

The Use of Analytic Hierarchy Process in Integrating The Balanced Scorecard and Activity-Based Costing

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Abstract

Activity-Based Costing (ABC) is a method of measuring the cost and performance of activities and cost objects. It helps identify problems or ways to take advantage of opportunities by providing financial and nonfinancial information about activities and cost objects. Balanced Scorecard (BSC) has been accepted by the business world, worldwide, as a very promising tool for the performance measurement of an organization at the firm level. Although ABC and BSC are in practice well accepted as reliable tools for business operations, and seems reasonable to adopt these two as an integrated tool for a better service to the top management and the firm, to our knowledge there are very few if any existing researches covering this specific field. Since BSC is a multi-goals targeting model that focuses on the decision-making problems where multiple criteria are involved, and since each function of the firm usually comprises a large number of embedded activities leading to an exhaustive list of cost drivers, it seems appropriate for this research to adopt AHP in identifying the performance (cost) drivers of the outcome measures of a BSC. Thus, the main contribution of this paper is to demonstrate the potential of AHP as a tool that could easily integrate ABC/ABM and BSC. This integrated system is expected to induce innovation, improve customer service, increase customers and employee satisfaction, and enhance total performance.

Keywords: Activity-Based Costing, Balanced Scorecard, Analytic Hierarchical Process.

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1. Introduction

1.1 The Balanced Scorecard and Activity-Based Costing

Organizations face many hurdles in developing performance measurement systems that truly measure the right things. In the past, as companies invested in programs and initiatives to build their capabilities, managers relied solely on financial-accounting measures. Today, however, the financial accounting model must be expanded to incorporate the valuation of the company's intangible and intellectual assets. What is needed is a system that balances the historical accuracy of financial numbers with the drivers of future performance, while also assisting organizations in implementing their different strategies. The Balanced Scorecard (BSC) is probably the tool that answers both challenges.

In 1990, Kaplan and Norton led a research study of a dozen companies exploring new methods of performance measurement (Niven, 2002, p 11). The impetus for the study was a growing belief that financial measures of performance were ineffective for the modern enterprise. The study companies, along with Kaplan and Norton, were convinced that a reliance on these measures was affecting their ability to create value. The group discussed a number of possible alternatives but settled on the idea of a Scorecard featuring performance measures capturing activities from throughout the organization-customer issues, internal business processes, employee activities, and of course shareholder concerns. Kaplan and Norton labeled this new tool the Balanced Scorecard and later summarized the whole concept in the first of three *Harvard Business Review* articles (1992, 1993, 1996a).

Over the next few years a number of organizations adopted the BSC and achieved immediate results. Kaplan and Norton (1996a) discovered that these organizations were not only using the BSC to complement financial measures with

drivers of future performance but were also communicating their strategies through the measures they selected for their BSC. As the BSC gained prominence with organizations around the globe as a key tool in the implementation of strategy, Kaplan and Norton summarized the concept and the learning to that point in their 1996 book *The Balanced Scorecard*. Since then the BSC has been adopted by nearly half of the *Fortune* 1000 organizations (Niven, 2002).

Although the BSC of Kaplan and Norton has managed to be welcomed by a large number of companies all over the world, there is a growing literature, since the late 1990s, on its limitations that should make companies more careful when they are thinking about its implementation as a performance measurement tool.

Atkinson, Waterhouse and Wells (1997) were among the first who criticized the BSC arguing that it has some important limitation such as: (a) the weakness to show in a clear way the beneficial contributions that the employees and suppliers made to the company, (b) the difficulty to identify the role of the local community in defining the environment that the company works, and (c) the identification of stakeholders' contributions.

Brignall (2002) proposes an amended BSC which adequately cater for social and environmental aspects of organizational performance.

Another disadvantage of the BSC is the fact that it is inflexible and inappropriate (Dinesh and Palmer, 1998). Also, Lorange (1998) argues that, in a world of international competition, the traditional, formal planning systems need to be replaced by procedures of incremental and flexible informal planning leading to strategies that will be continuously redefined. Thus, BSCs should also change and become more flexible.

Mooraj, Oyon and Hostettler (1999) believe that BSC is quite complicated to be understood and implemented by the employees. Moreover, a lot of effort is needed to combine and create coherence between the BSC and other management tools, such as the planning budgeting systems, so that employees are capable of receiving consistent strategic and operational information.

Buglione and Abram (1999) argue that although the BSC connects the goals and measures logically it does not provide the necessary support to represent quantitatively the relative or absolute contribution of each perspective.

Norreklit (2000) states that there are no clear cause and effect relationships between the four perspectives of the BSC. For example, even if there is a co-variation between financial performance and customer loyalty, this does not automatically imply that increased customer loyalty is the cause of financial performance. In another article (2003) he concludes that the BSC is not a theoretical innovation and lacks a reliable theoretical base: *“Kaplan and Norton wanted to solve problems that are common to all firms but they don’t provide the appropriate model to that direction”* (p. 592).

Hendricks, Menor and Wiedman (2004) examined empirically the impact of the BSC implementation on the firm’s performance. They note that there are no hard evidences associated with improved financial results to justify the adoption and implementation of the BSC, although a large number of the tested firms adopted the BSC after 2003.

