Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/01/jls.htm
2015 Vol.5 (S1), pp. 5011-5023/Shahroudi and Bahralolom

Research Article

A NEW METHODOLOGY BASED ON BSC/ABC AND GOAL PROGRAMMING TO MANAGING COST IN IRAN'S AUTO SUPPLY CHAIN

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ABSTRACT
During the past few years, we have seen a significant shift in cost accounting and management. In the new business environment, cost management has become a critical skill, but it is not sufficient for simply reducing costs; instead, costs must be managed strategically. Application of a successful Strategic Cost Management (StraCM) system plays the significant role in success of organization performance. In this study, we want to illustrate how the goal programming model in combination with tools of the StraCM can affect in improving organizations' performance and Optimize cost management decisions making. For this, we present a conceptual model with an integrated approach of Balanced Scorecard (BSC), Activity Based Costing (ABC) and Goal programming model. Then for evaluating the proposed model, a numerical example with its solution procedure will be illustrated.

Keywords: *Strategic Cost Management (StraCM); Goal Programming; Balanced Scorecard (BSC); Activity Based Costing (ABC)*

INTRODUCTION

StraCM, much broader than simple cost analysis, is the utilization of cost information to ''develop superior Strategies en route to gain a competitive advantage,''. Whereas the traditional cost analysis examines the financial impact of individual management decisions, StraCM also deliberately uses cost information to support the business strategy. StraCM can improve the organization's cost structure and/or product and service performance by simultaneously analyzing its cost drivers, strategic position, and value chain to better assess key decisions (Ellram and Stanley, 2008).One of problems faced in StraCM, is that no tool exists to connect strategic costing principle with their implementation at the operational level (Venkatramanan, 2006). With regard to weaknesses that exist in tools and techniques of StraCM, there has to be a method that can link costs to strategy of organization. In this study, we present a combined model of ABC/BSC and in order to optimize decisions, this Model is presented in a mathematical model (Goal programming). So far the pioneer studies that has been done in SCM's tools and technique include Cooper (Cooper, 1996), Kaplan and Anderson (Kaplan *et al.*, 2004). The main parts of these studies focus on ABC and target costing. There are limited studies that link structure of cost management and Balanced Scorecard. Kaplan and Norton (1996) were the first group to design the BSC-ABC combined model [5]. Venkatramanan (2006) applied this model for the first time in a health care study. Shapiro (Shapiro, 1999) examined connections between cost-driven models for analyzing a firm's strategic plans, which uses ABC mathematical model and the resource-based view of the firm. However, no Study has been done to combine the BSC- ABC and Goal programming.
Performance appraisal and implement of strategy are the key advantages of BSC framework, hence the structure of BSC integrated with organizational systems, such as the cost management system can have a synergistic effect on company performance and strategy implementation.

Strategic Cost Management

This section briefly reviews the underlying concepts adopted by this research, such as the concepts of StraCM, their framework and tools.

Definitions of Strategic Cost Management

StraCM is extensively applied in the accounting literature. The theoretical underpinning of StraCM lies in the economic model transaction cost analysis (Ellram and Stanley, 2008). StraCM is understood in different ways in literature. Shank and Govindarajan (1992) argued that StraCM could be defined as using cost information to do the following: help formulates and communicates strategies, carry out tactics that implement those strategies, and then develop and implement controls that monitor the success at achieving strategic objectives (Govindarajan and Shank, 1992). Cooper and Slagmulder argued that StraCM is the application of cost management techniques so that they simultaneously improve the strategic position of the firm and reduce costs. Furthermore, Cooper argued that StraCM need to include all aspects of production and delivering the product. So, StraCM should be inherent to each stage of a product's life cycle (Cooper *et al.*, 1997).

Framework of Strategic Cost Management

A framework that Recommended for StraCM encompassing: (1) Value chain analysis, (2) Strategic positioning analysis, (3) Cost driver analysis. These three practices arguably provide a source of competitive advantage. None of these approaches itself represents StraCM rather the combination of these three items that constitute StraCM (Ellram and Stanley, 2008).

Tools of Strategic Cost Management

StraCM is a set of reliable techniques. These Techniques or tools may be used individually to support a specific goal or together to serve the overall needs of the organization (El Kelety, 2006). Some of the practices that have been related as supportive of StraCM include: total cost of ownership analysis, target costing, and activity-based costing (Ellram and Stanley, 2008). A set of StraCM techniques that Are used together to support the organization's goals and activities are called strategic cost management system (Hilton *et al.*, 2003). When designing a cost management system, it must be considered many tradeoffs such as costs and benefits of the cost management system (El Kelety, 2006).

