UCT JOURNAL OF SOCIAL SCIENCE AND HUMANITIES RESEARCH 2014(02)

Available online at http://journals.researchub.org

The Evaluation of Bahman Automotive Companies Group by Balanced Scored Card Approach and Data Envelopment Analysis

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ARTICLE INFO

Article history:
Received 12 March 2014
Received in revised form 15 April 2014
Accepted 10 May 2014

Keywords:
Bahman
Automotive.Companies
Group.optimized
Performance.

ABSTRACT

Objective: With a growing level of competition, companies have been looking for tools to develop and increase competitive performance, in the competitive environment, the design of Performance Measurement Systems (PMS) shows it importance to business' evolution. automotive industry in Iran in recent year and in sanction situation had many problems in their section. **Methodology**: in this paper we evaluating Bahman industries by BSC and DEA method and recognized problems. **Results**: According to the results achieved by solving DEA models, the improvement of efficiency and optimized performance of inefficient unit can be programmed by introducing the sample unit to inefficient unit and executive authorities. The appropriate amount of output and input is exactly determined (in the virtual unit). **Conclusion**: If the units match the amount of output and input with the determined amount, they can achieve the complete efficiency..

1. Introduction

With a growing level of competition, companies have been looking for tools to develop and increase competitive performance. Senge notes that systems react to how they are measured. Therefore, choosing a wrong measure could create, in the worst case, distorted judgment and local sub-optimal performance. On this environment, the design of Performance Measurement Systems (PMS) shows it importance to business' evolution.

Maskell characterizes traditional cost systems as irrelevant (not linked with strategy), distorted (overhead allocation) and inflexible (over time). In order to overcome those problems, one of the most relevant PMS developed is the Balanced Scorecard (BSC), proposed by Kaplan and Norton.

BSC is well developed and known, but how to deploy it from the high levels down to the lower level inside the company without compromising the integration among the measures in all levels still a problem that should be better investigated. A promising possible solution is to use some kind of methodology as Hoshin Kanri or Axiomatic Design to address this task.

The balance comes from tracking not only financial performance measure such as operating income, sales growth and sales revenue, but non-financial ones as well. This is because non-financial measures are likely to facilitate organizational decisions and actions that support strategies based on the stakeholders need. It has also been suggested that non-financial performance measure helps manager to assess changes in the business environments, determines and evaluates progress towards the firm's goal, and affirm achievement of business performance.

"Performance evaluation" increases competitiveness in the industries, provides the appropriate information for investors to invest, informs the companies of their situations and creates the opportunities for companies to develop and progress which results in society's advancement. According to the importance of "performance evaluation" and its influence on the industries' evolution, applying the suitable technique to evaluate the performance has become a major concern for managers. Evaluation includes multiple criteria such as rewards, the relation between company's mission and targets,

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DOI: https://doi.org/10.24200/jsshr.vol2iss02pp32-39

potential strategic leverages, the probable technical commercial success and so on. After determination of the criteria, they were rated by their weight to verify the degree of emphasis.

Balanced score card includes qualitative criteria and is counted as a recent management innovation introduced by Norton and Caplan as a performance measuring tools in 1992, and as a strategic tool in 1996 and as a model for alignment between organizations' human resources, information and organizational capitals.

BSC is viewed in different perspectives by various authors such as strategic management tool, strategic implementation tool, or strategic management system (Kaplan and Norton, 1996a). However, the original BSC was created by Robert Kaplan and David Norton (1992) who argued that BSC was not only performance measurement, but also it aligned organizations with Strategic Control Systems (SCS) which directly translated an organization's strategies into action oriented plans.

In addition to benchmarking, DEA can provide information related to either the most efficient or the inefficient companies. Furthermore, it can analyze multiple inputs and outputs simultaneously, as well as show what percentage the inputs should decrease in order to achieve a given output level and what percentage the outputs should increase given original levels of inputs in order to reach the efficiency. Hence, DEA can transform performance measures into the managerial information. On the other hand, BSC can provide appropriate outputs for DEA. Serrano-Cinca et al. (2005) argued that different combinations of inputs and outputs would produce different efficiency. Hence, the results of DEA depend on the selection of inputs and outputs. Serrano-Cinca et al. (2005) also stated that the DEA model could not involve redundant information. BSC is able to dissolve these two concerns in that it not only minimizes information overload by limiting the number of measure used (Kaplan & Norton, 1992) but also develops the scorecard by linking to key success factors (Frigo & Krumwiede, 2000). Accordingly, BSC and DEA are the complements for each other.

