Supply Chain Performance Measurement

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16. INTRODUCTION

Supply chain management is the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served to fulfill the customer request. The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole. A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers

Supply chains encompass the companies and the business activities needed to design, make, deliver, and use a product or service. Businesses depend on their supply chains to provide them with what they need to survive. Every business fits into one or more supply chains and has a role to play in each of them. Those companies that learn how to build and participate in strong supply will have a substantial competitive advantage in their markets.

1.1 Supply Chain Performance Measurement

The importance of performance measurement in the context of SCM cannot be overstated. Timely and accurate assessment of overall system and individual system component performance is paramount. An effective performance measurement system (1) provides the basis to understand the system, (2) influences behavior throughout the system, and (3) provides information regarding the results of system efforts to supply chain members and outside stakeholders. In effect, performance measurement is the glue that holds the complex value-creating system together, directing strategic formulation as well as playing a major role in monitoring the implementation of that strategy. In addition, research findings suggest that measuring supply chain performance in and of itself leads to improvements in overall performance.

In one study of U.S.-Mexican manufacturing operations, performance improvements were found in order cycle time reduction, routing and scheduling, and effective handling of border crossings of outbound freight. Another study found that implementation of performance measurement systems led to improvements in process cycle time, cost, quality, and delivery performance. Despite its importance, however, prior to 1990, supply chain performance often was measured in oversimplified and sometimes counterproductive (cost-reduction based) terms. Lack of an appropriate performance measurement system has been cited as a major obstacle to effective supply chain management.

1.2 Need of supply chain performance measurement:

The supply chain of any organization is the life line of that organization. The progress or decline of organization is depending on supply chain. In any organization there is always a need of improvement in every department & system. The extensity of improvement is decided by the performance of that department or system.

Thus it is important to measure the performance of supply chain as well. The supply chain is end to end i.e. Tier to end customer process. There are two types of supply chain internal & external. The performance measurement enables the organization to plan, measure & control its performance according to its predefined strategy. The performance measurement should consider the efficiency & effectiveness of supply chain. The system without performance measurement is nothing but aero plane without compass or a manager operating without strategy. The purpose of performance measurement is not only to know the system is performing but also to enable it to perform better. The ultimate aim of implementing the performance measurement system is to find out loop holes in the system & root causes of that & finally to improve the performance.

1.3 Developments in Supply Chain Performance Measurement

The concept of SCM requires measuring overall supply chain performance rather than just the performance of the individual chain members. It is the combined performance of the supply chain, the final outcome of the efforts of all integrated members that is of greatest importance from a measurement perspective. Although measures of supply chain performance differ in terms of individual indicators employed, virtually all have one overriding focus continuous improvement of end-customer service. After all, the final customer of the supply

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chain must be satisfied for the overall supply chain to succeed long-term. These customers care little about the time required to move materials between intermediate supply chain members or about the cost associated with this activity. The customer is concerned with the time required to meet its demands and the cost of doing so. This fundamental concern is reflected most generally in a desire to continually reduce total cycle time. A good performance measurement system also is "actionable." It allows managers not only to identify but also to eliminate causes of supply chain operational problems so that relationships with customers are not permanently harmed. Beyond these general customer-oriented aspects of effective supply chain performance measurement, researchers have stressed the desirability of assessing a wide variety of phenomena indicative of overall supply chain performance. These include measurement of (1) changes in both the average volume of inventory held and frequency of inventory turns across the supply chain over time, (2) the adaptability of the supply chain as a whole to meet emergent customer needs, and (3) the extent to which intra-supply chain relationships are based on mutual trust. Finally, effective measurement of supply chain performance entails looking beyond the integrated chain itself in a variety of ways.

While SCOR provides a proven model to measure and benchmark supply chain performance, it does not include measures for the other business processes in the value chain, i.e. product design, sales, etc. The true method to organize your key performance indicators is' The Balance Scorecard', an approach to strategic management developed in the early 1990's by Dr. Robert Kaplan (Harvard Business School) and David Norton. The basic idea is that an organization must measure its performance from a balanced view against its goals as established in its vision and strategy.

