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Abstract

Purpose – The purpose of this paper is to develop the strategy map (SM) of an Iranian automotive industry and the causal and effects relations of the SM's variables though fourth generation of balanced scorecard (BSC) and fuzzy DEMATEL (decision-making trial and evaluation laboratory) technique.

Design/methodology/approach – This research has employed a fuzzy DEMATEL approach in order to find cause and effect relations. At first step, CSFs in Company A's SM were determined. Then four experts' views of Company A's strategic planning department were gathered and calculated by fuzzy set theory.

Findings – Results showed the important role of customer perspective in supporting and achieving the organization's vision which ultimately will lead to fulfillment of the financial objective of the company through satisfied customers. In other words, the dominant approach to logic of SM design in Company A and the obtained results from this research indicate, Company A can achieve strategic result with a more prominent role of customer and financial perspective, through employing the enabler perspective, i.e. learning and growth perspective.

Research limitations/implications – Current study is limited to Iranian automotive industry. So, the strategic planning managers and future researchers shall consider their own company's strategic structures for developing their SM.

Originality/value – To the best of knowledge of the authors, it is the first attempt, particularly in the context of Iran, aimed at using fourth generation of BSC and fuzzy DEMATEL technique in an automotive industry which led to the confirmation that these two approaches can jointly be employed for the identifying cause and effect relations in SM and clarification and easy understanding of it. This proposed research structure can be a suitable base for the development of SM in other companies.

Keywords Company performance, Balanced scorecard

Paper type Research paper

1. Introduction

Logic of cause-and-effect principle to create strategy map (SM) is a famous problem for researcher to solve it. Formation of causes and effects group can help manager to know about strategic enablers (causes group) and strategic results (effects group). The main objective of this research is to propose a group decision-making technique for ranking SM components. By distinguishing the highest influencing and permeability component in SM, strategic managers will be able to find an optimum strategy path to achieve

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the organization's vision. Achieving these results will help managers to select a best approach in critical and competitive environment. In other words, clarifying the organization's path and managers' approach can lead to the transparency and public understanding of the concepts of the organization's vision. Authors propose a "fuzzy DEMATEL" (fuzzy decision-making trial and evaluation laboratory) (Lin and Wu, 2004) for SM ranking. On the other hand balanced scorecard (BSC) is a decision support tool at the strategic management level which improves the satisfaction of the strategic objectives. Since it was proposed in the early 1990s, it has demonstrated its suitability to assist decision making in management (Bobillo *et al.*, 2009). Scorecard introduces four new management processes that separately and in combination, contribute to linking long-term strategic objective with short-term actions (Kaplan and Norton, 2007). BSC can be best characterized as a "strategic management system" that claims to integrate all quantitative and abstract measures of true importance to the enterprise in an integrated total system called "close-lope management system" (Kaplan and Norton, 2008). A good BSC contains several strategic or future-focussed metrics that tell the organization how it is doing on its path towards its vision (Brown, 2000). Usefulness of BSC as a practical theory has been questioned by referring to some of its assumptions, especially the cause-and-effect relationship (Norreklit, 2000, 2003). Kaplan and Norton (2004,a, 2006) have emphasized the existence of such relationships of cause and effect through a BSC SM, which gives an explicit description of the hypotheses behind business strategy. SM is a "logical and comprehensive architecture for describing strategy", and it "specifies the critical elements and their linkages for an organization's strategy" (Kaplan and Norton, 2001a). SM also indicates the connection between the desired outcomes from the strategy with the drivers that will lead to the desired outcomes (Huang and Lee, 2006). The reason for employing fuzzy DEMATEL technique in this research is the similarity of cause and effect structure in both SM and fuzzy DEMATEL. The remainder of the paper is organized as follows; Section 2 provides a review of the related research on BSC in fuzzy environment and SM. Section 3 reviews background about fuzzy DEMATEL and research conducted in this area. In Section 4 development of the SM of an Iranian automotive company, which is one of the largest and important Iranian automotive manufacturers, is presented. It should be noted in order to respect the confidentiality of information of this company from now on it is called Company A. And finally Section 5 wraps up the paper with conclusion and recommendations for future studies.

2. Literature review

BSC is a useful tool for focussing and sustaining continuous improvement efforts (Chan, 2004) and provides an internal and external view of the business providing another sense of balance (Beckenholdt Patricia, 2011). It will also enable an organization to become a high-performing enterprise (Heimdahl, 2010). Köppen *et al.* (2007) suggest, BSC is more than a business model. Our literature review shows BSC is used in many different industry and services. For example, Arias *et al.* (2010) developed a new tool based on fuzzy logic that it can help managers to simulate strategic environment to obtain valuable information about the level of strategy, flexibility and performance required in the area of operation management. Bobillo *et al.* (2009) proposed a semantic fuzzy expert system for a fuzzy BSC. Shafia *et al.* (2011) applied fuzzy BSC for evaluating the CRM performance. Wu *et al.* (2010) used a BSC with

a fuzzy linguistic scale in order to evaluate government performance. Glykas (2013) presented fuzzy cognitive strategic maps in business process performance measurement. Also Glykas (2012) in his study using fuzzy cognitive strategic maps discusses about performance measurement scenarios.

