Developing a Balanced Scorecard for Strategic Alliances in Textile Industries

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Abstract
Today, companies increasingly are using alliance to fill gaps in their own capabilities and to grow in new markets and regions. Because of challenge of global competition, textile companies are increasingly using strategic partnership to maintain competitiveness. Although there seems to be an increase in the number of alliances formed, at the same time, there is also evidence that strategic alliances are underperforming, due to different levels of risk, resource requirements, and interaction among the partners. Developing an Alliance Balanced Scorecard (ABS) can mitigate the natural risk in alliance making process. This study focuses on how to apply the Balanced Scorecard on an alliance-making of three Textile companies as a result of a demand. We present a multiple criteria approach for evaluating Strategic Alliances in the first stage during their initiation and planning. In order to get multiple dimensional perspectives on the partners and industry, the ABS is embedded in the strategic model such as Porter's five competitive forces, the Internal Factors Evaluation Matrix, and SWOT through a hierarchical structure of criteria that reflect the ABS balance considerations. All motivations and issues of making alliances classified in four-perspective framework based on ABS: financial, strategic, operational, and relationship.
The proposed approach integrates the Alliance Balanced Scorecard with data analysis by Fuzzy Multiple Criteria Decision Making (FMCDM) and develops a Strategic Alliances making model. These finding provide the rationale for a firm in alliance to develop a Strategy Map and Balanced Scorecard as part of the Strategic Alliance making integration process and evaluate a firm's capability for strategic alliances making with data analysis in fuzzy environment.

Keywords
Strategic Alliances, Balanced Scorecard, Fuzzy Set Theory.

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1 Introduction

Strategic Alliances are increasingly gaining popular for Textile companies to achieve fast and economical growth in today's globalization. They are an important source of resources, learning, and thereby core competencies improvement. Strategic alliances are "the relatively enduring inter firm co-operative arrangements, involving flows and linkages that utilize resources and, or governance structures from autonomous organizations, for the joint accomplishment of individual goals linked to the corporate mission of each sponsoring firm" (Divita and Cassill 2002).

For several decades the supply side of apparel industry has been a global market. Most major manufacturers and many leading retailers around the world use global sources for the products they sell in their home markets. This condition gives rise to a new and very important role of alliances and partnerships in emerging markets. As a result of globalization, it is apparent that strategic alliances, supplier and manufacturer partnering, value chain relationships, joint ventures, and other forms of collaboration between previously independent organizations have escalated in importance during the 1990s. Indeed, more than 20,000 inter-organizational alliances were formed in the period between 1996 and 1998 alone (Cravens, Piercy, and Cravens 2000).

The underlying logic of such strategic alliances is that combining the distinctive capabilities of two or more companies enables each participant to obtain greater productivity from its skills and resources, while at the same time sharing external risks and uncertainties with partners. For example, in theory, the high-tech European Textile and Clothing Industries would be an ideal partner for Asian countries in a global economy. Because apparel and even textiles are labour-intensive when compared to many other industries, Asian countries could provide lower labour costs to drive costs down. So, Cooperation between them should itself improve market access for former. But such cooperation is unlikely and expect on a limited scale (Divita and Cassill 2002). Yet, there are significant risks involved in agreeing to form an alliance with a partner or partners, including such actions or outcomes as poor contract development, misrepresentation of partner firms' competencies, failure of partners to make complementary resources available, being held hostage through specific investments associated with the alliance or the partner, and misunderstanding of a partner's strategic intent. Research (Hitt, Hoskisson, and Ireland 1999) is also beginning to explore the interaction between potential gains from the alliance as compared to increased risk of opportunistic behavior by a partner. In recent years considerable attention has been devoted to determine the advantages and limitations of strategic partnerships, for example in terms of the selection of suitable partners, and the development of collaboration plans. However, it should be noted that recent estimates suggest that two-thirds of the inter-organizational strategic alliances formed between 1992 and 1995 were dissolved (The Economist 1999). Also it is surprising that far less attention has been focused on assessing a firm's capability for strategic alliances making. The high failure rate of alliances is that only 31 percent have developed and implemented formal

performance measures, and only one in five executives considered the measures that have been implemented to be reliable indicators of alliance success (Business Week 1999). In order to succeed in such an unforgiving environment, managers need integrated decision making process that are capable of using a wide variety of models along with data and information resources available to them at various internal and external repositories (Wen et al. 2005).

