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Comparison of dashboard-based and balanced scorecard-based corporate performance management system

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COMPARISON OF DASHBOARD-BASED AND BALANCED SCORECARD-BASED CORPORATE PERFORMANCE MANAGEMENT SYSTEM

by

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ABSTRACT

Under current hypercompetitive and technology driven economic environment, more companies are using a corporate performance management (CPM) system to gain more accurate understandings of the company goals and strategies and to craft methods of achieving those goals and strategies. While CPM systems are generally implemented in two approaches: dashboard approach and scorecard approach, very few studies examine the effectiveness of each type of CPM systems implementation. Therefore, the main objective of this study is to assess the effectiveness of a dashboard based and a balanced scorecard based corporate performance management system. The effectiveness is examined through management effectiveness, degree of employee involvement, and usability.

In the research study, a dashboard prototype and a BSC prototype were created for a case company to address research objectives. A balanced scorecard framework and a strategy map were first proposed for the case company to facilitate the prototype construction. SAP Strategic Enterprise Management (SEM) 6.0 and SAP BusinessObjects' Xcelsius 2008 were used to construct and to deploy the proposed BSC based and the dashboard based CPM, respectively. Results were analyzed and conclusions were derived from surveys obtained from both company users and academic users.

Results indicated that a BSC based CPM system provides a higher degree of employee involvement than a dashboard based CPM system while a dashboard based CPM system have better level of usability than a BSC based CPM system to users. The scorecard approach will lead to higher degree of employee involvement in terms of helping users to understand the company's strategies, goals, and objectives, helping users to understand initiatives/actions that the company is taking, and helping users to understand their roles and responsibilities in the company. While the dashboard approach will result in better usability in terms of easy to understand, user-friendly interface and easily to learn to operate. However, a BSC based CPM does not appear to be more effective than a dashboard based CPM.

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1. INTRODUCTION

The emergence of the information era has shifted companies from industrial-age competition to information-age competition. During the industrial age, companies succeeded based on how well they achieved economies of scale and scope. However, in the information era, companies can no longer gain sustainable competitive advantage just by rapidly deploying new technology to support physical assets or to manage financial assets and liabilities. Instead, in order to succeed in information-age, companies must operate within a framework of integrated business processes crossing business functions and linking customers to suppliers. They must provide more individualized and customized products and services, and they must exploit the knowledge of every employee of the company.

In a new, more competitive, technological, and capability-driven information era, companies cannot survive or succeed just by monitoring and measuring financial performance using the traditional financial model. This model, which was developed for industrial-age companies, measures only past events and performance, not the capability to drive future financial values. To navigate and succeed in today's complicated business environment, companies will need tools to understand their business goals and strategies. A corporate performance management (CPM) system is just such a tool.

Thanks to highly developed information technologies that support Enterprise Resource Planning (ERP) systems and Business Intelligence (BI) systems available in most of the companies, the sourcing of the data used by the CPM system is now more efficient than ever. An ERP system enables companies to integrate various operation processes and data flows across multiple departments into one single computer system. While a BI system serves to translate raw, meaningless data from various sources into useful and actionable information to help the company make better decisions. Furthermore, BI and performance management has converged to create the CPM system. The ERP system and the BI system serve as the foundations for the CPM system.

CPM system is generally implemented using two approaches, the dashboard approach and the scorecard approach. A dashboard system monitors the performance of

daily operational processes using a rich visualization of data results in graphs, charts, and gauges on a real-time or right-time basis. While balanced scorecard (BSC), the other most popular CPM system, provides the companies and managers with tools to translate the company's mission and strategies into objectives, measures, and initiatives which provide a framework for a strategic measurement and management system. The BSC displays periodical snapshots of summarized data for business executives and managers who need to track the progress of their group or work towards future.

This study assesses the effectiveness of a dashboard-based and a BSC-based CPM system. It focuses on the study of the effectiveness of the CPM systems, the degree of the employee involvement and the usability of the CPM systems. In this research study, a dashboard prototype and a BSC prototype were created for a case company. A BSC framework and a strategy map were first proposed for the case company to facilitate the construction of the prototype system. SAP Strategic Enterprise Management (SEM) 6.0 and SAP Business Objects' Xcelsius 2008 were used to construct and deploy the BSC-based and the dashboard-based CPM systems respectively. The results were analyzed, and conclusions were derived from the results.

This thesis reviews the literature of CPM, BSC, ERP and BI systems, describes the research methodologies, and presents the results. It also addresses the research limitations and future research direction.

2. LITERATURE REVIEW

Since the research focuses on the comparison of two CPM system implementation approaches and CPM systems are built on ERP and BI platforms, this literature review will address CPM, BSC, ERP and BI systems.

2.1. CORPORATE PERFORMACE MANAGEMENT SYSTEM

2.1.1 Definition. In order to succeed, corporate management must understand their company's strengths and weaknesses. To do so, they must track business performance and manage the business accordingly. Thanks to the fast-paced development of information science and technologies, more and more companies have greater access to the real time data, especially through ERP systems, which provides managers with the resources to assess and govern companies (Batty, 2007). However, this availability of data is a hindrance for mangers if they cannot make use of this data. Companies are thus driven to seek ways to address the data overload (Case, 1998).The need to manage data has led to the broad use of CMP system.

"CPM system is an umbrella term that describes the methodologies, metrics, processes and systems used to monitor and manage the business performance of an enterprise." (Buytendijk and Rayner, 2002) Currently, popular CPM methodologies range from simple double entry accounting system to sophisticated activity-based costing (ABC), economic value added (EVA) accounting practices and BSCs (Shinder and McDowell, 1999). Metrics commonly used in CPM include both traditional financial measures and non financial measures (Kaplan and Norton, 2001).

There is a saying that is particular in the context of a CPM system: "you can't manage what you can't measure". Once a company determines its missions and goals, it must choose specific metrics to be tied to each strategy to monitor and assess the company performance. This will raise the first question: how to figure out measures that matter? Traditionally, managers have relied largely on financial and accounting measures to monitor the company's performance (Eccles, 1991). However, these old fashioned

finance-focused measurements are increasingly viewed as biased and skewed because hard numbers reflect only historical performance and reveal little about progress towards long term strategic objectives (Kaplan and Norton, 2001). Soft measures like customer satisfaction rates however are leading indicators predictive of future financial performance. Most modern companies have implemented ERP systems to integrate their resources and gain access to an overwhelming amount of real-time data. Providing a variety of information from financial to operational, such information can be utilized to manage a business. To evaluate performance in a balanced and holistic way, companies have to supplement financial measures with non-financial measures (Eccles, 1991). The introduction of BSC methodology has laid a cornerstone for development of CPM, by supplementing traditional financial measures with criteria that evaluate performance from three other perspectives: customer, internal business process and learning and growth (Kaplan and Norton, 1992).

Once key measures have been selected for tracking, the next challenge is to understand what the numbers mean (Case, 1998). Thus, CPM must decompose the measures into their component parts to drill down to identify cause and affect relationships. For instance, a company may have gross sales revenue goals for various territorial teams. If the aggregate sales numbers are not satisfactory, they should be easily broken down into component parts so that the manager can pinpoint and attack key problems. The BSC methodology permits the identification of cause-effect relationships in the context of CPM, by facilitating both horizontal and vertical drill-down analysis. For horizontal analysis, BSCs link the measures used to track performances from all four perspectives. For example, customer satisfaction may be correlated with faster payment of invoices, a relationship that may lead to a substantial reduction in accounts receivable and thus a higher return on capital employed (Kaplan and Norton, 2001). On the other hand, BSC also permits the vertical drill-down analysis of aggregated and abstract measures so that managers can more closely examine detailed performance numbers and identify exact causes (Viaene and Willems, 2007).

Metrics that cannot be compared to a meaningful target are worthless (Case, 1998). Too often, companies set their goals just intuitively or based simply on the prior year's performance. Such goals however may prove impossible to attain. In fact, CPM

enables companies to set realistic goals by analyzing past performance, competitors' performance, their own capabilities and input from employees and suppliers.

Good metrics permits ongoing evaluation of performance and a mean to forecast the future (Case, 1998). In today's dynamic and competitive business environments, companies cannot rely only on tracking and assessment of business performance, they must also anticipate future conditions and act proactively, tasks facilitated by CPM (Eccles, 1991). For instance, the BSCs provide predictive measures and information feedback mechanisms to help managers forecast future performance (Viaene and Willems, 2007).

Overall, the CPM system enable busy managers concerned with boosting the business performance to exploit fully the data held by their companies.

2.1.2 Trends and Current Practices. Currently, the CPM system can be implemented in one of two approaches, using either the dashboard approach or BSC approach. Both approaches permit monitoring, analysis, and management, but they do so at different levels (Eckerson, 2006).

The dashboard approach emphasizes helping managers and analysts track and analyze departmental processes and activities to manage a department's performance. It focuses on the monitoring and analytical functionality other than on management. A typical dashboard monitors the performance of core operational processes that drive the business on a day-to-day basis. It displays data on a really-time or right-time basis as required by analysts, front-line staff, and supervisors. The rich visualization of data displayed in a dashboard enables users to explore information and identify trends or patterns to pinpoint the root causes of problems or issues as displayed. Dashboard approach generally includes the online analysis process (OLAP) tools, interactive reporting, advanced visualization, and scenario modeling tools (Eckerson, 2006).

Unlike the dashboard approach, BSCs chart a company's progresses toward achieving objectives, strategies, and long-term goals. First, a typical scorecard can help a company to translate its missions and goals into strategies, objectives, and coherently linked measures. Secondly, it can show up cause-effect relationships among different strategies, objectives, and measures. Moreover, a BSC aligns all activities and efforts of each individual and department towards achieving the company's overall goals. It

clarifies each employee's roles and responsibilities to facilitate further accountability and traceability. The BSC generally displays monthly or even yearly snapshots of data summarized for business executives and managers who must track the progresses of their group or project towards achieving goals. BSCs generally include more metrics than dashboards. These metrics stretch across the whole organization and track progress with periodic summaries from which mangers can be drill down through additional layers of detailed information (Eckerson, 2006). Table 2.1 summarizes main differences between the dashboard approach and the BSC approach.

Although both approaches have been widely implemented, BSCs are more popular because executives must closely track organizations performance (Eckerson, 2006).

Table 2.1 Comparison of dashboard and scorecard approach. Source: Wayne W. Eckerson (2006)

	Scorecard	**Dashboard**
Purpose	Charts progress	Measure performance
Users	Executives, managers	Supervisors, analysts
Updates	Periodic snapshots	Right-time feeds
Data	Summaries	Events
Display	Visual graphs, text comments	Visual graphs, raw data

A BSC can be deployed as a part of a company's existing information system with a user interface similar to that shown in Figure 2.1. Alternatively, it may be

available from an internal portal with a more user-friendly interface, as shown in Figure 2.2, or from a web portal that provides better accessibility, as shown in Figure 2.3.
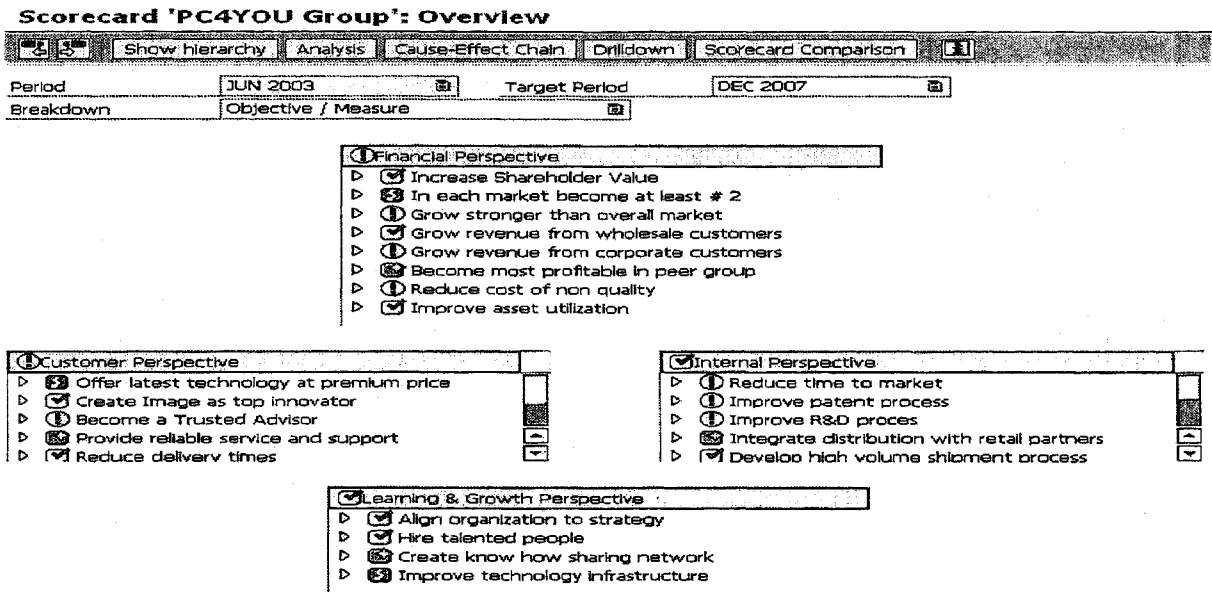

Figure 2.1 BSC as a part of a company's information system.
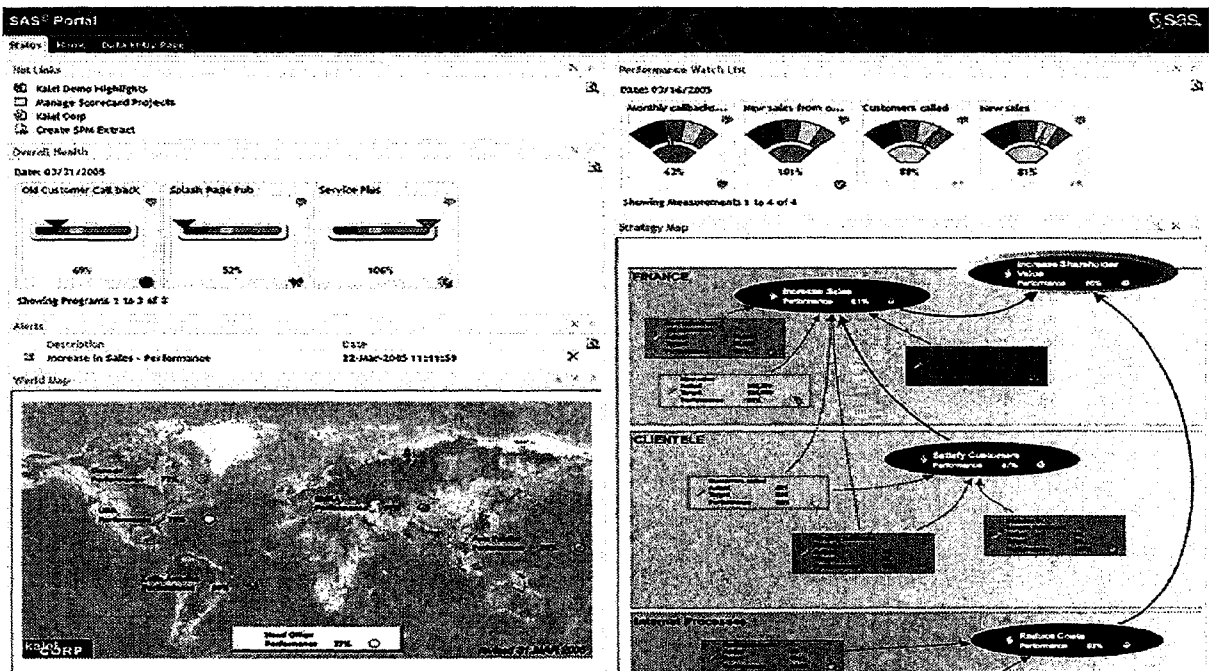
Figure 2.2 BSC accessible from an internal portal. Source: www.fsn.cn.uk
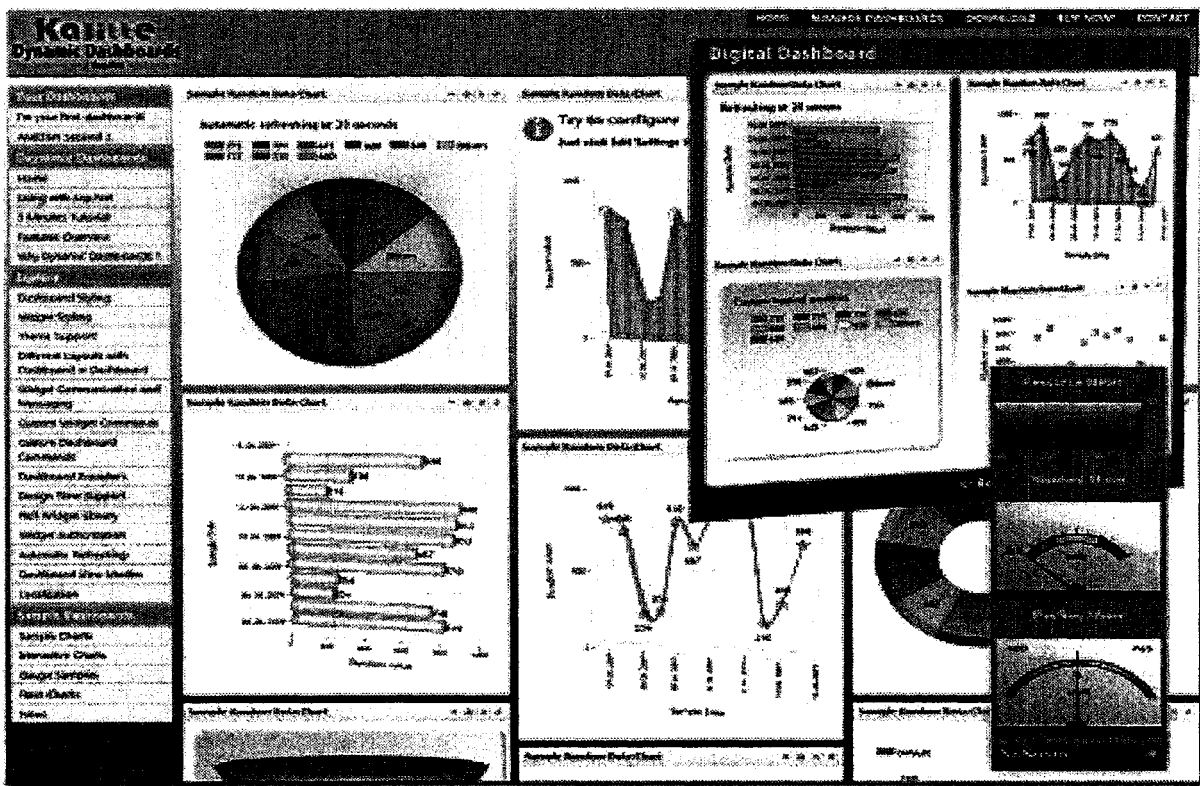
Figure 2.3 BSC accessible from a web portal. Source: www.Filesbuzz.com

2.2. Balanced Scorecard

2.2.1 Definitions and Concept. Balanced Scorecards are currently popular implemented CPM system. They incorporate both financial and nonfinancial objectives and measures derived from an organization's visions and strategies to monitor, analyze, and manage the corporate strategy over the long term (Kaplan and Norton, 1996). The basic framework of BSC considers four perspectives: customer perspective, internal business perspective, learning and growth perspective, and financial perspective. These perspectives allow organizations to evaluate: how customers see the company, what the company must do to excel internally, how the company can continue to improve and create value, and how the shareholders view the company (Shinder and McDowell, 1999).

A BSC remains the financial perspective because financial measures are still valuable to evaluate the economic consequences of past actions or decisions (Eccles, 1991). Financial objectives are linked to corporate strategy, and they provide a focus for

the objectives and measures in all other perspectives (Kaplan and Norton, 1996). Additionally, financial performance measures indicate whether a company's strategy, implementation, and execution are contributing to bottom-line improvement.

By tracking customer perspective in a BSC, companies can identify customers and market segments in which they are competitive and measure performance in targeted segments. The customer perspective enables companies to align both the core customer outcome measures (e.g., satisfaction, retention, acquisition, and profitability) with leading indicators or value drivers (e.g., on time delivery rate) to targeted customers and markets (Kaplan and Norton, 1996).

The internal business process perspective identifies and evaluates key business processes that influence customer perspective and financial perspective. From a business processes perspective, the BSC represents a fundamental improvement over traditional performance measurement approaches by incorporating quality- or time-based metrics (Kaplan and Norton, 1996). It also monitors and improves the innovation processes (Kaplan and Norton, 1996). This significant improvement brought by BSC enables the companies to also focus on the creation of long-term value, which is the real driver of future economic performance. The BSC provides the objectives and measures not only for short-term business operations, but also for the long-term innovation cycles, a change that dramatically minimizes the tradeoffs managers might make.

The final perspective addressed by a BSC is learning and growth. This perspective focuses on the fundamentals necessary to support the creation of long- term value for financial, customer and internal business processes (Viaene and Willems, 2007). Under today's intense competitive business environments, companies must be up to date on the latest technologies and business processes necessary to meet their corporate goals, customer requirements, and shareholder expectations. Thus, companies must establish objectives and measures to assess employee training, technology and system improvement, and business process optimization. Their goal must be to ensure that employee skills and company procedures are sufficient to meet or exceed expectations (Sim and Koh, 2001).

A BSC provides a balanced view of corporate performance by tracking measures of four different perspectives. Financial and customer-related metrics address the external

perspectives of shareholders and customers. These interests are balanced with the internal perspectives, which measures business processes, and innovations and learning. The BSC also balances leading indicators that predicting future corporate performance (e.g., customer satisfactions) with lagging indicators (e.g. financial ratios) that assess results of past event (Eccles, 1991).

The measures used in the BSC are not unrelated or isolated, rather, they track links in a chain of the cause and effect relationships and thus articulate a company's goals and strategies to their employees. For example, if a company enhances employee retraining programs, the employees become more knowledgeable and competitive, increasing operational effectiveness. As a result, defect rates decrease and product quality improves. Customers are more satisfied and customer loyalty increases, driving them to cross purchase company products and pay their bills more quickly. Thus company revenue eventually increases, and shareholders' value improves. (Sim and Koh, 2001)

BSC is not just an operational or tactical measurement system, but a strategy management system, which helps corporations achieve crucial management goals. First, BSC systems clarify and translate company strategies into specific objectives and measures. In addition, they communicate objectives and measures throughout the corporations from top executives to front-line staff, making every employee aware of corporate goals, long-term strategies, and the effects of their own actions on corporate performances. (Porter, 2002) Furthermore, BSC provides targets and initiatives, establishing benchmarks and identifying inputs necessary to accomplish objectives. Finally, a BSC facilitates periodic strategic performance reviews and thus improves the strategy (Kaplan and Norton, 1996)

2.2.2 Advantages and Drawbacks of the Balances Scorecards. In this section, we will talk about the advantages and drawbacks of the balances scorecards.

2.2.2.1 Advantages. By using BSCs, instead of just focusing on the financial measures as the solely indicator to assess the company's performances which bears little relation to the company's long term goals, the company can bridge the gap between the short term actions and long term strategies. The ability to make this connection is the most important benefit resulted from adopting the BSCs, which enables the company to

translate their visions, communicate and link the strategies from top to down, better business plan, and formulate feedback and learning loop. (Kaplan and Norton, 1996)

Almost all companies have their own corporate mission and vision, but these are generally lofty statements that bear little relation with the day to day operations of employees. Therefore, translating a company's mission and vision into useful guidance for the operational-level workers clarifies the purposes of workers' activities and shows how they contribute to the company goals. BSCs permit such translation, thus helping companies use all their resources to their goals.

Traditionally, a company uses financial measures to evaluate departmental and individual performance and to tie incentives and remuneration policies to short-term financial goals. This approach often led companies to sacrifice long-term investments for short-term financial performance. By adopting a BSC, a company can link rewards systems to long-term performance measures, including both financial and nonfinancial indicators. Companies can thus ensure that departments and individuals focus on long-term vision and strategies (Kaplan and Norton, 1996).

Before the adoption of BSC, companies typically had separate systems in charge of long-term strategy planning and resource allocation; therefore, there were often gaps between strategy implementation and budgeting. With the utilization of BSCs, however, companies can integrate long-term strategy planning with the budgeting processes to ensure that resource allocation supports the strategic goals (Kaplan and Norton, 1996).

The BSCs also help companies to establish feedback and learning processes to focus on customer, internal business processes, and learning and growth in addition to the financial perspective. Thus, companies can monitor processes and modify them as necessary based on real-time learning (Kaplan and Norton, 1996).

2.2.2.2 Drawbacks. Although BSCs are an excellent performance management tool, they offer no single focus for accountability. To measure success, management needs an overriding measure that provides a summary view of all the factors that influence company performance. The shareholders and creditors who trust the management to implement strategies are mostly primarily concerned with the return of their investments.

2.2.3 Implementation Issues. Many companies have invested tremendous amounts of monetary and human resources into implementing BSC projects but without success. The reasons result in the project failures are mainly design drawbacks of scorecards or poor organizational processes.

Companies fail their scorecard projects due to poor design are mostly just not paying close attention or simply building some ad hoc collection of performance measures. For instance, companies sometimes define too many measures for each objective, distracting users from the real significant ones reflecting the company's most significant performances. However, design flaws can be easily identified and quickly fixed as long as a company is committed to implementation.

The real threat to the success of BSC implementation is poor organizational processes. These processes generally fail in one or more of seven ways:

1. Project champions fail to obtain the buy-in of senior management. Without the involvement and commitment of senior management, the project lacks the comprehensive knowledge and power necessary to make decisions about strategies and objectives (Kaplan, 1999).

2. A single senior manager attempts to build a scorecard alone, without input from others. If only part of the management team is involved in the creation of BSC objectives, measures, and targets, the remaining team members will still hold the old opinions and acts the same way as before (Kaplan, 1999).

3. BSC responsibilities are not designed to filter down from the corporate level to divisions, business units, and individual departments. Without communication to all employees, the BSC will lose its fundamental power to motivate all employees to contribute to the achievement of goals and objectives. For instance, without the support of mid-level managers, a project may fail because these managers control departmental budgets and funds, and their actions and words convey to their staff that the project need not be taken seriously (Eckerson, 2006).

4. BSCs are treated as one-time event. The implementation process must be a continuous process and the project champions should avoid trying to launch it perfectly with everything accurately (Kaplan, 1999).

5. A BSC is mistaken for a systems project. By treating a BSC

implementation as a system project rather than a management project will mislead the project to a wrong direction and miss the fundamental benefits of BSCs (Kaplan, 1999).

6.   BSCs are introduced only for compensation. If a scorecard is only used as checklist of performance measures linked to employees' compensation plans, employees may circumvent established measures out of laziness or for personal gains, thus result in undermining performances (Eckerson, 2006).

7.   IT infrastructure is not ready. Without a strong technical foundation, especially in BI, few BSC can survive long. They will be crushed by the weight of cumbersome and costly data-gathering processes, inaccurate and untrustworthy data, poor performance and antiquated functionality (Eckerson, 2006).

2.3. ERP SYSTEMS

2.3.1 Introduction to ERP. With the rapid development of the global economy, more and more corporations are realizing that in order to gain a competitive advantage they must implement an ERP solution that offers an integrated software solution to all functions of the corporation. ERP systems integrate the data required to manage an enterprise and provide seamless transaction automation across all enterprise functions (*Stratman*, 2007). The result of a long development process, ERP systems today can be used in almost any industry or company.

From the inception of inventory control tools to modern business integrated enterprise package, ERP systems remains its crux the same all the way along, that is attempting to integrate all the operational processes and data flows across a company into a single computer system to serve the needs of all departments. Before the use of ERP, individual departments had separate computer systems to run their own business processes.

With ERP, however, a company can combine all these systems into a single integrated computer software sharing system with one database, so allowing departments to communicate with each other more easily. Replacing the stand-alone computer systems of accounting, finance, logistics, production, marketing, and human resources, ERP system roughly approximate them using software modules synergizing all the

corporation's resources, including money, machine, materials, and personnel. Typical ERP software modules include manufacturing, financials, sales and distribution, human resources, supply chain management, projects, customer relationship management, and data warehousing.

2.3.2 Advantages and Benefit of ERP. ERP systems offer a lot of benefits and competitive advantages, because they provide a systematic method of dynamically balancing and optimizing a company's overall resources. The most significant benefit of ERP is that it allows companies to react quickly to competitive pressures, market opportunities, new product configurations, reduced inventory, and tightened supply-chain links by integrating all departments into one system. This integration approach gives companies more controls over business operations, provides employees with faster access to the information system, and saves resources (Jenson and Johnson, 2002). One example of the benefits of integration is the customer order process. Before ERP, a customer order had to be entered into the various computer systems causing delay or loss of order, and inviting error. Furthermore, the employees and customer cannot easily determine the status of an order. With ERP, however, when entering a new order, a sales person can immediately access the customer's credit rating and order history and determine the company's inventory level. The order information can then be available to employees across all departments.

Shang and Seddon (2000) classify the benefits of ERP systems into the following three categories:

1. Operational benefits: ERP streamlines the business processes and automate business transactions, ERP systems enable companies to reduce operating costs, shorten cycle time, improve productivity and quality, and strengthen customer services.

2. Managerial benefits: ERP systems are able to facilitate day-to-day management; in addition, ERP systems can offer better access to data so that management can have up-to-the-minute access to information for decision making and managerial control.

3. Strategic benefits: ERP systems support resource planning and strategic planning, building cost leadership, generating product differentiation and building external linkages.