Lee *et al.* (2008) applied a fuzzy AHP and BSC for evaluating performance of IT department in the manufacturing industry. Wu *et al.* (2009) by utilization a hybrid MCDM model (FAHP, TOPSIS, VIKOR) evaluated the performance of banking services based on BSC. Yüksel and Dağdeviren (2010) offered fuzzy analytic network process for BSC. Tseng (2010) proposes a hybrid ANP and DEMATEL model usage in BSC and finally Jassbi *et al.* (2011) offered a fuzzy DEMATEL framework for modeling cause and effect relationships of SM.

Given the importance of the fourth generation of BSC and its capabilities on the one hand and paucity of the studies regarding this approach of BSC on the other, in this study though fourth generation of BSC we developed SM of company A and then using fuzzy DEMATEL technique the causal and effects relations of the SM's variables were determined. Following we discuss about the nature of SM and propos a SM for company A. Kaplan and Norton (2001a, p. 90) state that SM is a "logical and comprehensive architecture for describing strategy" and it specifies the critical elements and their linkages for an organization's strategy. According to Kaplan and Norton (2004b), a SM is based on strategy balances, contradictory forces and differentiated customer value proposition. Value is created through internal business processes, and strategy consists of simultaneous, complementary themes. Strategic alignment determines the value of intangible assets. And SM is designed to help execute strategy and bring predictive qualities to key performance indicators (Buytendijk *et al.*, 2010) and also, help organizations focus on their strategies in a comprehensive yet concise and systematic way (Kaplan and Norton, 2000). Kaplan and Norton (2001b, c) advocate the use of SM as an organization's strategic management system. Also, SM is a tool for constructing linkages between strategic objectives among perspectives of a BSC system and depicts objectives in multiple perspectives with their corresponding cause-effect relationship (Jassbi *et al.*, 2011). Kaplan and Norton (2004a) argue widely usage of SM provides the missing link between strategy formulation and strategy execution. All in all, SM provides:

- a visual framework and a concise description of an organization's strategy, and they can convert intangible assets into tangible outcomes (Banker *et al.*, 2004);
- employed to provide organizations with ways to create value (Kaplan and Norton, 2004a);
- logic of strategy;
- identifying gaps or blind spots;
- making more effective and efficient use of resources;
- aligning remuneration with strategy (Glykas, 2013);
- SM does not discriminate among logical and causal links (Norreklit, 2003);
- interpret all causal relationships so that effective strategies can be developed and deployed and then fulfilled optimally over time (Wu, 2012); and
- tools for review organization's performance by manager.

The BSC (Kaplan and Norton, 2008) is a performance management system that enables organizations to implement a business vision and strategy. The above description of SM could be named the core of BSC. SM shows how drawn objectives from four BSC perspectives are linked together in a chain of cause-and-effect relationships (Kaplan and Norton, 2004a). Introduced strategic tools, could stimulate managers to ascertain whether the current strategy is applicable to the current situation and eventually lead to a revision of current strategy (Rompho, 2012). This use of MS is a "strategic learning loop." Thus a SM is a "double-loop learning" tool (Kaplan and Norton, 2001b, c).

3. Fuzzy DEMATEL

The DEMATEL technique constructs the interrelationship between factors/criteria to build a network relationship map (Huang *et al.*, 2007; Yang *et al.*, 2008; Ou Yang, 2013). This technique is a comprehensive method for designing and analysis of structural model of casual relationship (Wu and Lee, 2007). The origin of DEMATEL is related to Battelle Memorial Institute of Geneva. For the first time DEMATEL was used on Science and Human Affairs program to solve complex and interrelated problems (Gabus and Fontela, 1973; Lin *et al.*, 2009). Many researchers and scientists used this technique in various fields and developed it by other MCDM method. Some studies in this regard are as follows; ME-OWA based on DEMATEL (Liwa *et al.*, 2011), identification of risk factors of IT outsourcing (Fan *et al.*, 2012), restaurant space design (Hrong *et al.*, 2012), ADEMATEL-ANP fuzzy goal programming in supply chain management (SCM) (Hung, 2011), auto spare parts industry (Wu and Tsai, 2011), performance evaluation in hotels (chen *et al.*, 2011), theory of acceptance and use of technology (Fu Jeng and Tzeng, 2012; Tzeng *et al.*, 2007), selection management system (Tsia and Chou, 2009), choosing knowledge management strategy (Wu, 2008), organic light emitting diode technology selection (Shen *et al.*, 2011).