Despite these difficulties, Strategic Alliances should be evaluated and prioritized, as they compete for resources. In fact, because alliances are typically more structured than organizations, they are even more suitable for evaluation. The model we propose in this article tries to respond to these challenges by integrating two well-established managerial methodologies: balanced scorecard and fuzzy set theory.

The balanced scorecard was first proposed by Kaplan and Norton (1992) as a methodology aimed at revealing problem areas within organizations and pointing out areas for improvement. The Balanced Scorecard is a model for performance measures from different perspectives. The measures from the different perspectives are to give a more balanced view of the organization that reflects the different drivers that in the end contribute to wide range of attributed motivators for entering into and maintaining strategic alliances. It was also promoted as a tool to align an organization with its strategy, by deriving objectives and measures for specific organizational units from a top–down process driven by the mission and strategy of the entire organization (Kaplan and Norton 1996).

Using the scorecard in this way produces two important benefits. First, for new company provides a mechanism by which managers from the two previously independent entities have an opportunity to work together toward a common objective. The second benefit is that a language that executives can use to describe how to capture the intended synergies from alliance

In order to resolve the vagueness, ambiguity and subjectivity of human judgment, fuzzy sets theory was introduced to express the linguistic terms in decision making (DM) process. Zadeh and Bellman (1970) were the first researchers to survey the decision-making problem using fuzzy sets, and initiated the fuzzy multi-criteria decision-making (FMCDM) methodology. FMCDM was developed to resolve the lack of precision in assigning importance weights of criteria and the ratings of alternatives regarding evaluation criteria (Chen, Klein 1997). This study applies the FMCDM method to determine the importance weights of alternatives under criteria based on the Balance Scorecard and to synthesize the ratings of Textile firms for strategic alliances making. All motivations and issues of making alliances can be classified into four-perspective framework: financial, strategic, operational, and relationship (Kaplan and Norton 1996).

The work has been conducted as a qualitative case study at a Textile firm in Isfahan. So in this paper the scorecard was developed by using fuzzy set theory. We argue that results based on fuzzy analysis would help a company to make more informed strategic management decision concerning further investment for competences and key assets development, and outsourcing non-core assets and competences (Dadashian, Shakibfar 2007). Also, the necessity of conducting a multi-

dimensional performance analysis implies solving a multi-criteria decision-making problem. Therefore we propose to use FMCDM here due to its suitability for undertaking qualitative analysis (Chen and Hwang 1992).

2 Isfahan Textile Industries in brief

Before World War II there were only 12 Textile mills in Isfahan province producing woven cotton and wool textiles. After that the Textile Industries expanded more until 1970 decade that their production were mainly for a protected local market. Now the problem is that the equipment in some of these mills is antiquated over 50 years, shuttle less looms, narrow width resulting in poor productivity, low quality and high cost. Imported fabric was also another major problem that the local mills suffered from that. Although successive governments attempted to attract investments in this sector, they failed due to the high cost of machinery, non-availability of local raw material (neither cotton nor synthetic) and the labors cost. However, recently there has been some success with some Textile companies interesting to focus on customer's services as well as investments from some of the garment and carpet exporters. As a result, the recent globalization of the textile trade has opened up highly demanding and evolving requirements for outsourcing in textiles. The global market can play a major role in the success of the domestic textile; however, low-cost imports have presented a major threat to the industrial's stability. This condition gives rise to a new and very important role of alliances and partnerships. Alliances provide three major benefits to their partners. Local partners can greatly ease and accelerate access to necessary infrastructure, cutting through red tape, brokering access to providers of important operating services and smoothing relations with banking, legal and government officials.

3 Methodological approach

The alliance making evaluation problem is a challenging decision-making problem faced by decision makers that deal with alliance management. The evaluation involves multiple criteria measuring rewards, relevance to the organization's mission and objectives, strategic leverage potential, probability of technical and commercial success, etc. So Particular elements will be more critical to partners with various combinations of resources and risks and will have implications for the selection of evaluation mechanisms to assess the firm's potential in alliance making.