In short, management performance measurement is a complex task since multiple inputs and multiple outputs are involved in the process. The balanced scorecard is one of approaches to measuring the management performance. When the efficiencies of multiple performance organizations are to be compared quantitatively, however, the DEA will be appropriate because DEA enables management to integrate unlike multiple inputs and outputs to make simultaneous comparisons. DEA rests on the economic notion of the production technology transforming inputs to outputs. It is a non-parametric approach for estimating maximum output level for given inputs or minimum input levels for given output levels. Its advantage is to deal with aggregate information rather than detailed information (Chang et al., 2005). Therefore, DEA is viewed as a methodology that provides a valid starting point for specifying balanced performance. The main purpose of this study is to fit the research gap and develop a comprehensive framework to encompass the basic concepts of BSC and DEA to measure the management performance. On one hand, BSC is a widely acceptable performance measurement system. Like Kaplan and Norton (1992) stated that "what you measure is what you get," BSC can provide appropriate outputs of performance for DEA. BSC is able to not only minimize information overload by limiting the number of measure used (Kaplan & Norton 1992) but also develop the scorecard by linking to key success factors (Frigo & Krumwiede 2000). On the other hand, DEA can set benchmarking for companies based on their inputs and outputs, as well as transform performance measures into the managerial information. Thus, BSC and DEA are complemental to each other. As BSC is commonly used on traditional industries and creates too many numbers to deal with easily, this study expects to combine BSC with DEA to evaluate the management performance on manufacturing industries (i.e. auto industries) The results of this study could also provide for governmental administrators and business managers to make decisions on investment and management.

1.1. Organizational Performance

Performance measurement is common in any firm, be it for measuring on financial aspect, nonfinancial aspect, or both financial and non-financial measurement. Based on that, Kaplan and Norton (1992) proposed multiple performance measure in balanced scorecard approach. These comprehensive measures of performance are based on four perspectives: financial, customer, business process/operation, and innovation/learning growth. Kanji & Esa (2002), suggested four key areas for measuring organizational performance, namely: maximize stakeholder value, achieve process excellence, improve organizational learning and delight the customer. These four key areas are also consistent with the four perspective of Balanced Scorecard as documented by Kaplan and Norton (1996a).

According Ittner, et al. (2003) managers need to focus on both financial and non-financial measures to achieve organizational goals. The balanced comes from tracking not only financial performance measure such as operating income, sales growth and sales revenue, but non-financial ones as well. This is because non-financial measures are likely to facilitate organizational decisions and actions that support strategies based on the stakeholders need (Hoque & James, 2000). It has also been suggested (Kaplan & Norton, 1996a, 2001) that non-financial performance measure helps managers to assess changes in the business environments, determine and evaluate progress towards the firm's goal, and affirm achievement of business performance.

Ungar (2007) explored the adaptation of BSC in Malaysian organizations. From his finding, the reason for BSC adaptation is because it is a part of a process to improve performance, implement a major change in strategy, help manage a corporate turnaround process, to rationalize operation, integrate the operation of the organization, overcome past weaknesses in strategy implementation process, and ensure continuity of existing techniques.

1.2. BSC

BSC combines the financial and operational criteria and focuses on short and long term targets of the company. Actually most of the companies apply BSC approach to perform management process, clarify the perspectives and strategies, transit and relate the strategic targets and criteria, improve the strategic feedback. Balanced Scored card can conceptualize the strategies of the company and help the managers to connect the control function to company's strategies through offering the criteria related to strategies as a control and motivation tools Financial aspect as one of the scored card's facet causes the financial plans to connect with strategies; it also creates a motivational system based on strategies.