1.4 Objective of project

Basically there are two supply chain one is internal & another is external. The performance of these supply chain is measured to improve the performance of supply chain. This can be measured by many ways with many criteria's.

The objective of the project is to measure the performance of supply chain within organisation with one major criterion. Also to analyse the problems while measuring the performance.

1.5 Problem definition

The measurement of the supply chain is become essential today. The analysis based on this measurement is also a critical task. The measurement along with criteria's is to be done & then it has to be observe that whether every parameter is meeting with target or not. If any criterion is not meeting then loop holes finding & improvement of that parameter is also a critical task.

2. LITERATURE REVIEW

In this section we review the literature on supply chain management performance measurement & methods of that .The literature provides theoretical foundation for the work on SCM performance measurement. The literature portrays SCM performance measurement with a Balance Scorecard system which ultimately results in improving organizational performance.

The need of performance measurement systems at different levels of decision-making, either in the industry or service contexts, is undoubtedly not something new. Kaplan and Norton (1992) have proposed the balanced scorecard (BSC), as a means to evaluate corporate performance from four different perspectives: the financial, the internal business process, the customer, and the learning and growth. Their BSC is designed to complement ''financial measures of past performance with their measures of the drivers of future performance''. The name of their concept reflects an intent to keep score of a set of items that maintain a balance ''between short term and long term objectives, between financial and non-financial measures, between lagging and leading indicators, and between internal and external performance perspectives''. The early image of the BSC serving the CEO like a control panel serves an aircraft pilot seems to have expanded to include mechanisms to alter the course of action as well. Now, the BSC seems to serve as a control panel, pedals and steering wheel .Many companies are adopting the BSC as the foundation for their strategic management system. A large number of methods of performance measurement systems have been reported in the literature.

2.1 Performance Measurement in a Supply Chain

In this paper the author convinced that the supply chain is an important element in logistics development for all industries. It can improve efficiency and effectiveness of not only product transfer, but also information sharing between the complex hierarchies of all the tiers. There is no systematic grouping of the different performance measures in the existing literatures. This paper presents the formulization of both quantitative and qualitative performance measurements for easy representation and understanding.

Apart from the common criteria such as cost and quality, five other performance measurements are defined: resource utilization; flexibility; visibility; trust; and innovativeness. In particular, new definitions are developed for visibility, trust, and innovativeness.

In addition, a multi-attribute decision-making technique, an analytic hierarchy process (AHP), is used to make decisions based on the priority of performance measures. This paper

outlines the application and particularly the pair wise comparison which helps to identify easily the importance of different performance measurements. An example from the electronic industry is used to demonstrate the AHP technique.

Recently, quality would be the emphasis for most manufacturers; however, it has not been extended to the whole supply chain. Quantifying these measures has no common consensus. Similarly, other performance measures have to be standardized. In this paper, seven categories of performance measurement have been identified. Quantitatively, cost and resource utilization are the main concern. They are easily understood by their numerical representation. Qualitatively, quality, flexibility, visibility, trust, and innovativeness were identified. For qualitative measurements, they are usually conceptual ideas, and people usually judged these performances by their own understanding. This leads to a major problem of inconsistency because of lack of standardization, hence leading to confusion and biased

judgment. Thus, all these five categories are quantified into measurable elements. One important reminder is that there may be more than one way of measuring a performance, e.g. on a time or cost basis. However, a company should adopt only one kind of measurement, which is most related to the particular characteristic of the company.. A multi-attribute decision-making technique, AHP, aids it. It helps to priorities the performance by simply inserting data or using pair wise comparison functions. A reference to the electronic industry is used to show the use of AHP to rank performance measurements. [1]