Angel and Rampersad (2005), on the other hand, argue that there is not enough scientific empirical research concerning the resulted costs/benefits from the implementation of the BSC. In their empirical research of more than fifty Canadian medium and large firms found that many users of the BSC expressed skepticism and

stated negative results after the adoption of the BSC. The majority of the large firms noted that the BSC did not work and they were faced with many difficulties during its implementation, especially with problems concerning its understanding and the measurement of their results.

The BSC communicates the multiple, linked objectives that companies must achieve to compete based on their intangible capabilities and innovation. The BSC translates mission and strategy into goals and measures, organized into four different perspectives: financial, customer, internal business process, and learning and growth.

The BSC retains the financial performance perspective because financial measures are essential in summarizing the economic consequences of strategy implementation.

In the customer perspective of the BSC, managers identify the customer and market segments in which the business desires to compete. Targeted segments could include both existing and potential customers. Then, managers develop measures to track the business unit's ability to create satisfied and loyal customers in these targeted segments.

In the internal business process perspective, managers identify the critical internal processes for which the organization must excel in implementing its strategy. The internal business processes dimension represents the critical processes (innovation processes, operations processes, and post-sales service processes) that enable the business unit to deliver the value proportions that will attract and retain customers in targeted market segments, and satisfy shareholder expectations regarding financial returns. Thus, the internal business process measures should be focused on the internal processes that will have the greatest impact on customer satisfaction and achieving the organization's financial objectives.

The fourth perspective-learning and growth- identifies the infrastructure that the organization must build to create long-term growth and improvement. The customer and internal business process perspectives identify the factors most critical for current and future success. However, businesses are unlikely to be able to meet their long-term targets for customers and internal processes using today's technologies and capabilities for delivering value to customers and shareholders. Intense global competition requires companies to continually improve their capabilities for delivering value to customers and shareholders. Organizational learning and growth come from three principal sources: people, systems, and organizational procedures.

The financial, customer, and internal business process objectives will typically reveal large gaps between existing capabilities and those required to achieve targets for breakthrough performance. To close these gaps, businesses must invest in training employees, enhancing information technology and systems, and aligning organizational procedures and routines. These objectives are articulated in the learning and growth perspective of the BSC.

All BSCs use certain *generic measures*. These generic, or core outcome, measures reflect the common goals of many strategies, as well as similar structures across industries and companies. These generic measures include profitability, market share, customer satisfaction, customer acquisition, customer retention, and employee satisfaction (Kaplan and Norton, 1996b), although recently, the founders of the BSC (Kaplan and Norton, 2001a; b) start to talk in detail about different customer value propositions, while some other researchers (Ittner and Larker, 2003) begun to unpack some of the difficulties of both measuring and setting targets for customer satisfaction.

These generic measures usually cover the two perspectives, the financial and the customer, and reflect decisions and actions taken much earlier, thus they are the long-term indicators of any company. The *drivers of performance* are the ones that tend to be unique for a particular business unit. The performance drivers reflect the uniqueness of the business unit's strategy. They are the short-term indicators of present and future success. They should lead the entire organization to focus on these drivers, to show what people should be doing day-by-day to enable successful outcomes to be produced in the future. In most cases, the performance drivers describe how a business process is intended to change, thus covering the remaining two perspectives, the internal business processes (mainly) and the learning and growth. The BSC, by providing short-term indicators of long-term outcomes, has become the guidance system to the future of any firm (Kaplan and Norton, 1996b).

A good BSC should have a mix of outcome measures and performance drivers (i.e., critical input and process measures). Outcome measures without performance drivers do not communicate how the outcomes are to be achieved. They also do not provide early warning about whether the strategy is being implemented successfully. Conversely, performance drivers based on inputs and processes alone enable the business unit to achieve short-term operational improvements. However, these measures fail to reveal whether the operational improvements have been translated into expanded business with existing and new customers, and, eventually, into enhanced financial performance. Thus, a good BSC should have an appropriate mix of core outcome measures (lagging indicators) and the performance drivers (leading indicators) of these outcomes. In this way, the BSC translates the business unit's strategy into a linked set of measures that define the long-term strategic objectives, as well as the mechanisms for achieving those objectives.

A BSC must be used for both strategic evaluation processes: (a) the evaluation of the alternative strategic options, during the strategic formulation process, for the selection of the best strategy, and (b) the continuous evaluation of the implemented strategy for confirming whether or not it is capable of achieving its stated goals and objectives. In the latter case the alternatives could be different departments or divisions of the same Strategic Business Unit (SBU) of a company.

Activity Based Costing (ABC) is a product costing technique that has gained much attention. Its history starts by the late 1980s. “In *Relevance Lost* (Johnson and Kaplan, 1987) it has no name; in April 1988 it is ‘transaction costing’ (Cooper and Kaplan, 1988a); by June 1988 it has become ‘activity-based costing’ (Johnson, 1988); and in October 1989 it achieves the status of a technical term coded as TLA-three letter acronym (Woolgar, 1991): ‘ Activity-based costing-ABC- is a relatively new concept, the oldest known system only having existed for a few years’ (Cooper, 1989c, p.1)” (Jones and Dugdale, 2002, p.134).

In the early 1990s the second wave ABC made its appearance. Cooper and Kaplan (1991, p. 130) comment that: “Initially, managers viewed the ABC approach as a more accurate way of calculating product costs. ABC is a powerful tool-but only if managers resist the instinct to view expenses at the unit level. Managers must refrain from allocating all expenses to individual units and instead separate the expenses and match them to the level of activity that consumes resources”. This amended ABC relies on the separation of firms’ activities into four levels: the unit, batch, product-sustaining and facility-sustaining level.