Balanced Scorecard

Kaplan and Norton (1992) originally introduced the Balanced Scorecard. During next decades, it called "Strategic management system". Not only this method applied for performance evaluation, but also it uses as a framework for formulate of strategy, communication and control of strategy implementation (Kaplan and Norton, 2001). Evidence suggests that managers tend to weight financial measures more heavily than non-financial measures for reasons such as outcome effects, outside pressure, and familiarity (Cardinaels and van Veen-Dirks, 2010). Whereas apply performance evaluation systems by non-financial measures are suggested in order to enhance strategy implementation. Performance measurement systems is strategy tool, because they contribute towards strategic objectives through three mechanisms: (i) a better understanding of the linkages between various strategic priorities; (ii) more effective communication of the association between objectives and actions; and (iii) more efficient allocation of resources and tasks (Dossi and Patelli, 2010). Kaplan and Norton (1996) stress the importance of adhering to three principles in developing BSC:

Maintaining cause-and-effect relationships, comprising sufficient performance drivers and keeping a linkage to financial measures .They also emphasize that the BSC is only a template and must be customized for the specific elements of an organization or industry. Depending on the sector in which a business operates and on the strategy chosen, the number of perspectives can be enlarged, or one perspective can be replaced by the other (Martinsons *et al.*, 1999).

The Synergistic Effect of BSC and Strategic Cost Management

In order to demonstrate the synergistic effect of BSC and StraCM, we argue by two reasons. First, BSC is as linkage tool between cost management and strategy and another reason is the synergistic effect of BSC by value chain analysis Approach. One of the problems faced in StraCM is that no tool exists to connect strategic costing principles with their implementation at the operational level (Venkatramanan, 2006). However StraCM tools can help in providing important information for strategy formulation, evaluation of strategy implementation, and highlighting the practical limitations or problems with the adopted strategy (Shank and Govindarajan, 1993). Furthermore, as the complexity of operation increases, StraCM tools tend to become time-consuming and expensive to implement and maintain (Kaplan and David, 1992). A combined model of BSC and StraCM tools can adapt the strategic BSC dimensions, and use them as a means of collecting, organizing, and analyzing activity and cost information. This would overcome the above mentioned limitation by organizing complex activity and cost data, and by providing a clear strategic link between dimensions of activity, cost information, and strategic goals. BSC is a performance management tool that identifies quantifiable performance measures and targets and links them to a unified strategy (Kaplan and Norton, 1996).

In order to do this, the BSC defines performance dimensions that are critical to strategy achievement. These dimensions are termed "perspectives" (Kaplan and David, 1992). A StraCM tool could create this link by taking advantage of the BSC principle that allows it to relate performance to achievement of strategic goals (Kaplan and Norton, 2001). By clearly defining the goals of an organization and then identifying the different dimensions of activity and activity costs that are directed towards that purpose, an explicit link can be created between activities, resource utilization, and objectives. This can provide a more strategic orientation to cost management at the operational level (Venkatramanan, 2006).

Moreover, one of the most important concepts of StraCM is value chain analysis. The initial step in undertaking strategic cost analysis is to identify the firm's value chain (El Kelety, 2006).

A company cannot reduce costs and/or create value for customer by looking at its activities as a whole. Creating competitive advantage originates from many separate activities a company performs in designing, production, marketing, delivering, and supporting its products (Porter, 1998). Each of these activities can contribute to improve a company's cost position and customer value (El Kelety, 2006). The BSC measures organizational performance from four perspectives, including financial, customer, internal business process, and learning and growth, in relation to the four functions of accounting and finance, marketing, value chain, and human resource (Wu *et al.*, 2009).

The BSC scheme integrates the interests of the key stakeholders, customers and employees on a scoreboard. The essence of BSC lies in seeking a balance between financial and non-financial measures (Wanga *et al.*, 2010). These assets have to integrate in a set with other assets for value creation. BSC method provides a framework for description of strategy, by mean of connecting tangible and intangible assets in value activities (Kaplan and Norton, 2001).

This selection process requires knowledge of the cost and value of each activity. With value chain analysis, the StraCM efforts are focused on improving the strategic activities of the company, trace costs to value chain activities, and use the activity-cost information to manage the strategic value chain activities better than other companies. For example, in customer perspective of BSC framework, proposed value to customer and how this value is resulted to growth and profitability for stockholders, is a substructure of strategy. Porter argued, decentralization on special segment of customers and their desirable values, lead to organizations cannot achieve the competitive advantage or in internal business process perspective, organizations have to recognize the processes that can create value for customers and ultimately their stockholders. Organization's activities lied to internal business processes and constitute value chain of organization (Kaplan and Norton, 2001).

Conceptual - mathematical Model

In this section, we presented a combined model of BSC and ABC. Then for optimizing decisions, we proposed application of a mathematical model (Goal programming model). ABC technique is the most application systems in costing of product, but it can't find answers for following questions: How to allocate resources to manufacturing activity in order to minimizing a total cost? What is Optimum combination of corporation Productions? How production activities in order to minimize the overall costs and access to the desired level of production should be used? How can assume different objectives for a corporation? In addition, is it considered in strategic planning?

Furthermore, in many organizations, especially in the manufacturing sector, the resources which are used in the processes of the value chain can be categorized into manufacturing resources and non-manufacturing resources. Manufacturing resources refer to the resources that immediately enter manufacturing processes, such as the parts that are assembled into a car. On the other hand, non-manufacturing resources include the resources that are used in non-manufacturing processes such as research and development. Non-manufacturing resources that are used across the value chain processes had long received far less attention in the manufacturing sector (Hilton *et al.*, 2003).