The BSC was originally created primarily as a measurement system and as an answer to a criticism concerning the unilateral measurement of the performance ability of a company. It was organized through four different perspectives. (Fig. 1)

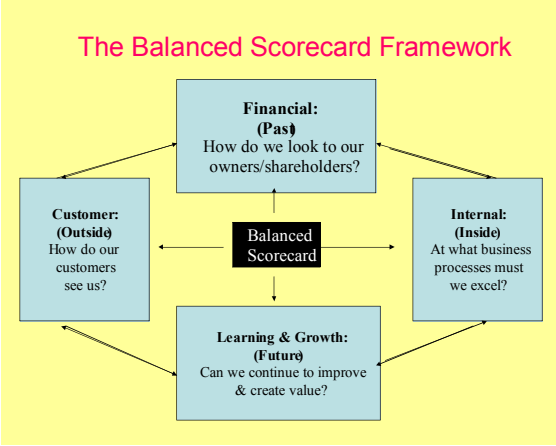

Figure 1. Adapted from Kaplan & Norton (1992)

1- The Customer Perspective of the BSC measures how customers view the organization and its products and services. In essence this perspective often captures measures of both customer satisfaction and the future needs of customers. (Kaplan & Norton, 1996). The customer perspective on the performance will help an organization to be concern about quality of product and service, cost of their products, customer service and satisfaction, effectiveness of its delivery, and then align its internal business process well with customers in order to improve financial result (Kaplan & Norton, 1992, 2001; Jusoh et al., 2008). This perspective encompasses measures such as customer satisfaction, retention, response time, loyalty, market share, and on time delivery. (Kaplan & Norton, 2001; Jusoh et al.,2008).

Therefore, the information and analysis data gathered from understanding of customers' need based on specification and requirement will assist an organization to produce high quality product and service. This is because, customer's evaluation has a direct impact on organization performance. For example, information given for customer retention and loyalty gained through systematic service and follow-up investigations, including a form of exit interview with defectors. Other study suggests an effort to improve customer satisfaction and practicing customer need analysis will improve productivity, sales growth, increase the company earning. In summary, the author believes organizational performance can be measured by customer perspective which consists of seven elements namely increase market share, increase customer satisfaction, improve customer loyalty, improve customer presentation rate, reduce the number customer complaints, reduce the number of warranty claims, reduce the number of shipment returned due to poor quality, and reduce the number of overdue deliveries

2-The Internal Business Perspective focuses on translating customer expectations into actions that must occur internally for the organization to deliver to customers. This perspective focuses attention on internal processes, decisions, and actions that occur. It is in this arena where operational efficiencies are typically diagnosed and improved. In order to develop internal business process measurement, top management should identify the operation management processes that give beneficial effects to organization strategy. This can be done through customer satisfaction, financial returns to shareholders, and increase of the employee skill level and satisfaction (Kaplan & Norton, 2001). Basically, operations management processes activities in manufacturing organization involving acquire raw materials from suppliers, convert raw materials to finished goods, distribute finished goods to customers, and manage risk (Kaplan & Norton, 2001). The key performance measures under this perspective may include such as manufacturing efficiency, quality, defect rate, and cycle time for continually improving the internal process (Kaplan & Norton, 1992, 1996, Jusoh et al., 2008).

3- The Learning and Growth Perspective recognizes that the targets for an organization to be successful are constantly changing, and to remain in business one must change and innovate. Typically, this innovation involves not only making improvements to existing products and services, but also introducing entirely new products and services that meet changing customer needs. It is through the introduction of new products and services that the organization increases its value to customers, and thus encourages customer loyalty. Often this innovation comes about by investing in the skills and abilities of the organization's workforce, along with the acquisition of new tools and technology.