2.3.3 The Future of ERP. With the development of e-business, a company's success relies increasingly on real-time information not only across the company but also across the supply chain. Therefore, ERP II has been introduced. The following sections will discuss the EPR II.

2.3.3.1 Scope. ERP II systems are moving toward collaborative commerce, permitting information sharing outside the enterprise. The future system will not be only enterprise-centric but it will also provide information link in supply chain, allowing businesses to play multiple roles in supply chains from traditional sources to electronic marketplaces.

Two development trends characterize ERP II: first, it will accurately aggregate and manage data surrounding all enterprise transactions in real time. Secondly, the system will be open, making the information available to trading partners.

2.3.3.2 Architecture. The trend in ERP development is toward service oriented architecture (SOA). SOA is an approach to designing, implementing, and deploying information systems such that the system is created from components implementing discrete business functions. These components, called 'services', can be distributed geographically and reconfigured into new business processes as needed.

The services are loosely coupled, allowing for more flexibility than was possible with older technologies. Indeed, services will be reused and re-combined to create new business functions both within and across an organization. SOA also reduces complexity, eliminates point-to-point integrations, and introduces flexibility through process-driven applications.

2.3.3.3 Technologies. During the development of hardware and software, future ERP systems will be much easier to configure. Preconfigured ERP software for standard business processes will be popular means to simply the implementation. The rapid development of hardware capacity will also dramatically increase the number of ERP functions, leading to broader use of such system. As a result, CPM tools and BI tools are now incorporated in ERP systems to help make business decisions. Simulation will become an important element of an integrated extended enterprise planning and execution systems (Jacobs and Weston.Jr. 2006).

2.4. BUSINESS INTELLIGENCE SYSTEMS

2.4.1 Introduction. Over the decades, technology has evolved in many ways. Business environments have imbibed the technology trends to a great extent in order to enhance their functionality as complete units integrating diverse areas of work. The need to manage data and information related to vendors, consumers, employees, work processes, business transactions, stakeholders, and so on must be addressed down to the minutest details. These conditions have demanded the evolution of a system that can store the information generated by diverse work groups and effectively support its handling. The technology that is being implemented to integrate diverse information for analysis is known as BI.

BI is the process by which businesses transform relatively meaningless data into useful, actionable information, and then into knowledge. This knowledge can be used to guide business in their day-to-day activities, and it provides a basis for effective strategic planning and efficient decision-making (Lönnqvist& Pirttimäki, 2006).

2.4.2 Role and Application of BI in CPM. To enable the managers to compare data from mutiple activities or organizational departments, the system underlying a CPM must be able to share data consistently and reliably (Business or corporate performance management, 2003).

BI technologies are the lifeblood of a contemporary automated CPM environment, which includes data warehousing, multidimensional data analysis, and data mining.

Data warehousing is the centerpiece of the automated CPM environment. It represents the enterprise-wide consolidated and standardized data, grounded in agreed-upon data definitions, business rules and data registration requirements and methods (Viaene and Willems, 2007). Inmon (1992) defines a data warehouse as "A data warehouse is a subject-oriented, integrated, time-variant, non-volatile collection of data that is used primarily in organizational decision making." The term subject-oriented indicates that, instead of being organized around applications in operational systems, data in data warehousing is organized based on how users refer to them. The data in data warehousing should also be summarized and integrated because the data warehouse is targeted for decision support; without data consolidation, the system cannot provide a

consolidated view at the corporate level. Furthermore, unlike operational databases containing only current data, the data in data warehousing normally has a time horizon of 5 to 10 years so that it can be analyzed over a long period of time to identify trends and patterns. In data warehousing, loading and access are the only operations that can be performed on data. Finally, therefore, the last feature of data warehouse is that the data it stores are unchangeable and nonvolatile (Katherine, 1998).

Typically, a data warehouse is maintained separately from the organization's operational databases because the data warehouse supports on-line analytical processing (OLAP), the functional and performance requirements of which are quite different from the online transaction processing (OLTP) applications traditionally supported by operational databases(Surajit & Umeshwar, 1997). Forsman (1977) defines OLAP as a category of software technology that enables analysts, managers and executives to gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information that have been transformed from raw data to reflect the real dimensionality of the enterprise as understood by the user." During analysis, OLAP technology can effectively facilitate navigation among the data in the warehouse and assist the search for cause and effect relationships (Viaene and Willems, 2007). For instance, a query can be developed to request a comparison of product sales results from various regions at various times over multiple years. Thus, users can forecast, indentify trends, and perform more complex analyse.

Although OLAP provides tools to explore and navigate among data cubes to extract interesting information, it is not capable of explaining relationships present exist in a data cube; this is the function of data mining.

Data mining is the third element of BI that enables the enterprise to produce actionable predictive information. Data mining refers to the algorithmic extraction of interesting patterns from enormous amounts of (structured) data (Viaene and Willems, 2007). With data-mining tools, developers can quickly automate predictions and indentify patterns hidden in the data. General techniques used in data mining can be categorized into four groups: classification, association, sequence, and clustering. The classification approach is designed to establish rules that determine whether an item belongs to a particular subset or class of data. Association searches all transactions from the

operational system for patterns with a high probability of repetition. Sequence uses time-series analysis to indentify relationships among events over time; it is normally used to discover highly predictive events. In some cases, when the parameters of a class of data cannot be defined, a clustering approach can be used to group together the objects with similar attributes.

When a CPM environment incorporates data warehousing, OLAP, and data mining, ,the CPM system is capable of linking aggregated, abstract performance information with the more detailed performance numbers in an efficient, consistent, transparent, and user-friendly way.

2.5. COMPARISON OF TOOLS/MODULES AVAILABLE FROM MAJOR ERP VENDORS (SAP,ORACLE, MICROSOFT)

Since there will be CPM system prototype implemented in the research, this section will describes the current products available from various vendors. The CPM vendor market currently is evolving toward to fewer vendors with broader offerings, after a few merger and acquisitions occurred in recent years.

CPM market now only leaves several large vendors leading the pack, which are Oracle, SAS, SAP, IBM and Microsoft. These big vendors all offer solutions with broad breadth and depth.

Companies seeking to invest in CPM software are interested in linking CPM applications with other business software, like ERP and customer relationship management (CRM) systems. Thus, if the investor has already installed the ERP or CRM software from one big vendor, issues of data integration, security, and other challenges can be prevented by deploying BI and CPM tools from the same vendors. This gives the major ERP vendors offering CPM modules advantages against the pure CPM vendors (Andrew, 2008). The following discussions describe three major ERP vendors offering various business softwares: Oracle, SAP, and Microsoft.

Oracle has a set of finance-oriented offerings as well as an emerging set of analytical performance applications. The core parts of Oracle's CPM offerings include planning, financial management, financial performance management, strategic finance

and financial data quality tools. In addition, Oracle also provides BI tools and prepackaged analytic applications ("Oracle and Hyperion." n.d.).

SAP offers a CPM system including financial performance management packages, governance, risk and compliance packages, enterprise query, reporting, and analysis packages, visualization and reporting packages, master data services packages and data integration and data quality management packages ("SAP and Business Objects." n.d.).

Microsoft offers a CPM system, utilizing widely used and supported Microsoft technologies (e.g., windows server, SQL server, and Microsoft office SharePoint portal server) ("Microsoft Office PerformancePoint Server 2007 product overview", n.d.

3. METHODOLOGY

3.1 RESEARCH QUESTIONS AND HYPOTHESES

Although CPM systems are generally implemented with a dashboard or a BSC approach, few studies have compared the effectiveness of these options. The main objective of this study was to make just such a comparison. This work studied the effectiveness of each approach from the perspectives of management effectiveness, degree of employee involvement, and usability.

Following are the research questions and research hypotheses developed for the study:

Research Question 1: Does a BSC-based performance management system provide a higher degree of employee involvement than a dashboard-based performance management system?

The research model is stated as below:

$Involvement_j = \mu + CPM\text{-}Type_i + e_i$

Where

μ = the overall mean effect;

$CPM\text{-}Type_i$ = CPM type effect, $i = 1, 2$

$CPM\text{-}Type_1$ = Dashboard

$CPM\text{-}Type_2$ = BSC

$Involvement_j$ = Degree of employee involvement, $j = 1, 2, 3$

$Involvement_1$ (Strategies) = Understand strategy, goals, objectives

$Involvement_2$ (Initiatives) = Understand initiatives

$Involvement_3$ (Roles) = Understand roles and responsibilities

e_i = random effect.

Hypothesis 1: There is no significant difference in the degree of employee involvement between a BSC-based performance management system and a dashboard-based CPM system. $(H_0: CPM\text{-}Type_i = 0)$

Employee involvement has been described as "a feeling of psychological ownership among organizational members" (Harvey and Brown, 1996). Four research questions were designed to measure employee involvement:

1.   The proposed system could help me to:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Understand my company's strategies, goals, and objectives.	☐	☐	☐	☐	☐
Understand initiatives/actions that my company is taking.	☐	☐	☐	☐	☐
Understand my roles and responsibilities in my company.	☐	☐	☐	☐	☐

Research Question 2: Is a BSC-based CPM system more effective than a dashboard-based CPM system for top management than lower-level management?

$Effectiveness_j = \mu + CPM\text{-}Type_i + e_i$

Where

μ= the overall mean effect;

$CPM\text{-}Type_i$ = CPM type effect, i = 1, 2

$CPM\text{-}Type_1$ = Dashboard

$CPM\text{-}Type_2$ = BSC

$Effectiveness_j$ = Effectiveness of the proposed system, where j =1, 2, 3, 4

$Effectiveness_1$ (Tracking) = Track my team's performance consistently

$Effectiveness_2$ (Linkage) = Understand clearly the cause-effect relationship

$Effectiveness_3$ (Overview) = Give a clear overview of the company governance

$Effectiveness_4$ (Communication) =Allow better communication

e_i = random effect.

Hypothesis 2: There is no significant difference in the level of effectiveness between BSC-based CPM and a dashboard-based CPM at either the top or the middle management level. (H_0: CPM-Type$_i$ =0)

Effectiveness is defined as the ability of an organization to fulfill its mission through a sound management, strong governance, and a persistent rededication to achieving results. ["Providing", 2004]. Four questions were designed to measure the relative effectiveness of the two implementation approaches:

1.   The proposed system helps me to consistently track my team's performance, which allows me to take proactive action and better manage my team to achieve company strategies and goals.

☐   ☐   ☐   ☐   ☐

Strongly   Agree   Neutral   Disagree   Strongly
agree   disagree

2.   The proposed system helps me to understand clearly the cause-effect relationship and linkage among performance measures, objectives, actions plans, and strategies.

☐   ☐   ☐   ☐   ☐

Strongly   Agree   Neutral   Disagree   Strongly
agree   disagree

3.   The proposed system would give me a clear overview of the company governance.

☐   ☐   ☐   ☐   ☐

Strongly   Agree   Neutral   Disagree   Strongly
agree   disagree

4.   The proposed system better allows me to communicate with other groups or departments and cooperate with them to achieve company goals and strategies.

☐   ☐   ☐   ☐   ☐

Strongly   Agree   Neutral   Disagree   Strongly
agree   disagree

Research Question 3: Do a BSC-based CPM and dashboard-based CPM systems have equal levels of usability?

The research model is stated as below:

$Usability_j = \mu + CPM\text{-}Type_i + e_i$

Where

μ = the overall mean effect;

$CPM\text{-}Type_i$ = CPM type effect, $i = 1, 2$

$CPM\text{-}Type_1$ = Dashboard

$CPM\text{-}Type_2$ = BSC

$Usability_j$ = Usability of the proposed system, where $j = 1, 2, 3$

$Usability_1$ (Understand) = Easy to understand

$Usability_2$ (Interface) = User-friendly user interface

$Usability_3$ (Learnability) = Easy to learn

e_i = random effect.

Hypothesis 3: There is no significant difference in usability between BSC-based and dashboard-based CPM systems. (H_0: $CPM\text{-}Type_i = 0$)

Usability is defined as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use. (Matera, Rizzo, and Carughi, 2006). Two questions were designed to address usability:

1.   Reports and charts provided by the proposed software prototype are easy to understand.

☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

2.   The proposed software prototype provides a user-friendly user interface.

☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

3.   I believe that I can learn to operate the proposed software easily.

☐   ☐   ☐   ☐   ☐
Strongly   Agree   Neutral   Disagree   Strongly
agree   disagree

3.2 CASE COMPANY OVERVIEW

This study created a dashboard prototype and a BSC prototype for a case company. First, a BSC framework and a strategy map were proposed to facilitate the prototype construction. Company data needed for project were obtained through company visits, interviews, and the company's published reports and news releases.

The case company is a leading global provider of technology-based tools and agricultural products that improve farm productivity and food quality. With a corporate mission of delivering agricultural products and solutions to meet the world's growing food needs, conserve natural resources, and protect the environment, the company manages its business in two segments. The first is seeds and genomics, and the second is agricultural productivity.

To realize the corporate mission, the company established a corporate goal "to grow value for farmers and shareholders." (Case company annual report, 2007) The company has several business strategies to achieve its corporate mission and goals: 1) Optimize the chemistry business; 2) realize the potential of the acquisitions; 3) strengthen and grow the seeds and traits business; 4) position the company for the future; and 5) implement the people strategy (Jordon, 2008).

To align all these business strategies, the company invested high-level technologies for its IT departments, including ERP and BI systems. These measures have given the company a strong foundation for further development of a CPM system to improve its monitoring, assessment, and management of operations. The development of both dashboard and scorecard framework will be address in Section.4 and research results will be discussed in Section.5.

3.3 PROTOTYPING PLATFORMS

This study used SAP Strategic Enterprise Management (SEM) 6.0 and SAP BusinessObjects' Xcelsius 2008 to construct and deploy the proposed BSC-based and the dashboard-based CPM system.

The SAP SEM 6.0 system enables users to develop key performance indicators that support a number of popular scorecard methodologies, including BSC, economic value-added, and activity-based costing methods. Users can link operational and strategic plans and develop scorecards and performance measures based on financial and nonfinancial data.

The SAP BusinessObjects Xcelsius 2008 empowers the business users and the IT department to leverage interactive, reliable reporting and visually stunning, accurate dashboards, giving users visibility of the timely, relevant data they need to overcome their unique challenges and succeed in today's economy. Through SAP BusinessObjects Xcelsius 2008, users can create interactive dashboards from Microsoft Excel or a live data source and export their dashboards to a familiar format such as Microsoft Office, Flash (SWF) files, Adobe PDF, and Adobe AIR.

3.4 DATA COLLECTION PROCESS

This study collected the data is through both online survey and on-site surveys. The online survey was administered through a specially created website that included video demonstrations along with the surveys. The video demonstrations presented the research objectives, introduced the dashboard, demonstrated a real system prototype, introduced the BSC and finally demonstrated a real system prototype. The website link was sent out through emails to various companies and individuals. The details can be found in Appendix C.

Three on-site presentations were given for both students and industry users. These presentations provided the same information available through the website. After each system prototype demonstration, a survey was carried out to collect data.

4. CASE STUDY: DEVELOPMENT OF DASHBOARD AND BALANCED SCORECARD FRAMEWORK

The BSC developed for the case company incorporated the four generic perspectives which are generally included in all BSCs. To address the specific business goals of the case company, on additional perspective was added: the supplier perspective.

Based on the corporate goal to grow value for farmers and shareholders (case company annual report, 2007), a specific corporate strategy was proposed for the BSC framework: Create financial value for shareholders research and development leadership and operational efficiency (See Figure 4.1).
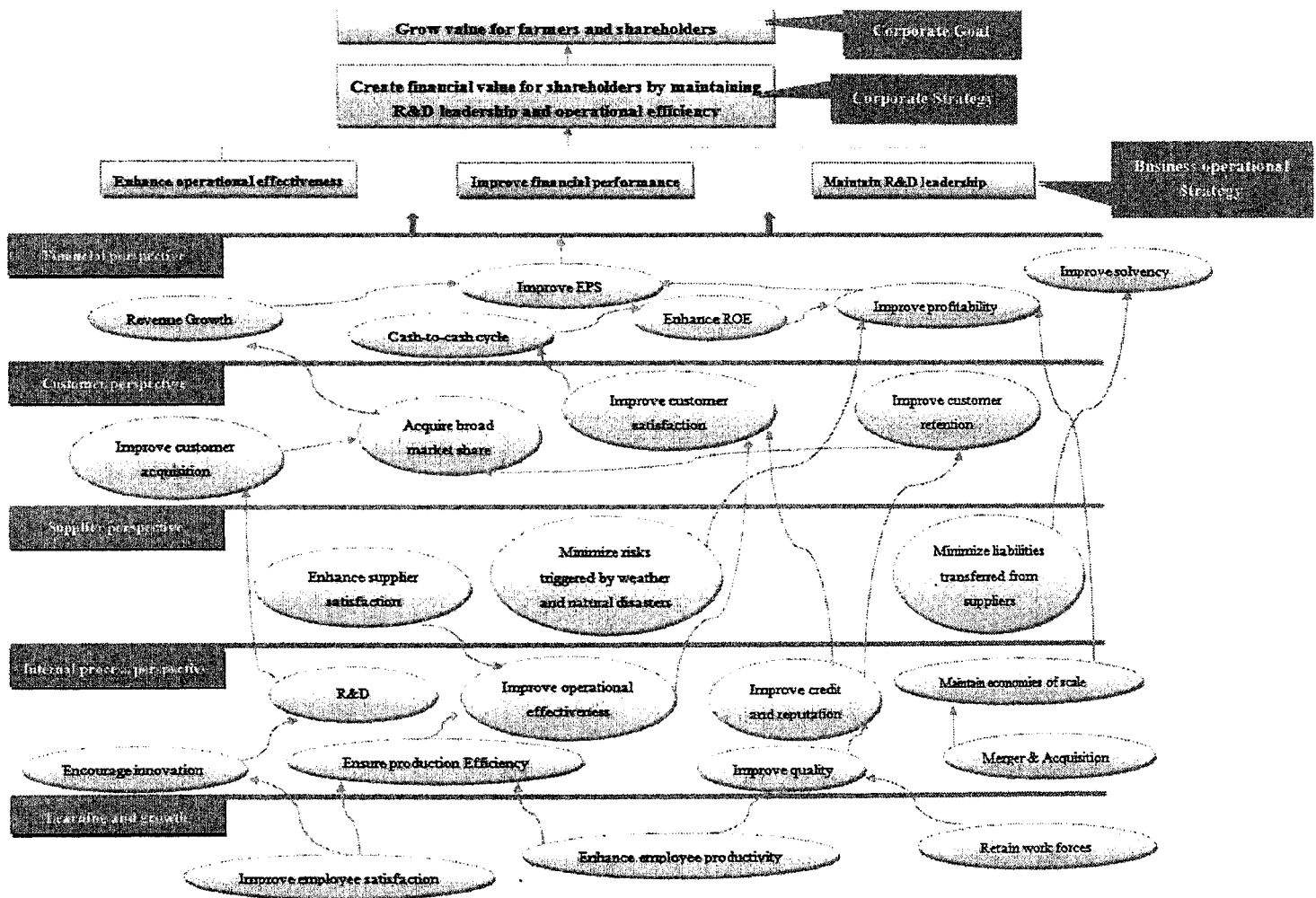
Figure 4.1 BSC framework.

Figure 4.1 also shows the three businesses operational strategies proposed to support the company's overall goals and strategies: improve financial performance, enhance operational effectiveness, and maintain a leadership position research and development.

4.1 IMPROVING FIANACIAL PERFORMANCE

The case company has maintained strong financial performance in its industry. Based on its history of effective asset management, it has good potential to maintain the strong growth pattern and improve its financial performance.

The case company has improved its profitability consistently as demonstrated by its return on assets (ROA), return on equity (ROE), return on investment (ROI), and earnings per share (EPS) from the period of year 2001 to 2007, excepting only in year 2002 and 2003, see Figure 4.2. The ROA first dropped from 2.55% in 2001 to -16.66% in 2002. If they rose to -0.38% in 2003, and in 2004 the ratio increased to 2.86%.This progress was followed by a small decrease to 2.58% in 2005, after which the ratio continued to increase from 6.18% in 2006 to 8.04% in 2007. This trend applied also to all other profitability ratios over the last seven years, providing evidence that the case company has been enhancing its profitability constantly. The exception of in 2002 was due to the cumulative effect of a change in accounting principles. In 2003, the company paid a $396-million PCB litigation settlement for its subsidiaries (case company annual report, 2003).
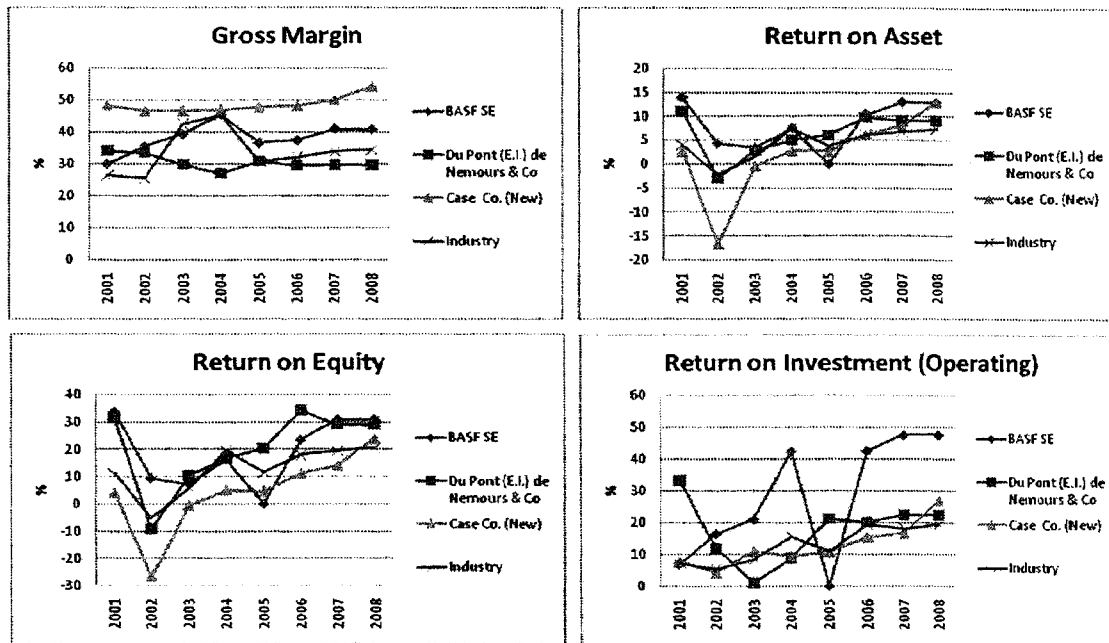
Figure 4.2 Profitability ratios comparison.

Based on the case company's profitability patterns, a presentation made by management, and a discussion with the management, on operational strategy to improve financial performance was proposed. Figure 4.3 shows that from 2001 to 2007, all the company's liquidity ratios followed the same pattern: From 2001 to 2004, there was a steady increase, followed by a reduction in 2005. There as a brief increase in 2006, and finally a drop in 2007. This trend indicates the company has been trying to improve its liquidity capability; however, in 2005 and 2007, the company was relatively low on cash and high on short-term liabilities. The 2005 decrease was triggered by $1.7 billion in investment to complete four major acquisitions. The 2007 drop was the result of $1.5 billion in investments to complete an acquisition.

Although these two exceptions were not good signs for the company's ability to meet its short-term obligations, they reflected appropriate investment decisions and have not affected the company's operations.
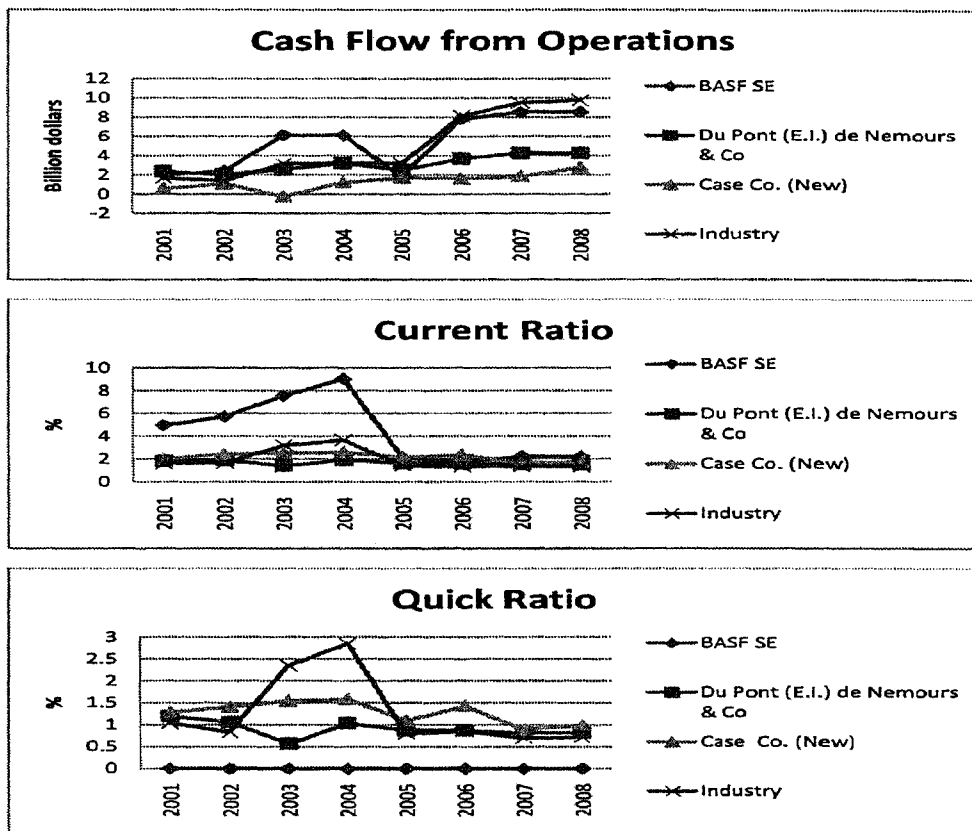
Figure 4.3 Liquidity ratios.

The debt to equity and debt to equity ratios shown in Figure 4.4 indicate that the case company remains equity-leveraged. Both debt ratios remained under 1 and are reveal a decreasing trend, although there were increases from 2001 to 2003. These exceptions were due to new long-term debts of $243 million at 4% in senior notes and $172 million in medium-term notes. Overall, the case company manages its debts to maintain a strong solvency status.
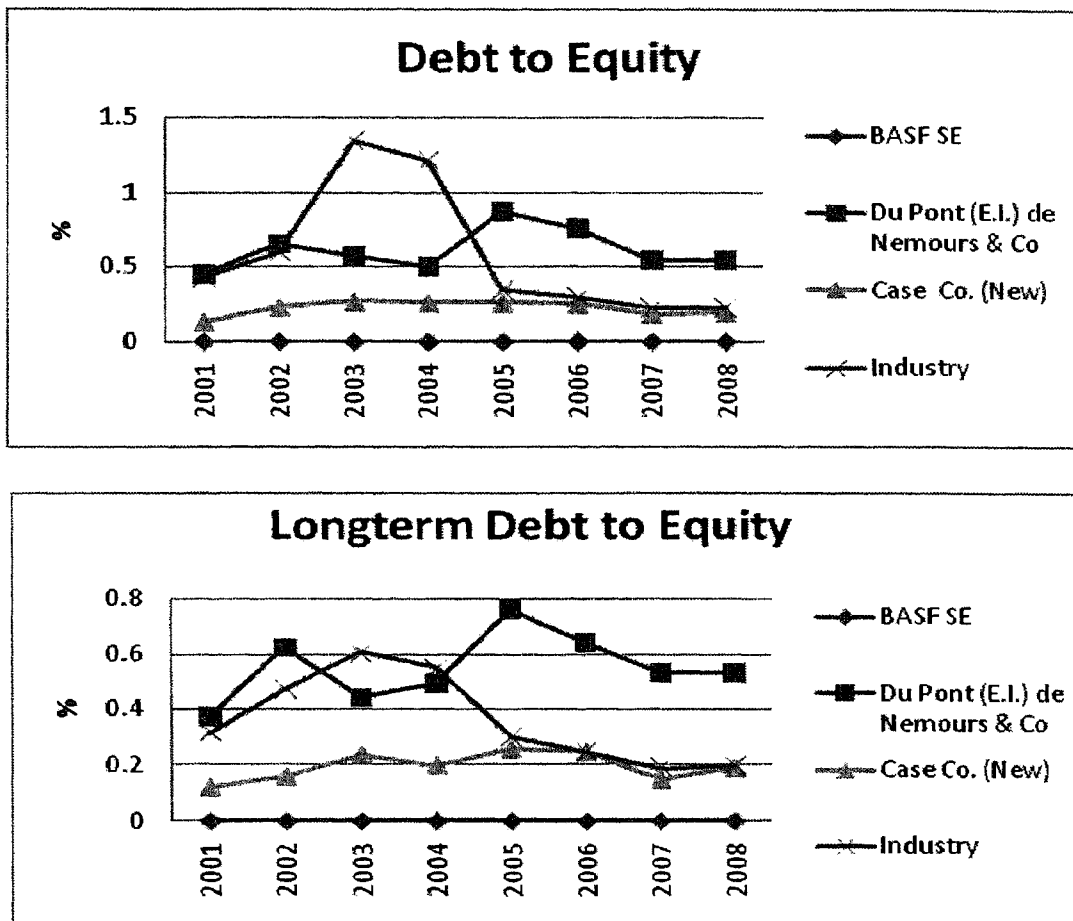
Figure 4.4 Debt management ratios.