In comparison to manufacturing resources, non-manufacturing resources cover a wider range of resources; they typically represent a significant portion of the cost structures of some organizations. The relevant expected costs include all costs that can be identified across the value chain. The processes and activities that the organization employs across the value chain determine how it uses its resources. Following model is presented for solving these problems. Figure 1 is illustrated the Conceptual model of the research.

Step 1: application of Balanced Scorecard

We define perspectives of BSC that are vital for access of strategy. With acceptance strategic dimensions of BSC, we can be used them as a framework to collect, classify and Organize activity information and cost. In order to this, initial step, getting the clear perception of corporation processes. It is applied by identifying important activity dimensions. Then developing list of activities and creating an initial Model. Figure 2 is a generic representation of a combined ABC/BSC model using the activity dimensions presented by Kaplan and Norton (Kaplan and Norton, 1996). Information collection is doing base on categorization of identified activities in activity dimensions. This information is based on previous literature and interview with managers and experts in the organization.

Step 2: Application of Activity Based Costing (ABC)

ABC is centralized on activities as basic factors of cost and using activities' costs as main structure for gathering costs. In this system, the argument is that production need to doing various activities and activities are consumer of resources. So, in ABC, initially overhead costs allocate to activities. Then allocated costs to activities base of factors that named "cost driver", allocating them to products or production lines. ABC system identifying, operational organization costs, relation between these costs and performed activities, relationship of final performed activities with manufacturing's products and serves.

Main goal of ABC system is identification and elimination of activities and costs that have no value added. Generally, in this stage, we perform cost Collection and information of cost drivers; it consists of work on gathered information in previous stage to estimate costs of activity dimensions and cost objectives. It performed by gathering cost resources for processes, link processes to each objective of cost, calculate cost of each unit cost driver, and at finally allocating costs of cost's objectives.

Step 3: Application of Analytic Hierarchy Process (AHP)

Goal programming is a capable tool to considering simultaneously several factors in decision making. A problem that has to consider in this model is how prioritizing goal, constraints and coefficient of penalty take into account for each deviation. Goal programming can't perform it. Furthermore, application of intangible and qualitative criteria is out of capable this programming. So use of AHP can cover weaknesses of Goal programming. Finally, it can provide an adequate model for organization's decision-making. AHP can use for prioritizing perspectives of BSC, if has been used ordinal ranking in Goal programming.

p_i is a priority of ith activity, For example, if goals related to internal process perspective as production and marketing costs have high importance than goals inside customer perspective as advertisement and guarantee costs, in this state, minimizing additive weight of undesirable deviations of internal process perspective that have more priority, and this perspective is p_1 and goals inside customer perspective is p_2 .In cases where Deviation variables have a same measurement unit, for example, if overall goals in internal process perspective were unitize dollar, in this state have to use cardinal ranking. For getting specific weight to each variable can use AHP method. Otherwise, several heterogeneous units (dollar, market's share) cannot use of this method. Goal programming has ability to simultaneous use of both ordinal and cardinal weighing. We use of experts' opinions for doing pair wise comparisons in AHP method.

Step 4: Presentation mathematical model by Goal programming:

One of the decision-making methods with multiple objectives is Goal programming. Basic of Goal programming is identification specific number as a goal for each of objectives, then formulating related objective function and answer is searched to minimized additive weight of undesirable deviations of each objective than the goal is identified for them(Schrage, 2003).

Positive deviations are usually displayed by d_i^+ and negative deviations are displayed by d_i^-. Each of two deviations must be non-negative. Goal programming models are constituted of four critical sections:
1. Decision variables: Decision variables of goal programming are similar Decision variables in linear programming.
2. Systematic constraints: this constraints display crisp constraints and no deviation allow in them. System and crisp constraints must be satisfied firstly, before a goal constraint is considered.
3. Goal constraints: Goal constraints display desire levels or specific value that must be access to it.
4. Objective function: objective function in goal programming model is formulated to minimize additive of undesirable deviations. So, structure of function related to weighting system to objectives (Jones and Tamiz, 2010).

Suggested goal programming model is presented in following:

$$MinZ = P_1W_1(w'_1d_1^+ + w'_2d_2^+ + ... + w'_nd_n^+) + P_2W_2(w'_{n+1}d_{n+1}^+ + w'_{n+2}d_{n+2}^+ + ... + w'_n$$

$$+ P_3W_3(w'_{m+1}d_{m+1}^+ + w'_{m+2}d_{m+2}^+ + ... + w'_kd_k^+) + P_4W_4(w'_{k+1}d_{k+1}^+ + w'_{k+2}d_{k+2}^+ +$$

$$S.T$$

$$\sum_{j=1}^{n} a_{ij}x_j + d_i^+ + d_i^- = b_i \qquad i = 1,2,..., \quad j = 1,2,...$$

$$\sum_{j=1}^{n} a'_{ij}x_j \le b'_i$$

$$d_i^-, d_i^+ = 0$$

$$x_j, d_i^-, d_i^+, b_i, b'_i \ge 0$$

p_i $(i = 1,2,3,4)$: Denoting priority of BSC perspectives that their cost deviations must be minimized.

w_i $(i = 1,2,3,4)$: Weights allocated to each dimension of BSC that calculated by AHP.

w'_t : Weights allocated to deviation variables, that calculated by AHP.

d_i^+, d_i^- : Respectively, are as positive and negative deviations.

a_{ij} : Represent consumption coefficients of resource/activity.

b_i : Desirable level of goals.