Learning and growth perspective can determine organization future in which it develops employee skill and satisfaction, improvement in technology system and procedure, and innovation of new market development (Kaplan & Norton, 1992, 1996; Jusoh et al., 2008). In short, innovation and learning growth accomplish two vital components focusing on how organization innovate and learn following these an organization strategy's which are: (1) the development of new product, new pattern, quality of leadership, new market, and new technology, (2) the improvement level of employee skill, health and safety, absenteeism, and satisfaction. Thus, innovation and learning growth measure is important to achieve long term-value creation process, competing for global demand, enhancement external product markets (Jusoh et al., 2008; Kaplan & Norton, 2001). This is also supported by (Kaplan & Norton, 1992) who opinionated that successful companies that innovate and learn growth in continually activity will improve value for customer, improve operation process, and increase return to shareholder. For instance, the use of information technology in developing performance measure will assist an organization to focus on the causal relationship and linkages for each performance measure within organization and make it as more strategic performance evaluation (Kaplan & Norton, 2001). Other study finds that employee satisfaction has positive influence on organizational performance. In short, the combination of improved innovation, and learning growth of product, human, technology and market are essentials to support the organization strategy.

4- The financial perspective: to succeed financially, how should we appear to our shareholders? Examples of this perspective include financial ratios and various cash flow measures. On managing and improving business process, customer and employee satisfaction, the financial perspective should improve

accordingly. The importance of financial performance is to measure whether organization strategy and implementation results the better bottom-line improvement, and good return to shareholders (Kaplan & Norton 1992, 1996, 2001; Jusoh et al., 2008).

Furthermore, improved sales revenue, sales growth, net profit and gross profit among financial measure are preferred by Malaysian manufacturing firm. Financial performance in terms of profitability such as operating income, return on investment and economic value-added (EVA) (Kaplan & Norton 1992, 1996, 2001; Jusoh et al., 2008) and improved competition position, have been proven to increase market share, increase revenue, reduce expense, and improve financial results which in turn has positive effect on measure of organizational performance. Given the evidence with supported arguments, the author believes that financial performance is one of the important measures for organizational performance.

2. Material and Methods

2.1. Research Model

The purpose of this study is to evaluate the performance on distinct industries by means of BSC and DEA. According to the purpose and hypotheses of this study, a research framework is developed shown in Figure 2. Manager must adopt the BSC to evaluate their management performances from four perspectives including the financial perspective, customer perspective, internal-business process perspective, as well as learning and growth perspective. In addition, in order to evaluate the competitive position of the firm, managers need to apply DEA to identify the efficient frontier, benchmarking partners and inefficient slacks for the firms. DEA is a non-parametric approach for estimating maximum output level for given inputs or minimum input levels for given output level, which has been applied to evaluate benchmarking and identify a best-practice frontier (Chang et al., 2005). DEA can indicate and compare relatively inefficient and efficient units and suggest how to reduce the inefficiencies. Therefore, by using DEA, the results of this study intend to provide competitive information and learning partner, which are essential for firms to design long term strategy and objective.

