5	5	6	7	5.25	0.53
			Progress visible to the customer	0.34	80	63	62	58	53	51	62	73	75	62.13	0.78
															0.64
															0.68



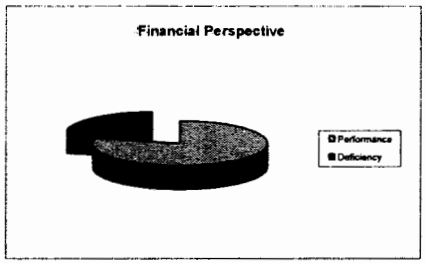
Internal Business Process (30%)							Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	25-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
P1	Process should be visible	0.23	Process Documented	0.43	90	77	81	55	56	54	63	67	73	65.75	0.73
			Plan each process before execution	0.57	100	56	52	55	63	67	71	74	77	64.38	0.64
															0.68
P2	Ensure the timeliness of activities for in time delivery	0.27	Number of activities/reviews that were completed during the period	0.25	80	53	57	61	63	68	71	74	77	65.50	0.82
			More effort performed on critical activities	0.50	100	43	51	59	61	67	70	77	79	63.38	0.63
			Managed unplanned/vacant working days	0.25	100	51	52	57	64	68	69	75	84	65.00	0.65
															0.68
P3	Increase the sustainability, integrity, and reliability to give quality of service	0.50	Expert Reviews	0.33	80	63	67	59	51	48	62	67	73	61.25	0.77
			Tests Performed	0.33	80	41	43	46	52	58	70	79	70	57.38	0.72
			Defects Rectified	0.34	100	33	56	55	80	88	77	85	92	70.75	0.71
															0.73
															0.71

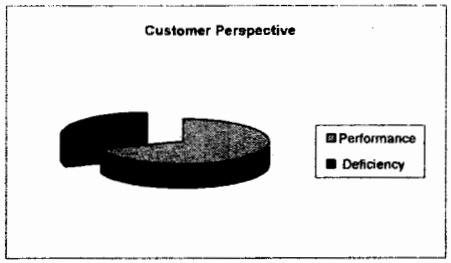


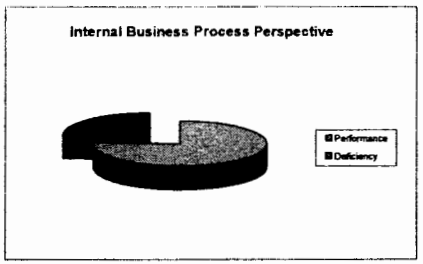
Learning & Growth (15%)								Measurements							
	Objectives	Weight	Performance Measures	Weight	Targets	25-Aug-07	8-Sep-07	22-Sep-07	6-Oct-07	20-Oct-07	3-Nov-07	17-Nov-07	30-Nov-07	Mean	Performance
L1	Highly Skilled, Flexible & Competent Workforce	0.33	Traning in the relevent branches	0.60	100	33	45	52	73	68	77	78	81	63.38	0.63
			Training about the domain field	0.40	80	41	47	51	45	48	41	40	62	46.88	0.78
															0.69
L2	Encourage the project team	0.20	Level of appreciation	0.66	80	48	33	37	41	58	55	62	53	48.38	0.60
			Level of rewards	0.34	60	12	18	23	21	27	33	42	49	28.13	0.47
															0.56
L3	Motivate & Develop High quality project team	0.27	Salary Satisfaction	0.25	60	20	30	40	40	50	50	55	56	42.63	0.71
			Work Distribution	0.50	60	21	23	25	37	41	44	47	51	36.13	0.60
			Facilities Provided	0.25	60	31	34	38	50	52	59	59	62	48.13	0.80
															0.65
L4	Develop Friendly Team Environment	0.20	Level of coordination among the team	0.67	100	33	37	55	56	59	63	67	71	55.13	0.55
			Level of support among the team	0.33	100	43	59	68	69	73	77	82	89	70.00	0.70
															0.60
															0.64

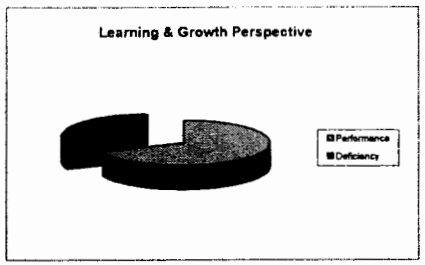


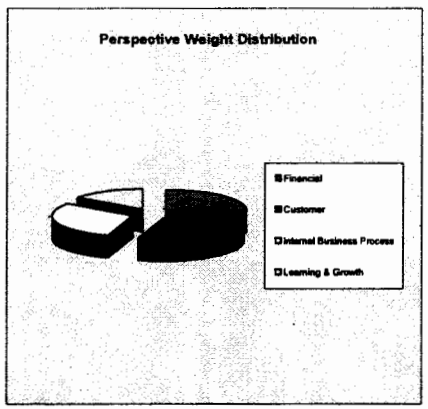
Balanced Scorecard						
	Perspective	Weight	Performance	Deficiency	Actual	Ideal
P1	Financial	0.25	0.74	0.20	0.19	1.00
P2	Customer	0.30	0.68	0.30	0.20	1.00
P3	Internal Business Process	0.30	0.71	0.23	0.21	1.00
P4	Learning & Growth	0.15	0.64	0.29	0.10	1.00
			0.70	0.26	0.74	1.00