However, Johnson (1992b, p. 26 and p. 31) disagrees openly with the proposed ABC system (second wave) saying “As someone who helped put the activity-based concept in motion, I feel compelled to warn people that I believe it has gone too far. It

should be redirected and slowed down, if not stopped altogether...What has emerged is a new competitive environment-call it the global economy- in which accounting information is not capable of guiding companies toward competitiveness and long term profitability". He reaffirms his earlier commitment to managing activities rather than costs and makes a careful distinction between ABC and activity-based management (Johnson, 1991), advocating a 'cross-functional activity cost analysis' (Johnson, 1992b:232). Similarly, Anderson (1995) and Gosselin (1997) suggest that in many cases ABC is a complex phenomenon, whereas Gosselin (1997) argues that organizations that adopt and implement ABC are bureaucracies, mostly with high vertical differentiation, centralization and formalization.

By the end of the 1990s ABC becomes a stable socio-technical system. Enterprise Resource Planning (ERP) systems are being installed in many companies and ABC will be installed with them (Kaplan, 1998). The Harvard network made a strategic alliance with a large consulting firm (KPMG Peat Marwick), trained their US and overseas consultants, and served as consultants and observers to their clients' activity-based costing projects (Kaplan, 1998, p.102). "In the process of turning activity-based thinking from 'costing technique' to 'management philosophy' the large consulting houses typically make close links between ABC and ABM (without the careful distinctions made by Johnson) and treat ABCM and ABM as synonymous. So we find an easy progression from costing to management: "ABC supplies the information, and ABM uses this information in various analyses designed to yield continuous improvement" (Turney, 1992, p. 20)" (Jones and Dugdale, 2002, p. 150).

Armstrong (2002) argues that ABM inherits the 'productionist' orientation of ABC and is centrally concerned with making staff departments accountable: "The ABM approach is to analyze activities in terms of what they do for products or

services to establish their value or otherwise. Then these activities are measured as though they are routine, standardized acts. Activities that cannot be defined in this way, with their costs allocated to production, are seen as illegitimate. As ABC mutates into ABM it becomes a technology of management control promising to enable executives to cut into the ‘managerial fat’ that has accumulated in the bureaucratic structures of enterprises” (Jones and Dugdale, 2002, p. 151).

Turney (1996) defined ABC as a method of measuring the cost and performance of activities and cost objects. It assigns costs to activities based on their consumption of resources and then allocates costs to cost objects based on their required activities. The focus of ABC is on accurate information about the true cost of products, services, processes, activities, distribution channels, customer segments, contracts and projects. ABC helps identify problems or ways to take advantage of opportunities. It does so by providing financial and non-financial information about activities and cost objects. Numerous articles address the design and implementation of ABC systems (Shank and Govindarajan, 1993; Alan, 1995; David and Robert, 1995; Booth, 1996). According to Innes and Mitchell (1990), ABC provides process control information. A measure of the volume of each activity (cost drivers) is used to generate a cost rate for estimating production cost, and as a performance measure for the activity concerned. In practice, most applications of ABC make arbitrary allocations of common costs. The search for the activities, which connect costs to products and processes, and for the cost drivers which proxy for them, involves compromise between accuracy and manageability. The result is that some indirect costs are excluded from the cost-pools associated with a practical set of cost drivers (Armstrong, 2002).

ABC is a useful method for firms to analyse activities and cost drivers of operations during the production and sales process. The second-generation ABC has two main views, the cost assignment view and the process view (Turney, 1996).

The first view reflects the need for organisations to assign costs to activities and cost objects in order to analyse critical decisions. These decisions include pricing, product mix, sourcing, product design decisions, and setting priorities for improvement efforts.

The process view reflects the need of organisations for a new category of information. This is information about events that influence the performance of activities and activity performance—that is, what causes work and how well it is done. Organisations can use this type of information to help improve performance and the value received by customers and shareholders. It provides information about the work done in an activity and the relationship of this work to other activities.

On a more detailed level, it includes information about cost drivers and performance measures for each activity or process in the value chain. These cost drivers and performance measures are primarily non-financial. Cost drivers are factors that determine the work-load and the effort required to perform an activity. They include factors relating to the performance of prior activities in the chain as well as factors internal to the activity. Cost drivers tell you why an activity is performed and how much effort must be expended to carry out the work. They are useful because they reveal opportunities for improvement.

Performance measures describe the work done and the results achieved in an activity. They include measures of the efficiency of the activity, the time required to complete the activity, and the quality of the work done. Activities in a process share common cost drivers and performance measures. The work of each activity affects the

performance of the next activity in the process. Performance measures for one activity, therefore, become cost drivers for the next activity (Turney, 1996).

While this method is able to collect important cost information through its cost allocation process, it brought little guidance in forecasting where and what firms should do for the future, as well as it could not be properly incorporated with the strategic decision making process (Greenwood and Reeve, 1991; Kaplan and Norton, 1992).

On the other hand, BSC technique was developed to include such financial and non-financial performance measures that the top management of any firm could adopt for clarifying its vision, goals, and strategies, for communicating and linking strategic goals and measures, for evaluating strategic alternatives, and for intensifying strategic learning and feedback.