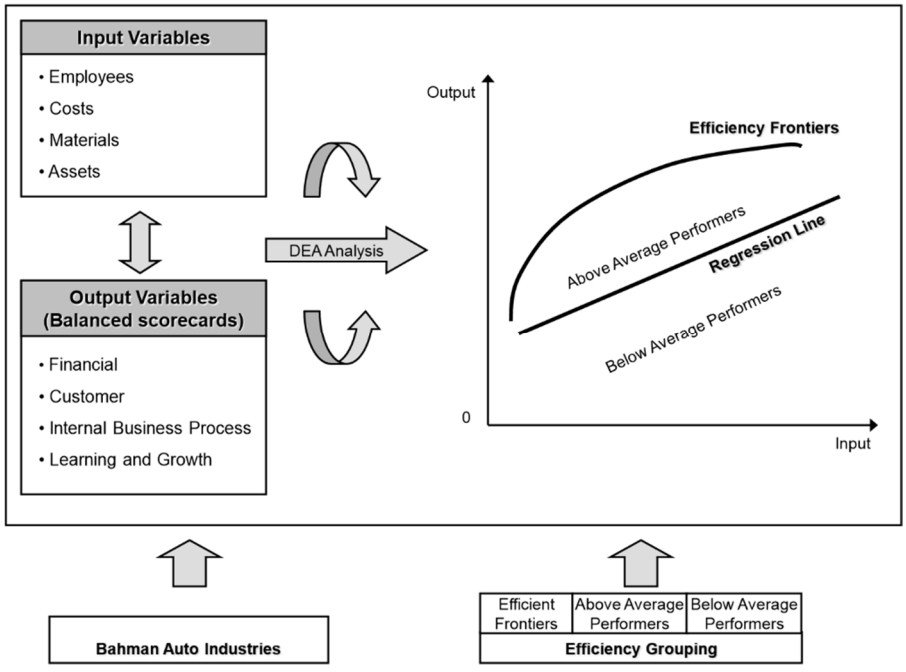

Figure 2. The Research Conceptual Framework

3. Discussion and Results

3.1. Interrelationships between Research Variables

In order to achieve the purpose of this research and test the hypotheses, SPSS 10.5 and DEA 2.1 software were employed to analyze the data. In order to examine the interrelationships among four perspectives of BSC, this study used canonical correlation analysis to test hypotheses 1, 2, and 3. The detailed information of canonical results was shown in Figure 3 to 5. For relationships between learning and growth perspective and internal business process perspective of BSC, Figure 3 demonstrated that levels of indicators of learning and growth perspective tended to significantly influence total assets turnover, inventory turnover, and property plant and equip turnover for Bahman Auto Industry (Can R2=0.388, F=80.46; $p<0.05$) (Table 1).

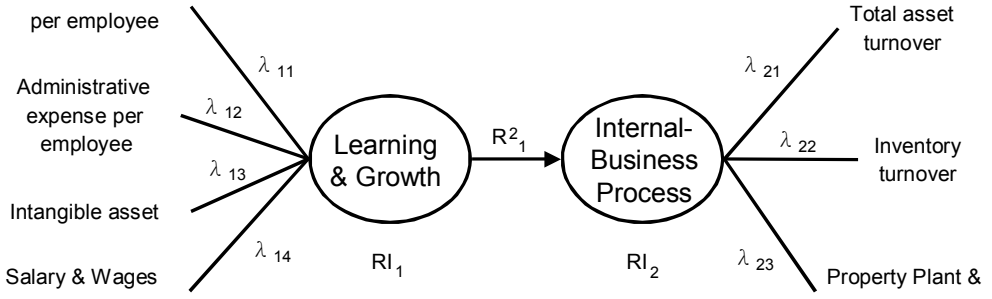

Figure 3. The Interrelationships among Learning and Growth Perspective and Internal—Business Process Perspective of BSC

Table 1. Bahman auto industry of hypotheses 1

	Bahman Auto Industry (n=39)
R21	.388
RI_1	22.395%
RI_2	14.088%
λ11	.677*
λ12	.480*
λ13	.633*
λ14	---
λ21	.977*
λ22	.632*
λ23	.615*

Hypothesis 2 described that the factors of internal business process perspective of the BSC had significant influences on the factors of customer perspective of the BSC. Figure 4 revealed the detail information of canonical correlation. Specifically, levels of indicators of internal business process perspective tended to significantly influence relative market share and the growth of market share for Bahman Auto Industry (Can R2=0.239, F=68.00; $p<0.05$) Thus, the hypothesis 2 was supported (Table 2).

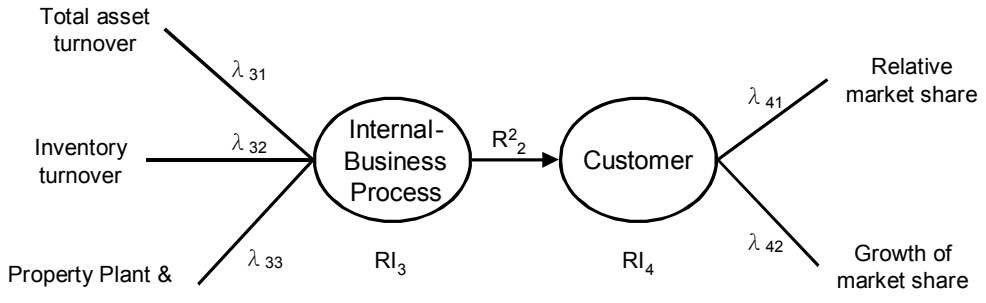

Figure 4. The Interrelationships among Internal—Business Process Perspective and Customer Perspective of BSC