2.2 Performance Measurement in a Supply Chain a balance score card approach

In this paper Rajat Bhagwat, Milind Kumar Sharma, develops a balanced scorecard for supply chain management (SCM) that measures and evaluates day-to-day business operations from following four perspectives: finance, customer, internal business process, and learning and growth. Balanced scorecard has been developed based on extensive review of literature on SCM performance measures, supported by three case studies, each illustrating ways in which BSC was developed and applied in small and medium sized enterprises (SMEs) in India. The paper further suggests that a balanced SCM scorecard can be the foundation for a strategies system provided that certain development guidelines are properly followed, appropriate metrics are evaluated, and key implementation obstacles are overcome. The balanced scorecard developed in this paper provides a useful guidance for the practical managers in evaluation and measuring of SCM in a balanced way and proposes a balanced performance measurement system to map and analyze supply chains. While suggesting balanced scorecard, different SCM performance metrics have been reviewed and distributed into four perspectives. This helps managers to evaluate SCM performance in a much-balanced way from all angles of business.

Performance measurement is an essential element of effective planning and control as well as decision making. The paper has proposed application of the balanced SCM scorecard to organizations with the objective to evaluate their day-to-day business performance. This paper has considered the use of a BSC framework to measure and evaluate SCM. While applying the BSC in SCM, it is interesting to observe that some of the metrics in one category contradict other metrics in another category

Metric 'responsiveness to urgent deliveries' from customer perspective category compromises with internal business metrics such as capacity utilization, total inventory cost and planned process cycle time. Reasons are obvious as serving to an urgent order could disturb routine production planning and planned delivery schedule. Maximum utilization of plant and machinery could affect delivery performance, delivery lead-time and delivery reliability adversely. Supplier's cost saving initiatives metric from innovation and learning category also compromises with other metrics such as delivery performance and delivery lead time of other categories. The four perspectives and related metrics represent a template rather than definitive strategic SCM measurement system. Future research is recommended in order to determine whether the proposed perspectives and measures are a necessary and sufficient set the value of the balanced SCM scorecard rises if it is used to evaluate SCM performance on daily routine basis to coordinate wide range of business operations simultaneously. The management of companies are likely to benefit at all decision levels from a systematic framework based on goals and measures that are agreed upon in advance .[2]

2.3 Measuring Performance In Supply Chain –A Framework

In this paper the author propose a framework model to help companies measure and evaluate the performance of their supply chains. Once that actually, companies operate their business in an increasingly changeable and unpredictable environment, where competition assumes a global scale, they need to look for new ideas, new tools and new methods. The proposed framework grounds on the methodology of performance measuring systems, applying to the measurement of both tangible and intangible assets, and also measuring supply chain performance internally and externally. The framework developed enhance the use of a group of metrics across all organization, this metrics are a fundamental part of a measuring system adapted to strategy, goals, key performance areas, process elements and activities, enabling evaluating defined goals, leading to decision making and the implementation of improvement actions.

The implementation of a performance measurement system is a complex task once that need the involvement of all organization, to perform a set of rules to make the system effective. Once the strategic goals for supply chain are defined, according to business strategy, it's necessary to define the metrics that best suit the objectives and connect them with company information systems. To implement this metrics it is necessary set rules to collect, analyze, and distribute gather data and develop appropriate tools to help decision making. According to the developed analysis organization has to develop improvement initiatives to achieve strategic goals initially defined. [3]

2.4 Selection of Supply Chain Performance Measurement System Using AHP Approach

Analytic hierarchy process (AHP) based decision model presented in this paper structures the problem related to selection of supply chain performance measurement system in a hierarchical form with alternatives available to the decision maker. AHP is a suitable approach for undertaking quantitative as well as qualitative analysis. The approach differs from other multi-criteria as subjective judgments are readily included and the relevant inconsistencies are dealt with appropriately. The final outcome of the AHP is an optimum choice among decision alternatives. Thus, AHP based approach proposed in this paper provides a more realistic and accurate representation of the problem for selecting supply chain performance measurement system.