The steps that should be taken toward the employment of the fuzzy DEMATEL are as follows (Chou *et al.*, 2012):

- Step1: selecting the committee of experts.
- Step 2: developing the criteria and designing the fuzzy linguistic scale.

In this study first, the experts of strategic unit defined the decision goals and developed criteria about the research question. Linguistic variables were taken on values defined in its set of linguistic terms. Linguistic terms and triangular fuzzy numbers of linguistic variables are show in Figure 1 and Table I.

- Step 3: generating the assessments of decision makers. To measure the relationships between the factors which are demonstrated by the $F = \{Fli = 1,2, \ldots, n\}$ the experts were asked to make sets of pair wise comparison. Then the $\tilde{Z}(1), \tilde{Z}(2), \ldots, \tilde{Z}(n)$

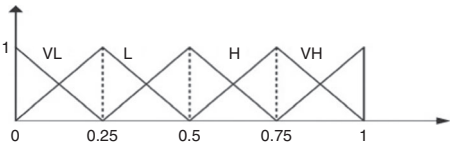

Figure 1.
Triangular
fuzzy numbers

can be obtained. Fuzzy matrix $\tilde{Z}(k)$ is the initial direction relation fuzzy matrix of expert k as follows:

$$\begin{bmatrix} 0 & \tilde{Z}_{12}^{(k)} & \cdots & \tilde{Z}_{1n}^{(k)} \\ \tilde{Z}_{21}^{(k)} & 0 & \cdots & \tilde{Z}_{2n}^{(k)} \\ \vdots & \vdots & \cdots & \vdots \\ \tilde{Z}_{n1}^{(k)} & \tilde{Z}_{n2}^{(k)} & \cdots & 0 \end{bmatrix} \quad k = 1, 2, ..., p$$

$$\tilde{Z}_{ij}^{(k)} = \left(\lambda_{ij}^{(k)}, m_{ij}^{(k)}, u_{ij}^{(k)}\right)$$

- Step 4: normalizing the direct-relation fuzzy matrix. The values of $\tilde{a}_i^{\langle k\rangle}$ and $\beta_i^{\langle k\rangle}$ are the triangular fuzzy numbers as in the following equation:

$$\tilde{a}_i^{\langle k\rangle} = \sum_{j=1}^{n} \tilde{Z}_{ij}^{\langle k\rangle} = \left(\sum_{j=1}^{n} \lambda_{ij}^{\langle k\rangle}, \sum_{j=1}^{n} m_{ij}^{\langle k\rangle}, \sum_{j=1}^{n} u_{ij}^{\langle k\rangle}\right),$$

$$\beta_i^{\langle k\rangle} = \max_{1 \leqslant i \leqslant n} \left(\sum_{j=1}^{n} u_{ij}^{\langle k\rangle}\right) 1 \leqslant i \leqslant n \tag{1}$$

In addition, the linear scale transformation is used to transform the criteria scale into comparable scales. Then we can calculate the normalized direct-relation fuzzy matrix as $\tilde{X}^{\langle k\rangle}$:

$$\tilde{X}^{\langle k\rangle} = \begin{bmatrix} \tilde{X}_{11}^{(k)} & \tilde{X}_{12}^{(k)} & \cdots & \tilde{X}_{1n}^{(k)} \\ \tilde{X}_{21}^{(k)} & \tilde{X}_{22}^{(k)} & \cdots & \tilde{X}_{2n}^{(k)} \\ \vdots & \vdots & \cdots & \vdots \\ \tilde{X}_{n1}^{(k)} & \tilde{X}_{n2}^{(k)} & \cdots & \tilde{X}_{nn}^{(k)} \end{bmatrix} \quad k = 1, 2, ..., p$$

Where:

$$\tilde{X}_{ij}^{\langle k\rangle} = \frac{\tilde{X}_{ij}^{\langle k\rangle}}{\beta^{\langle k\rangle}} = \left(\frac{\lambda_{ij}^{\langle k\rangle}}{\beta^{\langle k\rangle}}, \frac{m_{ij}^{\langle k\rangle}}{\beta^{\langle k\rangle}}, \frac{u_{ij}^{\langle k\rangle}}{\beta^{\langle k\rangle}}\right)$$

Linguistic terms	Linguistic values
Very high influence (VH)	(0.5, 0.75, 1)
High influence (H)	(0.25, 0.5, 0.75)
Very low influence (VL)	(0, 0.25, 0.5)
Low influence (L)	(0, 0, 0.25)
No influence (N)	(0, 0, 0)