Objective function of Goal programming model Constituted of four segments. These four segments defined in base of four Goal constraints. First segment, minimized cost deviations in Finance dimension, second, third and fourth segments, respectively displayed cost deviations of internal business processes, customer, learning and Growth (Figure 3). It is necessary to calculate importance’s coefficient (degree) and priority, for each section of deviation.

An Empirical Example

To assess the proposed model, we examined it in one of the car manufacturing industries in Iran. Automotive industry is a strategic and important industry. Therefore, implementing a successful StraCM system can play an important role in the success of these organizations and achieve them strategic objectives. Hence, Iran Khodro Company has been established below strategies:

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- Moving toward the targeted cost management system in Iran Khodro group.
- Identification costing system to determine effective cost.
- Identify the appropriate system of internal activity cost (products and services) between Iran Khodro companies.

Regardless of the type of strategy, organizations should offer Acceptable price to their customers.
With increased competition between domestic and foreign automakers, customers will not pay any price to purchase their desired vehicle. Collecting data about model parameters was very time consuming and difficult. Because, the main focus of this model is the cost data that offering them have limitations. However, with given limitations, we attempted to test the mathematical model for production of two automobile models A and B.

Decision Variables and Parameters

Variables

x_1: Number of model A, which must be produced

x_2: Number of model B, which must be produced

Parameters:

$p_i\ (i=1,2,3,4)$: Denoting priority of BSC perspectives that their cost deviations must be minimized.

$w_i\ (i=1,2,3,4)$: Allocated weights to each dimension of BSC calculated by AHP for prioritizing the goals.

w'_t: Weights assigned to deviation variables that resulted by AHP

d_i^+, d_i^-: denoting positive and negative deviations.

d_t^+:

(t: 1,..., 18) undesirable deviations of internal business process dimension
(t:19, 20, 21) undesirable deviations of customer dimension
(t: 23) undesirable deviations of financial dimension (Loan)
(t: 24, 25) undesirable deviations of learning and growth dimension

d_{22}^-: Undesirable deviations of financial dimension (Profitability)

y_i : (i: 10, 11, ..., 19) authorized distributors of model A.

y_j : (j: 20, 21, ..., 29) authorized distributors of model B.

Budget constraints for both models A and B are 26000000 million Rials and other cost details have mentioned in Table 1, 2.
The general model of goal programming can be written in the following manner:

$$MinZ = P_1(0.399)(0.75d_{23}^- + 0.25d_{22}^+) + P_2(0.278)(0.34d_1^+ + 0.31d_2^+ + 0.31d_3^+ + 0.31d_4^+$$

$$+0.31d_5^+ + 0.31d_6^+ + 0.24d_7^+ + 0.24d_8^+ + 0.24d_9^+ + 0.24d_{10}^+ + 0.24d_{11}^+ + 0.24d_{12}^+ + 0.24d_{1}$$

$$+0.24d_{14}^+ + 0.24d_{15}^+ + 0.24d_{16}^+ + 0.11d_{17}^+ + 0.11d_{18}^+) + P_3(0.207)(0.57d_{19}^+ + 0.25d_{20}^+ + 0.$$

$$+P_4(0.116)(0.67d_{22}^+ + 0.33d_{23}^+)$$

Goal Constraints

$$4500X_1 + 3700X_2 - d_1^+ + d_1^- = 140000000$$ Goal constraints of production

$$56X_1 + 33X_2 - d_2^+ + d_2^- = 14965000$$ Goal constraints of assembly (Stock Material)