Furthermore, Figure 4.5 shows a constant increase over the past seven years in asset turnover ratio and inventory turnover ratio. These figures show that the case company has been improving its asset utilization.

This improvement signals that the company is performing well in terms of production efficiency and effectiveness and sales and customer relationships. This strong asset management capability provides the company with a strong foundation to continue improving its financial performance.
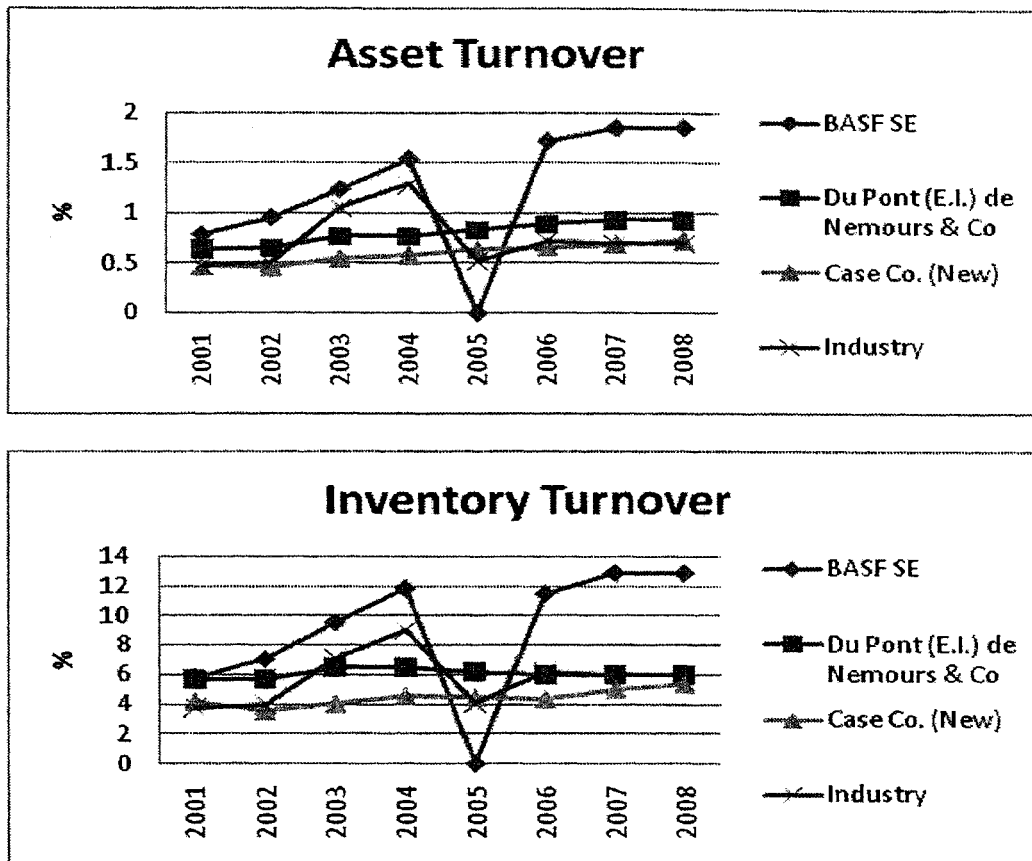
Figure 4.5 Asset management ratios.

These financial performance data indicate that the company has been working to improve on its profitability, liquidity, solvency, and asset management to enhance its financial performance.

To ensure that the company can achieve its operational goal of improving financial performance, this work proposed the BSC framework is shown in Table 4.1.

The financial perspective of the proposed BSC includes six objectives to articulate the strategy: increase profitability, improve revenue growth, create value for shareholders, improve liquidity, enhance solvency, and improve asset utilization. The proposed BSC relies on return on asset (ROA) and return on equity (ROE) to measure profitability and margins. To support the objective of revenue growth, it used sales revenue growth, which could be further broken down for individual products (seeds, genomics, and case productivity products), regions (domestic and international), and new

existing products. By breaking the sales revenue down into the detailed revenue growth measures, the company will be able to identify what their revenue drivers are and determine whether their new products represent an improvement over existing offerings. To measure shareholders' value creation, the measure of earning per share (EPS) was adopted. To monitor liquidity improvement the BSC use measures of current ratio, quick ratio, and free cash flow. To monitor solvency it uses debt ratio, debt-to-equity ratio and long-term debt-to-asset ratio. Finally, to evaluate asset utilization, the BSC measures asset turnover and cash-to-cash cycle.

In the 2007 annual report, the company describes itself as a "customer oriented company targeting on the value-seeking customer segments who value most of the maximization of seeds' yield and superior quality" and indicated that its "customer oriented market strategy is both a critical and sustainable competitive advantages." Reflecting the customer perspective financial performance, therefore, the BSC addressed objectives: maximize market share, improve customer satisfaction and retention, and increase customer acquisition. To satisfy the objective of maximizing market share, the BSC proposed a measure of growth in market share. To evaluate improvement in customer satisfaction, the BSC monitors order to delivery, customer demand fill rate, and the number of distinct customer. To monitor the third objective of improving customer retention, the BSC monitors the percentage of growth in revenue derived from existing customers. Finally, to measure customer acquisition, it adopts a measure of percentage of revenue from new customers.

Due to special nature of the business, some of the company's customers are also suppliers who provide various kinds of seeds. Thus good relationships with suppliers and minimal risks on the supplier side are vital for the company to provide high-quality products and improve financial performance. Thus, under the supplier perspective, The BSC includes three objectives: enhance suppliers' satisfaction, minimize risks triggered by weather and natural disasters, and minimizing liability transferred from suppliers guaranteed by the company. For this perspective, the number of distinct suppliers is monitored to evaluate supplier satisfaction. Raw material price fluctuation and the number of growing locations per seed assess progress forward minimization of risks triggered by weather and natural disasters. A measure of new liabilities incurred by

failure of suppliers guaranteed by the company was established to evaluate liability transferred from those suppliers.

Table 4.1 BSC framework for goal of improving financial performance.

Perspective	Objective	Measures
Financial	Increase profitability	Margin
		Net income
		ROE
	Growth revenue	Sales revenue
	Create Shareholder's value	EPS
	Improve liquidity	Current ratio
		Quick ratio
		Free cash flow
	Maintain solvency	Debt ratio
		Debt-to-equity ratio
		Long-term debt-to-asset ratio
	Improve asset utilization	Cash-to-cash cycle
		Assets turnover
Customer	Maximize market share	Growth of market share
	Improve customer satisfaction	Order-to-delivery time
		Customer demand fill rate
		Number of distinct customers
	Improve customer retention	Percentage growth of revenue derived from existing customers
	Increase customer acquisition	Percentage of revenue from new customers
Supplier	Enhance supplier satisfaction	Number of distinct suppliers
	Minimize risks triggered by weather and natural disasters	Raw material Price fluctuation
		Number of growing locations per seed
	Minimize liability transferred from suppliers guaranteed by the company	New liabilities incurred by failure of the suppliers guaranteed by the company

4.2 ENHANCING OPERATIONAL EFFICIENCY

Figure 4.5 show that the case company has a strong capability of managing assets. This capability is a sign of its strong potential to enhance its internal operational

efficiency. To ensure the company can successfully implement the operational strategy to enhance operational efficiency, the BSC framework in Table 4.2 was proposed.

This framework relies only on the perspective of internal business process to achieve the goal of enhancing operational efficiency. The BSC includes five objectives: improve production efficiency, ·enhance quality control, maximize operational effectiveness, maintain credit and reputation, and optimize mergers and acquisitions. To monitor improvement in production efficiency, the BSC uses measures of sales, production orders, and machine maintenance. To evaluate improvement in quality control, it uses defect rates. To monitor operational effectiveness, it relies on measures of sales and advertising expenses, inventory turnover, and total stock/inventory. Additionally, it uses measures of credit rating and percentage of revenue used annually to pay penalties and fines to assess the company's credit and reputation. Finally, to merger and acquisition results, the BSC measure the percentage increase in sales revenue derived from acquisitions.

Table 4.2 BSC framework for goal of enhancing operational performance.

Perspective	Objective	Measures
Internal process	Improve production efficiency	Number of production orders
		Number of machine maintenance
	Improve quality control	Defect rates
	Enhance operational effectiveness	Sales/ advertising expense
		Inventory turnover
		Total stock/inventory
	Maintain credit and reputation	Percentage of revenue used annually to pay penalties and fins
		Credit rating
	Maximize mergers and acquisition	Percentage increase in sales revenue derived from acquisitions

4.3 MAINTAINING RESEARCH AND DEVELOPMENT LEADERSHIP

Figure 4.6 shows that the case company has been investing heavily in research and development and has dramatically surpassed the average industry level.
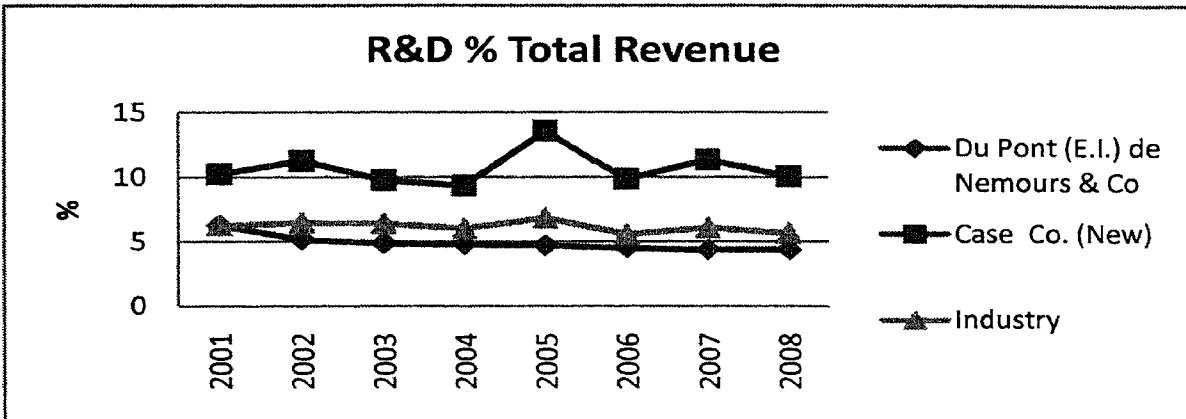
Figure 4.6 R&D as percentage of total revenue.

In its 2007 annual report, the case company pledged to "improve the yield of seeds through advanced breeding techniques and to protect those gains with the trait combinations produced by their industry-leading biotechnology capabilities." This statement clearly indicates that the company hopes to be a research leader (case company annual report, 2003).

Reflecting this goal, Table 4.3 monitors, analyzes and manages the company's research leadership objective using measures of cycle time to produce new products, percentage of R&D projects developed into new products, number of new products (which could be further broken down for seeds and traits), respectively and the increase in yields of new products (which could also be further broken down for seeds and traits).

To maintain R&D leadership, people are essential since the case company was ranked by Science magazine in September 2002 as one of the industry's top ten employers, the company appears to value its employees and understand the correlation between company performance and employees' contribution. To maintain R&D leadership, the company must maintain its commitment to its employees and ensure

employee productivity. Thus, under the learning and growth perspective, the BSC includes three objectives: improve employee satisfaction, enhance employee productivity, and retain work force. Table 4.3 lists the measures used to monitor these objectives: percentage of employee satisfied with the company, key staff turnover, and number of retraining programs.

Table 4.3 Balanced Scorecard framework for goal of maintaining R&D leadership.

Perspective	Objective	Measures
Internal process	Maintain research and development leadership	Percentage of sales revenue invested in R&D
		Percentage of sales revenue from new products
		Cycle time to produce new products
		Percentage of new projects in R&D pipeline developed into new products
		Number of new products per year
		Percentage increase in yield produced by the new products
Learning and Growth	Improve employee satisfaction	Percentage of employees satisfied with the company
	Increase employee retention	Percentage of key staff turnover
	Enhance employee productivity	Revenue per employee
	Retain the work force	Number of retraining programs

A BSC framework using various business intelligence tools and capabilities is shown in Figure 4.1.

5. DISCUSSION OF RESULTS

A basic demographic data analysis identified the background of the participants. Multiple analysis of variance (MANOVA) was used to test the hypotheses presented in above sections. The following discuss the results of both processes.

5.1 BASIC ANALYSIS

Table 5.1 shows the response rate for participating individuals, broken down by number of employees in the companies for which they work. Among companies with 50 employees or fewer, the response rate was 8.8%. Among these with 51 to 100 employees the response rate was 23.8%. For companies with 101 to 200 employees and those with 301 to 500 employees had a response rate of 43.8%. Those with an unknown number of employees had a response rate of 13.8%. No responses were received for companies with 201-300 employees. The data indicate that most participants work at mid-size or companies that likely have a need for information technology that would help them excel and the capability to implement such technology.

Table 5.1 Response rate based on number of employees.

Number of Employees	Response Percent	Response Count
1 - 50	8.8%	7
51 - 100	23.8%	19
101 – 200	5.0%	4
201 – 300	0.0%	0
301 - 500	5.0%	4
> 501	43.8%	35
Unknown	13.8%	11
TOTAL		80

Table 5.2 shows the managerial responsibilities of participants. The results indicate that 52.5% of participants have a supervisory role, whereas 47.5% of participants have no managerial responsibilities.

Table 5.2 Number of employees supervised by participants.

Number of Employees	Response Percent	Response Count	Response Percent	Response Count
None	47.5%	38	47.5%	38
1 - 50	46.5%	37		
51 - 100	1.25%	1		
101 – 150	1.25%	1	52.5%	42
151 – 200	0.0%	0		
201 - 500	3.75%	3		
> 501	0.0%	0		
TOTAL		80		

Table 5.3 shows the industries in which participants work and indicates that the survey results represent a wide range of industries.

Table5.4 shows how often the participants prepare their performance measurement reports. The results show that 13.3% of participants prepare such reports weekly, 2.7% prepare them bi-weekly, 17.3% prepare them monthly, 8% prepare them quarterly, 6.7% prepare them semi-annually, 29.3% prepare them annually, and 22.7% prepare them on an ad hoc basis.

Table 5.3 Results of industry classifications.

Answer Options	Response Percent	Response Count
Aerospace	1.3%	1
Banking	22.5%	18
Communications Carrier (telecommunication, data communication, cable)	0.0%	0
Computer Manufacturer (hardware, software, peripherals, etc.)	8.8%	7
Computer-related Retailer/Wholesaler/Distributor	1.3%	1
Construction/Architecture/Engineering	2.5%	2
Consulting	6.3%	5
Education	35.0%	28
Financial Services/VC/Accounting	1.3%	1
Government - Federal (including Military)	0.0%	0
Government - State	2.5%	2
Government - Local	0.0%	0
Healthcare/Pharmaceuticals/Biotech/Biomedical	0.0%	0
Insurance	2.5%	2
Internet/Online Service Provider)	0.0%	0
Legal	0.0%	0
Manufacturing and Process (non-computer related)	6.3%	5
Media/Marketing/Advertising	1.3%	1
Non-Profit/Trade Association	0.0%	0
Real Estate	0.0%	0
Service Provider (ASP, DP, FSP, Web Hosting)	0.0%	0
Transportation/Logistics	0.0%	0
Travel/Hospitality/Recreation/Entertainment	1.3%	1
Utilities	0.0%	0
Wholesale/Trade Distribution/Retail (non-computer related)	0.0%	0
Other (please specify in the box provided below)	7.5%	6
answered question		**80**

Table 5.4 Frequency of performance measurement reports.

Report Frequency	Response Percent	Response Count
Weekly	13.3%	10
Bi-weekly	2.7%	2
Monthly	17.3%	13
Quarterly	8.0%	6
Semi-annually	6.7%	5
Annually	29.3%	22
Other	22.7%	17
TOTAL		75

Table 5.5 indicates how participant's performance reports. The data show that 56.2% participants use them for reporting, 57.5% for accountability, 58.9% for continuous improvement, 6.8% for publicity, 15.1% to satisfy mandates, 43.8% for promotion, 43.8% for compensation, and 13.7% for other purposes. These results demonstrate the varied use of performance reports in the real business environments.

Table 5.5 Use of performance measurement reports.

Answer Options	Response Percent	Response Count
Reporting	56.2%	41
Accountability	57.5%	42
Continuous Improvement	58.9%	43
Publicity	6.8%	5
Satisfy Mandates	15.1%	11
Promotions	43.8%	32
Compensation	43.8%	32
Other (please specify)	13.7%	10
TOTAL		73

Table 5.6 shows how many participants are motivated by a clear understanding of how their job contributes to company goals, objectives and strategies. The results show

that 90.9% of participants strongly agree or agree that the employees are motivated if they can clearly identify how their job contributes to goals, objectives and strategies. Another 7.8% participants are neutral on this question, and 1.3% participants disagree. Clearly, most of the participants believe that it is important that they know how their jobs contribute.

Table 5.6 Degree to which participants are motivated by an understanding of how their job contributes to company's goals, objectives and strategies.

Answer Options	Response Percent	Response Count
Strongly agree	61.0%	47
Agree	29.9%	23
Neutral	7.8%	6
Disagree	1.3%	1
Strongly disagree	0.0%	0
TOTAL		77

Table5.7 demonstrates the results of what kind of comparison data the participants include in their current performance reports. According to the table results, there are 49.4% participants prepare reports compared with prior periods, 26% participants sometimes prepare, 14.3% participants never prepare, and 10.4% participants do not know. There are 50.6% participants never prepare reports compared with other organizations, 22.1% participants sometimes prepare, 15.6% participants do not know, and 11.7% participants do prepare. 36.8% participants never prepare industry best practices reports, 31.6% participants sometimes prepare, 18.4% participants do prepare, and 13.2% participants do not know. Moreover, there are 50% participants prepare internal comparative benchmarks reports, 19.2% participants sometimes prepare, 17.9% participants never prepare, and 12.8% participants do not know. Furthermore, 36.4% participants prepare departmental comparative data, 27.3% participants never prepare, 23.4% participants sometimes prepare, and 13% participants do not know. These data

results indicate what kind of comparative data are normally included in a real business performance measurement report.

Table 5.7 Types of comparison data included in current performance reports.

Answer Options	Definitely No	Sometimes	Definitely Yes	Do not know	Response Count
Prior periods	14.3% (11)	26.0% (20)	49.4% (38)	10.4% (8)	77
Other organizations (e.g., competitors)	50.6% (39)	22.1% (17)	11.7% (9)	15.6% (12)	77
Industry best practices	36.8% (28)	31.6% (24)	18.4% (14)	13.2% (10)	76
Internal comparative benchmarks (planned/budget value, actual value, target value)	17.9% (14)	19.2% (15)	50.0% (39)	12.8% (10)	78
Departmental/Divisional comparative data	27.3% (21)	23.4% (18)	36.4% (28)	13.0% (10)	77
answered question					78

5.2 HYPOTHESES TESTING AND RESULT DISCUSSIONS

Hypothesis 1: There is no significant difference measured by the degree of employee involvement between a BSC based CPM and a dashboard based CPM system. (H_0: CPM-Type$_i$ =0)

The basic results for degree of employee involvement from survey is shown in Table4.8 below. Based on the Table 4.8, there are 88.9% participants strongly agree or agree (20.8% strongly agree, 68.1% agree) that dashboard system could help the users to understand their company strategies, goals and objectives, while 2.8% participants are neutral, 6.9% disagree, and 1.4% strongly disagree. On the other hand, there are 81.7% participants strongly agree or agree (32.4% strongly agree, 49.3% agree) that balanced scorecard system could help the users to understand their company strategies, goals and objectives, while 14.1% participants are neutral, 2.8% disagree, and 1.4% strongly disagree.

For the factor of understanding initiatives of the company from Table 4.8, there are 75.7% participants strongly agree or agree (18.6% strongly agree, 57.1% agree) that

dashboard system could help the users to understand initiatives/actions their company is taking, while 12.9% participants are neutral, 8.6% disagree, and 2.9% strongly disagree. Compared with the dashboard system, there are 81.5% participants strongly agree or agree (36.6% strongly agree, 54.9% agree) that scorecard system could help the users to understand initiatives/actions their company is taking, while 2.8% participants are neutral, 4.2% disagree, and 1.4% strongly disagree.

Regarding on the factor of understanding roles and responsibilities from Table 5.8, there are 52.8% participants strongly agree or agree (11.4% strongly agree, 41.4% agree) that dashboard system could help the users to understand initiatives/actions their company is taking, while 28.6% participants are neutral, 14.3% disagree, and 4.3% strongly disagree. For the scorecard system, there are 87.3% participants strongly agree or agree (40.8% strongly agree, 46.5% agree) that scorecard system could help the users to understand initiatives/actions their company is taking, while 7.0% participants are neutral, 1.4% disagree, and 4.2% strongly disagree.

Table 5.8 Encouragement of employee involvement.

Measures	Type of CPM	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total Response
Understand my company's strategies, goals, and objectives.	Dashboard	20.8%	68.1%	2.8%	6.9%	1.4%	72
	Scorecard	32.4%	49.3%	14.1%	2.8%	1.4%	71
Understand initiatives/actions that my company is taking.	Dashboard	18.6%	57.1%	12.9%	8.6%	2.9%	70
	Scorecard	36.6%	54.9%	2.8%	4.2%	1.4%	71
Understand my roles and responsibilities in my company.	Dashboard	11.4%	41.4%	28.6%	14.3%	4.3%	70
	Scorecard	40.8%	46.5%	7.0%	1.4%	4.2%	71

As the three dependent measures (Involvement$_j$) are not independent to each other and the observation/respondent was measured for both types of CPM, so the designed is a Multivariate Repeated Measure. Multiple analysis of variance (MANOVA) is used to see

the main and interaction effects of categorical variables on multiple dependent interval variables.

MANOVA could be used to compare groups formed by categorical independent variables on group differences in a set of interval dependent variables. Therefore, the MANOVA is used to test if an overall effect is significant from using different types of CPM. The hypothesis test results for hypothesis 1 (H_0: CPM-Type$_i$ =0) are provided in Table 5.9.

Table 5.9 Multivariate analysis of variance [b,c] for employee involvement.

Within Subjects Effect		Value	F	Hypothesis df	Error df	Sig. (p value)
CPM-Type	Pillai's Trace	.302	9.382[a]	3.000	65.000	.000
	Wilks' Lambda	.698	9.382[a]	3.000	65.000	.000
	Hotelling's Trace	.433	9.382[a]	3.000	65.000	.000
	Roy's Largest Root	.433	9.382[a]	3.000	65.000	.000

a. Exact statistic

b. Design: Intercept

Within Subjects Design: Types

c. Tests are based on averaged variables.

Wilks' lambda is a test statistic used in multivariate analysis of variance (MANOVA) to test whether there are differences between the means of identified groups of subjects on a combination of dependent variables.

The Hotelling-Lawley Trace is a statistic for a multivariate test of mean differences between two groups. As p-value from Wilks' Lambda and Hotelling's Trace are less than 0.05 at α=0.05 level, the null hypothesis 1 is not supported. That is, the

degree of employee involvement is affected by the type of CPM used. Therefore, univariate analysis is conducted to test if the influence of CPM-Type is significant measured by the three measures of the degree of employee involvement (Involvement$_1$ (Strategies) = Understand Strategy, Goals, Objectives; Involvement$_2$ (Initiatives)= Understand Initiatives; Involvement$_3$ (Roles)= Understand Roles and Responsibilities). The results of univariate tests are provided in Table 5.10 below:

Table 5.10. Tests of within-subjects contrasts for employee involvement.

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig. (p-value)
Types	strategy	3.559	1	3.559	8.689	.004
	initiative	5.360	1	5.360	9.938	.002
	role	19.882	1	19.882	28.885	.000
Error(Types)	strategy	27.441	67	.410		
	initiative	36.140	67	.539		
	role	46.118	67	.688		

The p-values for Strategies, Initiatives, and Roles are 0.004, 0.002, and 0.000 respectively as shown in Table 5.10. Therefore, the influence of CPM-Type is significant for each of three employee involvement measures at $\alpha=0.05$ level. That is, as descriptive statistics provided in Table 5.11, a scorecard based CPM (mean value = 1.63) will result in higher degree of employee involvement than a dashboard based CPM (mean value = 1.96) measured by their understanding of an organization's strategies, goals, and objectives.

And a scorecard based CPM (mean value = 1.81) will lead to higher degree of employee involvement than a dashboard based CPM (mean value = 2.21) measured by their understanding of initiatives/actions their company is taking. Moreover, a scorecard based CPM (mean value = 1.82) will result in higher degree of employee involvement

than a dashboard based CPM (mean value = 2.59) measured by their understanding of roles and responsibilities in the company.

Table 5.11 Descriptive statistics for employee involvement.

	Mean	Std. Deviation	N
Dashboard__ Strategy	1.96	.781	68
Scorecard__ Strategy	1.63	.751	68
Dashboard__ initiative	2.21	.955	68
Scorecard __initiative	1.81	.815	68
Dashboard__ role	2.59	1.026	68
Scorecard __role	1.82	.961	68

Hypothesis 2: There is no significant difference measured by the level of effectiveness between a BSC based CPM and a dashboard based CPM system. (H_0: CPM-$Type_i$ =0)

The basic results of the effectiveness of the proposed system from the survey are displayed in Table 5.12. For factor of tracking performance, there are 84.7% participants agree (20.8% strongly agree and 63.9% agree) that the dashboard system helps to consistently track team's performance, while 11.1% participants are neutral, and 4.2% participants disagree (2.8% disagree and 1.4% strongly disagree). On the other hand, there are 81.7% (32.4% strongly agree and 49.3% agree) participants agree that scorecard system helps to consistently track team's performance, while 14.1% participants are neutral, and 4.2% participants disagree (2.8% disagree and 1.4% strongly disagree).

For factor of understanding linkage among company strategies and measures, there are total 78.9% participants agree (19.7% strongly agree and 59.2% agree) that the dashboard system helps users to clearly understand the cause-effect relationship and

linkage among performance measures, objectives, actions plans, and strategies, while 14.1% participants are neutral and 7% participants disagree (5.6% disagree and 1.4% strongly disagree). However, for the scorecard system, there are 85.9% participants agree (33.8% strongly agree and 52.1% agree) that the scorecard system helps users to clearly understand the cause-effect relationship and linkage among performance measures, objectives, actions plans, and strategies, while 9.9% participants are neutral and 4.2% participants disagree (2.8% disagree and 1.4% strongly disagree).

For factor of understanding the company's overview, there are 61.1% participants agree (9.7% strongly agree and 51.4% agree) that the dashboard system would give a clear overview of company, while 27.8% participants are neutral and 11.1% disagree (9.7% disagree and 1.4% strongly disagree). For the scorecard system, there are 66.2% participants agree (18.3% strongly agree and 47.9% agree) that the scorecard system would give a clear overview of company, while 27.8% participants are neutral and 7% disagree (5.6% disagree and 1.4% strongly disagree).

For factor of communication, there are 68.1% participants agree (12.5% strongly agree and 55.6% agree) that dashboard system would allow users to communicate better with other groups or departments, while 22.2% participants are neutral and 9.7% disagree. On the other hand, there are 70.4% participants agree (23.9% strongly agree and 46.5% agree) that scorecard system would allow users to communicate better with other groups or departments, while 9.9% participants are neutral and 8.4% disagree (7% disagree and 1.4% strongly disagree).

Table 5.12 Received effectiveness

Measures	Type of CPM	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Response rate
The proposed system could help me to track my team's performance consistently	Dashboard	20.8%	63.9%	11.1%	2.8%	1.4%	72
	Scorecard	32.4%	49.3%	14.1%	2.8%	1.4%	71
The proposed system could help me to understand clearly the links among my companies performance measures, objectives, actions plans, and strategies.	Dashboard	19.7%	59.2%	14.1%	5.6%	1.4%	71
	Scorecard	33.8%	52.1%	9.9%	2.8%	1.4%	71
The proposed system would give me a clear overview of company governance.	Dashboard	9.7%	51.4%	27.8%	9.7%	1.4%	72
	Scorecard	18.3%	47.9%	26.8%	5.6%	1.4%	71
The proposed system would allow me to communicate better with other groups or departments	Dashboard	12.5%	55.6%	22.2%	9.7%	0.0%	72
	Scorecard	23.9%	46.5%	21.1%	7.0%	1.4%	71

As the four dependent measures (Effectiveness$_j$) are not independent to each other and the observation/respondent was measured for both types of CPM, so the designed is also a Multivariate Repeated Measure.

The MANOVA is used to test if an overall effect is significant from using different types of CPM. The hypothesis test results for hypothesis 2 (H_0: CPM-Type$_i$ =0) are provided in Table 5.13.

Table 5.13 Multivariate analysis of variance [b,c] for effectiveness.

Within Subjects Effect		Value	F	Hypothesis df	Error df	Sig.
Effectiveness	Pillai's Trace	.069	1.227[a]	4.000	66.000	.308
	Wilks' Lambda	.931	1.227[a]	4.000	66.000	.308
	Hotelling's Trace	.074	1.227[a]	4.000	66.000	.308
	Roy's Largest Root	.074	1.227[a]	4.000	66.000	.308

a. Exact statistic

b. Design: Intercept
Within Subjects Design: Effectiveness

c. Tests are based on averaged variables.

As p-value from Wilks' Lambda and Hotelling's Trace are both more than 0.05 at $\alpha=0.05$ level, the null hypothesis 2 is supported. That is, the effective of a CPM is not affected by the type of CPM used.