Although ABC and BSC are in practice well accepted as reliable tools for business operations, and it seems reasonable to adopt these two as an integrated tool for a better service to the top management and the firm, to our knowledge there are very few if any existing researches covering this specific field. Since BSC is a multi-goals targeting model that focuses on the decision-making problems where multiple criteria involved it seems appropriate for this research to adopt AHP in identifying the performance drivers (cost drivers) of the generic or outcome measures proposed by Kaplan and Norton (1996b).

1.2 The Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP), developed at the Wharton Scholl of Business by Thomas Saaty (1980, 1996), allows decision makers to model a complex problem in a hierarchical structure showing the relationships of the goal, objectives

(criteria), sub-objectives, and alternatives. Thus, a typical hierarchy consists of at least three levels, the goal(s), the objectives, and the alternatives.

AHP enables decision-makers to derive ratio scale priorities or weights as opposed to arbitrarily assigning them. In so doing, AHP not only supports decision-makers by enabling them to structure complexity and exercise judgment, but allows them to incorporate both objective and subjective considerations in the decision process (Forman, 1983).

In most cases the priority ranking of the various measures is not uniform across all decision makers at all levels, i.e., different constituencies (such as departments or divisions) hold different opinions as to the relative importance of the measures. When opinions differ about ranking measures is where the AHP comes into its own. Whereas something like DELPHI technique seeks resolution by iterative polling until consensus is reached, the AHP user asks constituents (via a questionnaire) to make a sequence of pairwise comparisons of the measures, and the comparisons then are analyzed via a mathematical model to establish the relative priorities of the measures (usually taking the geometric mean of the answers for each specific question), after which another algorithm is applied to establish the final ranking of the decision objectives or alternatives (i.e., the different strategies, departments or divisions).

The results then are synthesized to determine the overall importance of each alternative in achieving the main (overall) goal. The pairwise comparisons are quantified using the standard one-to-nine AHP measurement scale (Saaty, 1980):

Table 1: The standard AHP measurement scale

Ratio	Term	Explanation
1	Equal Importance	Two activities contribute equally to the objective.
3	Moderate Importance	Experience and judgment slightly favour one activity over another.
5	Essential or Strong	Experience and judgment strongly favour one activity over another.

7	Demonstrated Importance	An activity is strongly favoured and its dominance is demonstrated in practice.
9	Extreme Importance	The evidence favouring one activity over another is of the highest possible order of affirmation.

The AHP is ideally suited to help resolve certain problems that arise when multiple criteria are used in performance evaluation. For example, the pairwise comparisons for measure (s) priority can be done using a ratio scale. This facilitates the incorporation of non-quantitative measures into the evaluation scheme, since it forces participants to translate all criteria into relative priority structures based on the scale. Thus, using the AHP means that non-quantitative assessments can be combined with quantitative assessments in rating a unit or an individual.

The AHP has been widely and successfully applied in a variety of decision-making environments (Zahedi, 1986; Golden, Wasil, and Harker, 1989; Zopounidis and Doumpos, 1997, 1998, 1999a, 1999b, 2000a, and 2000b).

2. The proposed BSC – ABC framework using AHP

2.1 The Balanced Scorecard Measures

Suwignjo, *et al.*, (2000) developed an approach for the quantitative modeling of performance measurement systems. The objective of their research was to identify tools and techniques that would facilitate:

- identification of factors (measures) affecting performance and their relationships,
- structuring the factors hierarchically, and
- quantifying the effect of the factors on the overall performance.

Stage one of the approach uses the cognitive mapping technique to identify factors, which affect performance and their relationship with one another. This is a

very similar approach to the 'strategy map' proposed by Kaplan and Norton (1996b; 2001).

In stage two the cognitive maps are converted into cause and effect diagrams, which are used as a discussion tool to structure the factors that affect performance hierarchically. Structure diagrams are then used to formalise the hierarchical nature of the performance measurement system (Suwignjo, *et al.*, 2000, p 233). Finally, in stage three the Analytical Hierarchy Process is used to quantify the relationship of each factor with the others with respect to overall performance.

Sohn, *et al* (2003, p. 282) proposed a list of BSC measures, after a complete survey of relevant literature, which '*can be considered as a revision of Kaplan and Norton's original measures*'. These BSC measures consist of the four major perspectives and twenty sub-measures, five by each major measure (perspective). For example, the financial measures include revenue growth, investment, profitability, asset utilisation, and unit cost. In particular, a measure called 'knowledge sharing' is included for the learning/growth perspective.

The relative weights for each performance measure can be calculated using the Analytic Hierarchical Process (AHP) on the basis of two stepwise questions. First, six questions are asked for comparing (pairwise) the major BSC measures (financial, customer, internal process, and learning/growth). Subsequently, ten questions are asked to compare (pairwise) the five sub-performance measures under each major measure (Saaty and Vargas, 1994).

Finally, Chen and Pan (2004) adopt the AHP in identifying key performance indicators (KPIs) for the service industry from a list of performance measures covering the four dimensions of the BSC. Their research employs two stages: They first identify as many as possible KPIs of the service industry that have been

discussed through a meta-analysis on SSCI journals published between 1999 and 2002. Moreover, several depth interviews with various executives were performed to identify relevant KPIs. Then, colleagues of respective disciplines and practitioners were invited to fill respective AHP questionnaires and the results gathered from this survey were then analyzed to verify the most important KPIs of each dimension. Computation was ended at clearly determined KPIs through comparison of weight loading. Any AHP importance weight values larger than 0.1, were included as KPI of particular dimensions.