$89X_1 + 122X_2 - d_3^+ + d_3^- = 35260000$	Goal constraints of work by machine (Stock Material)
$138X_1 + 121X_2 - d_4^+ + d_4^- = 43425000$	Goal constraints of Painting (Stock Material)
$90X_1 + 70X_2 - d_5^+ + d_5^- = 26850000$	Goal constraints of cut (Stock Material)
$33X_1 + 21X_2 - d_6^+ + d_6^- = 9075000$	Goal constraints of Press (Stock Material)
$12.5X_1 + 14.7X_2 - d_7^+ + d_7^- = 4550500$	Goal constraints of assembly (unit- hour / worker)
$9X_1 + 13.5X_2 - d_8^+ + d_8^- = 3757500$	Goal constraints of assembly (unit- hour / supervision)
$22.5X_1 + 28.8X_2 - d_9^+ + d_9^- = 8577000$	Goal constraints of work by machine (unit- hour / worker)
$14X_1 + 19X_2 - d_{10}^+ + d_{10}^- = 5515000$	Goal constraints of work by machine (unit- hour / supervision)
$18X_1 + 15X_2 - d_{11}^+ + d_{11}^- = 5535000$	Goal constraints of Painting (unit- hour / worker)
$12X_1 + 9.5X_2 - d_{12}^+ + d_{12}^- = 3607500$	Goal constraints of Painting (unit- hour / supervision)
$34X_1 + 39X_2 - d_{13}^+ + d_{13}^- = 12215000$	Goal constraints of cut (unit- hour / worker)
$22X_1 + 27.5X_2 - d_{14}^+ + d_{14}^- = 8277500$	Goal constraints of cut (unit- hour / supervision)
$25X_1 + 12X_2 - d_{15}^+ + d_{15}^- = 6230000$	Goal constraints of press (unit- hour / worker)
$11X_1 + 7.5X_2 - d_{16}^+ + d_{16}^- = 3107500$	Goal constraints of press (unit- hour / supervision)
$7X_1 + 8X_2 - d_{17}^+ + d_{17}^+ = 3000000$	Goal constraints of fuel
$10X_1 + 10X_2 - d_{18}^+ + d_{18}^+ = 3500000$	Goal constraints of electronic
$28000X_1 + 30000X_2 - -d_{19}^+ + d_{19}^+ = 30500000$	Goal constraints of marketing & selling
$18000X_1 + 19000X_2 - d_{20}^+ + d_{20}^+ = 599000000$	Goal constraints of transportation
$5000X_1 + 9000X_2 - d_{21}^+ + d_{21}^+ = 3000000000$	Goal constraints of guarantee
$2000X_1 + 1500X_2 - d_{22}^+ + d_{22}^+ = 630000000$	Goal constraints of profitability
$5000X_1 + 4500X_2 - d_{23}^+ + d_{23}^+ = 1590000000$	Goal constraints of getting loans
$1900X_1 + 2500X_2 - d_{24}^+ + d_{24}^+ = 1000000000$	Goal constraints of R&D
$3000X_1 + 4000X_2 - d_{25}^+ + d_{25}^+ = 1260000000$	Goal constraints of training

Systematic Constraints

$X_1 \le 180000$

$X_2 \le 170000$

Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/01/jls.htm
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$85X_1 + 70X_2 \leq 26000000$

Constraints of Automobile Demands by Authorized Distributors

$y10 + y11 + y12 + y13 + y14 + y15 + y16 + y17 + y18 + y19 - x1 \leq 0$

$y20 + y21 + y22 + y23 + y24 + y25 + y26 + y27 + y28 + y29 - x2 \leq 0$

$y10 \geq 15000$	$y11 \geq 134000$	$y12 \geq 116000$	$y13 \geq 12000$
$y14 \geq 135000$	$y15 \geq 12000$	$y16 \geq 13000$	$y17 \geq 135000$
$y18 \geq 9000$	$y19 \geq 9500$	$y20 \geq 13500$	$y21 \geq 11000$
$y22 \geq 9450$	$y23 \geq 11000$	$y24 \geq 11500$	$y25 \geq 9500$
$y26 \geq 12500$	$y27 \geq 11400$	$y28 \geq 6000$	$y29 \geq 6000$

RESULTS AND DISCUSSION

Result

After solving problem with the Lingo software, according to Table 3, following results has obtained and in seven cases of activity, deviation from ideal has observed.

Table 1: Data / cost drivers related to the consumption of resources

Model	Cost rate	Unit cost (Rial)	Target cost (Rial)	Unit	Activities	
A	12.5	13000	4550500	unit- hour / worker	Assembly	Production
B	14.7					
A	9	22500	3757500	(unit- hour / supervision)		
B	13.5					
A	56	45000	14965000	Raw material		
B	33					
A	22.5	13000	8577000	unit- hour / worker	Machining	
B	28.8					
A	14	23500	5515000	(unit- hour / supervision)		
B	19					
A	89	34000	3526000	Raw material		
B	122					
A	18	14500	5535000	unit- hour / worker	Painting	
B	15					
A	12	27000	3607500	(unit- hour / supervision)		
B	9.5					
A	138	175000	43425000	Raw material		
B	121					
A	34	12500	12215000	unit- hour / worker	Cutting	
B	39					
A	22	19500	8277500	(unit- hour / supervision)		
B	27.5					
A	90	335000	26850000	Raw material		
B	70					
A	25	13500	6230000	unit- hour / worker	Press	
B	12					
A	11	21500	3107500	(unit- hour / supervision)		
B	7.5					
A	33	189000	9075000	Raw material		
B	21					

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Table 2: Cost Consumption coefficient and production capacity

		Activities	Aspiration level (Rial)	Model A (Consumption coefficient)	Model B (Consumption coefficient)
BSC perspectives	Internal Business Process	Production cost	1400000000	4500	3700
		Material supply	*	*	*
		Work force	*	*	*
		Maintain & Support	Fuel (3000000)	7	8
			Electronic (3500000)	10	10
	Customer	Selling & Marketing cost	10000000000	28000	30000
		Transportation	5990000000	18000	19000
		Guarantee	3000000000	5000	9000
	Finance	Profitability	1590000000	5000	4500
		Loans	630000000	2000	1500
	Learn and Grow	R&D	1260000000	3000	4000
		Training	1000000000	1900	2500
Systematic constraint		Production capacity (volume)	-	180000	170000
		Total cost per unit (Rial)	-	85000000	70000000