The implementation of supply chain performance measurement system may cost in millions of dollars for company. The implementation of these may be a risky endeavor for the top management as it involves financial and operational aspects, which can determine the performance of the company in the long run. And no longer do the companies compete against each other; it is the supply chains which compete. So the question now is not whether to go for it or not, but which framework to pick up. This research is relevant in this sense. The AHP model presented in this paper

structured the problem of selection of supply chain performance measurement system in a hierarchical form and linked the determinants of the supply chain performance measurement system and the alternatives available to the decision maker. Thus, a AHP approach proposed in this paper can provide to the decision maker a more realistic and accurate representation of the problem for selection of supply chain performance measurement system. This study aids the decision makers in the complex task of prioritizing their options. The utility of the AHP methodology in integrating both quantitative as well as the qualitative characteristics, which need the attention of the decision maker in arriving at the best possible solution, assumes tremendous value. The model developed in this paper has a few limitations as well. The formation of the pair-wise comparison matrices and data acquisition is a tedious and time-consuming task. Also, more importantly, the results reported in this research are based on the opinion of the experts from the case company. Thus, the pair-wise comparison of the criteria always depends on the user's knowledge and familiarity with the firm, its operations, and its industry. [4]

2.5 Conceptual Foundations of the Balanced Scorecard

This paper describes the roots and motivation for the original Balanced Scorecard article as well as the subsequent innovations that connected it to a larger management literature. The paper uses the following structure for organizing the origin and subsequent development of the Balanced Scorecard:

1. Balanced Scorecard for Performance Measurement

2. Strategic Objectives and Strategy Maps

3. The Strategy Management System

4. Future Opportunities

The BSC retains financial metrics as the ultimate outcome measures for company success, but supplements these with metrics from three additional perspectives – customer, internal process, and learning and growth – that we proposed as the drivers for creating long-term shareholder value.

The Balanced Scorecard, of course, was not original for advocating that nonfinancial

measures are used to motivate, measure, and evaluate company performance. In the 1950s, a General Electric corporate staff group conducted a project to develop performance measures for 5 GE's decentralized business units. The project team recommended that divisional

Performance is measured by one financial and seven nonfinancial metrics.

1. Profitability (measured by residual income)

2. Market share

3. Productivity

4. Product leadership

5. Public responsibility (legal and ethical behavior, and responsibility to stakeholders including shareholders, vendors, dealers, distributors, and communities)

6. Personnel development

7. Employee attitudes

8. Balance between short-range and long-range objectives. [5]

2.6 Balanced Scorecard implementation in Small & Medium size Enterprises (SMES)

In this paper author agrees that recent research has indicated that the degree of strategic planning in organizations is likely to have a direct impact on business performance and business evaluation. However, these findings leave small and medium-sized businesses (SMEs) in particular, with the challenge of matching the requirement for an improved strategic planning processes with the competitive advantage associated with being a "simple" and highly responsive organization.

In response to that challenge, this paper discusses the potential benefits to SMEs in adopting the Balanced Scorecard methodology and the underlying management processes most relevant to SMEs. It also makes observations about how use and value may differ between Balanced Scorecard application in large and smaller enterprises. Despite the lack of comprehensive literature focused on Balanced Scorecard implementation, SMEs believe Balanced Scorecard and its associated management processes can prove equally beneficial to SMEs as to large organizations.

In smaller firms such as our own, a greater proportion of the value of Balanced Scorecard comes from two other elements: the description of strategic vision and associated strategic objectives and priorities in a way that builds consensus; and impetus given to the development and application of more effective strategic management processes. However, the Balanced Scorecard used at the centre of a strategic management system addresses effectively a number of the fundamental issues relevant to large as well as small businesses:

Using the Balanced Scorecard to regularly check whether the organization is doing what it set out to do and is achieving the results it expected, creates learning about the validity of the cause-and-effect relationships. It also forms a useful foundation for deciding what needs to get done in the future based on the above learning and any changes in the external environment In SMEs these Balanced Scorecard benefits can be achieved without the need for developing a complicated and administratively demanding measurement regime by simply using the Balanced Scorecard and its measures as a mental or verbal frame of reference for addressing general strategic and operational change issues resulting from the pursuit of long-term goals.