Table 2. Bahman auto industry of hypotheses 2

	Bahman Auto Industry (n=39)
R22	.239
RI_3	13.220%
RI_4	9.929%
λ31	.923*
λ32	.405*
λ33	.480*
λ41	.989*
λ42	.358*

For relationships between customer perspective and financial perspective of BSC, Figure 5 demonstrated that levels of indicators of customer perspective tended to significantly influence total revenue, operating income, cash flow, and accounts receivable for Bahman Auto Industry (Can R2=0.997, F=66.00; p<0.000) Therefore, the results were consistent with the hypothesis 3 that the factors of customer perspective of the BSC had significant influences on the factors of financial perspective of the BSC (Table 3).

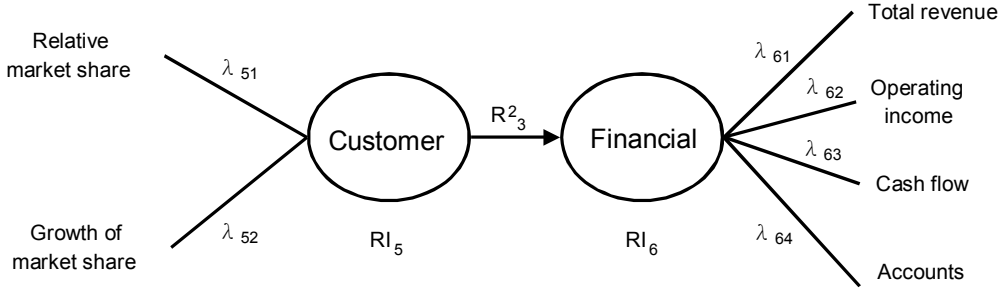

Figure 5. The Interrelationships among Customer Perspective and Financial Perspective of BSC

Table 3. Bahman auto industry of hypotheses 3

	Bahman Auto Industry (n=39)
R23	.997
RI_5	64.819%
RI_6	54.557%
λ51	1.000*
λ52	.307*
λ61	1.000*
λ62	.607*
λ63	.861*
λ64	.701*

According to the variables with higher levels of

canonical loading, R&D expense per employee and intangible assets are two of the most promising factors that would be positively related to total assets turnover which in turn positively related to relative market share for Bahman Auto Industry. (Table 4)

Table 4. Measurements of Constructs of BSC

Construct	Indicator	Factor Loading	Item-to-Total Correlation	Cronbach's alpha
Bahman Auto Industry				
Financial Perspective	Total Revenue	.968	.902	.835
	Operating Income	.724	.590	
	Cash Flow	.782	.791	
	Accounts Receivable	.796	.647	
Customer Perspective	Relative Market Share	.808	.505	.877
	Growth of Market Share	.808	.505	
Inter nal -Business Perspective	Total assets Turnover	.902	.691	.713
	Inventory Turnover	.830	.598	
	Property Plant & Equip Turnover	.653	.567	
Learning & Growth Perspective	Intangible assets	.696	.501	.618
	R&D Expense Per Employee	.908	.518	
	Administrative e Expense Per Employee	.650	.573	

4. Conclusion

According to the results achieved by solving DEA models, the improvement of efficiency and optimized performance of inefficient unit can be programmed by introducing the sample unit to inefficient unit and executive authorities. The appropriate amount of output and input is exactly determined (in the virtual unit). If the units match the amount of output and input with the determined amount, they can achieve the complete efficiency. It is suggested to become sure of the relation of targets and strategies with key performance indices, and also the balance of key performance indices in different aspects of the company while planning, because most of the companies were efficient in their normal model DEA_BSC, but couldn't maintain their efficiency in the balanced model, which resulted to an appropriate performance and increased the efficiency and competitive ability of the company.

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How to Cite this Article:

Farkhondehzadeh A., Rakhsha H. and Roshanfekr M., The Evaluation of Bahman Automotive Companies Group by Balanced Scored Card Approach and Data Envelopment Analysis, Uct Journal of Social Sciences and Humanities Research 02 (2014) 32–39.