Table I. Linguistic scales

this research assumes that at least one i such that $\sum_{j=1}^{n} u_{ij}^{\langle k\rangle} < \beta^{\langle k\rangle}$, furthermore we use the following equation:

$$\tilde{X} = \frac{\left(\tilde{X}^{\langle 1\rangle} \oplus \tilde{X}^{\langle 2\rangle} \oplus \ \ldots \ \oplus \tilde{X}^{\langle p\rangle}\right)}{p}; \quad \tilde{X} = \begin{bmatrix} \tilde{X}_{11} & \tilde{X}_{12} & \cdots & \tilde{X}_{1n} \\ \tilde{X}_{21} & \tilde{X}_{22} & \cdots & \tilde{X}_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ \tilde{X}_{n1} & \tilde{X}_{n2} & \cdots & \tilde{X}_{nn} \end{bmatrix} \tag{2}$$

where: $\tilde{X}_{ij} = \sum_{k=1}^{p} \tilde{X}_{ij}^{\langle k\rangle}/p$

- Step 5: establish and analyze the structural model. Once the normalized direct-relation X is obtained, the total relation matrix T can be calculated, we should ensure the convergence of $\underset{w\to\infty}{Lim}\tilde{X}^{w} = 0$. The total-relation fuzzy matrix is shown as follows:

$$\tilde{T} = \underset{w\to\infty}{Lim}\left(\tilde{X} + \tilde{X}^{2} + \ \ldots \ + \tilde{X}^{w}\right) = X \times (I - X)^{-1} \tag{3}$$

$$\tilde{T} = \begin{bmatrix} \tilde{t}_{11} & \tilde{t}_{12} & \cdots & \tilde{t}_{1n} \\ \tilde{t}_{21} & \tilde{t}_{22} & \cdots & \tilde{t}_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ \tilde{t}_{n1} & \tilde{t}_{n2} & \cdots & \tilde{t}_{nn} \end{bmatrix}$$

where: $\tilde{t}_{ij} = \left(\lambda''_{ij}, m''_{ij}, u''_{ij}\right)$

$$Matrix\left[\lambda''_{ij}\right] = X_{\lambda} \times (I - X_{\lambda})^{-1}$$

$$Matrix\left[m''_{ij}\right] = X_{m} \times (I - X_{m})^{-1}$$

$$Matrix\left[u''_{ij}\right] = X_{u} \times (I - X_{u})^{-1}$$

- Step 6: producing a casual diagram.

The human judgments with fuzzy linguistic variables are fuzzy numbers, so a defuzzification method is required to transform the crisp elements into scores. Proposed by Opricovic and Tzeng (2003), the converting fuzzy data into crisp scores defuzzification method is based on the procedure of determining the left and right scores by fuzzy min and fuzzy max, and the total score is determined as a weighted average according to the membership functions. This would provide a more appropriate crisp value when compared with other methods. Defuzzification is obtained through the following equationas follows:

$$L = \min(\lambda_k), R = \max(u_k); k = 1, 2, \ \ldots, \ n, \Delta = R - L$$

$$\tilde{n}_{k}^{def} = L + \Delta \times \frac{(m-L)(\Delta + u - m)^{2}(R - \lambda) + (u-L)^{2}(\Delta + m - \lambda)^{2}}{(\Delta + m - \lambda)(\Delta + u - m)^{2}(R - \lambda) + (u-L)(\Delta + u - m)} \tag{4}$$

4. The case study

Company A was founded under the name "Jeep Trading Company" by the late Jafar Akhavan in 1956. In 1979, company broke off relationship with GM. This company can be named the first automotive manufacturing company in Iran, the first company to attract foreign direct investment in the Iranian automotive sector and the first non American company in history which was granted the right to produce and assemble Cadillac vehicles. This company has strategic relationship with Japanese Nissan Automotive Company and French Renault Automotive Company. Now entering its 50th year of activity and by successfully overcoming the obstacles, the company is not only the primer manufacturer in a number of key sectors, but also by capitalizing on the resources and synergies garnered from its affiliation with the SAIPA Group, and combined with its re-emergence as a strategic regional partner with Renault-Nissan (one of the largest automotive groups in the world), has re-captured its past glories. Also, with the new records in production, productivity and a completely diversified model line-up, is now setting new benchmarks of the future. Figure 2 shows this company's SM based on Kaplan and Norton's (2008) the *Execution Premium* book. First section creates dynamic and joyful work environment. Second section, daily operation process excellence, third section, market penetration in different segments, and finally, fourth section product development based on limited platforms. To facilitate the analysis through fuzzy DEMATEL technique, SM's elements will be shown in abbreviation letters according to each perspective of BSC. Table II shows the abbreviation of SM elements.