These are real benefits experienced in our own company. But successful Balanced Scorecard implementation in any organization requires sustained management commitment to using it making sure it drives the necessary behavioral changes within the organization, starting with the managers themselves.

Observing these success criteria, Balanced Scorecard can prove an effective tool for SMEs in meeting the challenge posed by the need to introduce more efficient strategic planning processes while retaining the competitive advantage of having relatively simple structures. Finally, it should be noted that although this paper has highlighted the existence of important potential and real benefits to SMEs from applying the Balanced Scorecard as a strategic management tool, there is an obvious need for further substantiating these conclusions through empirical research .[6]

2.7 Decision making with the analytic hierarchy process

In this paper author convinced that decisions involve many intangibles that need to be traded off. To do that, they have to be measured alongside tangibles whose measurements must also be evaluated as to, how well; they serve the objectives of the decision maker. The Analytic Hierarchy Process (AHP) is a theory of measurement through pair wise comparisons and relies on the judgments of experts to derive priority scales. It is these scales that measure intangibles in relative terms. The comparisons are made using a scale of absolute judgments that represents how much more; one element dominates another with respect to a given attribute. The judgments may be inconsistent, and how to measure inconsistency and improve the judgments, when possible to obtain better consistency is a concern of the AHP. The derived priority scales are synthesized by multiplying them by the priority of their parent nodes and adding for all such nodes.

It appears inescapable that we need an organized way to make decisions and collect information relevant to them when a group must decide by laying out all the important factors and negotiating their understanding, beliefs and values. Here are a few examples where the process has been used in practice. The Analytic Hierarchy Process (AHPs) has been used in various settings to make decisions. [7]

2.8 Constructing Balance Score Card Using AHP

In this paper it is demonstrate that the uses of analytic hierarchy process choosing performance criteria of the balance score card considering organisations different strategies. The balance score card is strategic planning & management system which is aligning organisations activities & strategies, and is aimed to continually improve strategic performance.

Analytic hierarchy process is a multicriterion decision method including qualitative factors in addition to qualitative factors in a decision process. In this paper it is mentioned that how to choose performance criteria constructing the balance scorecard as organisations strategic performance measurement tool by using analytic hierarchy process.

The balance score card is a very effective multi attribute evaluation framework for firms. It employs performance metrics from financial, customer, internal business process& learning & growth. The use of balance score card should improve managerial decision making by aligning performance measure with the goals & the strategies. In this paper analytic hierarchy process is used to construct balance score card by aligning performance measures with goals of organisations. Analytic hierarchy process is multi criteria decision process that allows qualitative as well as quantitative judgement in decision making process. [8]

2.9 HOW TO BUILD A SUCCESSFUL BALANCED SCORECARD

The Balanced Scorecard concept has been adopted by all types of organizations (manufacturing and service, for-profit and not-for-profit, private and public) in virtually every developed and developing nation in the world and it has evolved from its initial purpose of an improved performance measurement system to become the basis of a new management system, one that aligns and focuses the entire organization on implementing and improving its strategy. In this paper it is agreed that Balanced Scorecard means three things: measurement system, strategic management system, and communication tool. The paper talks about the Balanced Scorecard philosophy and the issues that need to be solved for a successful BSC implementation, provides recommendations for the formulation and implementation of the Balanced Scorecard

In today's business environment strategy has never been more important. Yet research shows that most companies fail to execute strategy successfully. The Balanced Scorecard assists organizations in overcoming two key issues: effective organizational performance measurement and implementing strategy. The starting point in adopting Balanced Scorecard is to define Balanced Scorecard philosophy describing how the Balanced Scorecard will look, how will be used, who will be using it and how it will be build. The Gallup Organization has observed that when companies implement a balanced scorecard approach, four elements are vital: focus, validity, connectivity, and integration. Focus and validity ensure that a balanced scorecard contains vital metrics that will move the organization in the right direction. For performance measures to have the desired impact, however, two more things must happen. First, each manager and workgroup must be connected to their scorecard in ways they understand and can influence. Second, scorecards must be integrated into a company's performance management practices or they won't change managers' or employees' behavior. [9]