Our proposed methodology of integrating BSC and ABC is a different one based on the work of Hafeez *et al.* (2002), who employ AHP in determining key capabilities of a firm.

Cost drivers of the generic or outcome measures deserved firm's great amount of attention since costs appear whenever actions are performed and interacted. Supply chain perspective views the entire value-added flow that delivers products/services to customers as internal business process. BSC, as a dynamic strategic managerial tool, assumes that the four dimensions are interactive and interdependent. This research hence assumes that all selected generic measures, proposed by Kaplan and Norton (1996b) or any other researcher (professional or practitioner), could be significantly affected by an effective internal process control. Consequently, all our efforts are focused on the identification of the cost drivers of the internal business process that mostly affect the outcome measures, mainly, of the two perspectives, the finance and customer one.

2.2 The BSC – ABC framework

Cost drivers may be determined through internal business process or value chain analysis. This involves evaluating the contribution of firm cost drivers against the generic (outcome) measures of the finance and customer perspective (or any other perspective may be considered suitable by management). Essentially the framework consists of three steps:

Step 1: Determining generic performance measures and mapping firm cost drivers.

Step 2: Evaluating performance contributions using AHP.

Step 3: Determining key cost drivers

As we have already mentioned above, Kaplan and Norton (1996b) indicate which exactly these generic measures should be (profitability, market share, customer satisfaction, customer acquisition, customer retention, and employee satisfaction) and explain why these outcome measures should belong only to the two perspectives (financial and customer), mainly because they *'reflect the common goals of many strategies, as well as similar structures across industries and companies'*.

The cost drivers mapping exercise requires the management to fully understand their business processes and activities. Cost drivers could be mapped through the analysis of functional areas such as purchasing, R&D, manufacturing, marketing, and services after sales. Since each function usually comprises a large number of embedded activities, this could lead to an exhaustive list. However, firms that already use ABC could easily limit this list to an acceptable minimum through the use of the AHP.

Since most of the cost drivers are qualitative by nature, very often decision-makers have to resort to some subjective assessment procedure to conduct the

evaluation process. Also, the necessity of conducting a multi-dimensional performance analysis implies solving multi-criteria decision-making problem.

AHP is a suitable approach for undertaking quantitative as well as qualitative analysis (Saaty, 1980). The approach differs from other multi-criteria as subjective judgments are readily included and the relevant inconsistencies are dealt with appropriately (Chan and Lynn, 1991).

The application of the AHP is based on the following principles (Saaty, 1994):

1. *Decomposition* – A complex decision problem is decomposed into a hierarchy with each level consisting of a few manageable; each element is further decomposed and so on.
2. *Prioritisation* – Involves pairwise comparisons of various elements residing at the same level with respect to an element from the upper level of the hierarchy.
3. *Synthesis* – The priorities are pulled together through the principle of hierarchic composition to provide the overall assessment of the available alternatives.
4. *Sensitivity analysis* – The stability of the outcome is determined by testing the best choice against ‘what-if’ type of change in the priorities of the criteria.

The AHP provides a measure called the consistency ratio (CR) to check the consistency of judgment. Inconsistency is likely to occur when decision-makers make errors or exaggerated judgment during the process of pairwise comparisons. A consistency ratio of 0.1 is considered as the acceptable upper limit. If the consistency ratio is greater than 0.1 then the decision-makers have to re-evaluate their judgments in pairwise comparisons until the ratio becomes finally less than 0.1.

2.2.1 The financial perspective evaluation model

The overall objective of this evaluation is to examine the contributions made by cost driver alternatives to the financial business performance. Under this objective, the model may consist of evaluation criteria and cost driver alternatives. The criteria used here, as an example for demonstrational purposes, are those financial outcome measures proposed by Kaplan and Norton (1996b), margin growth and revenue growth. However, in reality, different companies may choose different outcome measures, based on the subjective preference of their management team in relation to their stated vision and strategy. The alternatives here are the cost drivers identified from the internal business processes and activities.

A typical three-level AHP model involves three basic steps. The first step is to determine the importance of the criteria, i.e., the two generic financial measures, to the overall objective by pairwise comparison. It involves an objective or subjective assignment of preference weights to each pair of the measures. Asking the following question may help to make the comparisons:

- Which outcome financial measure is more important with regards to the overall financial objective, margin growth or revenue growth, and by what scale (1-9)?

The second step involves evaluating the impact of each cost driver alternative on the financial business performance. The alternatives are compared among themselves with respect to each financial outcome measure; hence a weight vector is assigned for each of the alternatives. Asking the following questions may help to make the comparisons:

- Which cost driver is more important with regards to the financial objective of margin growth, cost driver x or cost driver y , and by what scale (1-9)?

- Which cost driver is more important with regards to the financial objective of revenue growth, cost driver x or cost driver y , and by what scale (1-9)?

The third step is to synthesize the assignment results. The weight vectors of the outcome measures and the cost driver alternatives need to be combined together to generate a final list of weighting vectors for the cost driver alternatives. The list illustrates which cost drivers are more important than others in terms of contributing to the firm's financial performance.

The decision-makers may make the pairwise comparison with the help of a computer software package, e.g., the Expert Choice (2004). The software, which has been developed by Saaty the founder of AHP technique, is able to execute each phase of the evaluation and then synthesize these judgments. It is also able to check the consistency ratio (CR) for the pairwise comparisons of each level automatically.