** They were described in Table 1*

Table 3: Amounts deviations from goals

Amount deviation from goal (1000 Rial)	Kind of activity	
85769.23	assembly (Stock Material) (d_2^+)	Production
26923.08	cut (Stock Material) (d_5^+)	
40384.62	Press (Stock Material) (d_6^+)	
2500	Painting (unit- hour /supervision) (d_{12}^+)	
56153.85	press (unit- hour / worker) (d_{15}^+)	
10192.31	press (unit- hour / supervision) (d_{16}^+)	
.17769	transportation (d_{20}^+)	Customer

Table 4: Optimum level of production

Optimum number of production	Kind of automobile
175384	Model A (x_1)
158461	Model B (x_2)

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In addition, we could obtain the optimal level of production that in this example is two model of automobile (table 4).

Conclusion

This study proposed an effective combined model of BSC/ABC and Goal programming for solving problems such as optimum allocation of resources to valuable activities, StraCM and access to strategic objectives like cost leadership. In addition, this model can improve the capability of mathematical models like goal programming to optimize decision-making and calculate the optimum level of production.

The main benefits of the an integrated system of ABC/BSC and goal programming presented in this study can establish a communication system that bridges the existing gap between StraCM and making optimum and strategic decisions.

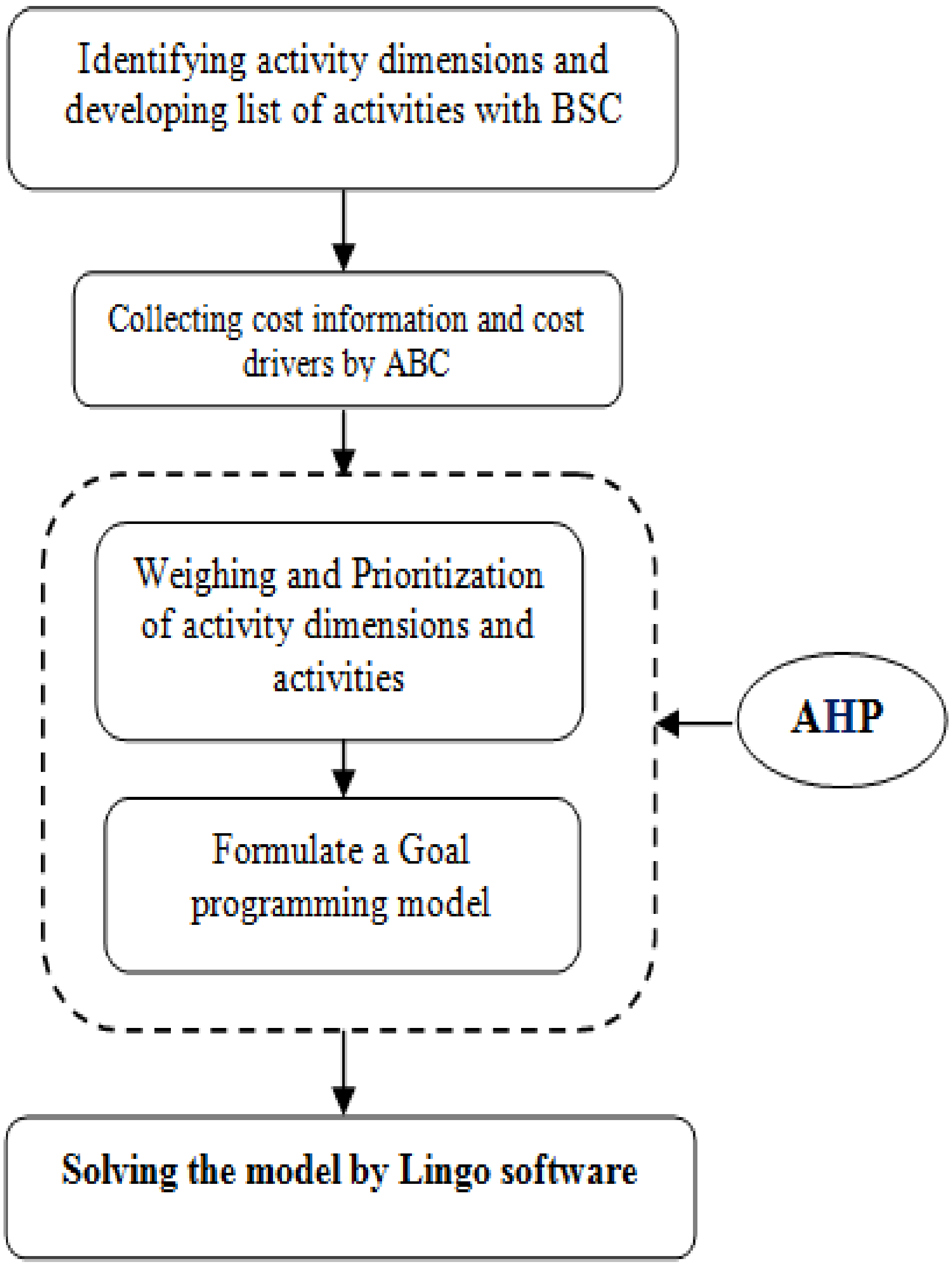

Figure 1: The Conceptual model of the proposed approach

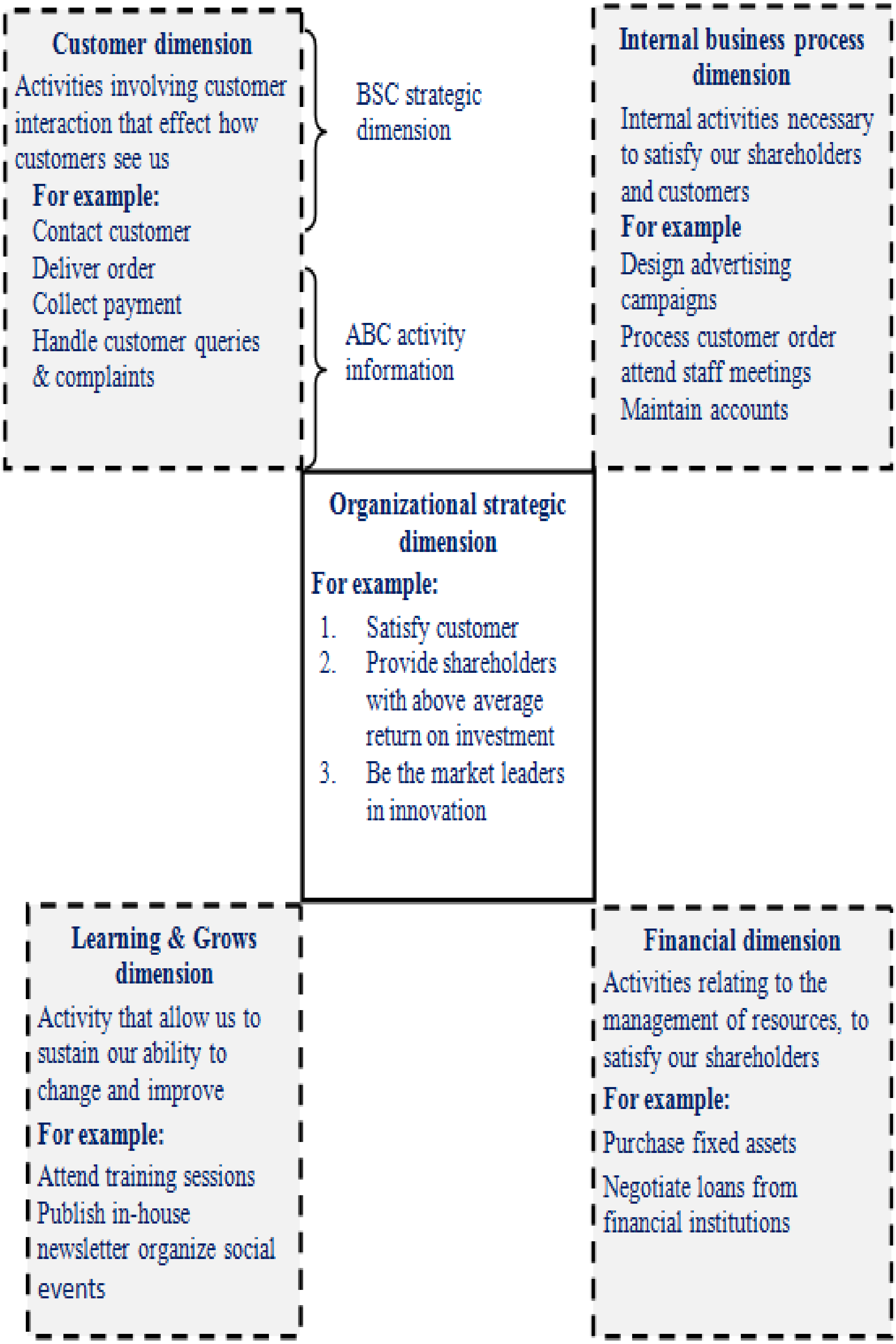

Figure 2: Adapted from generic representation of the ABC/BSC model by Kaplan & Norton (Kaplan and Norton, 1996)