Hypothesis 3: There is no significant difference in regard of usability between BSC based CPM and a dashboard based CPM system. ($H_{0:}$ CPM-Type$_i$ =0)

The basic results for the usability of the proposed system from the survey are shown in Table 5.14. For factor of easy to understand the proposed system, there are 88.9% participants agree (36.1% strongly agree and 52.8% agree) that reports and charts provided by the dashboard prototype are easy to understand, while 9.7% participants are neutral and 1.4% disagree.

However, for the scorecard system, there are 73.2% participants (35.2% strongly agree and 38% agree) that reports and charts provided by the scorecard prototype are easy to understand, while 21.1% participants are neutral and 5.6% participants disagree (4.2% disagree and 1.4% strongly disagree).

For factor of user-friendly interface in Table 5.14, there are 81.9% participants agree (37.5% strongly agree and 44.4% agree) that the dashboard prototype provides a

user-friendly interface, while 15.3% participants are neutral and 2.8% participants disagree. Compared with dashboard system, there are 64.8% participants agree (19.7% strongly agree and 45.1% agree) that the scorecard prototype provides a user-friendly interface, while 23.9% participants are neutral and 11.3% participants disagree (9.9% disagree and 1.4% strongly disagree).

Based on Table 5.14, there are 86.1% participants agree (40.3% strongly agree and 45.8% agree) that the users can learn to operate the dashboard system easily, while12.5% participants are neutral and 1.4% disagree. For the scorecard system, there are 76% participants agree (23.9% strongly agree and 52.1% agree) that the users can learn to operate the scorecard system easily, while16.9% participants are neutral and 7% disagree (5.6% disagree and 1.4% strongly disagree)

Table 5.14 Perceived usability of the proposed system.

Measures	Type of CPM	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Response rate
Easy to understand	Dashboard	36.1%	52.8%	9.7%	1.4%	0.0%	72
	Scorecard	35.2%	38.0%	21.1%	4.2%	1.4%	71
User-friendly interface	Dashboard	37.5%	44.4%	15.3%	2.8%	0.0%	72
	Scorecard	19.7%	45.1%	23.9%	9.9%	1.4%	71
Learnability	Dashboard	40.3%	45.8%	12.5%	1.4%	0.0%	72
	Scorecard	23.9%	52.1%	16.9%	5.6%	1.4%	71

As the four dependent measures ($Usability_j$) are not independent to each other and the observation/respondent was measured for both types of CPM, so the designed is still a Multivariate Repeated Measure. The MANOVA is used to test if an overall effect is significant from using different types of CPM. The hypothesis test results for hypothesis 3 (H_0: CPM-Type$_i$ =0) are provided in Table 5.15.

Table 5.15 Multivariate analysis of variance[b,c] for usability.

Within Subjects Effect		Value	F	Hypothesis df	Error df	Sig.(p-value)
Usability	Pillai's Trace	.155	4.170[a]	3.000	68.000	.009
	Wilks' Lambda	.845	4.170[a]	3.000	68.000	.009
	Hotelling's Trace	.184	4.170[a]	3.000	68.000	.009
	Roy's Largest Root	.184	4.170[a]	3.000	68.000	.009

a. Exact statistic

b. Design: Intercept
Within Subjects Design: Effectiveness

c. Tests are based on averaged variables.

As p-value from Wilks' Lambda and Hotelling's Trace are less than 0.05 at $\alpha=0.05$ level, the null hypothesis 3 is not supported. That is, the usability of proposed system is affected by the type of CPM used.

Therefore, univariate analysis is conducted to test if the influence of CPM-Type is significant measured by the three measures of the usability of proposed system Usability$_1$ (Understand) = Reports and charts are easily to understand; Usability$_2$ (Interface) = Provides a user-friendly interface; Usability$_3$ (Learnability) = Easy to learn to operate. The results of univariate tests are provided in Table 5.16 below:

Table5.16 Tests of within-subjects contrasts for usability.

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig.(p-value)
Usability	Understand	1.803	1	1.803	3.486	0.066
	Interface	7.211	1	7.211	12.687	0.001
	Learnability	4.056	1	4.056	8.619	0.004
Error(Usability)	Understand	36.197	70	0.517		
	Interface	39.789	70	0.568		
	Learnability	32.944	70	0.471		

The p-values for Understand, Interface, and Learnability are 0.066, 0.001, and 0.004 respectively as shown in Table 5.16. Therefore, the influence of CPM-Type is significant for the two usability measures of friendly user interface and learnability at $\alpha=0.05$ level. As descriptive statistics provided in Table 5.17, a dashboard based CPM (mean value = 1.76) will result in better usability than a scorecard based CPM (mean value = 1.99) measured by reports and charts are easily to understand. And a dashboard based CPM (mean value = 1.83) will lead to better usability than a scorecard based CPM (mean value = 2.28) measured by providing a user-friendly interface.

Moreover, a dashboard based CPM (mean value = 1.75) will result in better usability than a scorecard based CPM (mean value = 2.08) measured by easy to learn to operate

Table 5.17 Descriptive statistics for usability (N = 71).

Measures	Type of CPM	Mean	Std. Deviation
Easy Understand	Dashboard	1.76	.686
	Scorecard	1.99	.933
Friendly User Interface	Dashboard	1.83	.793
	Scorecard	2.28	.944
Learnability	Dashboard	1.75	.731
	Scorecard	2.08	.874

6. CONCLUSIONS, CONTRIBUTIONS, RESEARCH LIMITATIONS, AND FUTURE RESEARCH DIRECTIONS

6.1 CONCLUSIONS AND RECOMMENDATIONS

Based on the above demographic data analysis and hypothesis testing, it is indicated that a BSC based performance management system provides a higher degree of employee involvement than a dashboard based performance management system, a BSC based performance management system is not more effective than a dashboard based performance management system for top management than lower-level management, and a dashboard based performance management system have better level of usability than the BSC based performance management system to users.

By and large, according to the research study, the choice of selecting different approaches to implement the corporate performance management system will result in different level of employee involvement and system usability. The scorecard approach will lead to higher degree of employee involvement in terms of helping users to understand the company's strategies, goals, and objectives, helping users to understand initiatives/actions that the company is taking, and helping users to understand their roles and responsibilities in the company. While the dashboard approach will result in better usability in terms of easy to understand, user-friendly interface and easily to learn to operate.

Therefore, the research study provides a useful point of view to help the companies and managers who are going to implement the corporate management system on regarding of approach selection.

6.2 RESEARCH CONTRIBUTIONS

Generally the research study has focused on studying the comparison of a dashboard based and balanced scorecard based corporate performance management system, in terms of the effectiveness of the proposed system, the degree of employee involvement, and the usability of the proposed system. The research work has provided a

theoretical understanding of corporate performance management system, balanced scorecard, dashboard, enterprise resource planning system, and business intelligence. The analysis conducted has emphasized on proving whether the approach selection of CPM implementation will result in different effectiveness of the proposed system, the degree of employee involvement, and the usability of the proposed system.

6.3 RESEARCH LIMITATIONS

6.3.1 Limitations of Prototype Demo and Survey. The contents and structure of the presentation used for the prototype demonstration and survey are not tested firstly to avoid any bias that might influence the survey participants' opinions towards the proposed system. Therefore, there might be certain level of bias in the survey data results.

The presentation of the prototype demonstration and survey lasts about 20 to 30 minutes. And this might influence the survey participants especially for the online survey participants, as people might lose patience during the survey and just quit the survey. This might be the reason for the incomplete survey results.

The total number of survey results collected in the study is 80, due to the time limitations. This amount of survey data is enough for the research study, but if there could be more data results collected, there might be more meaningful results discovered.

6.3.2 Limitations of Prototype Implementations. The prototypes do not provide detailed information of each measure for users to further drill down how each measure is calculated. This detailed data sometimes are needed for users to troubleshoot the root causes of any problem or issues.

The prototypes do not implement any interactive charts or tables for users to conduct more comprehensive if-what data analysis which could facilitate users to simulate the business conditions.

There are not much leading indicators implemented in the prototypes, which limit the users regarding on predicting the company's future performance and making effective decisions.

The usability of the prototypes is not very good. Due to the limitations of research time and resources, the researcher does not spend much time on studying the

visualization of data and the usability of the proposed systems. Therefore, there are much potential to improve the prototypes usability.

The software used to implement the prototypes is all from SAP, so there might result certain level of limitations on the functionalities and features the prototypes provided.

6.4 FUTURE RESEARCH DIRECTIONS

There are certain potential improvement that could be made for the prototype implementations, prototype demonstrations and survey deployment in the research study, according to the above research limitations.

The research study also raised several other research questions for further research study. Firstly, will the choice of different system vendors affect the research results? Secondly, will the BSC based corporate performance management system require same level of company input to implement compared with dashboard based corporate performance management system? Thirdly, will the BSC based corporate performance management system requires same level of company information technology maturity to implement compared with dashboard based corporate performance management system? Future research can continue to study on these research questions and others, providing more insights on the research topic.

APPENDIX A.

BALANCED SCORECARD CONSTRUCTIONS FOR THE CASE COMPANY

BSC implementation involves the creation of infoCube, queries, a measure catalog, and a data loading and BSC configuration. Following is detailed information about all processes necessary to develop a BSC prototype for the case company.

InfoCube DESIGN AND CONSTRUCTION

Infocube creation. The InfoObject of the case company prototype includes two infoObject catalogs: one for Characteristics called "ThesisResearch_Prototype_Zhu_Char", and one for Key figure called "ThesisResearch_Prototype_Zhu _Key". Under the "ThesisResearch_Prototype_Zhu_Char" catalog, there are two infoObjects, "Product" and "Region". Under the "ThesisResearch_Prototype_Zhu _Key" catalog, there are 16 key figures: Asset Turnover, Asset Turnover_Target, Current Ratio, Current Ratio_Target, Debt/Equity, Debt/Equity_Target, Free Cash Flow, Free Cash Flow_Target, Gross Margin, Gross Margin_Target, Long-Term Debt-to-Assets, Long-Term Debt-to-Assets_Target, Quick Ratio, Quick Ratio_Target, ROE, and ROT_Target. Figure A.1 shows the InfoObject hierarchy of the financial perspective for the BSC prototype. After development of the InfoObjects, the ThesisResearch_Financial_Zhu Infocube was created. Under the phototype InfoCube, the characteristic InfoObjects of the Calendar Year/Quarter (default characteristic in SAP) was assigned to the time dimension. The characteristic InfoObjects of Product and Region are assigned to the organization dimension, and all key figure InfoObjects were assigned to the Key Figure. These assignments are demonstrated in Figures A.2 and A.3.

Figure A.1 InfoObjects hierarchy.

Figure A.2 Characteristics assignment in InfoCube.

Figure A.3 Key figure assignment in infoCube.

QUERY CREATION

A query is used to transfer the data from the infoCube to the BSC. For the prototype BSC , the queries ThesisResearch_FinancialPerspective_LinZhu,ThesisResearch_InternalPerspective_LinZ hu,ThesisResearch_Learning&GrowthPerspective_LinZhu,ThesisResearch_CustomerPer spective_LinZhu,andThesisResearch_SupplierPerspective_LinZhu were developed for the ThesisResearch_Financial_Zhu Infocube. Figure A.4 displays the design view of the query developed for the prototype. Figure A.5 displays the query result view for the ThesisResearch_FinancialPerspective_LinZhu query.
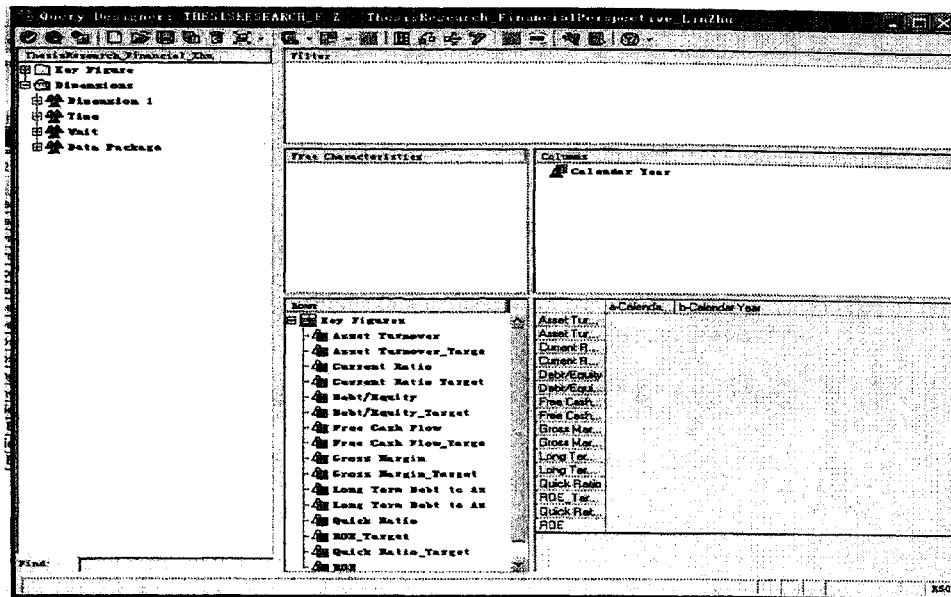
Figure A.4 Query design view.

Calendar Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	Overall Result
Asset Turnover	0.730	0.470	0.460	0.550	0.590	0.640	0.660	0.690	0.730	5.510
Asset Turnover_Targe	4.295	0.872	0.567	1.184	1.449	0.518	0.811	0.774	1.031	11.501
Current Ratio	1.710	2.020	2.440	2.550	2.600	2.150	2.400	1.650	1.710	19.230
Current Ratio Target	5.232	1.594	1.649	3.216	3.678	1.422	1.326	1.340	1.806	21.263
Debt/Equity	0.190	0.130	0.230	0.270	0.260	0.260	0.250	0.180	0.190	1.960
Debt/Equity_Target	0.494	1.673	0.510	1.510	1.039	0.294	0.251	0.189	0.556	6.516
Free Cash Flow	0	0	0	0	0	0	0	0	0	0
Free Cash Flow_Targe	0	0	0	0	0	0	0	0	0	0
Gross Margin	0.544	0.120	0.467	0.468	0.470	0.477	0.483	0.501	0.544	4.074
Gross Margin_Target	0.520	0.257	0.256	0.424	0.454	0.308	0.322	0.341	0.443	3.425
Long Term Debt to As	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Long Term Debt to As	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Quick Ratio	1.000	1.290	1.420	1.550	1.590	1.100	1.430	0.900	1.000	11.260
ROE_Target	0.106	-0.033	0.006	0.235	0.029	0.006	0.009	0.698	0.121	1.181
Quick Ratio_Target	0.861	0.870	0.838	2.353	2.855	0.798	0.853	0.698	0.963	11.099
ROE	0.239	0.040	0.014	0.016	0.051	0.047	0.114	0.142	0.239	0.902

Figure A.5 Query result view.

MEASURE CONSTRUCTION

In the prototype's financial perspective, eight measures were created: gross margin, return on equity, current ratio, quick ratio, free cash flow, debt/equity, long-term debt-to-asset, and asset turnover. Here, the gross margin is displayed in Figure A.6 as an example.
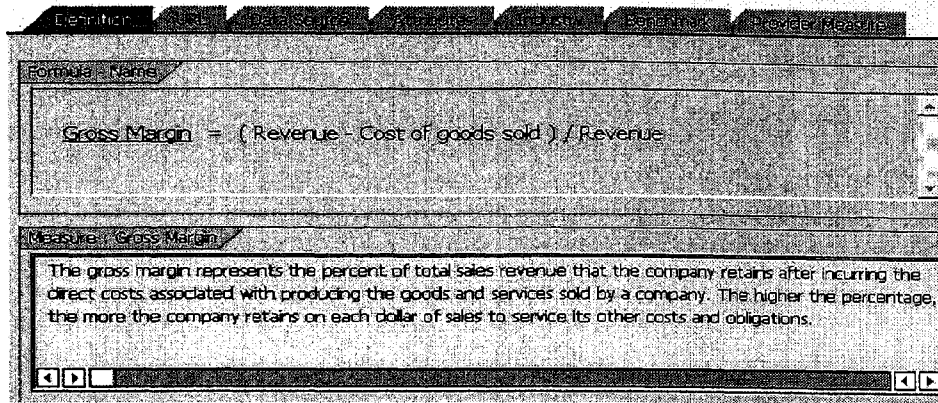
Figure A.6 Measure of gross margin.
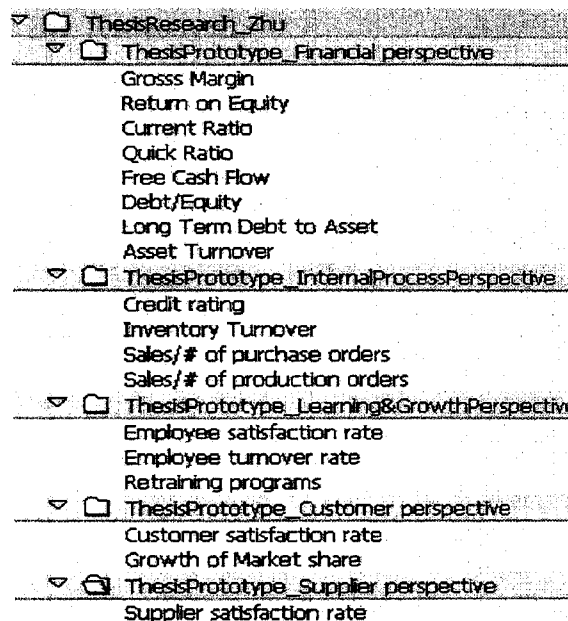
Figure A.7 Overview of all measures created for the case company.

DATA LOADING/DATA SOURCE CREATION

Three steps were required to load the data into the InfoCube in SAP: data source creation, transformation development, and data transfer. To load the data into SAP, the data source ThesisResearch was first created. The data was then loaded manually from the CSV file. Figures A.8, A.9, A.10 and A.11 show various data source views.
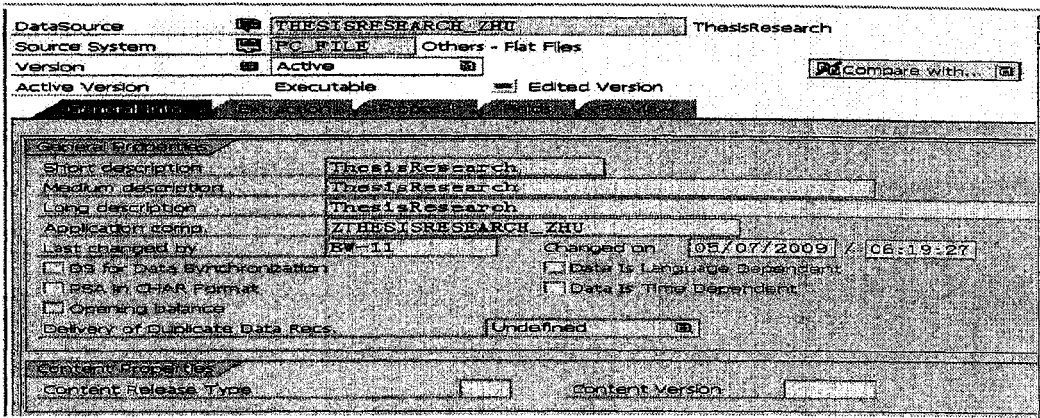
Figure A.8 General Information of the data source
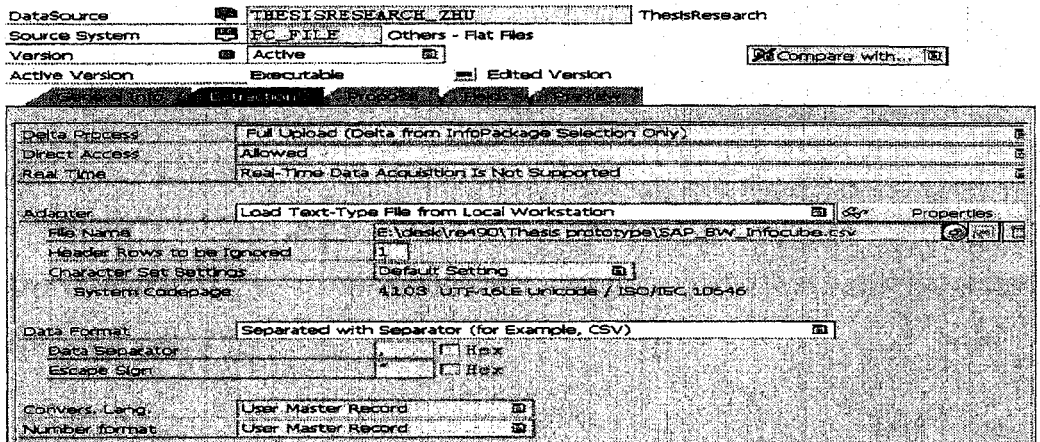
Figure A.9 Extraction view of the data source
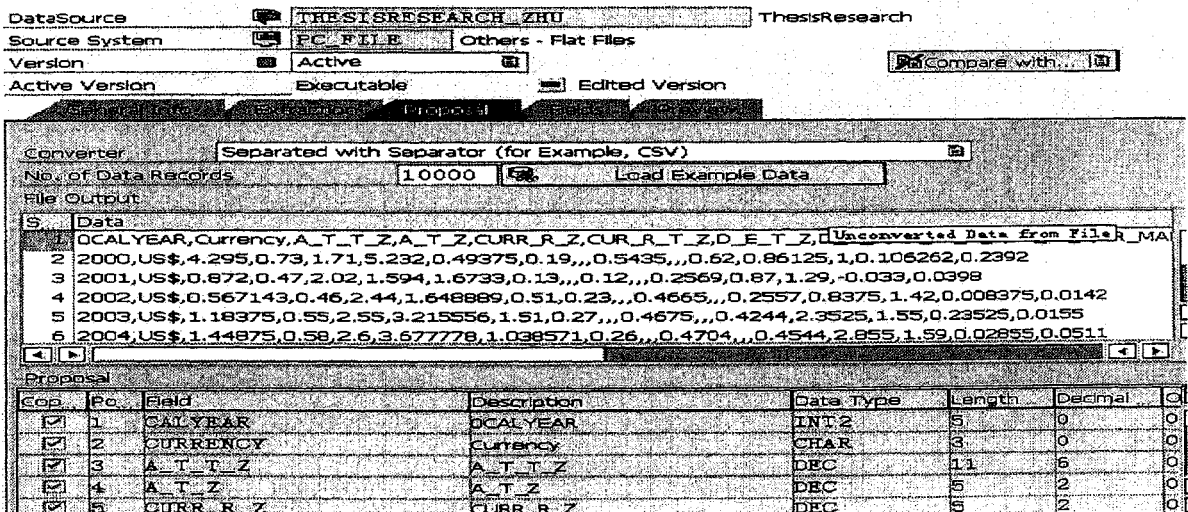
Figure A.10 Proposal view of the data source.

DataSource		THESISRESEARCH_ZHU		ThesisResearch
Source System		PC_FILE	Others - Flat Files	
Version		Active		
Active Version	Executable		Edited Version	

No. of Data Records 10000 Read Preview Data

OCALYEAR	Currency	A_T_T_Z	A_T_Z	CURR_R_Z	CUR_R_T_Z	D_E_T_Z	D_E_Z	FR_CF_T_Z	FR_CF_Z	GR_MARGIN	LD_A_T_Z	L
002000	US$	4.295000	0.73	1.71	5.232000	0.493750	0.19	0	0	0.5435	0	
002001	US$	0.872000	0.47	2.02	1.594000	1.673300	0.13	0	0	0.1200	0	
002002	US$	0.567143	0.46	2.44	1.648889	0.510000	0.23	0	0	0.4665	0	
002003	US$	1.183750	0.55	2.55	3.215556	1.510000	0.27	0	0	0.4675	0	
002004	US$	1.448750	0.58	2.60	3.677778	1.038571	0.26	0	0	0.4704	0	
002005	US$	0.518000	0.64	2.15	1.422000	0.294286	0.26	0	0	0.4773	0	
002006	US$	0.811429	0.66	2.40	1.325556	0.251429	0.25	0	0	0.4831	0	
002007	US$	0.773750	0.69	1.65	1.340000	0.188571	0.18	0	0	0.5005	0	
002008	US$	1.031429	0.73	1.71	1.805714	0.555714	0.19	0	0	0.5435	0	

Figure A.11 Preview of the data source.

After creation of the data source, the transformation was developed to map the data to the appropriate fields in the infoCube. Figure A.12 displays the mapping between the data source and the infoCube.

Figure A.12 transformation view.

Finally, once the data was mapped, the data transfer process was built to execute the data loading. Figure A.13 displays the data transfer process overview.
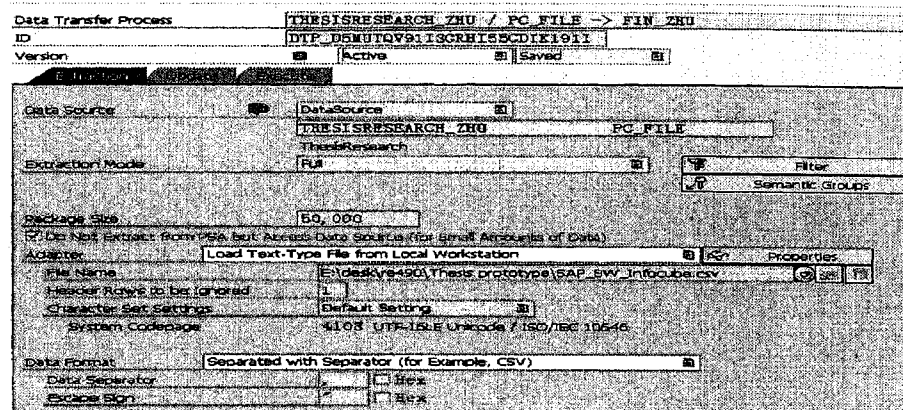
Figure A.13 data transfer process.

After the data transfer execution, data is uploaded to the target InfoCube. Figure A.14 demonstrates the master data view of the InfoCube for the case company prototype.

"FIN_ZHU", List output

DCAL YEAR	Currency	A T T Z	A T Z	CURR R Z	CUR R T Z	D E T Z	D E Z	FR CF T Z	FR CF Z	GR MARGIN	LD A T Z	LD A Z	MRG T ZHU	QU R T Z	QU R Z	ROE T ZH
2008		1.031	0.730	1.710	1.806	0.556	0.190	0.00	0.00	0.544	0.000	0.000	0.443	0.963	1.000	0.121
2001		0.872	0.470	2.020	1.594	1.673	0.130	0.00	0.00	0.120	0.000	0.000	0.257	0.870	1.290	0.033
2000		4.295	0.730	1.710	5.232	0.494	0.190	0.00	0.00	0.544	0.000	0.000	0.620	0.861	1.000	0.106
2007		0.774	0.690	1.650	1.340	0.189	0.180	0.00	0.00	0.501	0.000	0.000	0.341	0.698	0.900	0.698
2006		0.811	0.660	2.400	1.326	0.251	0.250	0.00	0.00	0.483	0.000	0.000	0.322	0.863	1.430	0.009
2005		0.518	0.640	2.150	1.422	0.294	0.260	0.00	0.00	0.477	0.000	0.000	0.308	0.798	1.100	0.008
2004		1.449	0.580	2.600	3.678	1.039	0.260	0.00	0.00	0.470	0.000	0.000	0.454	2.855	1.590	0.029
2003		1.184	0.550	2.550	3.216	1.510	0.270	0.00	0.00	0.468	0.000	0.000	0.424	2.353	1.550	0.235
2002		0.567	0.460	2.440	1.649	0.510	0.230	0.00	0.00	0.467	0.000	0.000	0.256	0.838	1.420	0.008

Figure A.14 Master data display in InfoCube.

BALANCED SCORED CONFIGURATION

BSC construction involves strategies, perspectives, objectives, and scorecard development.

Strategy Development. There goals were developed for the prototype: improve financial performance, enhance operational effectiveness, and maintain R&D leadership. Figures A.15, A.16 and A.17 show the views for each goal in SAP.

Figure A.15 Strategy of improving financial performance.

Figure A.16 Goal of enhancing operational effectiveness.

Figure A.17 Goal of Maintaining R&D leadership.

Perspective Development. Five perspectives were created based on the case company's specific business: financial, customer, internal process, supplier, and learning and growth. Figures A.18, A.19, A.20, A.21, and A.22 display the five perspectives developed in the case company prototype.

Figure A.18 Financial perspective.

Figure A.19 Customer perspective.

Figure A.20 Internal process perspective.

Figure A.21 Supplier perspective.

Figure A.22 Learning & Growth perspective.

Objectives creation. Four objectives were created for the financial perspectives: increase profitability, improve liquidity, enhance solvency, and improve asset utilization.

For the customer perspective, the objectives were to maximize market share, improve customer satisfaction, improve customer retention, and increase customer acquisition.

For internal process perspective, the objectives were to improve production efficiency, improve quality control, enhance operational effectiveness, maintain credit and reputation, maximize merger and acquisition optimization, and maintain R&D leadership. Figure A.23 displays these objectives.