In order to explain about the aim and the type of research and also for the exchange of views the authors held several meetings with the managers and experts of this company. At least three different definitions of the stages of the evolution of BSC exist in the literature. Many authors agree that the first generation BSC combines financial and non-financial indicators with the four perspectives (i.e. financial, customer, internal

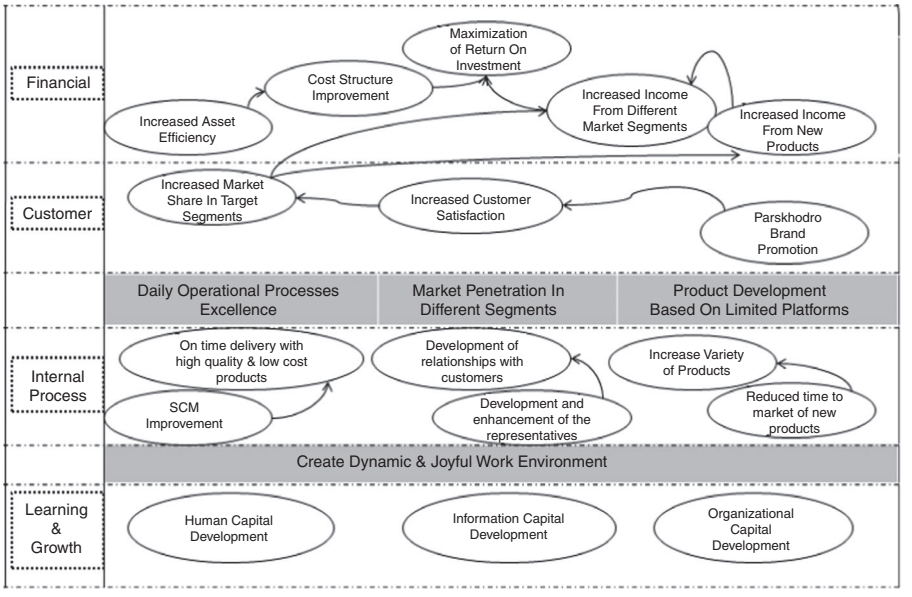

Figure 2.
Strategy map of company A

Perspective	Strategy maps elements	Abb.
Learn and growth	Human capital development	L1
	Information capital development	L2
	Organizational capital development	L3
Internal process	SCM improvement	I1
	On time delivery with high quality and low cost products	I2
	Development of the relations with customers	I3
	Development and promotion of car dealers companies	I4
	Increased variety of products	I5
	Reduced time-to-market of new product	I6
Customer	Increased market share in target segments	C1
	Increased customer satisfaction	C2
	Brand promotion	C3
Financial	Increased asset efficiency	F1
	Improved cost structure	F2
	Maximize return on investment	F3
	Increased income from different market segments	F4
	Increased income from new products	F5

Table II.
Abbreviation of strategy map

business process and learning and growth). At this stage, "measurement systems without cause-and-effect logic may also qualify as Balanced Scorecards" (Speckbacher *et al.*, 2003; Lawrie and Cobbold, 2004) argue that the second-generation BSC emphasized the cause-and-effect relationships between measures and strategic objectives. BSC became a strategic management tool, usually utilizing a SM to illustrate the linkage between measures and strategies (Valmohammadi and Servati, 2011). As this study aimed to determine the ranking of the company's SM factors and also due to the availability of all documents of the stratigic planning based on the third and fourth generation of BSC as explained in Section 2 we employed the fourth generation of BSC for our purpose. To collect data we asked four expert views in strategy department. By collection expert fuzzy views in direct matrix we should integrate four fuzzy direction matrices into one and the normalized integration matrix. The results of integration of our fuzzy direction matrices and normalized matrix are shown in: Lambda matrix (Table III), M matrix (Table IV) and U matrix (Tables V and VI) (Figure 3).

As shown in defuzzified matrix for direct and indirect relation and interrelationships among SM'S factors, maximum influencing among all components of the SM is related to L1, L2, L3, I1 and I5. Also maximum permeability among all components of the SM is related to F4, F5, C2, C3 and C1.

As shown in Table VII, the variables of SM could be divided into two groups, i.e. causes group and effects group. The causes group comprises of L1, L2, L3, I1, I2, I4, I5, I6 and effects group comprises I3, C1, C2, C3, F1, F2, F3, F4 and F5. As Kaplan and Norton (2008) have pointed out in their latest book for designing SM at the first stage we should consider and write down customer perspective and then examine financial, internal process, and learning and growth perspectives, respectively. Upon completion of the analysis process again we held a meeting with strategic department. During the meeting, strategic director of the company confirmed the usability and logic of fuzzy DEMATEL in determining of cause and effect relationships of the factors of the SM. As the current policy of the survey company is focussed on the enhancement of the company's growth through the improvement of human capital, information capital,