Developing an Alliance Balanced Scorecard can solve these problems by classifying criteria based on the evaluation of a firm's capability for entering strategic alliances and mitigate the natural conflict between alliance partners. Through this survey of textile firms, we examine various characteristics of the partnerships. A three-page interview instrument was developed based on key issues identified in

successful strategic alliances of textile companies. So the proposed methodological approach has strong grounding in the Kaplan and Norton's four perspective model as listed in Table 1. Others include the fuzzy set theory, hierarchical structure of criteria, and sub criteria and the concepts of ideal and anti-ideal solutions.
The objective for Strategic Alliances we propose here is to support the evaluation process during the entering stages of a firm to Strategic Alliances. At the selection phase, where firms are evaluated, the ABS could be useful to clarify and translate the vision and strategy of the organization, and to set the appropriate criteria for an alliance making. In planning phase, the scorecard might be used to set targets, align alliances with organizational strategy, and allocate resources within and among partners. So the ABS could be instrumental in providing a relative measure of performance, evaluating the value of the alliances in the face of changing circumstances and priorities, and communicating the results throughout the partners.
However, standards are hard to determine and can be misleading. Since this model is based on relative analysis, the firms are evaluated against each other; by combining the ABS with fuzzy set theory we overcome one of the major obstacles of Balanced Scorecard, namely, the need to determine standards. By using our methodology, the evaluation of the Alliance making could also set standards and point towards best practices.
The proposed Alliance Balanced Scorecard for strategic alliances making looks at a four-perspective framework: financial, strategic, operational, and relationship. Thus, this should be considered as a template for building specific ABS models by applying a systematic inquiry process, as defined by Kaplan and Norton (1996).
Once the criteria are determined, they should also be weighted to reflect the preferred emphasis of the organization. The focus on future events and opportunities in a dynamic environment cause much of the information required to be at best uncertain and at worst unavailable like Textile Industries. Opinions and judgments often have to substitute for data, and measures could be estimated only qualitatively. So the model we propose in this article tries to respond to these challenges by integrating two well-established managerial methodologies: balanced scorecard and fuzzy set theory.

4 Alliance Balanced Scorecard

To evaluate the Strategic Alliances making for firms, appropriate criteria should be determined. At least, it should include criteria that managers feel are most important, and for which they can provide hard data or firm opinions. It is also important that it be complete but not redundant, and that it be linked to the short- and long-term objectives of the organization. To determine the criteria set for alliances evaluation, we use a model based on the Balanced Scorecard approach.
The process of building an Alliance Balanced Scorecard ought to start with the most fundamental identifications for partners, such as: defining the industry, describing its development and role. The purpose is to develop a foundation for es-

tablishing an agreement on the characteristics and requirements of the industry, but also to arrive at a clear definition of the partners' current position and role.
The Alliance Balanced Scorecard model should be viewed as a tool for translating an abstract vision of partnerships and strategic alliance motivations into specific measures and goals. The purpose of this step is to achieve an overall balance by translating the vision into tangible terms from the established perspectives. Another important part is to formulate the overall strategy into more general terms. It include four-perspective framework: financial, strategic, operational, and relationship. The process of building the strategic alliance and scorecard brings together senior decision makers from both partners to articulate clearly the objectives of alliance and the strategy for achieving those objectives demonstrated in table1 (Kaplan and Norton 2006).
Alignment between business strategy and alliance is key. Textile firms may have designed their alliances with their business strategy in mind. We find significant differences between the firms in terms of strategy. Our point here is not that one particular strategy is more successful, but it is the alignment between business strategy and alliance strategy that is important. The implication is critical since most managers are focused on the allocation and management of internal resources to achieve business strategy. Inasmuch as firms relying on external knowledge resources from its alliance partners, managers must now ensure the proper alignment between business and alliance strategy.

Table 1. Alliance Balanced Scorecard model

Perspective	**Objectives**
Financial	Increase alliance revenues Reduce redundant cost across alliance members Increase partners' revenues through new customer relationships and related product sales Develop growth options for partners from alliance developing new products and new customer relationships
Strategic	Develop new technology Increase penetration with targeted customers Increase learning opportunities for partners' employees assigned to alliance
Operational	Meet project milestone Reduce costs in manufacturing, sales, or distribution Improve product development and launch processes Enhance coordination between alliance and parents
Relationship	Promote fast, effective decision making Communicate effectively within alliance and between alliance partners Build and maintain trust Develop clear roles, responsibilities, objectives, and accountabilities for alliance managers and employees