2.10 Balanced Scorecard Myths and Reality

The performance improvement process is a critical component of the strategic planning process. Call it by any name, the process is very vital, and it has always been practiced by many companies worldwide for a long time. This process has been recently dubbed as the balanced scorecard. The balanced scorecard is a system of combining financial and non-financial measures of performance in one single scorecard. It includes performance measures for four perspectives: financial, customer, internal business processes, and learning and growth (innovation). It need not be restricted to four perspectives; more may be added. The social responsibility and environmental concerns are two possible candidates. The balanced scorecard focuses on the link between business processes and decisions and results. It is considered as a device to guide strategy formulation, implementation, and communication. It also helps in tracking the performance and providing quick feedback for control and evaluation. A

number of companies in the USA and a few companies in India have implemented the balanced scorecard.

The success of the balanced scorecard or a similar device will depend on the clear identification of non-financial and financial variables and their accurate and objective measurement and linking the performance to rewards and penalties. The proponents of the balanced scorecard claim that it aligns with strategy leading to better communication and motivation which causes better performance. This assumption could be the single most important reason for the popularity of the balanced scorecard. However, this may or may not be true in practice. This is an empirical question. There is a need to document the experiences of the balanced scorecard companies and establish the cause-effect relationship. There are several reasons for the use of the balanced scorecard by organizations:

- The balanced scorecard is a comprehensive tool to understand the target customers, their requirements, and the performance gaps.
- The balanced scorecard provides logic for focusing on creating intangible and intellectual capital which under the traditional financial performance systems was difficult to do.
- The balanced scorecard is able to articulate the strategy of growth with business excellence which requires greater focus on non-financial initiatives.
- The balanced scorecard enables employees to understand strategy and link strategic

objectives to their day-to-day operations.

- The balanced scorecard facilitates performance review and feedback on a continuous basis.

The balanced scorecard, we strongly believe, will be useful to an organization when it is a part of the strategic planning process. A successful implementation of the balanced scorecard has the following other prerequisites:

- Top management commitment and support
- Linking performance measures to rewards
- Installing a simple tracking system
- Creating and linking the balanced scorecards at all levels of the organization
- Setting up a sound organizational communication

	A	B	C
A	1	R12	R13
B	1/R12	1	R23
C	1/R13	1/R23	1

system to harness advantages of the

balance scorecard

Linking strategic planning, balanced scorecard, and budgeting process for better allocation of resources.[10]

3. METHODOLOGY

The performance of supply chain is generally measured by the company according to financial view only. But as technology advances the need is developed to measure the performance according to other perspective also.

The assignment of weight age is done on the basis of discussion in meetings & experience. Hence it is necessary to have some base to assign the weight. To assign the weight to the criteria the AHP method is preferred among others.

3.1 Step 1: Define criteria for performance measurement.

The first step in any performance measurement procedure is to establish the criteria to be used for assessing the performance with the help of literature & structural interview .After defining the criteria for performance measurement, the measures has been decided. The structured interview consists of: the general characteristics of the company, model or the type of method used for performance measurement. The main criteria for performance measurement are as follows

1) Finance

2) Customer Service

3) Internal Business process

3.2 Step 2: Assignment of weight age for criteria's for performance measurement.

In this, the criteria's for performance measurement have been finalized by discussion in structural interview. •

• To weight and compare pair-wise for all criteria.

The pair wise comparison will be on the base of Satty's scale which is mentioned below: -

Verbal judgment or preference	Numerical rating
Extremely preferred	9
Very strongly preferred	7
Strongly preferred	5
Moderately preferred	3
Equally preferred	1
Intermediate values between two adjacent judgments (when compromise is needed)	2, 4, 6, and 8

3.3 Preparation of pair wise comparison matrix. (Mathematical Formulation of problem): -

The pair wise comparison is done on the basis of decision makers views. It may appear as follow:

A1=

	Customer	IB	Finance
Customer	1	0.2	0.111111
IB	5	1	0.25
Finance	9	4	1
	15	5.2	1.361111