	L1	L2	L3	I1	I2	I3	I4	I5	I6	C1	C2	C3	F1	F2	F3	F4	F5
L1	0	0.047	0.052	0.042	0.053	0.053	0.036	0.027	0.032	0.02	0.018	0.018	0.014	0.024	0	0	0.004
L2	0.023	0	0.035	0.049	0.044	0.044	0.039	0.008	0.027	0.008	0.024	0.008	0.008	0.008	0	0	0.004
L3	0.047	0.026	0	0.027	0.039	0.049	0.039	0.008	0.027	0.008	0.024	0.02	0.004	0.01	0	0	0
I1	0	0	0	0	0.063	0.02	0.004	0.022	0.023	0.024	0.025	0.024	0.03	0.025	0.01	0.012	0.012
I2	0	0	0	0	0	0.034	0.024	0.014	0.014	0.044	0.063	0.044	0.036	0.058	0.01	0.03	0.02
I3	0	0	0	0	0	0	0.022	0.019	0.004	0.053	0.063	0.063	0	0	0.019	0.025	0.025
I4	0	0	0	0.02	0.008	0.063	0	0.01	0	0.048	0.058	0.048	0	0	0	0.039	0.02
I5	0.008	0.008	0	0	0.01	0.025	0.008	0.034	0.034	0.04	0.063	0.058	0.008	0.008	0.02	0.052	0.058
I6	0	0.004	0	0	0	0.02	0.008	0.058	0	0.024	0.053	0.048	0.004	0.004	0.004	0.02	0.043
C1	0	0	0.004	0	0.004	0	0	0.044	0	0	0.018	0.022	0.012	0.004	0.004	0.063	0.063
C2	0	0	0	0	0	0.02	0	0.034	0	0.063	0	0.034	0.02	0	0.02	0.058	0.058
C3	0	0.004	0	0	0	0.008	0.008	0.028	0	0.02	0.063	0	0	0	0	0.052	0.052
F1	0	0	0	0.008	0.008	0	0.004	0	0	0	0	0	0	0.058	0.047	0.01	0.004
F2	0	0	0	0	0.004	0	0	0	0.004	0	0.02	0	0	0	0.063	0.004	0.004
F3	0	0	0	0	0	0.004	0	0	0	0.004	0.004	0	0	0	0	0.014	0.004
F4	0	0	0	0.008	0.008	0	0	0.01	0	0	0	0	0	0	0.033	0	0.014
F5	0	0	0.008	0.008	0.004	0.004	0.02	0.004	0	0	0	0	0	0	0.022	0.058	0

Table III.
Lambda matrix

Table IV.
M matrix

	L1	L2	L3	I1	I2	I3	I4	I5	I6	C1	C2	C3	F1	F2	F3	F4	F5
L1	0	0.068	0.073	0.064	0.074	0.074	0.059	0.02	0.049	0.034	0.034	0.034	0.029	0.04	0.004	0.004	0.014
L2	0.047	0	0.058	0.069	0.064	0.064	0.059	0.02	0.045	0.024	0.04	0.024	0.024	0.024	0.004	0.004	0.014
L3	0.068	0.043	0	0.049	0.059	0.069	0.059	0.02	0.045	0.024	0.04	0.034	0.014	0.019	0.004	0.004	0.004
I1	0	0	0	0	0.084	0.039	0.023	0.039	0.042	0.04	0.046	0.045	0.053	0.042	0.019	0.03	0.03
I2	0	0	0	0	0	0.054	0.045	0.025	0.019	0.064	0.084	0.059	0.059	0.079	0.019	0.044	0.034
I3	0	0	0.008	0	0	0	0.039	0.03	0.01	0.075	0.084	0.084	0.004	0.009	0.029	0.039	0.039
I4	0	0	0	0.03	0.02	0.084	0	0.019	0.004	0.069	0.079	0.069	0.004	0.004	0.009	0.059	0.034
I5	0.02	0.02	0	0	0.015	0.035	0.02	0.045	0.049	0.059	0.084	0.079	0.024	0.024	0.039	0.073	0.079
I6	0	0.01	0	0	0	0.03	0.02	0.079	0	0.04	0.074	0.07	0.01	0.01	0.015	0.034	0.065
C1	0	0	0.01	0	0.01	0	0	0.06	0.008	0	0.029	0.039	0.03	0.01	0.01	0.084	0.084
C2	0	0	0.008	0	0	0.03	0	0.045	0	0.084	0	0.049	0.034	0.012	0.034	0.079	0.079
C3	0	0.01	0	0	0	0.02	0.02	0.039	0	0.03	0.084	0	0.004	0.009	0.009	0.073	0.073
F1	0	0	0	0.02	0.02	0	0.01	0	0	0	0	0	0	0.079	0.068	0.014	0.01
F2	0	0	0	0	0.01	0	0	0	0.01	0	0.03	0.008	0	0	0.084	0.01	0.01
F3	0	0	0	0	0	0.01	0	0	0	0.01	0.01	0	0	0	0	0.019	0.01
F4	0	0	0	0.02	0.02	0	0	0.015	0	0	0	0	0	0	0.044	0	0.019
F5	0	0	0.02	0.02	0.01	0.01	0.03	0.01	0	0	0	0	0	0	0.033	0.079	0