2.2.2 The non-financial perspective evaluation model

The overall objective of this evaluation is to examine the contributions made by cost driver alternatives to the non-financial business performance. The criteria used here, as an example for demonstrational purposes, are those non-financial outcome measures proposed by Kaplan and Norton (1996b), customer acquisition, customer retention, and employee satisfaction. The alternatives here are the cost drivers identified from the internal business processes and activities.

Again, the final result of the AHP evaluation is a list of prioritized cost drivers whose values indicate their relative importance to non-financial business performance. As mentioned earlier, most of the non-financial measures are qualitative. This means that the pairwise comparisons of the non-financial measures rely upon the subjective judgment of the decision-makers. If there is more than one

decision-maker involved, the pairwise scores assigned to the criteria and cost driver alternatives should be based on the geometric mean of the individual scores.

3. A numerical example

Let us assume that the management of a hypothesized company was asked to identify the essential cost drivers of each functional area of their company. The business of the company is compartmentalized into five main functions, namely, purchasing, sales and marketing, R&D, manufacturing and performance management. Its current competitive strategy is (assumed) one of differentiation.

The mapping process was restricted to analyze the activities at the operational level. This was based on the assumption we made earlier (see p. 16) that all outcome measures (long-term objectives) could be significantly affected by an effective internal process control. Thus, all our efforts should be focused on the identification of the cost drivers (short-term objectives) of the internal business process that mostly affect the outcome measures.

A list of 34 cost drivers was generated, which were prioritized according to their perceived importance to the business. This helped to reduce the list to a set of twenty-six cost drivers understood (by management) to be the major cost drivers of the company keeping in mind the business objectives and strategies (Table 2).

Table 2: List of the most important cost driver alternatives

1	Scope of improvement of production procedure
2	Frequency of improvement of production procedure
3	Increase in capacity
4	Expenses associated with equipment updated
5	Expenses associated with process improvement
6	Reduce Errors
7	External marketing campaigns
8	External marketing expenses
9	Frequency of new products and services
10	Internal adjustment expenses
11	Quality of products/services
12	Expenses on R & D for new products' development

13	Expenses on Market Research
14	Short Lead-times
15	On-time Delivery
16	Expenses associated with on job training
17	Expenses associated with outside training
18	Number of returned products
19	Number of customers complaints
20	Number of retail outlets
20	Location of retail outlets
22	Information availability ratio
23	Number of new ideas from employees
24	Ways of performance appraisal
25	Efficiency of performance appraisal system
26	Human-oriented compensation system

The financial and non-financial AHP models were formed by translating the selected outcome measures and cost driver alternatives in a three-level hierarchical structure (Figures 1 and 2):

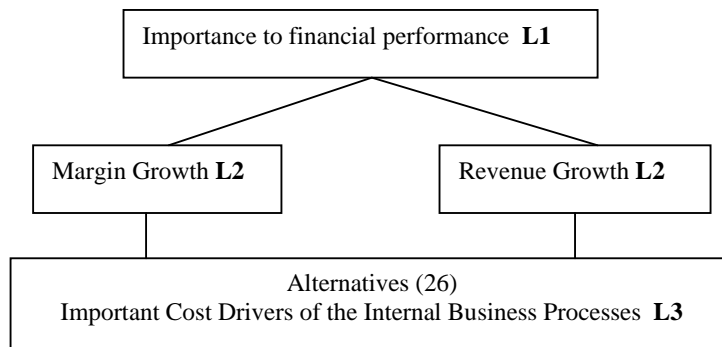


Figure 1: The financial AHP model of the Company (L1=Level 1, L2=Level 2 and L3=Level 3)

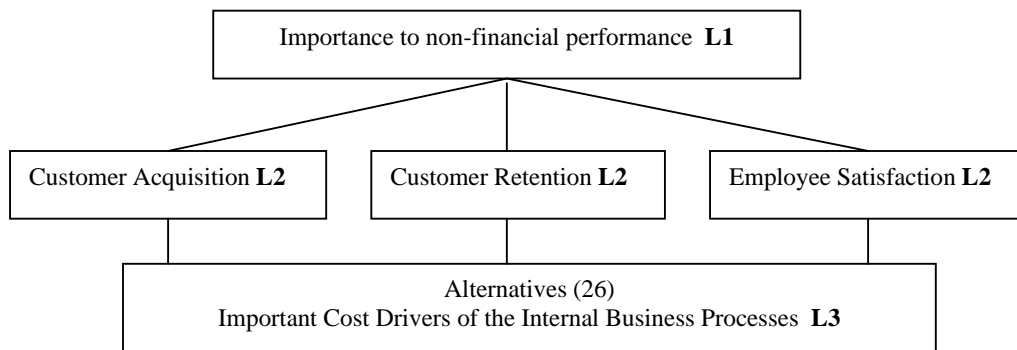


Figure 2: The non-financial AHP model of the Company (L1=Level 1, L2=Level 2 and L3=Level 3)

The first and second levels of the models were formed using respectively, the overall objective and the selected by management most important outcome measures. The third level was formed using the identified twenty-six most important cost driver alternatives. The evaluation process starts at the second level. The outcome performance measures were compared pairwise to assign the subjective priorities provided by the management of the company. These statements of pairwise comparisons can be summarized in a square matrix³, as given in tables 3 and 4, where reciprocals are used for reverse comparison⁴. The assigned scales were subsequently processed using the Expert Choice software package. Tables 3 and 4, respectively, show the priority weights of the financial and non-financial outcome measures⁵:

Table 3: The priority weights for financial outcome measures

	Margin Growth	Revenue Growth	Priority Weights
Margin Growth	1	2	0.58
Revenue Growth	1/2	1	0.42
CR=0<0.1			

Table 4: The priority weights for non-financial outcome measures

	Employee Satisfaction	Customer Acquisition	Customer Retention	Priority Weights
Employee Satisfaction	1	1/5	1/8	0.064
Customer Acquisition	5	1	1/4	0.237
Customer Retention	8	4	1	0.699
CR=0.02<0.1				

³ In the square matrix, the values of the diagonal elements are ones since any criterion, when compared with itself, must be of equal importance in making the promotion decision. For the other elements, for example, cell (1,2) in table 3, its value is 2 based on the response that “margin growth is two times as important as revenue growth with regards to the overall financial objective”.

⁴ According to the Reciprocal Condition (Axiom 1) specified in Saaty (1990), the intensity of preference of criterion **i** over criterion **j** is inversely related to the intensity of preference of criterion **j** over criterion **i**. That is, reciprocals are used for reverse comparison. Therefore, in this example, if the value of cell (1,2) is 2, then the value of cell (2,1) must be 1/2. Other cell values are determined in a similar manner.

⁵ Different methods can be used for computing the priority weights (or relative ranking) of the criteria (see e.g., Cogger and Yu, 1983; Jensen, 1983). Expert Choice uses, as a default method, the eigenvector approach as it offers the advantage of averaging the inconsistencies in judgments and responses (Harker and Vargas, 1987; Dyer, 1990), which are part of human nature.

For level three, the selected cost driver alternatives of table 2 were compared pairwise against each of the criteria (financial and non-financial outcome measures) employing the same procedure as described earlier. In order to collect data at the level three of the hierarchy the managers compare each of the cost driver alternatives in pairs, trying to answer questions of the form: “Which cost driver is more important with regards to the financial objective margin growth, the scope of improvement of production procedure or the frequency of improvement of production procedure, and by what scale (1-9)? or “Which cost driver is more important with regards to the non-financial objective employee satisfaction, the scope of improvement of production procedure or the frequency of improvement of production procedure, and by what scale (1-9)?, and so on. The final priority weights were calculated, automatically by Expert Choice software package, by cross-multiplying the priority weights from level three up to level one. Table 5 presents the overall scores for the financial and non-financial performance evaluations:

Table 5: The overall priority weights for cost driver alternatives

No	Cost driver alternatives	Priority weights of financial evaluation*	Priority weights of non-financial evaluation**
1	Scope of improvement of production procedure	0.0352	0.0216
2	Frequency of improvement of production procedure	0.0352	0.0277
3	Increase in capacity	0.0352	0.0152
4	Expenses associated with equipment updated	0.0354	0.0277
5	Expenses associated with process improvement	0.0596	0.0601
6	Reduce Errors	0.0463	0.0330
7	External marketing campaigns	0.0354	0.0236
8	External marketing expenses	0.0354	0.0349
9	Frequency of new products and services	0.0652	0.0604
10	Internal adjustment expenses	0.0177	0.0236
11	Quality of products/services	0.0808	0.0828
12	Expenses on R & D for new products' development	0.0769	0.0734
13	Expenses on Market Research	0.0330	0.0236
14	Short Lead-times	0.0277	0.0215
15	On-time Delivery	0.0215	0.0152
16	Expenses associated with on job training	0.0452	0.0877
17	Expenses associated with outside training	0.0277	0.0152

18	Number of returned products	0.0216	0.0154
19	Number of customers complaints	0.0136	0.0177
20	Number of retail outlets	0.0538	0.0584
21	Location of retail outlets	0.0249	0.0115
22	Information availability ratio	0.0572	0.0604
23	Number of new ideas from employees	0.0968	0.0872
24	Ways of performance appraisal	0.0036	0.0077
25	Efficiency of performance appraisal system	0.0036	0.0393
26	Human-oriented compensation system	0.0115	0.0552
	*CR=0.03<0.1 and **CR=0.02<0.1	1.0000	1.0000

Note that only seven cost driver alternatives (those in bold letters) have simultaneously secured high score (above 0.05) with respect to both dimensions (financial and non-financial). For example, ‘expenses associated with on job training’ and ‘human-oriented compensation system’ were rated high (0.0877 and 0.0552 respectively) with regards to the non-financial performance but low (0.0452 and 0.0115 respectively) against the financial performance. Therefore, these two cost drivers are not candidates for being included in the final BSC model of our example.