	Customer	IB	Finance	Row total	Average	Weitage	% Weitage
Customer	0.066667	0.038462	0.081633	0.186761	0.062254	6.225362	6%
IB	0.333333	0.192308	0.183673	0.709314	0.236438	23.64382	24%
Finance	0.6	0.769231	0.734694	2.103925	0.701308	70.13082	70%
	1	1	1				100%

After preparing the matrix normalize it & find the weight of the each criterion it may appear:-

A2 =

	Weights
A	X1
B	X2
C	X3

Customer	6
IB	24
Finance	70

The calculated weights may be consistent or not. If the C.R. is less than 0.10 then the weights are consistent. The consistency ratio (C.R.) for the comparison above is calculated to determine the acceptance of the priority weighting. The consistency test is one of the essential features of the AHP method which aims to eliminate the possible inconsistency revealed in the criteria weights, through the computation of consistency level of each matrix. It is conducted as follows: -

A3= A1 * A2.

3.4 Step 3 Conduct consistency test.

It is necessary to conduct the consistency test weather

A4= A3/A2.

1.4460
2.0270
2.0185

5.8072
8.1406
8.1064

A5= eig (A4).

=4.14

C.I.=A5-m\m-1.

m=3

C.I=0.10

C.R.=C.I/R.I.

R.I = 1.35.

= 0.077

If C.R < 0.10 then the matrix is consistent.

As the C.R. is less than the 0.10 hence consistency test result is positive and assigned weight age are confirmed.

3.5 Develop a scorecard module to calculate the performance

A scorecard has developed which contain the three performance criteria's which has specific weight ages. The bench mark set here in industry is 100%.The sore card is prepared after industrial case study the data has been collected .There three types of score card depending upon three criteria's.

Balance Score Card -2011-Internal Business Process

Parameter	Measures	Month	Target	Actual	Avg. of Target	Avg. of Actual
Internal Business Process (24%)	1)Total Supply chain cycle time	Jan-11	100%	85%	100%	85%
	2)Purchase order cycle time		100%	85%		
	3) Resource utilisation		100%	85%		
Internal Business Process (24%)	1)Total Supply chain cycle time	Feb-11	100%	85%	100%	84%
	2)Purchase order cycle time		100%	84%		
	3) Resource utilisation		100%	84%		
Internal Business Process (24%)	1)Total Supply chain cycle time	Mar-11	100%	83%	100%	83%
	2)Purchase order cycle time		100%	83%		
	3) Resource utilisation		100%	84%		
Internal Business Process (24%)	1)Total Supply chain cycle time	Apr-11	100%	85%	100%	85%
	2)Purchase order cycle time		100%	85%		
	3) Resource utilisation		100%	86%		
Internal Business Process (24%)	1)Total Supply chain cycle time	May-11	100%	86%	100%	87%
	2)Purchase order cycle time		100%	85%		
	3) Resource utilisation		100%	88%		
Internal Business Process (24%)	1)Total Supply chain cycle time	Jun-11	100%	85%	100%	87%
	2)Purchase order cycle time		100%	86%		
	3) Resource utilisation		100%	89%		
Overall						85%

Balance Score Card -2011-Finance

Parameter	Measures	Month	Target	Actual	Avg. of Target	Avg. of Actual
FINANCIAL (70%)						
	1) Productivity ratio	**Jan-11**	100%	90%	**100%**	**91%**
	2)Rate of return on investment		100%	95%		
	3)Delivery performance		100%	88%		
FINANCIAL (70%)						
	1) Productivity ratio	Feb-11	100%	91%	100%	**93%**
	2)Rate of return on investment		100%	95%		
	3)Delivery performance		100%	90%		
FINANCIAL (70%)						
	1) Productivity ratio	Mar-11	100%	90%	100%	**91%**
	2)Rate of return on investment		100%	93%		
	3)Delivery performance		100%	90%		
FINANCIAL (70%)						
	1) Productivity ratio	Apr-11	100%	88%	100%	**90%**
	2)Rate of return on investment		100%	93%		
	3)Delivery performance		100%	90%		
FINANCIAL (70%)						
	1) Productivity ratio	May-11	100%	90%	100%	**89%**
	2)Rate of return on investment		100%	90%		
	3)Delivery performance		100%	88%		
FINANCIAL (70%)						
	1) Productivity ratio	Jun-11	100%	90%	100%	**89%**
	2)Rate of return on investment		100%	89%		
	3)Delivery performance		100%	88%		
Overall Performance						**90%**