Table V.
U matrix

	L1	L2	L3	I1	I2	I3	I4	I5	I6	C1	C2	C3	F1	F2	F3	F4	F5
L1	0	0.084	0.084	0.079	0.084	0.084	0.074	0.041	0.064	0.056	0.055	0.055	0.051	0.061	0.026	0.026	0.036
L2	0.068	0	0.074	0.075	0.075	0.075	0.075	0.041	0.059	0.046	0.061	0.046	0.046	0.046	0.026	0.026	0.036
L3	0.084	0.064	0	0.065	0.075	0.075	0.075	0.041	0.059	0.046	0.061	0.056	0.036	0.041	0.026	0.026	0.026
I1	0.021	0.021	0.021	0	0.084	0.062	0.047	0.055	0.058	0.061	0.068	0.067	0.074	0.063	0.042	0.051	0.051
I2	0.021	0.021	0.021	0.021	0	0.072	0.067	0.046	0.035	0.072	0.084	0.065	0.074	0.084	0.042	0.065	0.056
I3	0.021	0.021	0.031	0.021	0.021	0	0.055	0.046	0.031	0.079	0.084	0.084	0.026	0.032	0.045	0.056	0.056
I4	0.021	0.021	0.021	0.051	0.041	0.084	0	0.041	0.026	0.084	0.084	0.084	0.026	0.026	0.032	0.075	0.056
I5	0.041	0.041	0.021	0.021	0.036	0.051	0.041	0	0.065	0.072	0.084	0.084	0.046	0.046	0.062	0.084	0.084
I6	0.021	0.031	0.021	0.021	0.021	0.051	0.041	0.084	0	0.061	0.084	0.079	0.031	0.031	0.037	0.056	0.079
C1	0.021	0.021	0.031	0.021	0.031	0.021	0.021	0.07	0.031	0	0.045	0.055	0.051	0.031	0.031	0.084	0.084
C2	0.021	0.021	0.031	0.021	0.021	0.051	0.021	0.055	0.021	0.084	0	0.065	0.056	0.036	0.056	0.084	0.084
C3	0.021	0.031	0.021	0.021	0.021	0.041	0.041	0.055	0.021	0.051	0.084	0	0.026	0.032	0.032	0.084	0.084
F1	0.021	0.021	0.021	0.041	0.041	0.021	0.031	0.021	0.021	0.021	0.021	0.021	0	0.084	0.084	0.035	0.031
F2	0.021	0.021	0.021	0.021	0.031	0.021	0.021	0.021	0.031	0.021	0.051	0.031	0.021	0	0.084	0.031	0.031
F3	0.021	0.021	0.021	0.021	0.021	0.031	0.021	0.021	0.021	0.031	0.031	0.021	0.021	0.021	0	0.035	0.031
F4	0.021	0.021	0.021	0.041	0.041	0.021	0.021	0.036	0.021	0.021	0.021	0.021	0.021	0.021	0.054	0	0.035
F5	0.021	0.021	0.041	0.041	0.031	0.031	0.051	0.025	0.021	0.021	0.021	0.021	0.021	0.021	0.054	0.084	0

Notes: Calculated numerical coefficient for L in Λ matrix and M matrix is 0, it should also be noted numerical coefficient for Δ and R in matrix U is 0.055 and 0.033, respectively. These coefficients will be used in the final step of analysis for defuzzification of the expert's views and the formation of direct and indirect relation matrix

Table VI.
Fuzziness matrix for direct and indirect relation

	L1	L2	L3	I1	I2	I3	I4	I5	I6	C1	C2	C3	F1	F2	F3	F4	F5
L1	0	0	0	0	0	0.001	0.001	0	0	0.001	0.001	0.001	0	0.001	0	0.001	0.001
L2	0	0	0	0	0	0.001	0.001	0	0	0.001	0.001	0.001	0	0	0	0.001	0.001
L3	0	0	0	0	0	0.001	0.001	0	0	0.001	0.001	0.001	0	0	0	0.001	0
I1	0	0	0	0	0	0	0	0.001	0	0.001	0.001	0.001	0.001	0	0	0.001	0.001
I2	0	0	0	0	0	0	0	0	0	0.001	0.001	0	0	0	0	0.001	0.001
I3	0	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0	0	0	0.001	0.001
I4	0	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0	0	0	0.001	0.001
I5	0	0	0	0	0	0	0	0	0	0.001	0.001	0.001	0	0	0.001	0.001	0.001
I6	0	0	0	0	0	0	0	0.001	0	0	0.001	0.001	0	0	0	0.001	0.001
C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.001
C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.001
C3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.001
F1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