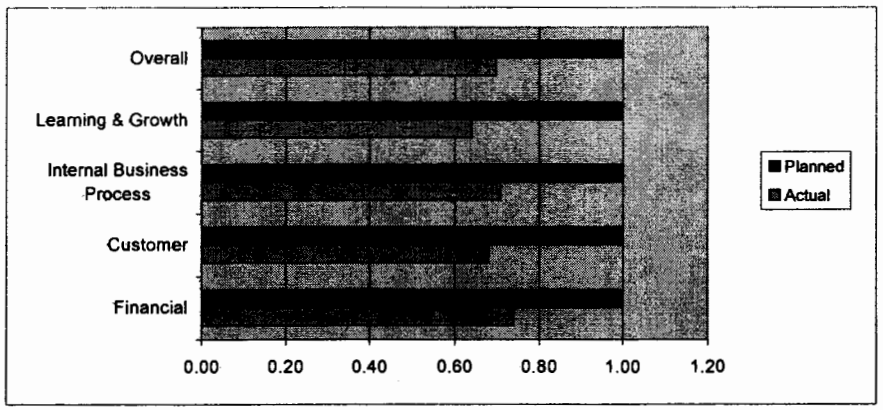


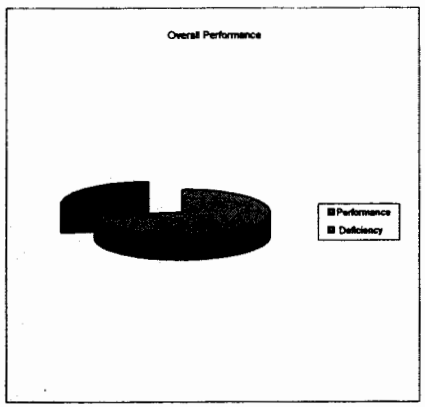












	Weight		Objectives	Weight	Performance Measures	Weight	Targets	Measures	Performance
Financial	0.25	F1	Accuracy in Estimates	0.32	% Accuracy in cost estimation	0.34	90	68.50	0.76
					% Accuracy in the time Estimation	0.33	80	63.50	0.79
					% Accuracy in effort estimation	0.33	80	66.25	0.83
									0.79
		F2	Well organize the project team	0.16	Production of the project team	0.50	100	56.50	0.57
					Project Team Collaboration	0.50	80	61.88	0.77
									0.67
		F3	Effective and Efficient optamization of resource utilization	0.32	% resource utilization allocated to project	0.50	100	74.50	0.75
					Effectiveness of expenditures	0.50	100	73.38	0.73
									0.74
		F4	Performance requirement change management	0.20	% changes performed by change management procedure	1.00	100	72.25	0.72
									0.72
									0.74
Customer	0.30	C1	Satisfy the customer with quality	0.20	How much the customer is satisfied with the quality	1.00	100	61.75	0.62
									0.62
		C2	Well organize the project team	0.17	How much the customer is satisfied with in time delivery	1.00	80	57.38	0.72
									0.72
		C3	Support the customer by providing effective service	0.20	Response time to the customer request	0.50	80	56.75	0.71
					Level of communication with the customer	0.50	80	70.63	0.88
									0.80
		C4	For best valued services satisfy customer's current and future requirements	0.13	Current requirements entertained	0.50	100	74.25	0.74
					Future requirements entertained	0.50	60	39.13	0.65
									0.70
		C5	Our efforts will focus on providing best solutions	0.17	Level of focus on demanded solution	1.00	100	68.38	0.68
									0.68
		C6	Retain customer partnership and innovation	0.13	Reviews performed with the customers	0.33	10	3.25	0.33
					Project breifings to the customer	0.33	10	5.25	0.53
					Progress visible to the customer	0.34	80	62.13	0.78
									0.64
Internal Business Process	0.30	P1	Process should be visible	0.23					0.68
					Process Documented	0.43	90	65.75	0.73
					Plan each process before execution	0.57	100	64.38	0.64
									0.68
		P2	Ensure the timeliness of activities for in time delivery	0.27	Number of activities/reviews that were completed during the period	0.25	80	65.50	0.82
					More effort performed on critical activities	0.50	100	63.38	0.63
					Managed unplanned/vacant working days	0.25	100	65.00	0.65
									0.69
		P3	Increase the sustainability, integrity, and reliability to give quality of service	0.50	Expert Reviews	0.33	80	61.25	0.77
					Tests Performed	0.33	80	57.38	0.72
					Defects Rectified	0.34	100	70.75	0.71
									0.73
									0.71
[redacted]		L1	Highly Skilled, Flexible & Competent Workforce	0.20	Traning in the relevent branches	0.60	100	63.38	0.63
					Training about the domain field	0.40	60	46.88	0.78
									0.69
		L2	Encourage the project team	0.20	Level of appreciation	0.66	80	48.38	0.60
					Level of rewards	0.34	60	28.13	0.47
									0.55
		L3	Motivate & Develop High quality project team	0.27	Salary Satisfaction	0.25	60	42.63	0.71
					Work Distribution	0.50	60	36.13	0.60
					Facilities Provided	0.25	60	48.13	0.80
									0.70
		L4	Develop Friendly Team Environment	0.33	Level of coordination among the team	0.67	100	55.13	0.55
					Level of support among the team	0.33	100	70.00	0.70
									0.62
									0.70