Balance Score Card -2011-Customer Service

Parameter	Measures	Month	Target	Actual	Avg. of Target	Avg. of Actual
Customer Service (6%)						
	1)Customer query time	Jan-11	100%	90%	100%	**92%**
	2)Order lead time		100%	85%		
	3)Delivery lead time		100%	100%		
Customer Service (6%)						
	1)Customer query time	Feb-11	100%	95%	100%	**93%**
	2)Order lead time		100%	85%		
	3)Delivery lead time		100%	100%		
Customer Service (6%)						
	1)Customer query time	Mar-11	100%	90%	100%	**92%**
	2)Order lead time		100%	85%		
	3)Delivery lead time		100%	100%		
Customer Service (6%)						
	1)Customer query time	Apr-11	100%	97%	100%	**94%**
	2)Order lead time		100%	85%		
	3)Delivery lead time		100%	100%		
Customer Service (6%)						
	1)Customer query time	May-11	100%	95%	100%	**93%**
	2)Order lead time		100%	85%		
	3)Delivery lead time		100%	100%		
Customer Service (6%)						
	1)Customer query time	Jun-11	100%	95%	100%	**93%**
	2)Order lead time		100%	85%		
	3)Delivery lead time		100%	100%		
Overall Performance						**93%**

simulation. It is easy to review the process with simulation so that we can compare the results also & find out the loophole so as to improve the process.

Parameter/ Monthwise Performance	Finance	Customer Service	IB
Jan	91%	92%	85%
Feb	93%	93%	84%
Mar	91%	92%	83%
Apr	90%	94%	85%
May	89%	93%	87%
Jun	89%	93%	87%
Half yearly Performance	90%	93%	85%

Finance	Customer	IB	Half yearly Performance
93%	90%	93%	96%

1) **If actual performance is > 90%, then Remark is met.**

2) **If actual performance is < 90 %, then Remark is not met.**

From the above observation we can say that the benchmark has been not achieved for internal business process. Therefore it is very much necessary to review the process again. The way to review the process is

3.6 Next six months plan

1) Literature review continue

2) Data collection for Internal Business Process

3) Analysis of data collected

4) Simulation of supply chain

17. CONCLUSION

The performance of supply chain within organization with three criteria's is evaluated by balance score card method and weight age of criteria is developed by using AHP method. The four-level of AHP model is assessing decision-makers to identify and evaluate the supply chain performance. The benchmark has been achieved for finance & customer service & not achieved for internal business. So review for this process is necessary. The way to review help to find the loop holes & ambiguities in the process.

18. REFERENCES

1. Bowman, M., Debray, S. K., and Peterson, L. L. 1993. Reasoning about naming systems. .
2. Ding, W. and Marchionini, G. 1997 A Study on Video Browsing Strategies. Technical Report. University of Maryland at College Park.
3. Fröhlich, B. and Plate, J. 2000. The cubic mouse: a new device for three-dimensional input. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems
4. Tavel, P. 2007 Modeling and Simulation Design. AK Peters Ltd.
5. Sannella, M. J. 1994 Constraint Satisfaction and Debugging for Interactive User Interfaces. Doctoral Thesis. UMI Order Number: UMI Order No. GAX95-09398., University of Washington.
6. Forman, G. 2003. An extensive empirical study of feature selection metrics for text classification. J. Mach. Learn. Res. 3 (Mar. 2003), 1289-1305.
7. Brown, L. D., Hua, H., and Gao, C. 2003. A widget framework for augmented interaction in SCAPE.