Consequently, those seven cost drivers should represent the performance indicators (short-term objectives) of the BSC of our example. The complete BSC of our example, under an AHP environment, should look like figure 3:

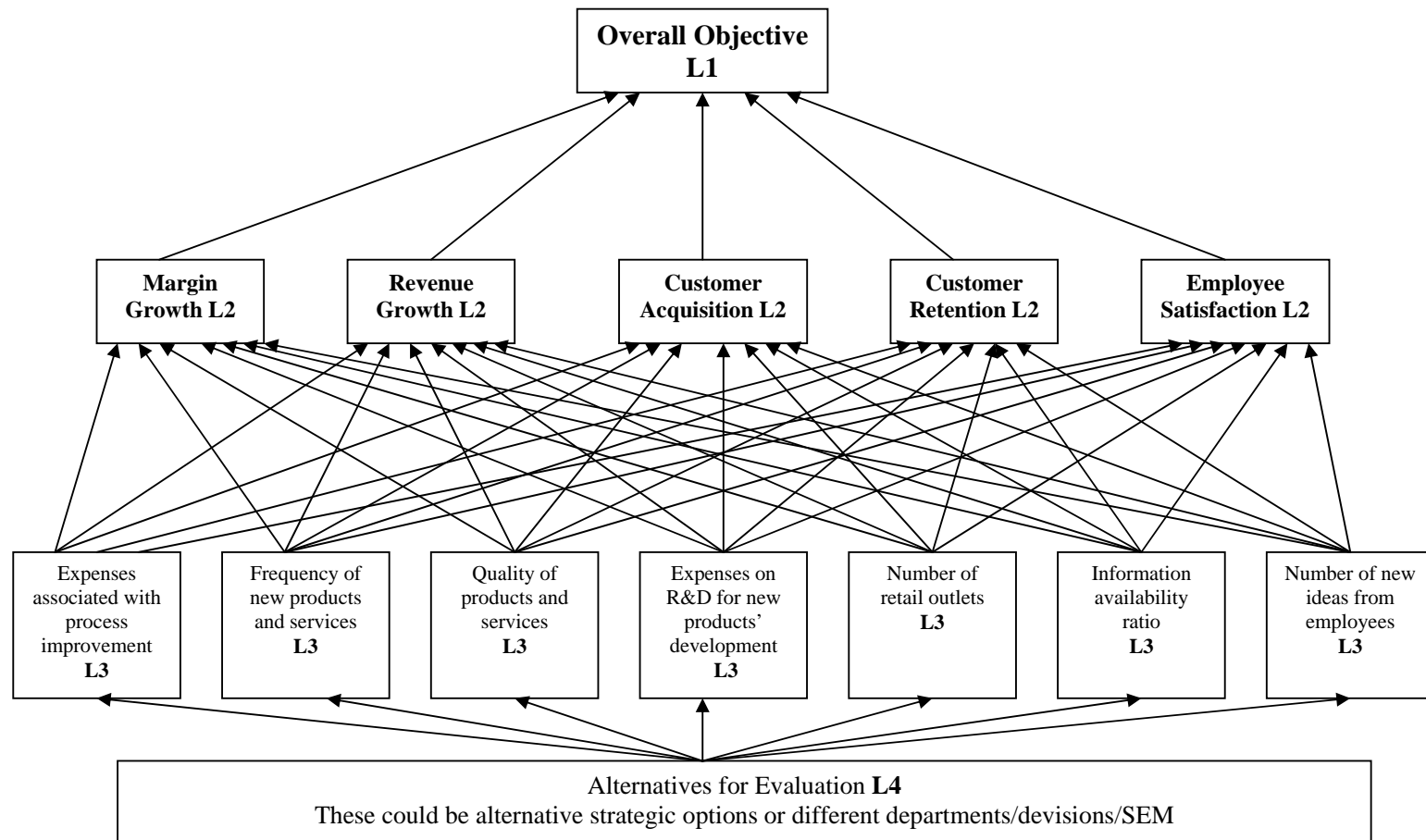


Figure 3: The complete BSC-AHP framework (L1=Level 1, L2=Level 2, L3=Level 3 and L4=Level 4)

4. Conclusion

To ensure its survival in the global economy, the modern organization needs to develop better methods of assessing its performance than simply using financial measures such as return on investment or residual income. In addition to the goal of financial well-being, other goals are vital to the company's long-term profitability and survival. Kaplan and Norton (1992, 1993, 1996a, and 1996b) proposed the BSC as a suitable model for the performance measurement process of any type of organization.

On the other hand, Activity-Based Costing (ABC) provides correct costing information characteristics of being efficient and relevant.

Although ABC and BSC are in practice well accepted as reliable tools for business operations, and it seems reasonable to adopt these two as an integrated tool for a better service to the top management and the firm, to our knowledge there are few if any existing researches covering this specific field. Since BSC is a multi-goals targeting model that focuses on the decision-making problems where multiple criteria are involved it seems appropriate for this research to adopt AHP in identifying the performance drivers (cost drivers) of the generic or outcome measures proposed by Kaplan and Norton (1996b).

This paper presents a structured framework for determining the key performance (cost) drivers of the BSC from the ABC system using the analytic hierarchy process (AHP). The AHP is utilized due to its ability for taking into account both the quantitative and qualitative measures. The framework is illustrated using a numerical example.

The proposed framework is viewed as a tool, combining the BSC and ABC information advantages, capable of assisting the whole decision-making process of an organization, from the evaluation of the strategic options formed during the formation

and formulation stages to the continuous evaluation of the implemented strategy through the evaluation of the various departments, divisions, and SBUs. The framework is generic in nature, and is suitable to be exploited for identifying key cost drivers of any organization.

This framework has nothing to do with any of the criticisms made to both techniques of the BSC and ABC by various researchers stated in the first section of the paper. Whatever improvement or change in either of the two techniques (e.g., the increase of the BSC perspectives or the increase of the outcome measures) will have no effect at all to this proposed framework of integrating these two techniques, the BSC and ABC.

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