▽ Financial perspective	F_P_Z
Increase Profitability	F_P_Z
Liquidity improvement	F_P_Z_2
Enhance Solvency	F_P_Z_3
Improve utilization of assets	F_P_Z_4
▽ Customer Perspective	C_P_Z
Maximize market share	C_P_Z_1
Improve Customer Satisfaction	C_P_Z_2
Improve Customer retention	C_P_Z_3
Increase Customer acquisition	C_P_Z_4
▽ Internal process perspective	I_P_Z
Improve Production Efficiency	I_P_Z_1
Improve quality control	I_P_Z_2
Enhance Operational Effectiveness	I_P_Z_3
Maintain Credit and reputation	I_P_Z_4
Maximize Merger and acquisition optimization	I_P_Z_5
Maintain Research and development leadership	I_P_Z_6
▽ Supplier Perspectvie	S_P_Z
Enhance Supplier satisfaction	S_P_Z_1
Minimize risks triggered by weather and natural	S_P_Z_2
Minimize liability transferred from suppliers	S_P_Z_3
▽ Learning&Growth perspectiv	L&G_P_:
Improve employee satisfaction	L&G_P_Z_
Increase employee retention	L&G_P_Z_:
Enhance employee productivity	L&G_P_Z_:
Reskilling work forces	L&G_P_Z_:

Figure A.23 Objectives of case company.

Balanced scorecard creation. Once goals, perspectives, and objectives were developed for the prototype, the BSC could be created.

The prototype of BSC was defined with the calendar year as the fiscal variant, Perspective/Objective/Measure as the breakdown overview, and Objective/Measure as the breakdown analysis view. These properties are displayed in Figure A.24.
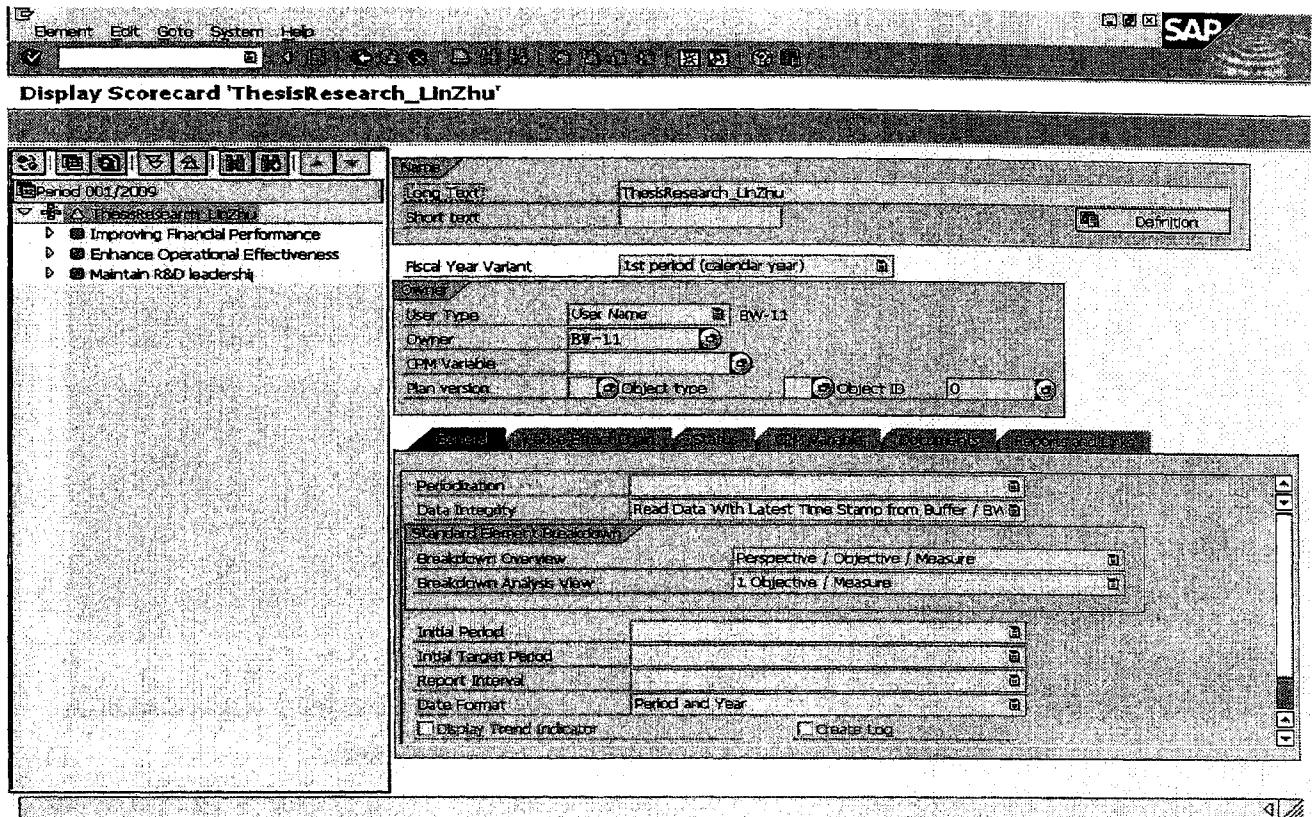
Figure A.24 Property of the scorecard.

After the BSC was created and assigned to the proper hierarchy, fields, strategies, perspectives, and objectives were assigned. Four value fields were assigned to track company performance: which are actual, score, target, and trend as shown in Figure A. 25
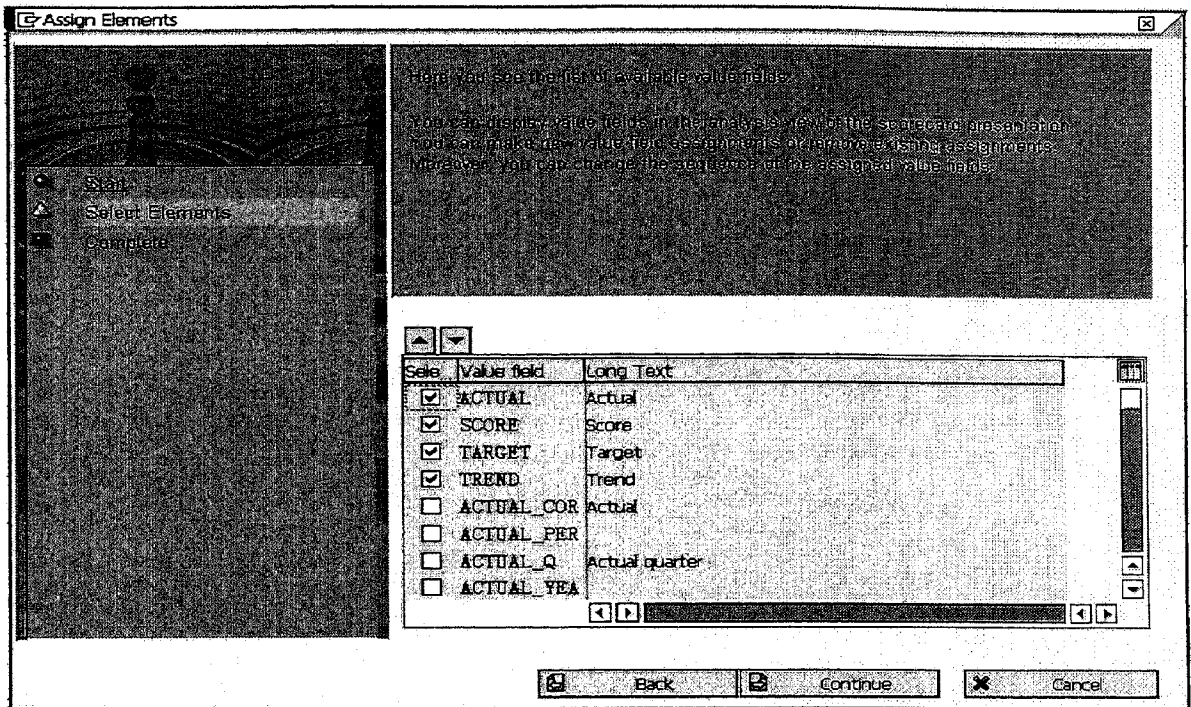
Figure A.25 Value fields of the scorecard.

Next, strategies, perspectives, objectives, and measures were assigned as shown in Figures A. 26, A. 27, A.28, and A.29.
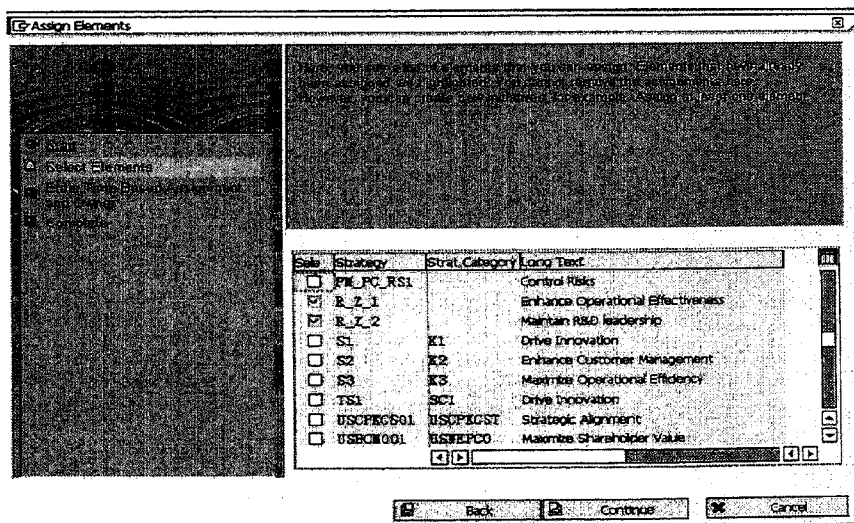
Figure A.26 Strategy assignment wizard.
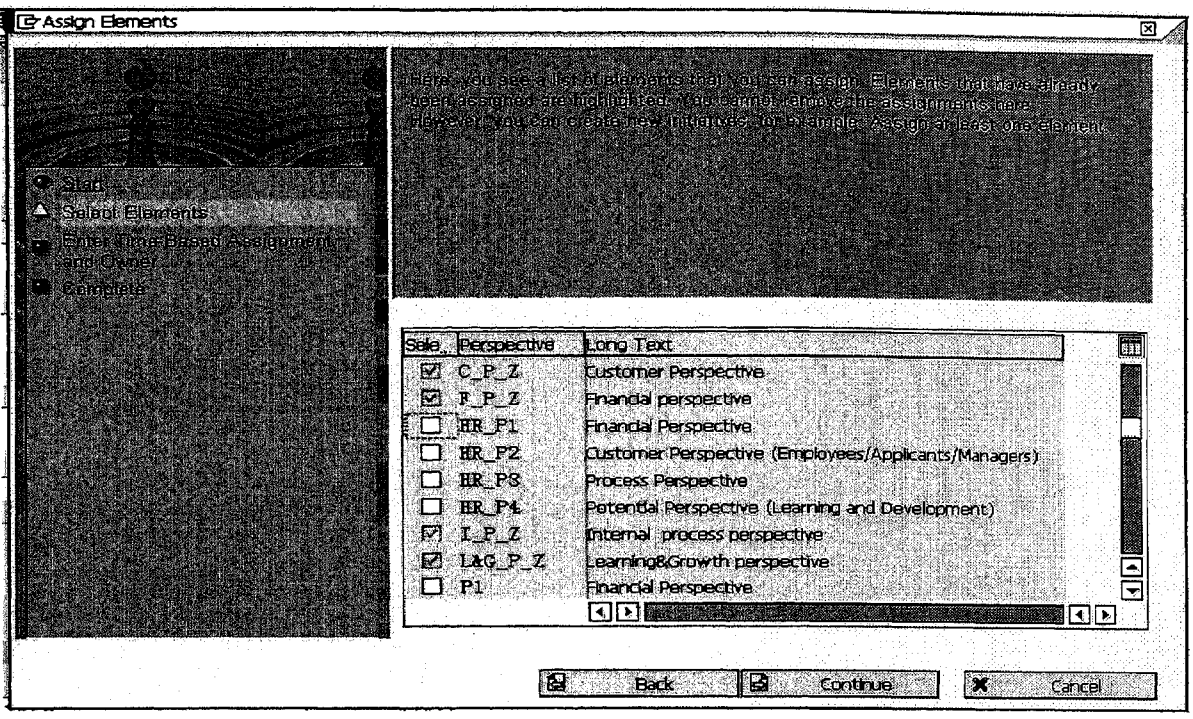
Figure A.27 Perspective assignment wizard.
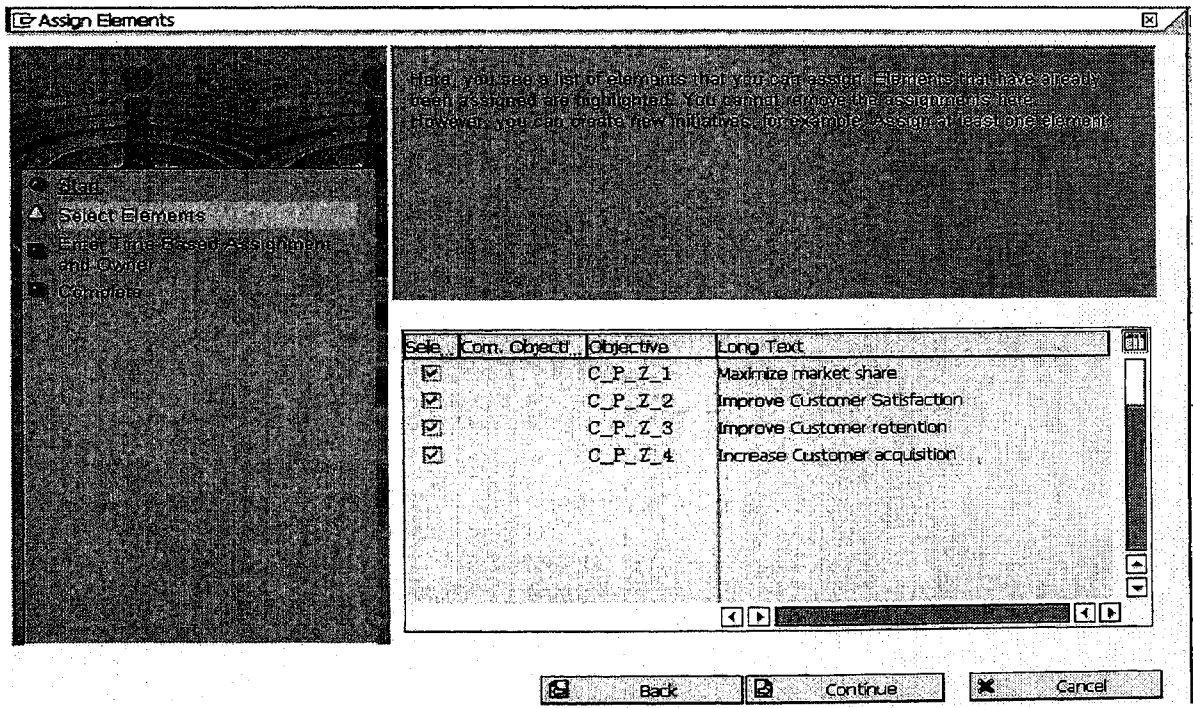
Figure A.28 Objectives assignment wizard.
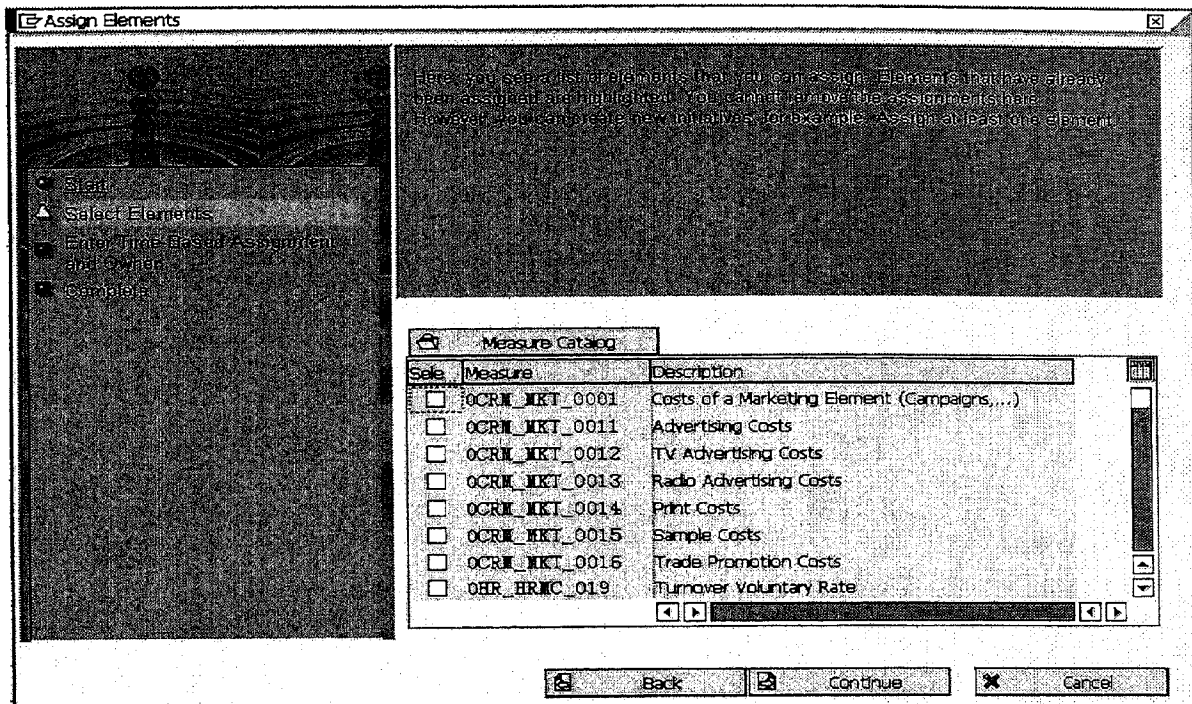
Figure A.29 Measure assignment wizard.

Once all the necessary strategies, perspectives, objectives, and measures were assigned, BSC shown in Figure A.30 was generated:

Figure A.30 Balanced scorecard under design view .

Finally, the BSC could be displayed in SAP-SEM through menu path: SAP menu->Strategic Enterprise Management/Business Analytics-> Strategic Enterprise Management/business analytics->Strategy Management->UMB_PRES1-Balanced Scorecard (see Figures of A.31 and A.32):
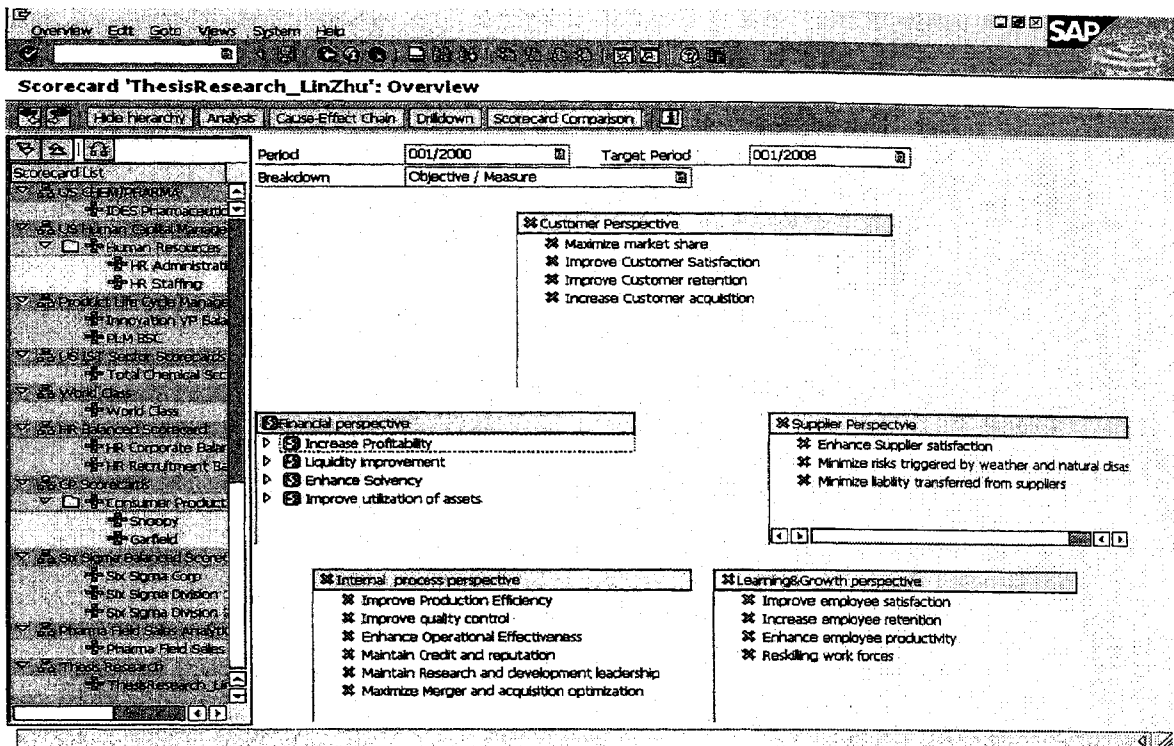
Figure A.31 Balanced scorecard overview.
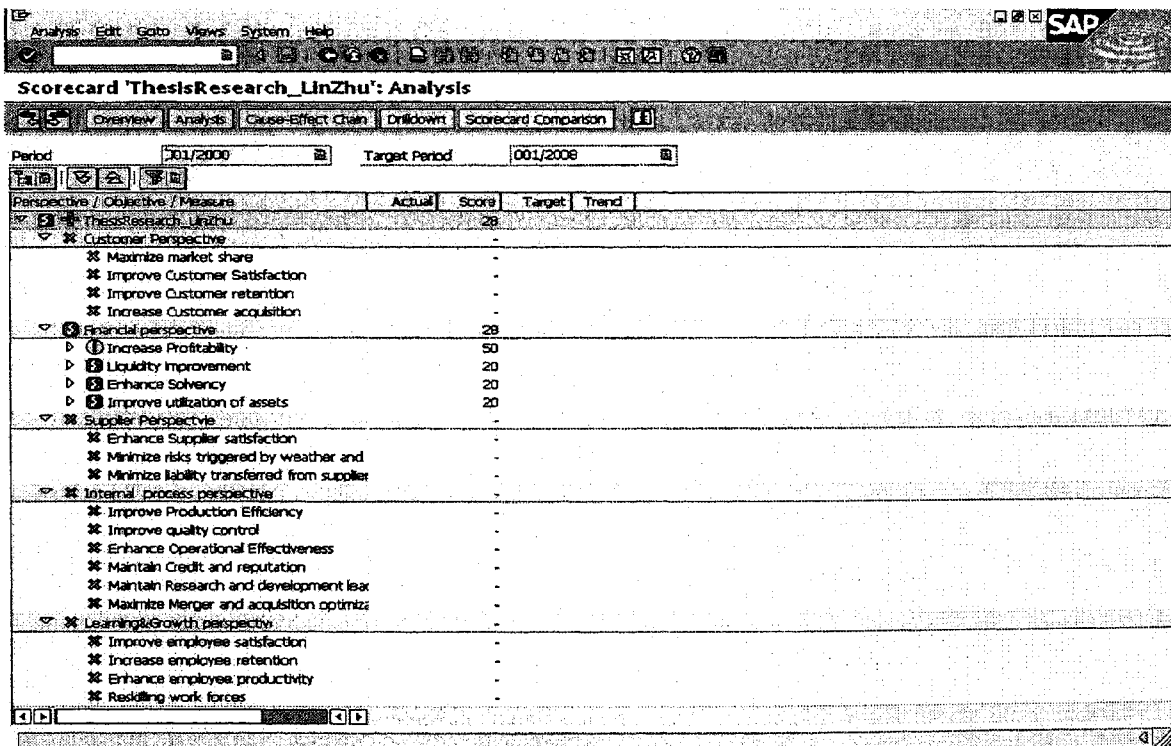
Figure A.32 Balanced scorecard analysis view.

APPENDIX B.

DASHBOARD CONSTRUCTION FOR THE CASE COMPANY

This research used software of Business Objects Xcelsius to construct dashboards for the case company. Dashboard construction involved three steps: 1) Import data; 2) Dashboard build up; and 3) Export dashboard.

IMPORT DATA

Data were imported using an Excel spreadsheet format by selecting Data>Import. Alternately, the Import Model button on the toolbar can be used to import the file. Once the data is imported, the Excel spreadsheet data appear in the middle bottom of the Xcelsius screen as in Figure B.1.
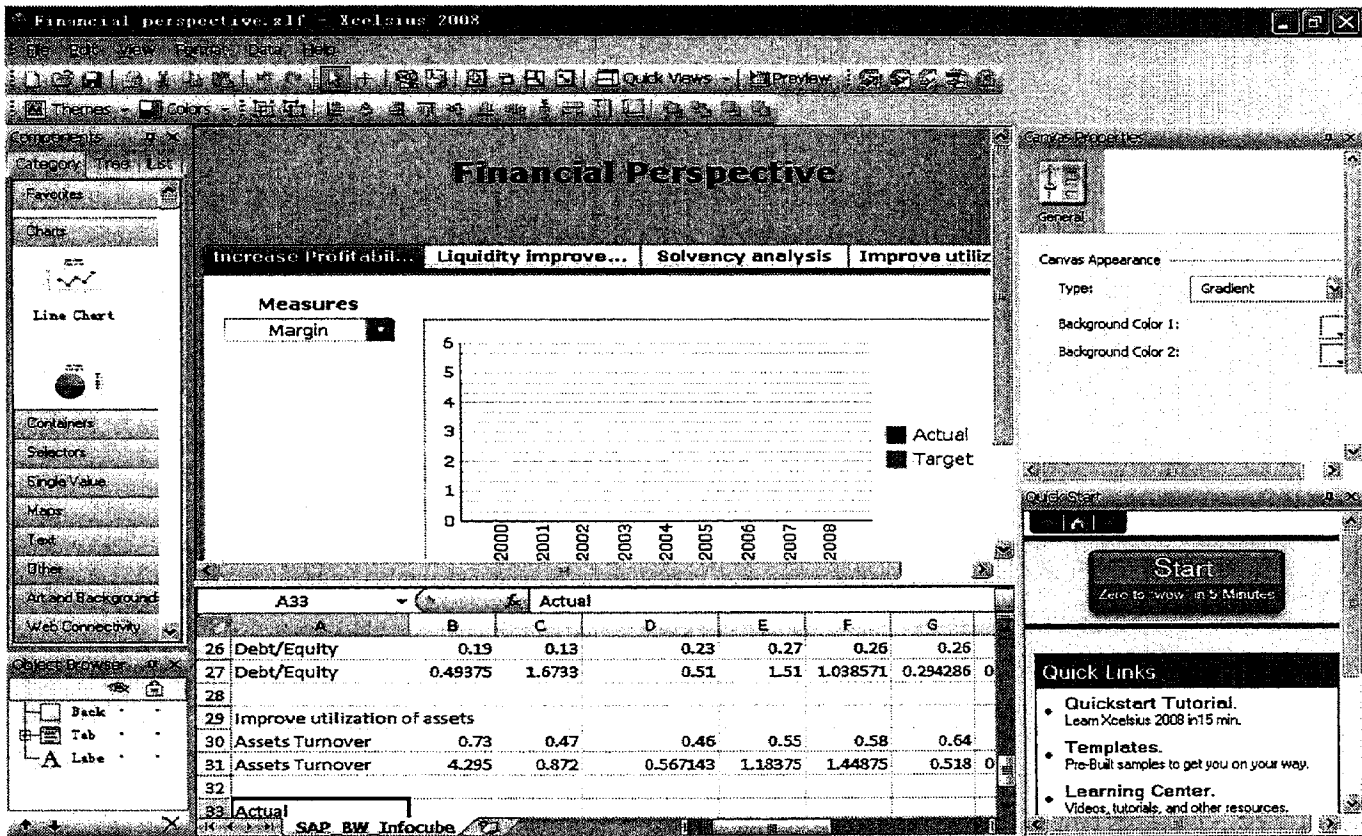
Figure B.1 Excel spreadsheet import in Xcelsius.

Dashboard Construction

In alignment with the BSC created using SAP SEM, five dashboards were built for five perspectives in Xcelsius. The dashboard included tabs, combo boxes, charts,

tables, gauges, and text. The following explains the basic steps to create these components:

Tab creation:

1.   On the components panel, select **containers** (as shown in Figure B.2).
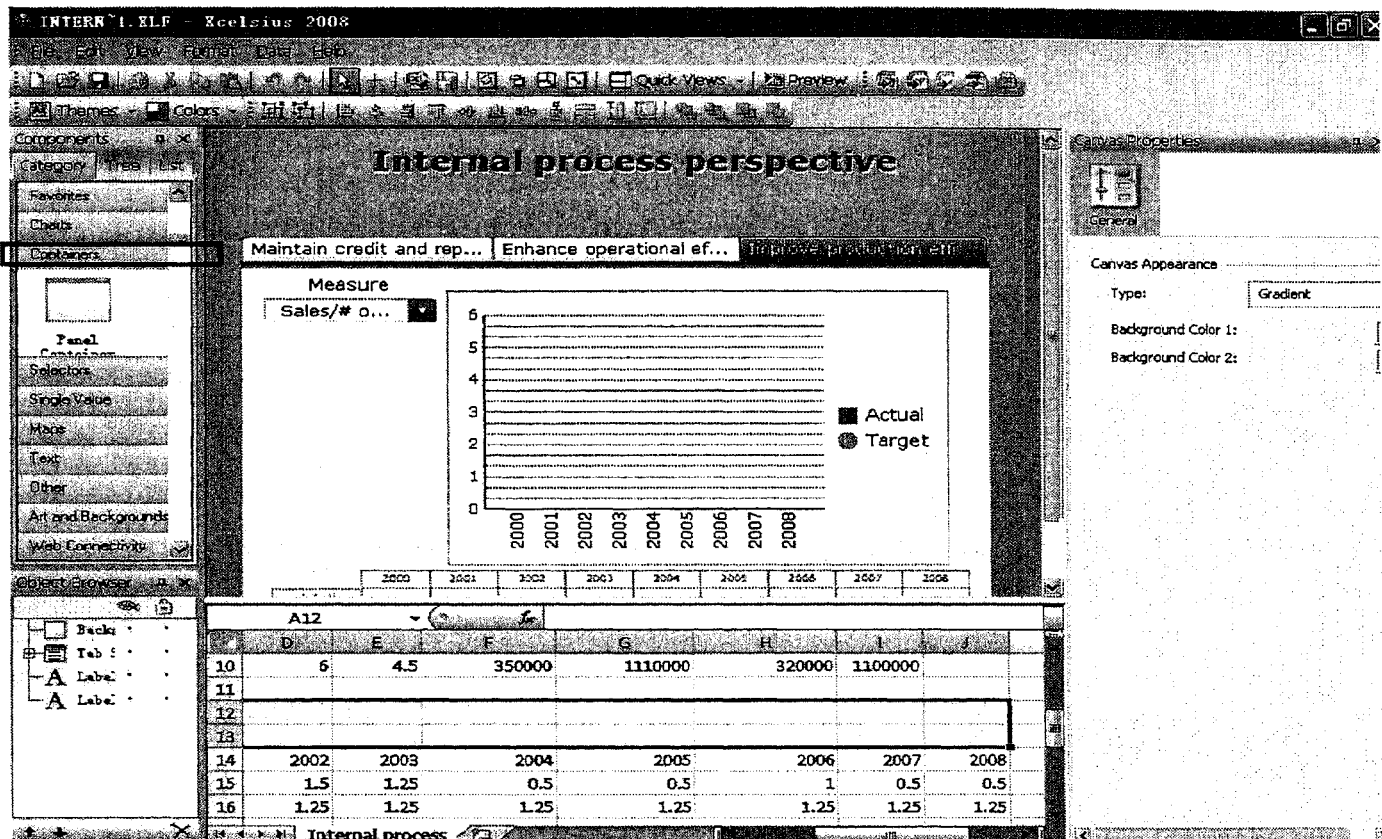
Figure B. 2 Tab creation.