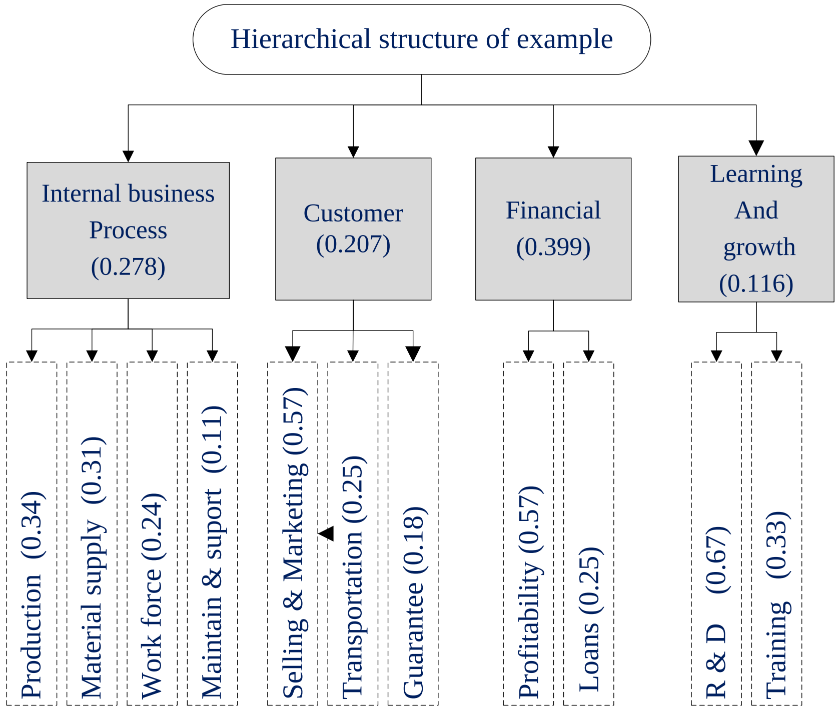

Figure 3: Hierarchical structure of example on BSC framework

In this study, we adopted a goal programming model to solve the proposed ABC/BSC model, difficult to quantify and cause-and-effect relationship among various perspectives. An important advantage of this approach is that the interaction of the perspectives and activities can we clearly identified, also applied AHP structure can create clear perception of experts' tendency in the organization. We could gather experts' opinions and allocate weights of each perspectives and key activities through the pair wise comparisons. This weighting system can be effective in the decision making process and optimum allocation of resources and access to cost targets.

Future studies may extend the combined model with other tools and techniques of StraCM. Finally, this model can be used to other industries.

REFERENCES

Cardinaels E and Van Veen-Dirks PMG (2010). Financial versus non-financial information: The impact of information organization and presentation in a Balanced Scorecard. *Accounting, Organizations and Society* **35** 565-578.

Cooper R (1996). Costing techniques to support corporate strategy: evidence from Japan. *Management Accounting Research* **7** 219-246.

Cooper R, Slagmulder R, Research IFFA and Accountants IOM (1997). *Target Costing and Value Engineering* (Productivity Press).

Dossi A and Patelli L (2010). You Learn From What You Measure: Financial and Non-financial Performance Measures in Multinational Companies. *Long Range Planning* **43** 498-526.

El Kelety I (2006). Towards a conceptual framework for strategic cost management-The concept, objectives, and instruments. Universitätsbibliothek der Technischen Universität.

Ellram LM and Stanley LL (2008). Integrating strategic cost management with a 3DCE environment: Strategies, practices, and benefits. *Journal of Purchasing and Supply Management* **14** 180-191.

Govindarajan V and Shank JK (1992). Strategic cost management: tailoring controls to strategies. *Journal of Cost Management* **6** 14-25.

Hilton RW, Maher M and Selto FH (2003). *Cost Management: Strategies for Business Decisions* (McGraw-Hill/Irwin).
Jones D and Tamiz M (2010). *Practical Goal Programming* (Springer Verlag).
Kaplan RS, Anderson SR and Research HBSDO (2004). Time-driven activity-based costing. Division of Research, Harvard Business School.
Kaplan RS and David P Norton (1992). The balanced scorecard–Measures that drive performance. *Harvard Business Review* 71-79.
Kaplan RS and Norton DP (1996). Using the balanced scorecard as a strategic management system. *Harvard Business Review* **74** 75-85.
Kaplan RS and Norton DP (2001). *The Strategy-Focused Organization: How Balanced Scorecard Companies Thrive in the New Business Environment* (Harvard Business Press).
Martinsons M, Davison R and Tse D (1999). The balanced scorecard: a foundation for the strategic management of information systems. *Decision Support Systems* **25** 71-88.
Porter ME (1998). *Competitive Advantage: Creating and Sustaining Superior Performance: with a New Introduction* (Free Press).
Schrage L (2003). *Optimization Modeling with LINGO* (Chicago, IL LINDO Systems Inc.).
Shank JK and Govindarajan V (1993). *Strategic Cost Management: The New Tool for Competitive Advantage* (Free Press).
Shapiro JF (1999). On the connections among activity-based costing, mathematical programming models for analyzing strategic decisions, and the resource-based view of the firm. *European Journal of Operational Research* **118** 295-314.
Venkatramanan A (2006). Developing a strategic cost management model: combininig the balanced scorecard and activity-based costing in the context of diabetes education.
Wanga C, Lu IY and Chen C (2010). Integrating hierarchical balanced scorecard with non-additive fuzzy integral for evaluating high technology firm performance. *International Journal of Production Economics*.
Wu HY, Tzeng GH and Chen YH (2009). A fuzzy MCDM approach for evaluating banking performance based on Balanced Scorecard. *Expert Systems with Applications* **36** 10135-10147.