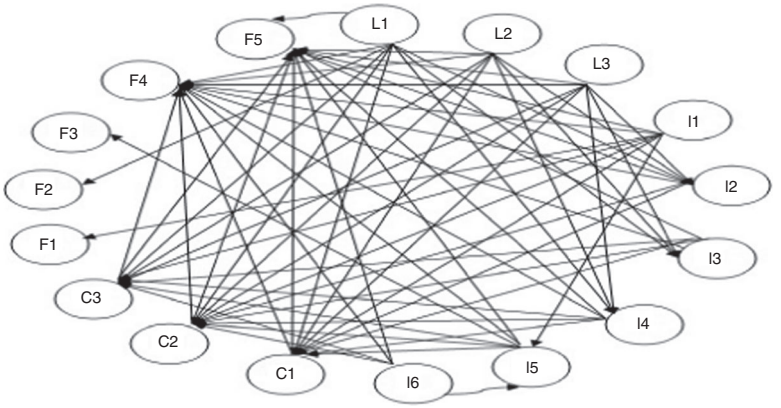

Figure 3.
Interrelationships among strategy map factors

Factor	R	J	R+J	R−J	Factor	R	J	R+J	R−J
L1	0.009	0.003	0.0112	0.0060	I6	0.006	0.004	0.0098	0.0018
L2	0.009	0.003	0.0113	0.0058	C1	0.005	0.007	0.0116	−0.0022
L3	0.008	0.003	0.0112	0.0049	C2	0.005	0.008	0.0127	−0.0027
I1	0.007	0.004	0.0111	0.0033	C3	0.005	0.007	0.0117	−0.0023
I2	0.006	0.005	0.0110	0.0017	F1	0.003	0.005	0.0081	−0.0016
I3	0.005	0.006	0.0112	−0.0004	F2	0.003	0.005	0.0078	−0.0023
I4	0.006	0.005	0.0112	0.0005	F3	0.002	0.006	0.0084	−0.0042
I5	0.007	0.006	0.0133	0.0015	F4	0.003	0.008	0.0110	−0.0056
F5	0.004	0.008	0.0113	−0.0042					

Table VII.
The total matrix

organizational capital, paying attention to the SCM and increased diversification of products, therefore, based on the obtained result it could be expected that through the empowerment of the causes group (as mentioned in the previous section) effects group can provide more robust results. So this company could realize its vision through linking its strategy and operations of all the company's units. Based on the final results the most influencing perspective in this company's BSC is learning and growth and also the most permeability perspectives are financial and customer perspectives, respectively. Figure 4 shows causal diagram of total relationships in the SM.

5. Conclusion and directions for further research

This study attempted to clarify the information for the top managers of an Iranian automotive company contained in the SM in order to select the best path to accomplish the organization's vision. Therefore, in the first part of the paper we introduced the survey company's SM according to fourth generation of BSC and by using fuzzy DEMATEL technique tried to find causes and effects group in MS. Results showed the important role of customer perspective in supporting and achieving the organization's vision which ultimately will lead to fulfillment of the financial objective of the company through satisfied customers. In other words, the dominant approach to logic of SM design in this company and obtained results from this research indicate, company A can achieve strategic result with a more prominent role of customer and financial

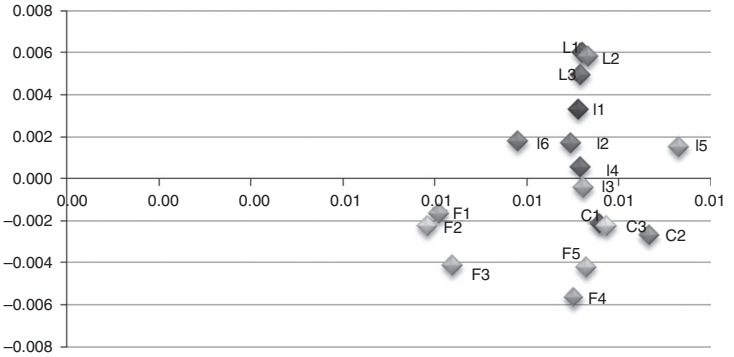

Figure 4.
Causal diagram of total relationships

perspective through employing the enabler perspective, i.e. learning and growth perspective. It is recommended for future research, SM be explored by fuzzy cognitive map and the obtained result be compared with fuzzy DEMATEL and fuzzy cognitive map. Also to get more accurate and efficient results researchers can apply the hybrid model of fuzzy ANP and fuzzy DEMATEL.

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