2.   Drag the **Tab Set** icon onto the canvas, and place it in the center (as shown in Figure B.3).
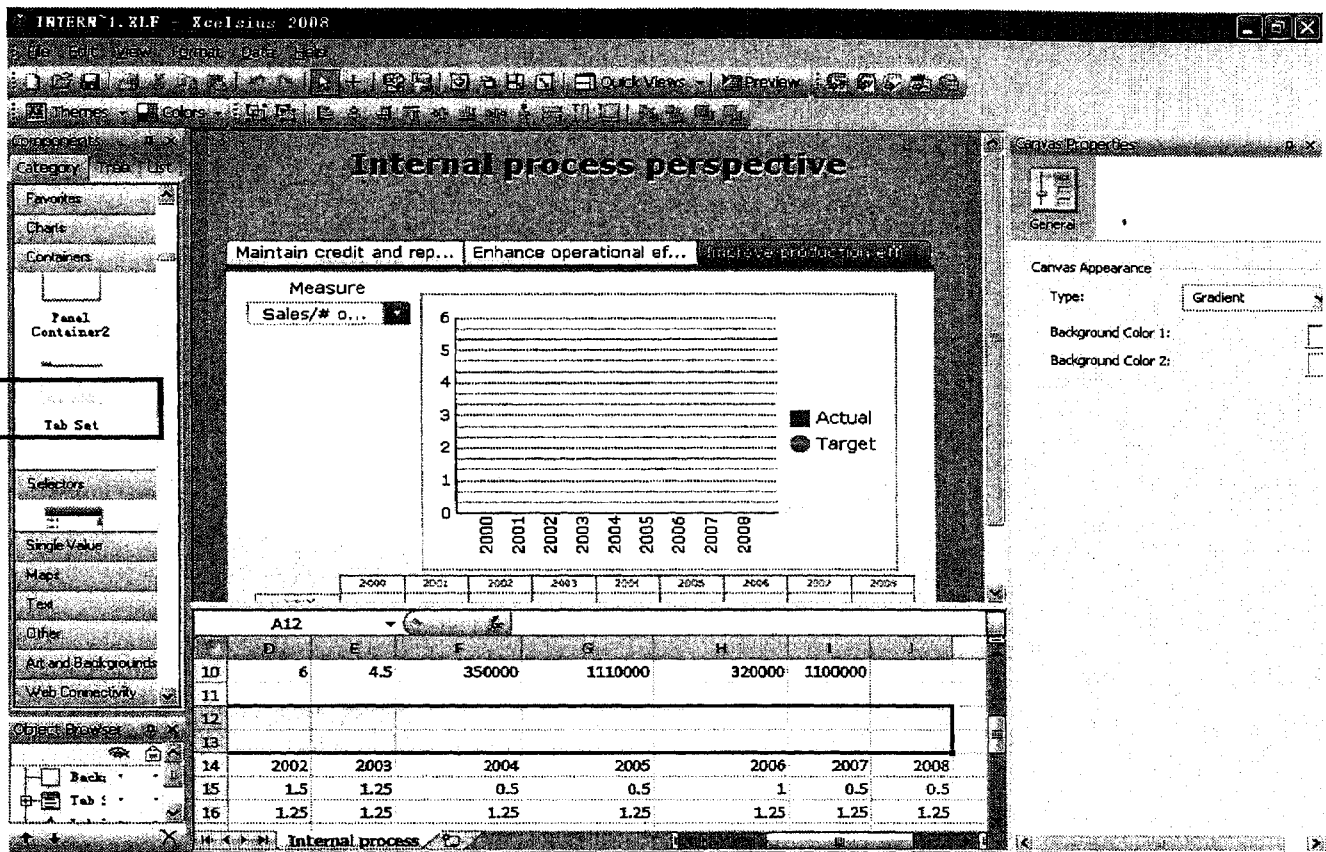
Figure B. 3 Tab creation.

3.　　Click the **Tab Set** component on the canvas to open its properties panel, under **General tab**, specify the name of Tab Set component under **Label** (as shown in Figure B.4).
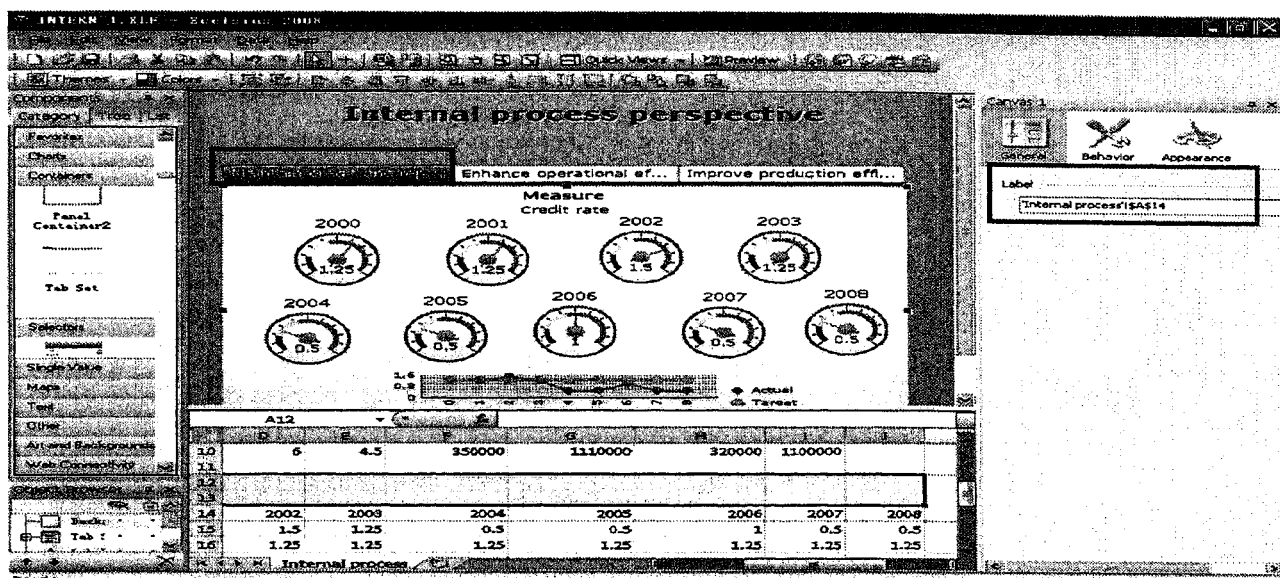
Figure B. 4 Tab creation.

Combo Box construction:

1.   On the components panel, select **Selectors** (as shown in Figure B.5).
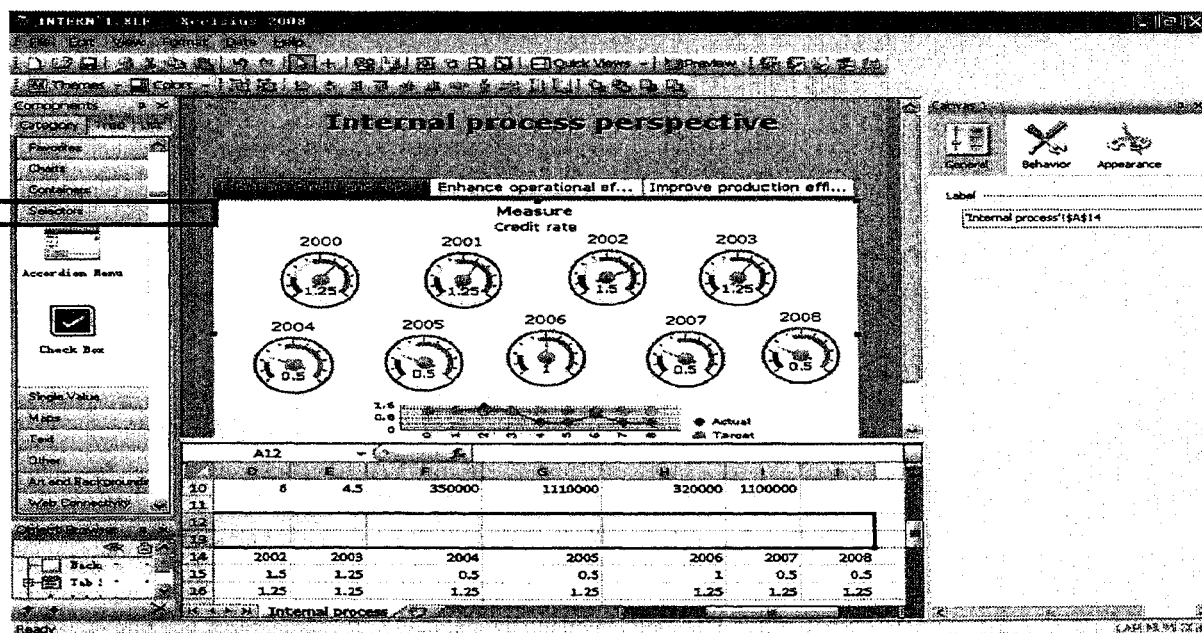

Figure B. 5 Combo box creation.

2. Drag the **Combo Box** icon onto the Tab Set component, and place it in the upper left corner (as shown in Figure B.6).
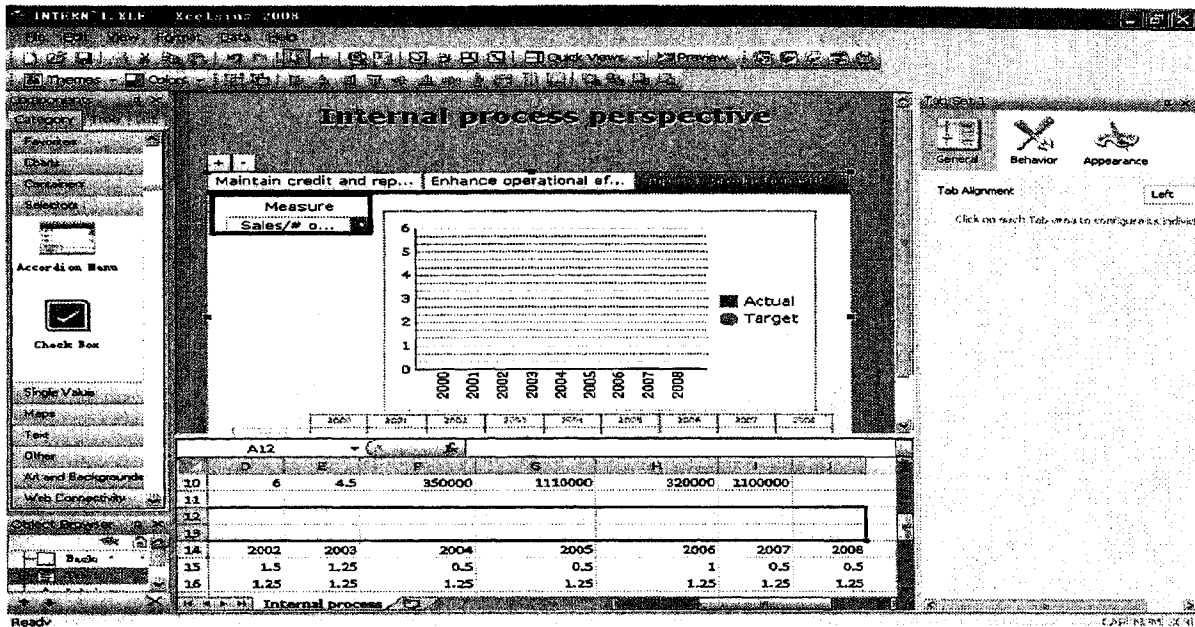

Figure B. 6 Combo box creation.

3. Click the Combo Box component to open the properties panel.

4. On the properties panel, under the General tab, specify the name of the Combo Box under **Title area** (as shown in Figure B.7).
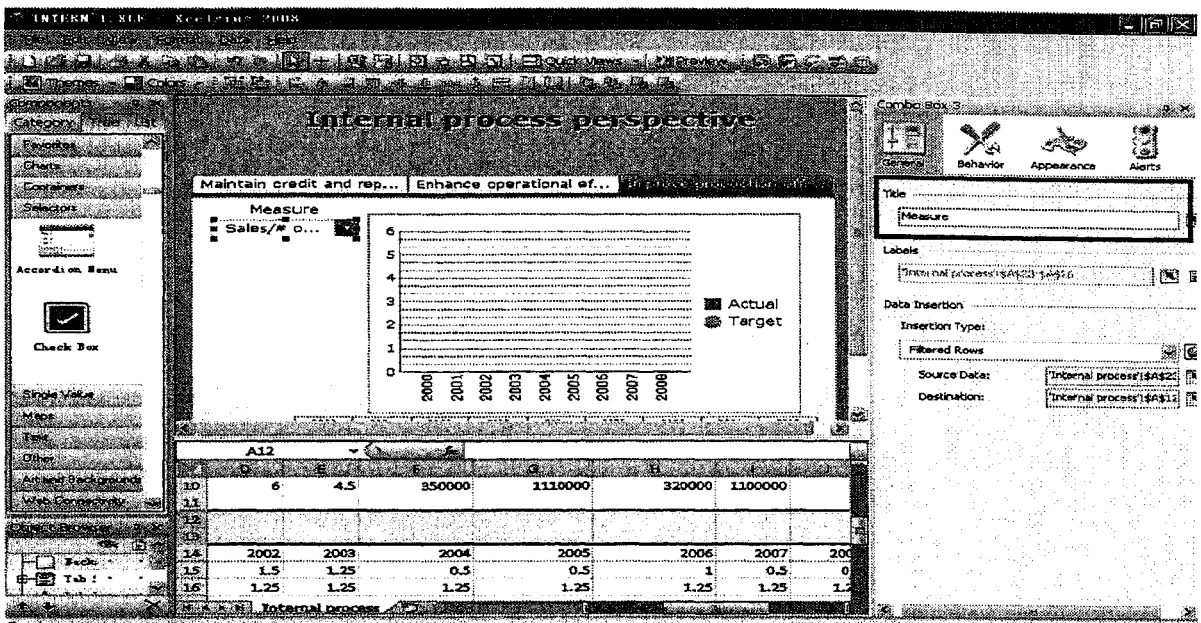
Figure B. 7 Combo box creation.

5.   Under General tab, in the **Labels** area, specify the select options under the combo box by selecting the data from the Excel spreadsheet (as shown in Figure B.8).
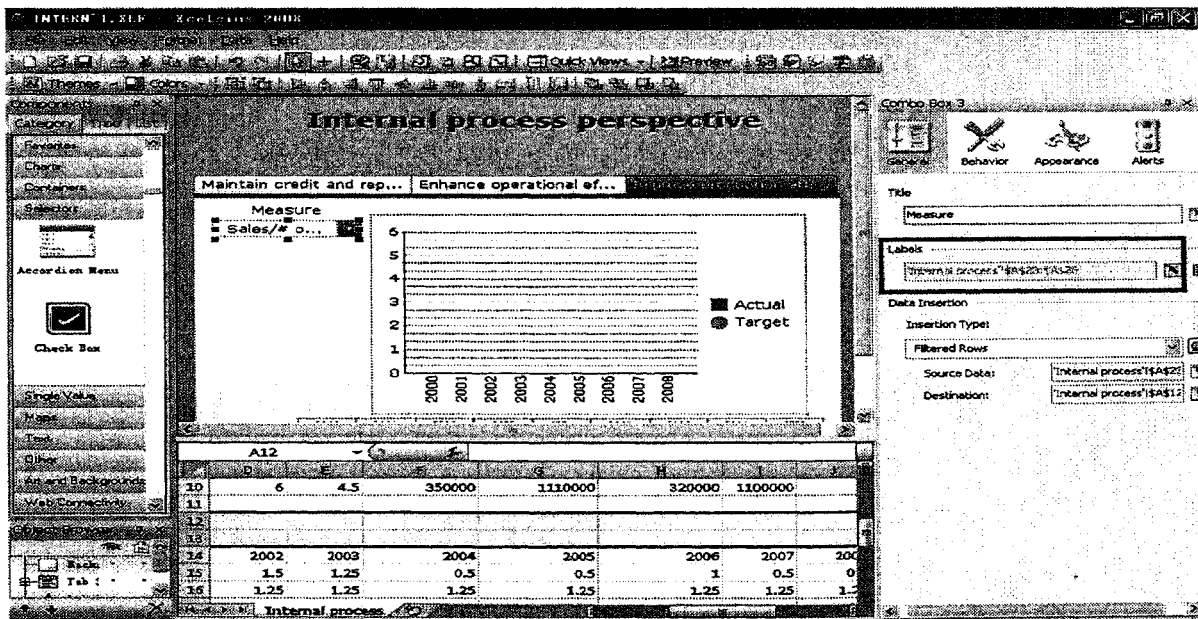
Figure B. 8 Combo box creation.

6.   Under the General tab, in the **Data Insertion** area, select Filtered Rows as the **Insertion Type**, and select the data from the Excel spreadsheet as the **Source Data** and **Destination** (as shown in Figure B.9).
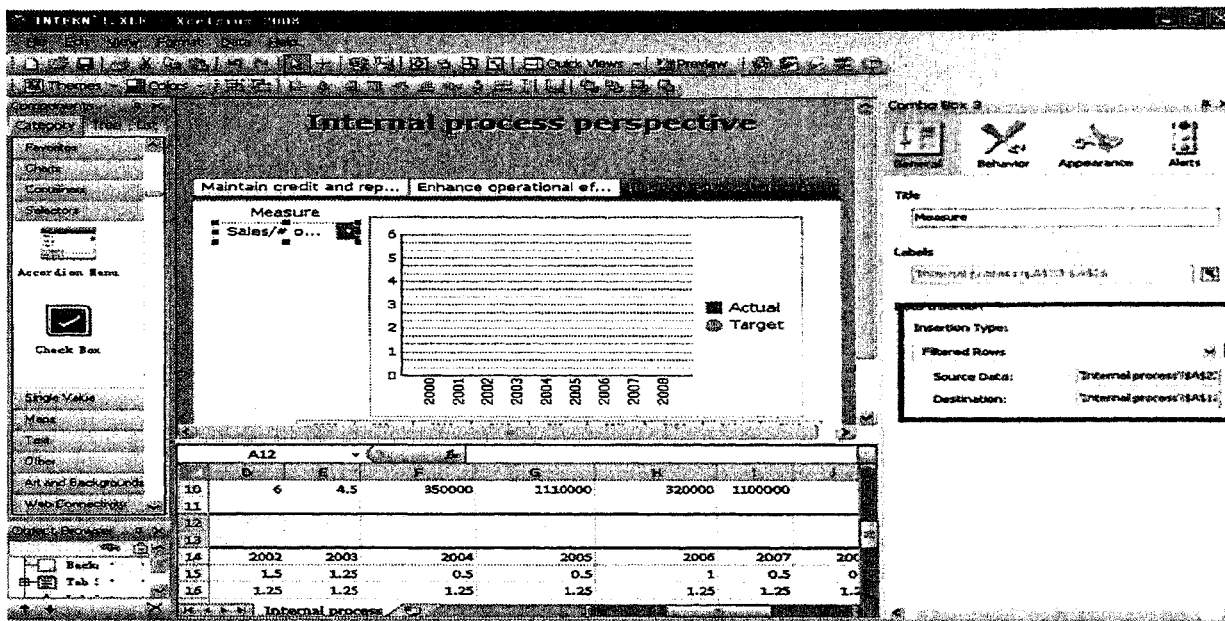
Figure B. 9 Combo box creation.

Chart construction:

1.   On the components panel, select **Charts** (as shown in Figure B. 10).
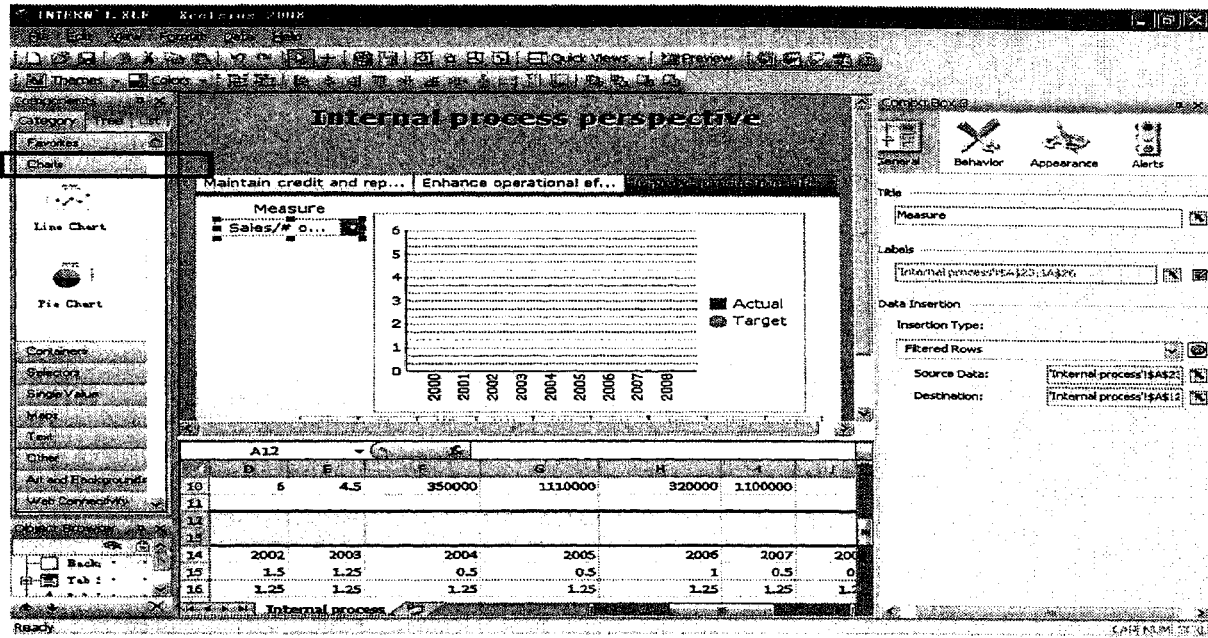
Figure B.10 Chart creation.

2.   Drag the **Column Chart** component onto the Tab set component (as shown in Figure B. 11).
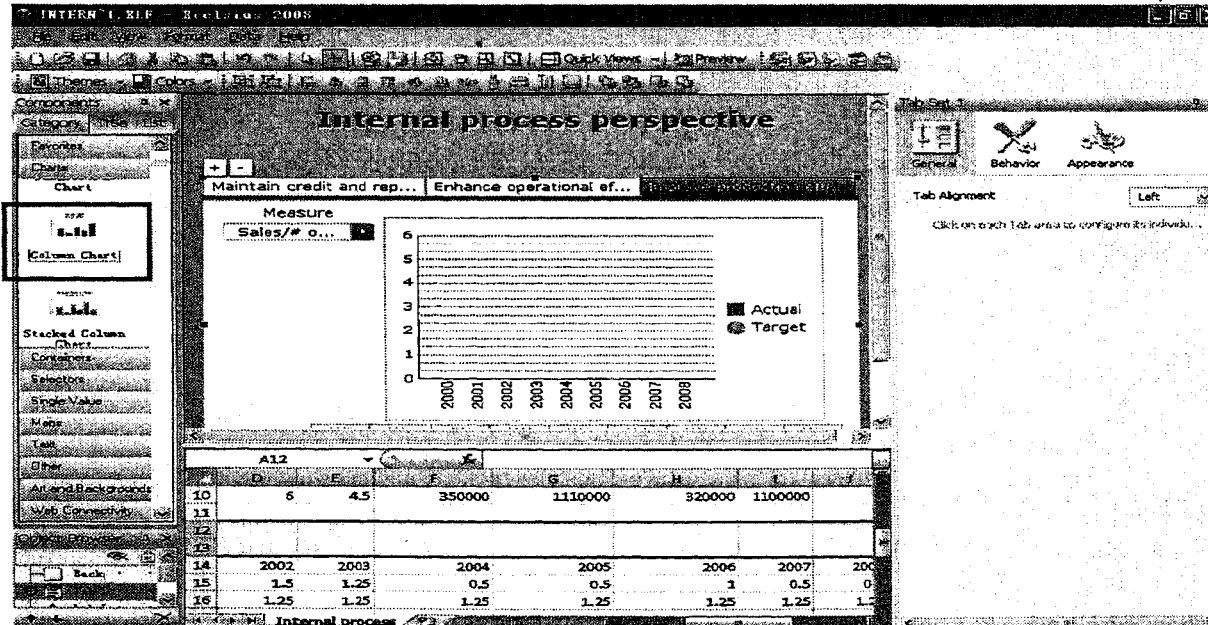
Figure B.11 Chart creation.

3.   Click on the **Column Chart** to open the properties panel.

4.   On the properties panel, under the **General** tab, specify the column chart name under the **Chart** field in the **Titles** area (as shown in Figure B.12).
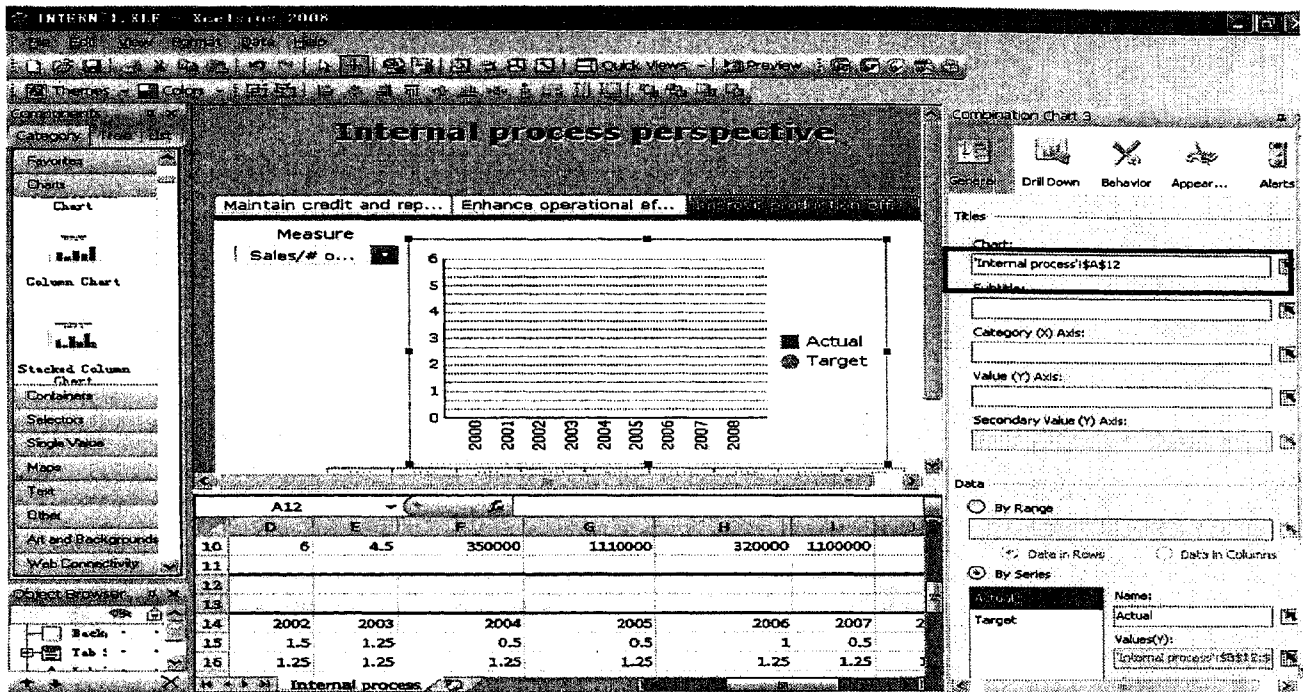
Figure B. 12 Chart creation.

5.   Under **General** tab, in the **Data** area, click **By Range**. As the source data, select the cells in the Excel spreadsheet labeled **Destination** in the **Combo Box** (as shown in Figure B.13).
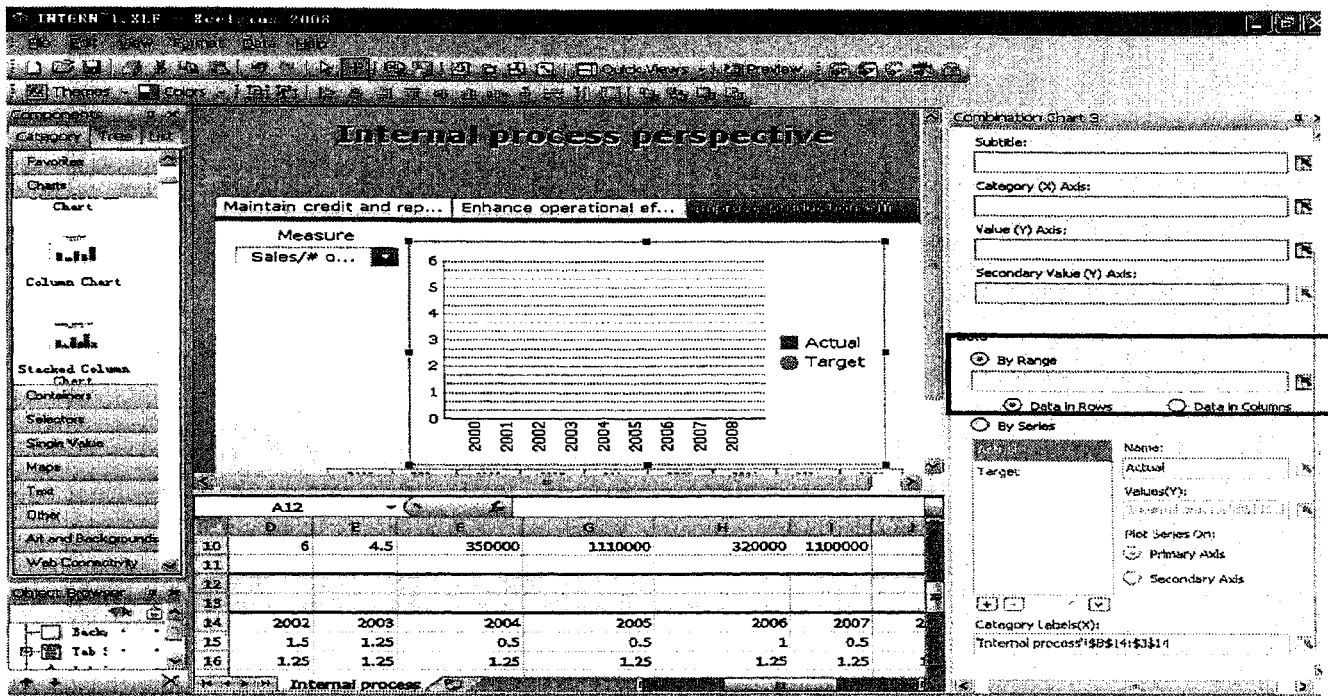
Figure B. 13 Chart creation.

6. Click By Series, then click the series, and change its name of the series.

7. Under Category Labels(X), specify the X-ray labels by selecting the cells from the Excel spreadsheet (as in Figure B.14).
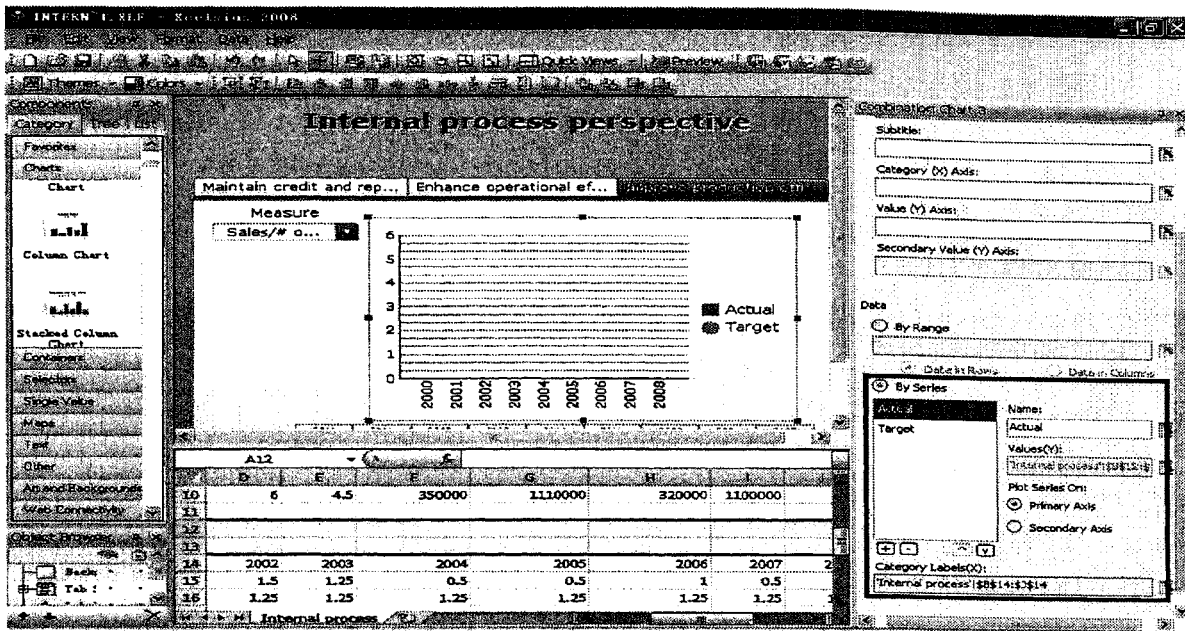
Figure B.14 Chart creation.

Table construction:

1.   On the components panel, select **Others** (as shown in Figure B.15).
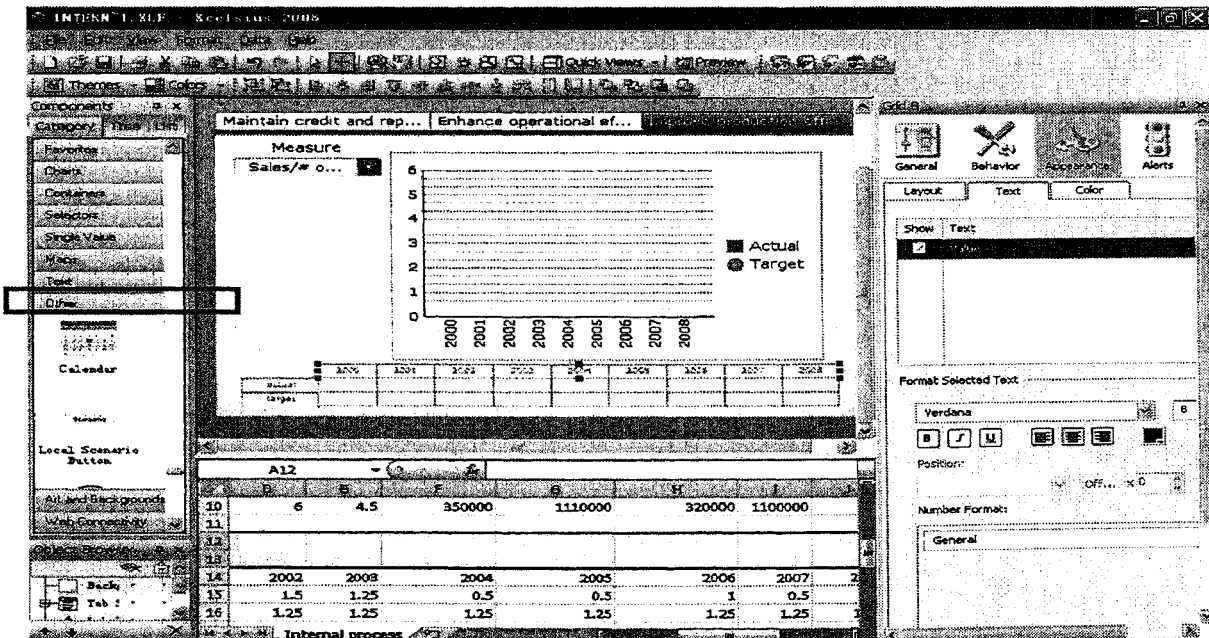
Figure B.15 Table creation.

2.   Drag the **Grid** component onto the Tab set component and place it below the Column chart (as shown in Figure B.16).
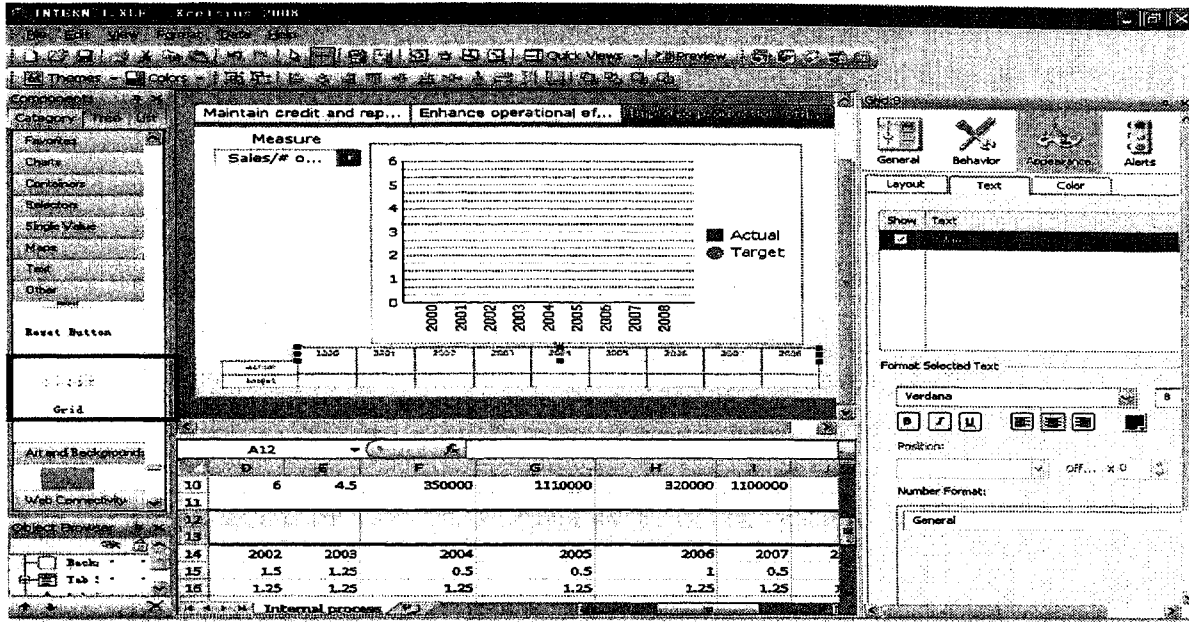
Figure B. 16 Table creation.

3.   Click the **Grid** component to open its properties panel.

4.   Under the **General tab**, in the **Data** area, specify the data source by selecting the cell from the Excel spreadsheet which is defined as the **Destination** from the **Combo Box** component (as in Figure B.17).
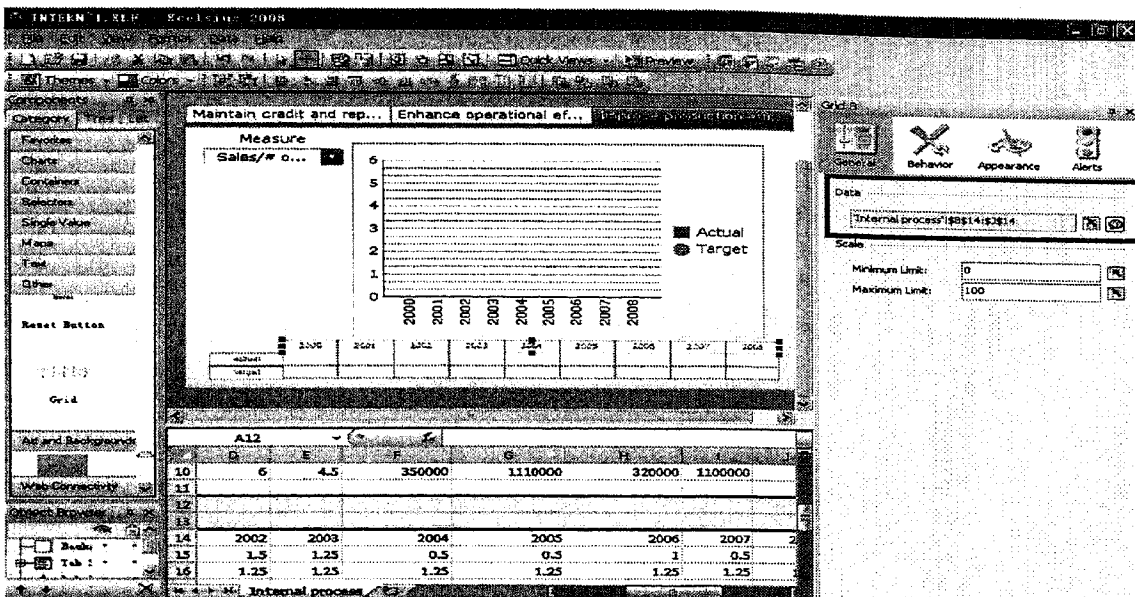
Figure B. 17 Table creation.

5.   Drag another two additional Grid components onto the Tab Set component to specify the row name and column name.

Gauge construction:

1.   On the components panel, select the **single value** (as shown in Figure B.18).
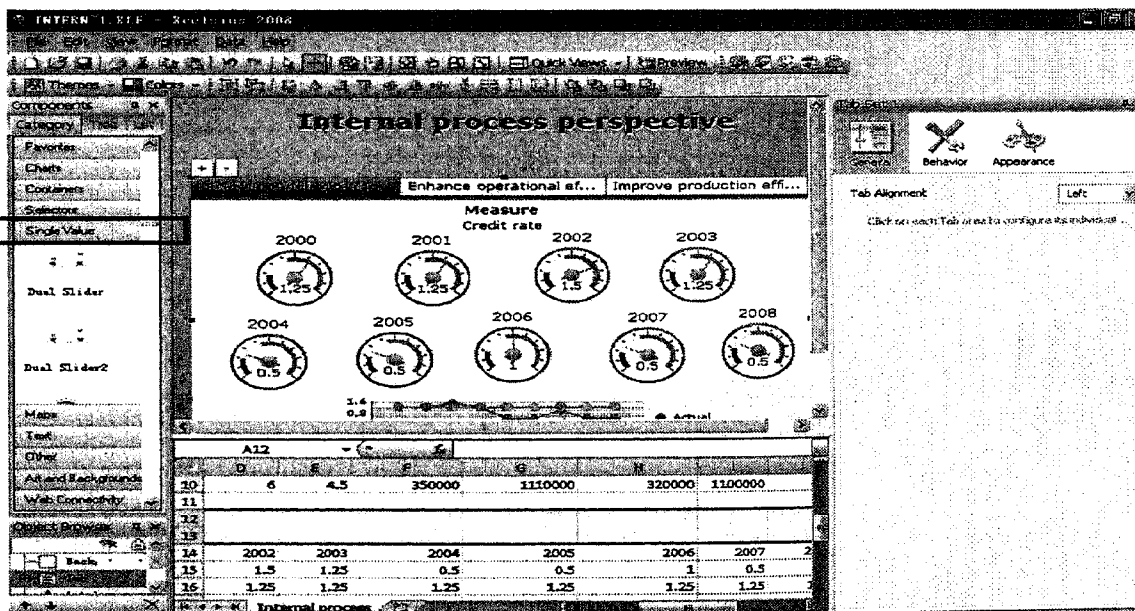
Figure B.18 Gauge creation.

2.   Drag a **Gauge** icon onto the canvas.

3.   Click the **Gauge** icon to open its properties panel.

4.   On the **General** tab, specify its name in the **Titles** area and in the **Data** area. Specify the data source by selecting the cell from the Excel spreadsheet (as shown in Figure B.19).
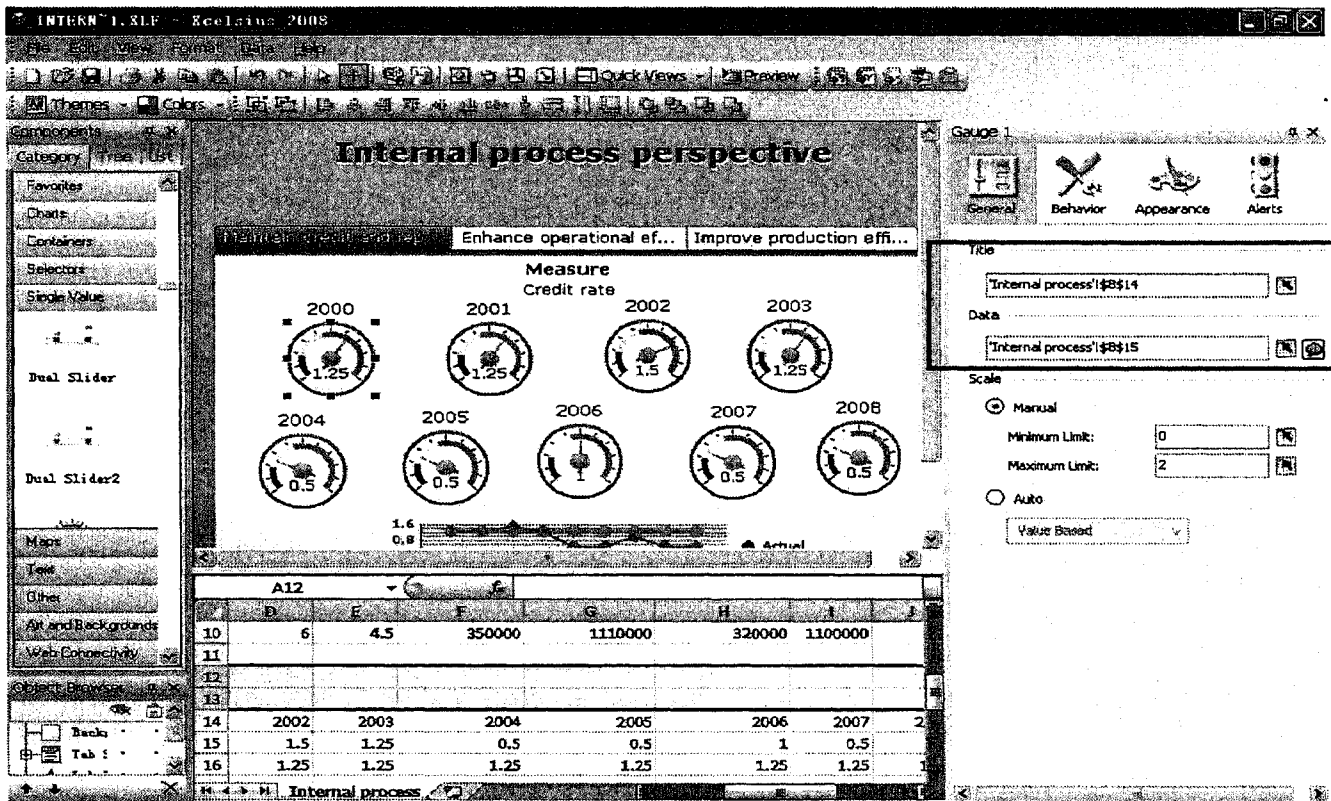
Figure B.19 Gauge creation.

5.   Click on the **alerts** tab of the property area, and click **Enable alerts.** Select **As percent of Target,** and then click the cell button to choose the target source data.

6.   Under the color order area select **High values are good** (as shown in Figure B.20).
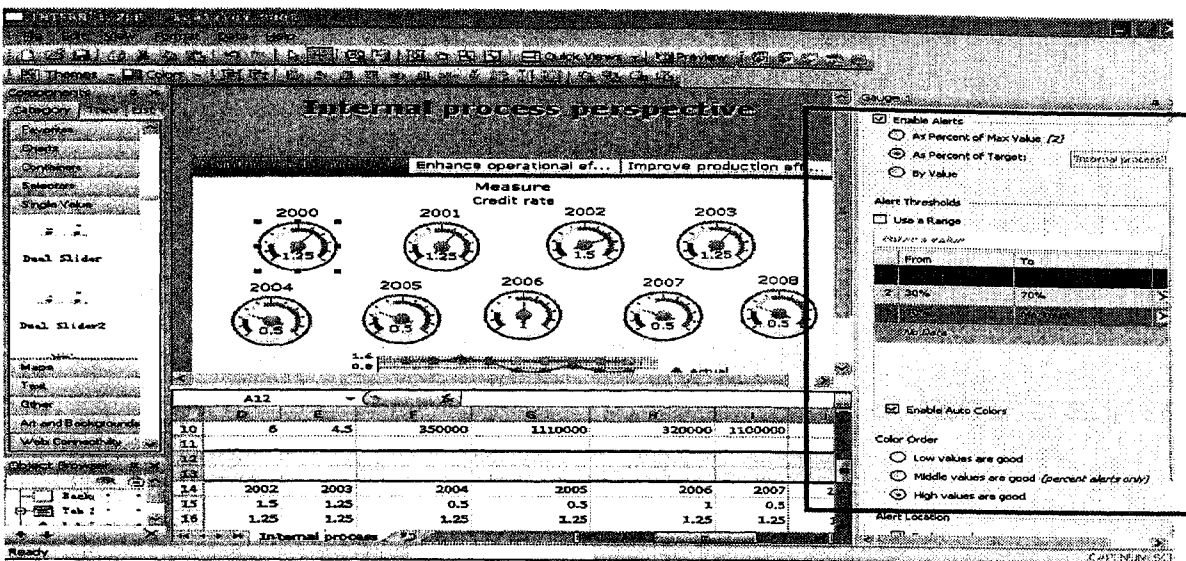
Figure B.20 Gauge creation.

Text construction:

1.   On the components panel, select **Text** (as shown in Figure B.21).
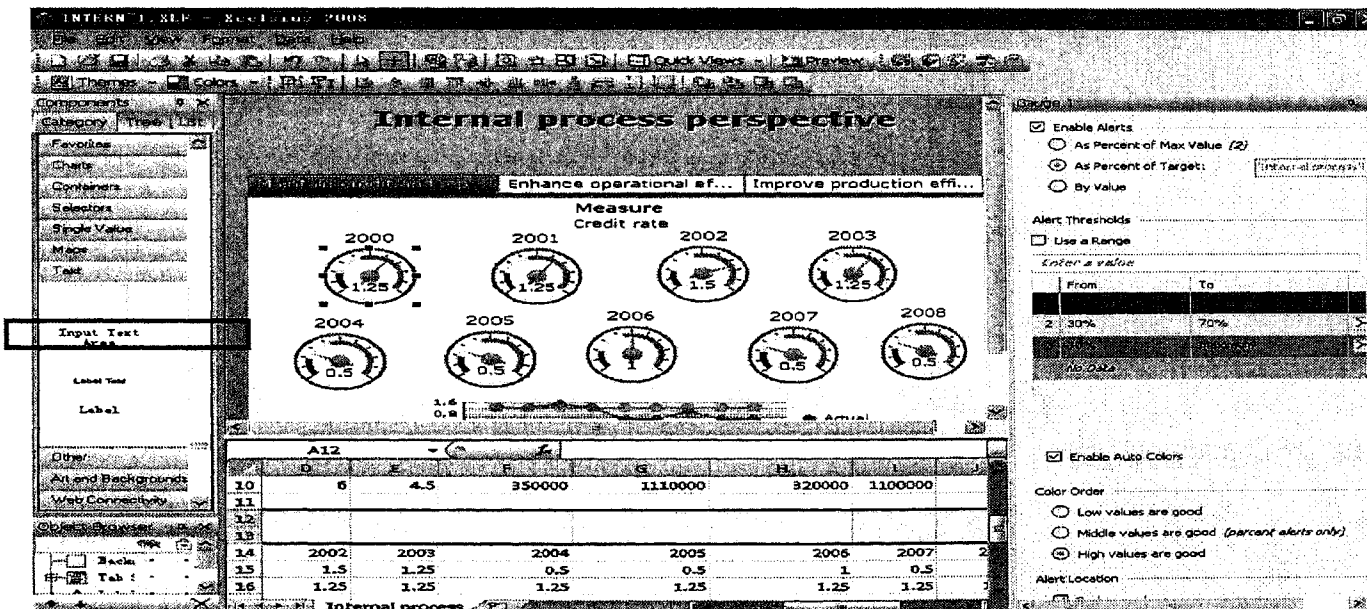
Figure B. 21 Text creation.

2.   Drag a **Label** component onto the canvas, and put it at the top center (as shown in Figure B.22).
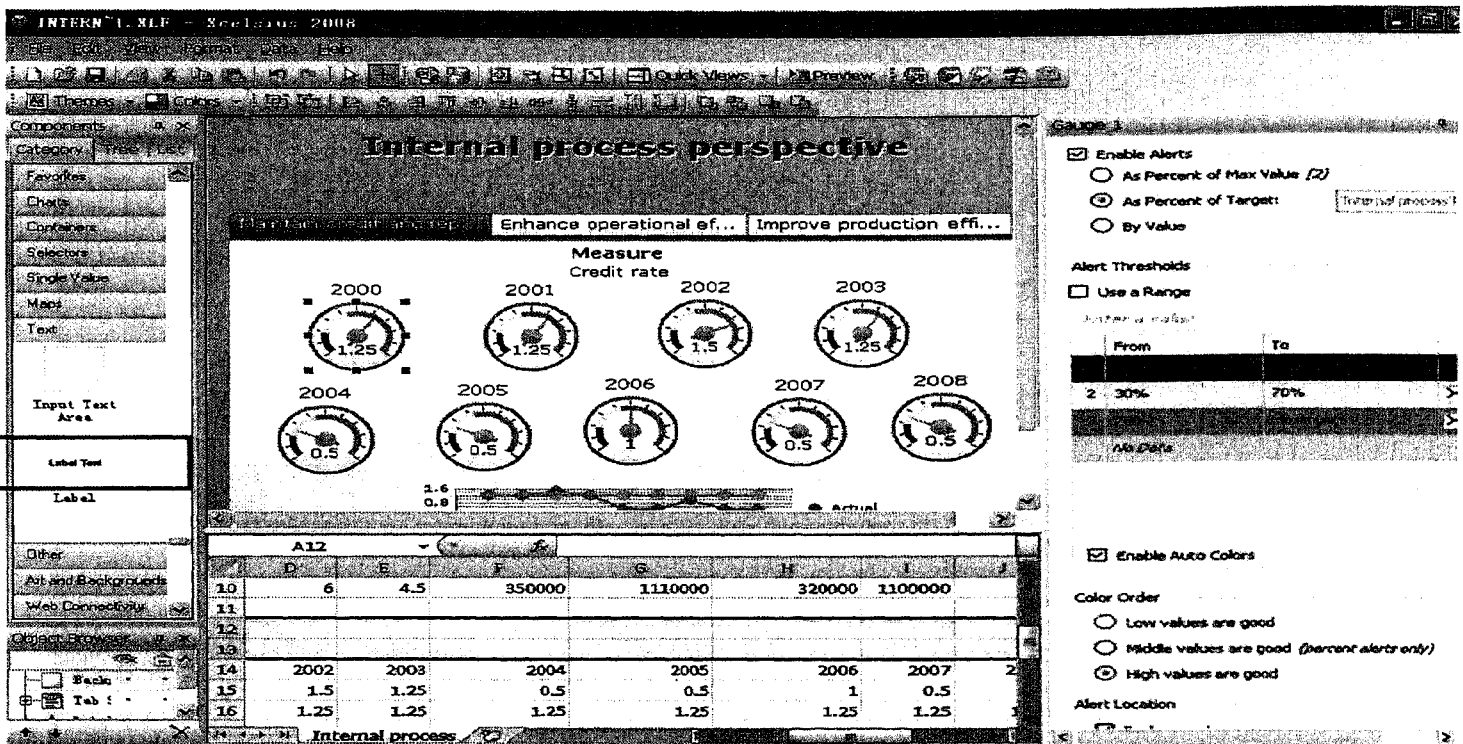
Figure B. 22 Text creation.

3.   Click the **Label** component to open its properties panel;

4.   On the **General** tab, click the **Enter Text** radio button. In the **Enter Text** box, type the name of the dashboard (as in Figure B.23);
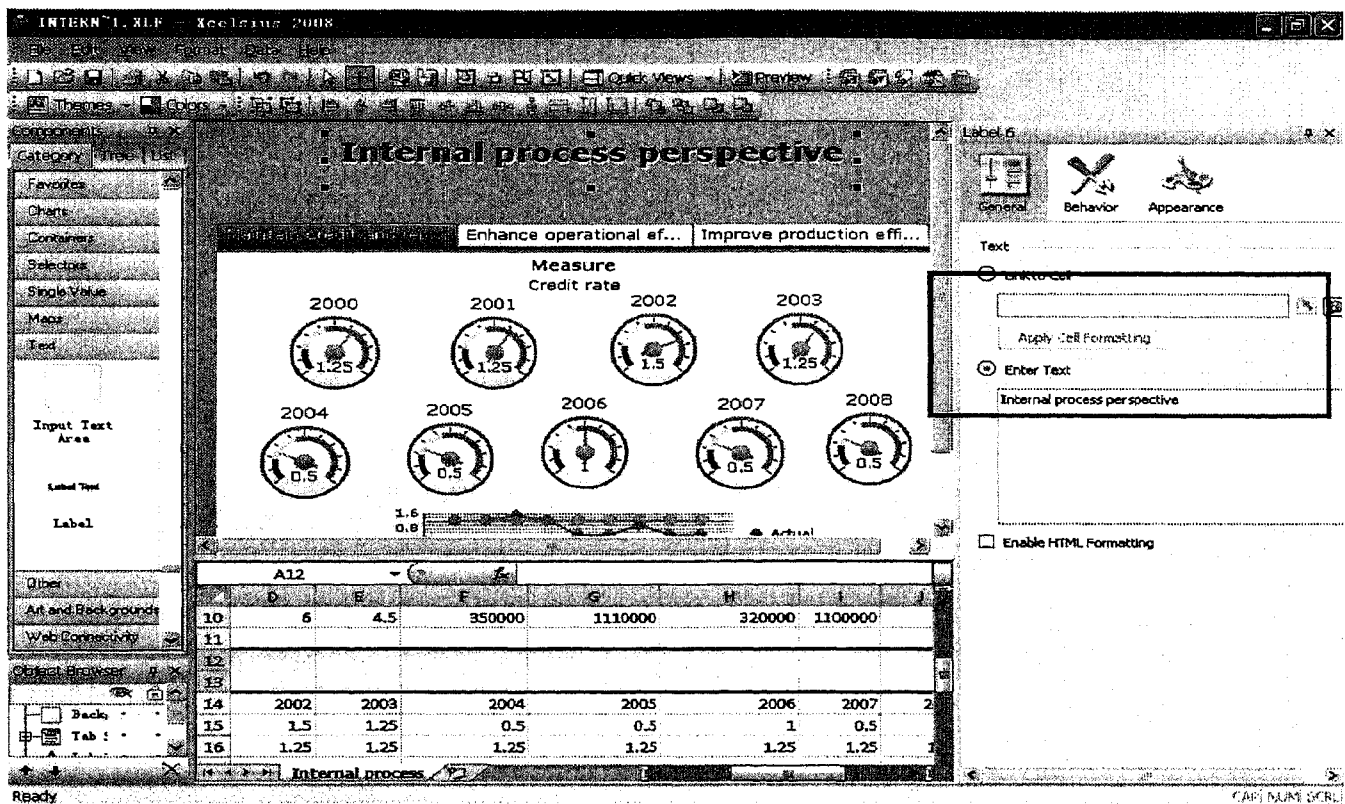
Figure B.23 Text creation.

Finalization of the dashboard:

1.   On the components panel, expand the **Arts/Backgrounds** folder.

2.   Drag the **Background** icon onto the canvas, and resize the background component until it covers all the other components on the canvas.

3.   Ensure that the background component is selected, and on the **Format** menu, select **Order** and click **Send to Back**.

4.   Click **Preview** to see how the final presentation works.

Figures B.24, B.25, B.26, B.27, and B.28 shows the five dashboards created for the case company.
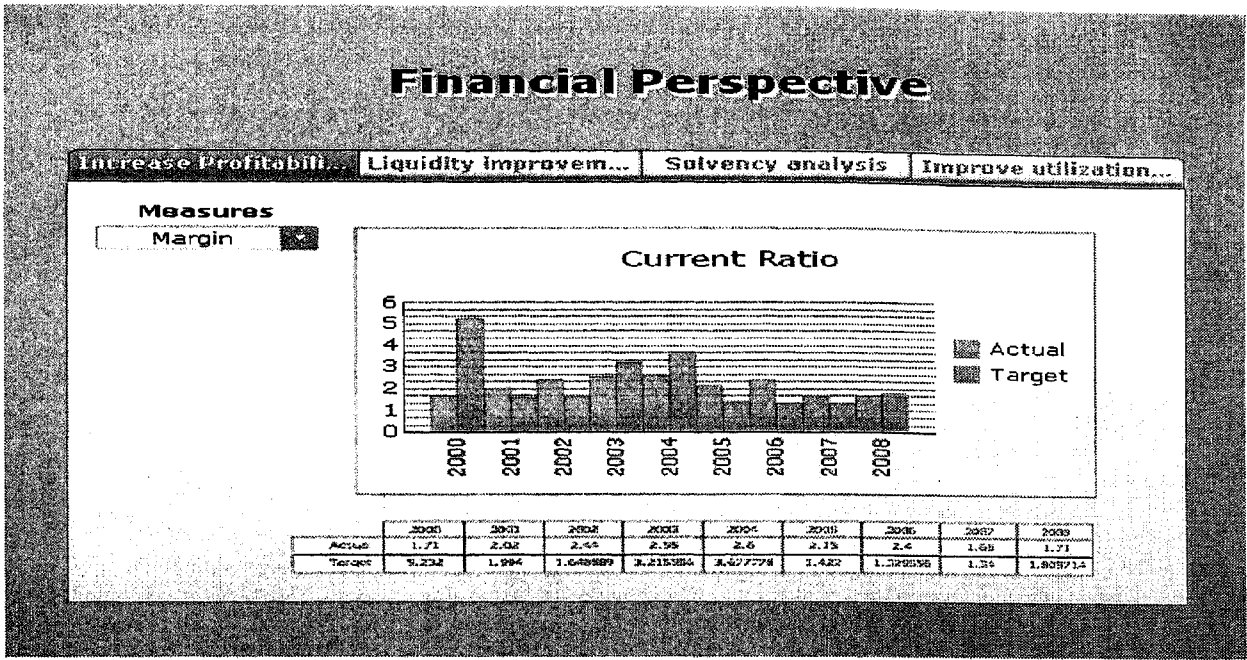
Figure B.24 Financial perspective dashboard.
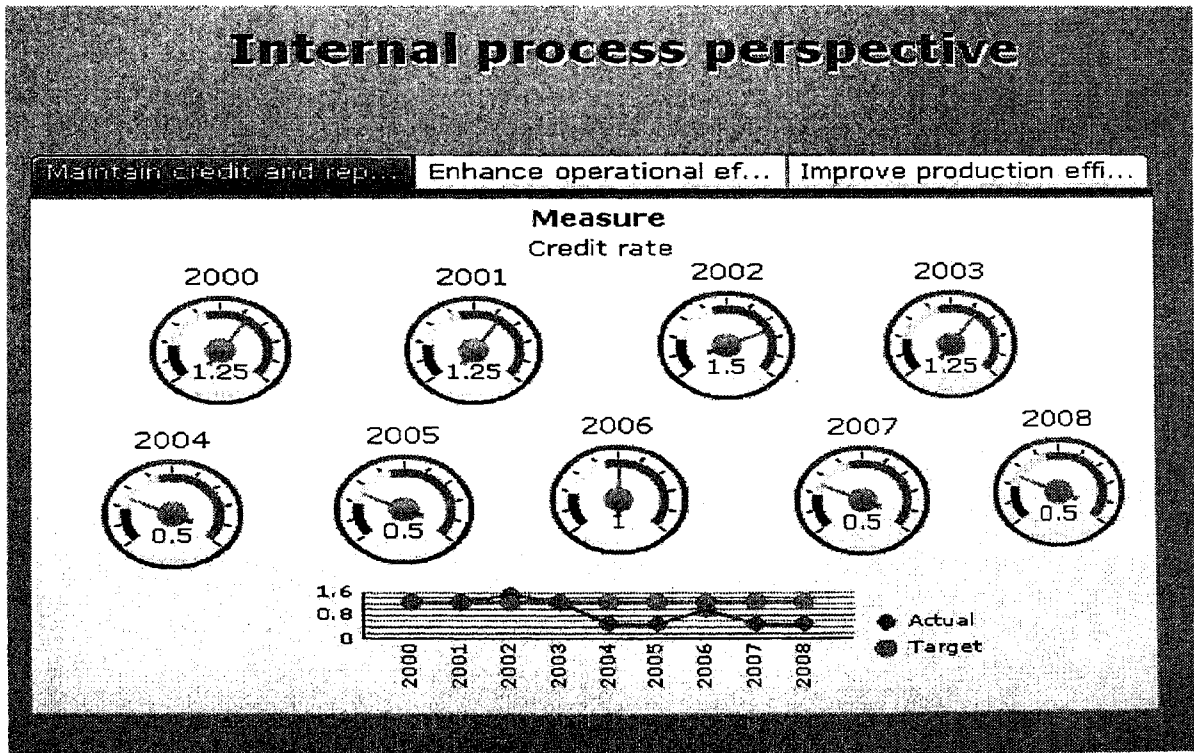
Figure B.25 Internal process perspective dashboard.
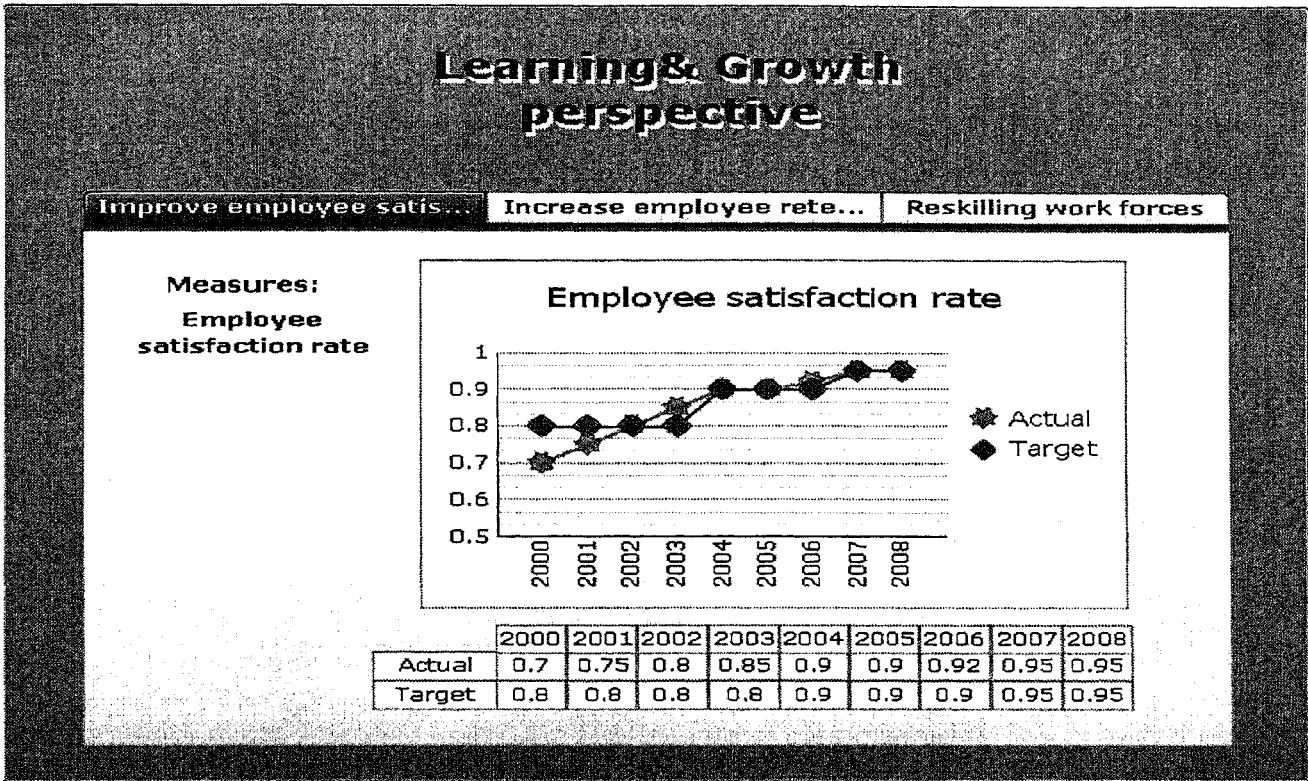
Figure B.26 Learning and growth perspective dashboard.
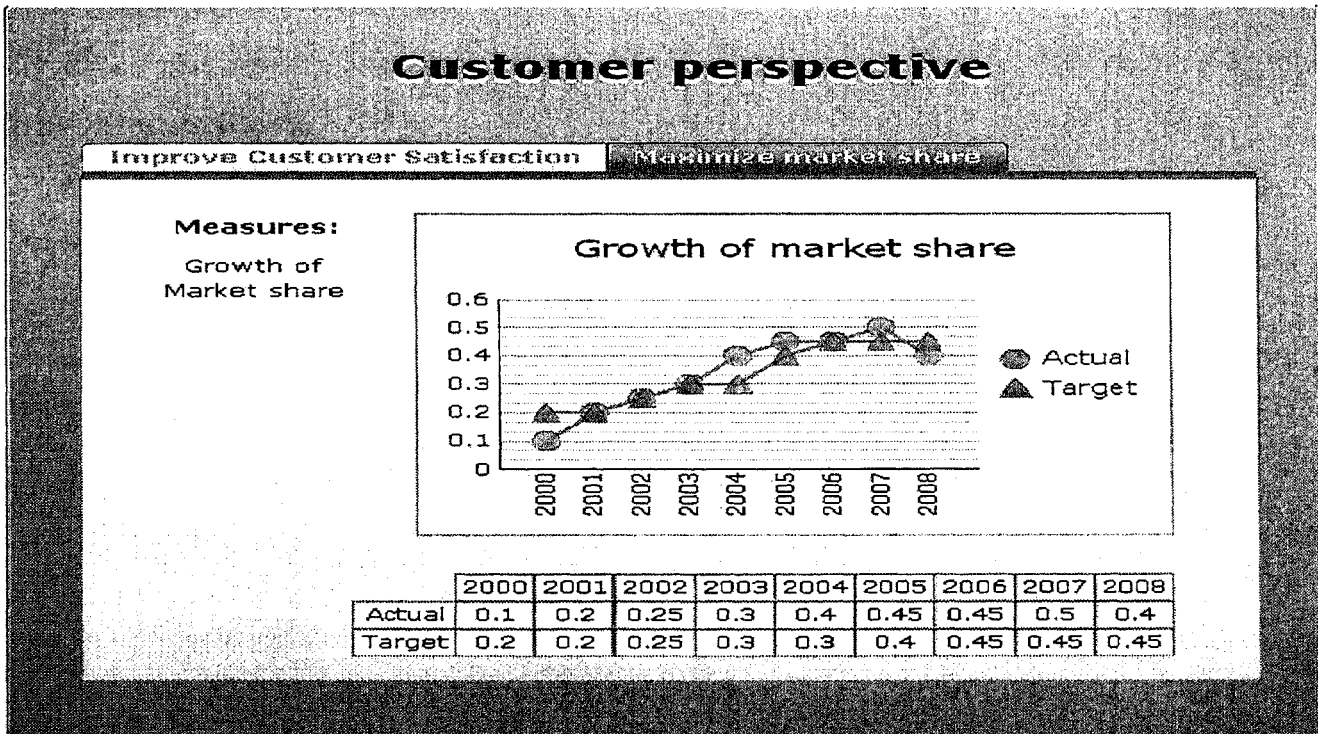
Figure B.27 Customer perspective dashboard.
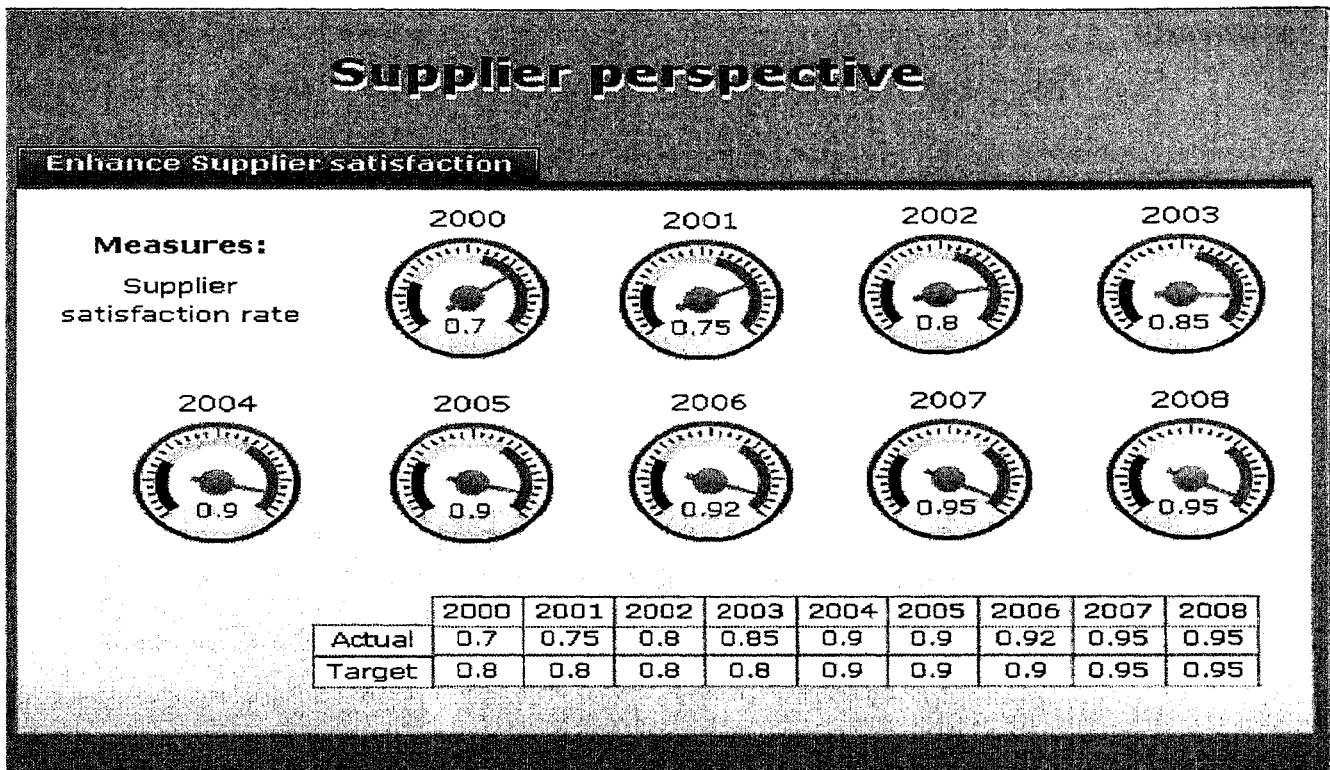
Figure B.28 Supplier perspective dashboard.

VISUALIZATION PUBLISH

Once the results are satisfactory, the visualization can be published using one of the following methods:

- Export as Adobe Flash (SWF)

- Export as HTML

- Export to Microsoft PowerPoint

- Export as Adobe PDF

- Email Using Microsoft Outlook

- Export to Microsoft Word

- Export to BusinessObjects Platform

For the case company, dashboard were exported as HTML documents and assembled on one page. Figure B.29 shows the overview of the HTML.
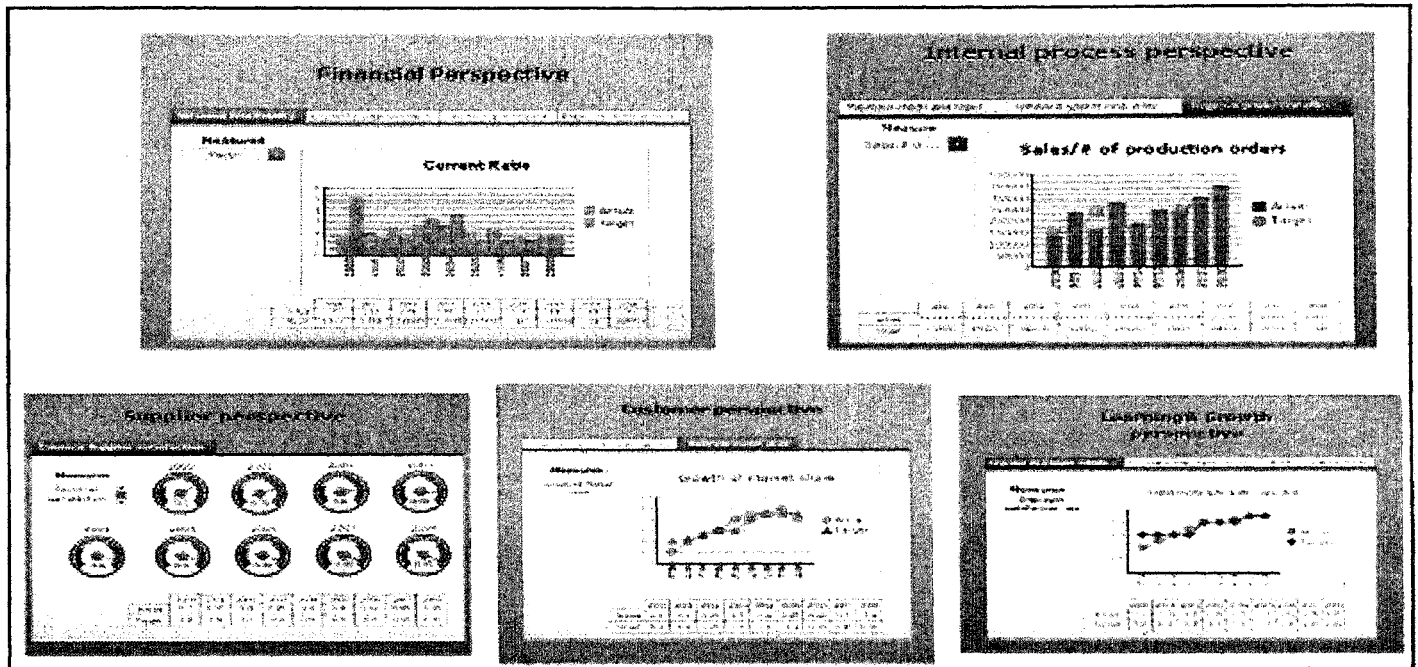
Figure B.29 Overview of Dashboard based CMP system.

APPENDIX C:
CORPORATE PERFORMACE MANAGEMENT SYSTEM DEMONSTRATION AND SURVEY

Corporate Performance Management System Demonstration and Survey

The purpose of this survey is to assess the effectiveness of performance management and monitoring system based on the use of a dashboard and a balanced scorecard. The prototype demonstration and survey will take approximately 20 to 30 minutes to complete.

The survey is anonymous, participation is voluntary, and all answers will be strictly confidential. No reports or publications resulting from this survey will identify respondents or their organization.

The following outlines the demonstrations and survey process:
1. Respondent complete the basic demographic data page (**white** paper).
2. A brief research overview provided.
3. A dashboard prototype is demonstrated and respondents complete a short survey (**green** paper).
4. A balanced scorecard prototype is demonstrated and respondents complete a short survey (**ivory** paper).
5. Respondents return the survey.

Thank you sincerely for agreeing to participate.

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Corporate Performance Measurement System Prototype

Demographic Information:

1. Job title: _____ (if you have more than one positions, please use the position with higher management responsibilities)

2. Number of employees your company/organization has (please include all branches and subsidiaries).

   □ 1 - 50   □ 51 - 100   □ 101 – 200   □ 201 – 300   □ 301 - 500

   □ > 501   □ Do not know

3. Number of employees currently under your direct supervision:

   □ None   □ 1 - 50   □ 51 - 100   □ 101 – 150   □ 151 – 200

   □ 201 - 500   □ > 501

4. What is the primary business activity performed at this location?
   Please enter a classification code (1 – 25) from the list provided on the back of this page _____

5. Gender

   □ Male   □ Female   □ Do not wish to disclose

6. How often do you prepare performance measurement reports?

   □ Weekly   □ bi-weekly   □ Monthly   □ Quarterly   □ Semi-annually

   □ Annually   □ Other. Please Specify

   _____

7. How is your performance measurement reports used? (Check all that apply.)

   □ Reporting   □ Accountability   □ Continuous Improvement   □ Publicity   □ Satisfy Mandates

   □ Promotions   □ Compensation   □ Other. Please Specify

   _____

8. Do you use a manual, electronic, or both systems to support the performance reporting and monitoring function at your organization?

   □ Manual   □ Electronic   □ Both   □ Not Applicable

9. I am motivated to do my best when I can clearly identify how my job contributes to the company's strategies, goals, and objectives.

   □ Strongly agree   □ Agree   □ Neutral   □ Disagree   □ Strongly disagree

10. Do you provide any of the following comparison data in your current performance reports?

	Definitely No	Sometimes	Definitely Yes	Do not know
Prior periods	□	□	□	□
Other organizations (e.g., competitors)	□	□	□	□
Industry best practices	□	□	□	□
Internal comparative benchmarks (planned/budget value, actual value, target value)	□	□	□	□
Departmental/Divisional comparative data	□	□	□	□

If your answer is "Definitely No" or "Do not know" for ALL items listed in #10, stop here. Otherwise, please answer #11.

11. How often are the comparative data provided?

	Weekly	Monthly	Quarterly	Yearly	By request only
Prior periods	□	□	□	□	□
Other organizations (e.g., competitors)	□	□	□	□	□
Industry best practices	□	□	□	□	□
Internal comparative benchmarks (planned/budget value, actual value, target value)	□	□	□	□	□
Departmental/Divisional comparative data	□	□	□	□	□

Classification Code for primary business activity:

1. Aerospace
2. Banking
3. Communications Carrier (telecommunication, data communication, cable)
4. Computer Manufacturer (hardware, software, peripherals, etc.)
5. Computer-related Retailer/Wholesaler/Distributor
6. Construction/Architecture/Engineering
7. Consulting
8. Education
9. Financial Services/VC/Accounting
10. Government - Federal (including Military)
11. Government - State
12. Government - Local
13. Healthcare/Pharmaceuticals/Biotech/Biomedical
14. Insurance
15. Internet/Online Service Provider)
16. Legal
17. Manufacturing and Process (non-computer related)
18. Media/Marketing/Advertising
19. Real Estate
20. Service Provider (ASP, DP, FSP, Web Hosting)
21. Transportation/Logistics
22. Travel/Hospitality/Recreation/Entertainment
23. Utilities
24. Wholesale/Trade Distribution/Retail (non-computer related)
25. Non-Profit/Trade Association
26. Other

Corporate Performance Measurement System Prototype-Dashboard

1. The proposed system could help me to:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
understand my company's strategies, goals, and objectives.	☐	☐	☐	☐	☐
understand initiatives/actions that my company is taking.	☐	☐	☐	☐	☐
understand my roles and responsibilities in my company.	☐	☐	☐	☐	☐

2. The proposed system could help me to track my team's performance consistently and allows me to take proactive actions to manage my team better in achieving company's strategies and goals.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

3. The proposed system could help me to understand clearly the links among my companies performance measures, objectives, actions plans, and strategies.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

4. The proposed system would give me a clear overview of company governance.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

5. The proposed system would allow me to communicate better with other groups or departments and collaborate effectively to achieve company goals and strategies.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

6. Reports and charts provided by the software prototype are easy to understand.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

7. The software prototype provides a user-friendly interface.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

8. I believe that I can learn to operate the proposed software easily.
☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

9. Rate usefulness of the proposed software for the tasks indicated below:

	Very useful	Useful	Neutral	Not useful	Not useful at all
Prepare report	☐	☐	☐	☐	☐
Interpret data and results	☐	☐	☐	☐	☐
Meet accountability standards	☐	☐	☐	☐	☐
Visualize data	☐	☐	☐	☐	☐
Improve operations or processes	☐	☐	☐	☐	☐
Determine promotions	☐	☐	☐	☐	☐
Determine compensation	☐	☐	☐	☐	☐
Manage publicity	☐	☐	☐	☐	☐
Satisfy mandates	☐	☐	☐	☐	☐
Provide timely information	☐	☐	☐	☐	☐
Tailor information variety purposes	☐	☐	☐	☐	☐
Making corrective initiatives/actions decisions	☐	☐	☐	☐	☐
Other (Please specify.)	☐	☐	☐	☐	☐

10. On the back of the paper, please provide any additional comments that you may have for the proposed software prototype.

Corporate Performance Measurement System Prototype-Balanced Scorecard

1. The proposed system could help me to:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
understand my company's strategies, goals, and objectives.	☐	☐	☐	☐	☐
understand initiatives/actions that my company is taking.	☐	☐	☐	☐	☐
understand my roles and responsibilities in the company.	☐	☐	☐	☐	☐

2. The proposed system could help me to track my team's performance consistently and allow me to take proactive actions to manage my team better in achieving company's strategies and goals.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

3. The proposed system could help me to understand clearly the links among the company's performance measures, objectives, actions plans, and strategies.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

4. The proposed system would give me a clear overview of the company governance.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

5. The proposed system would allow me to communicate better with other groups or departments and collaborate effectively to achieve company goals and strategies.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

6. Reports and charts provided by the proposed software are easy to understand.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

7. The proposed software provides a user-friendly interface.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

8. I believe that I can learn to operate the proposed software easily.

   ☐ Strongly agree   ☐ Agree   ☐ Neutral   ☐ Disagree   ☐ Strongly disagree

9. Rate usefulness of the proposed software for the tasks indicated below:

	Very useful	Useful	Neutral	Not useful	Not useful at all
Prepare report	☐	☐	☐	☐	☐
Interpret data and results	☐	☐	☐	☐	☐
Meet accountability standards	☐	☐	☐	☐	☐
Visualize data	☐	☐	☐	☐	☐
Improve operations or processes	☐	☐	☐	☐	☐
Determine promotions	☐	☐	☐	☐	☐
Determine compensation	☐	☐	☐	☐	☐
Manage publicity	☐	☐	☐	☐	☐
Satisfy mandates	☐	☐	☐	☐	☐
Provide timely information	☐	☐	☐	☐	☐
Tailor information variety purposes	☐	☐	☐	☐	☐
Making corrective initiatives/actions decisions	☐	☐	☐	☐	☐
Other (Please specify.)	☐	☐	☐	☐	☐

10. On the back of the paper, please provide any additional comments that you may have for the proposed software prototype.

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