Building scorecard with an external partner -a key customer, supplier, or joint venture partner- provides another opportunity to create value through alignment. The process enables the senior managers of the two entities to work together to reach a consensus about the objectives for the relationship. The process also builds understanding and trust across organizational boundaries, leading to lowered transaction costs and reduced misalignment between the two parties. And the scorecard itself provides the explicit contract by which inter organizational performance will be measured. Without an ABS, external contracting focuses on financial measures, such as price and cost. The scorecard provides a more general contractual mechanism that allows the venture to explicitly incorporate measures of relationship, service, timeliness, innovation, quality, and flexibility, as well as cost and price.
Yet, the principal reason for poor alliance performance was an excessive concentration on achieving cost saving and insufficient attention to growing revenues. The few merged companies that succeeded focused on leveraging existing customer relationships for increased revenue, especially by retaining key revenue-generating employees. These finding provide the rationale for a firm in alliance to develop a Strategy Map and Balanced Scorecard as part of the merger integration process. Managers from the two independent companies formulate a specific strategy for leveraging the strengths of each company to create new revenue opportunities beyond what either company could have achieved operating interdentally. The process also produces a road map for implementing the revenue growth, as well as cost reduction; strategic themes through investment in key processes, employees, and information technology; and unified corporate culture.

4.1 Identification of critical factors for success

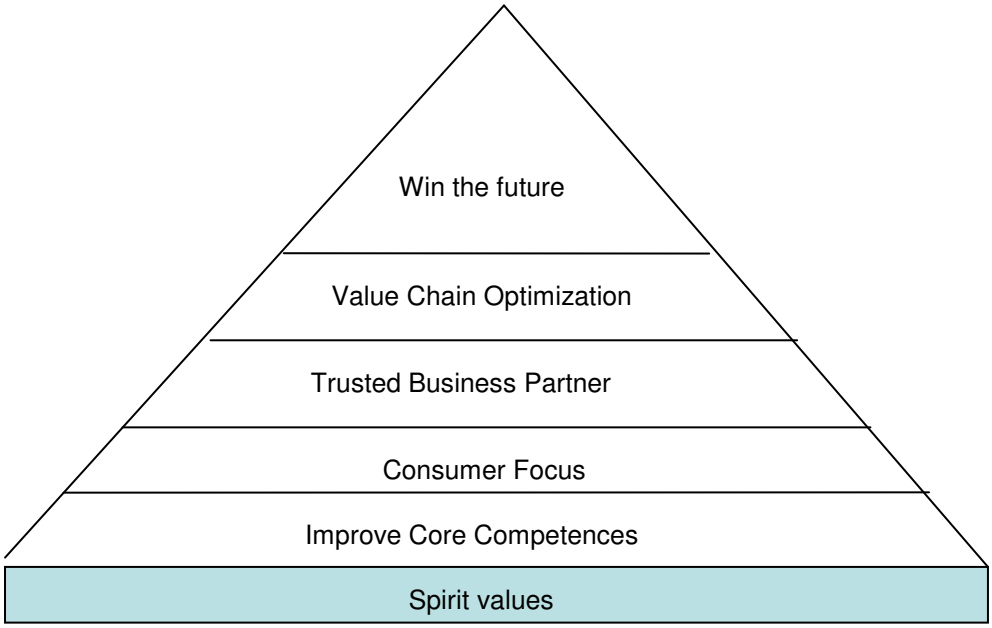
It is important to develop a view of the partners and their characteristics from as many angles as possible. This is in order to get multi dimensional perspectives on the partners and industry. For this purpose there are many models that are helpful, this study, however only deal with Porter's five competitive forces, the Internal Factors Evaluation Matrix, and SWOT (strengths/weaknesses, opportunities/threats). With the aid of a SWOT model a company can analyze what it can do (the organization's strengths and weaknesses) and what it might do in relation to alliance (external opportunities and threats). Strengths and weaknesses have to be balanced against opportunities and threats.
Identification of critical factors for success, takes the descriptions and strategies outlined above to discuss and judge what is required for the vision to succeed. It will identify which factors that will have the greatest effect on the outcome. In other words, the alliance must in this step decide what it thinks is its most critical factors for success (objectives) and rank them in order of priority. We find that there are some success factors for strategic alliance formation and maintenance in textile companies:
1- Maintain market position; 2- Expanding their competencies; 3- Gain access to complementary resources; 4- Compete against common competitor; 5- Reducing

risk and uncertainty; 6- Exchange of complementary technology; 7- Faster pay-back on investment; 8- Reduce competitions; 9- Produce at lower cost location; 10- Conform to government policy. This list of factors will then provide a base for developing key measures.

4.2 Strategy map

Since one of the intended achievements with a Balanced Scorecard is to get the involved partners attention, it should focus on the entity's strategy for maximum impact. The strategic alliance should inform how the company expects to create future, sustainable value. However, no two companies think about strategy in the same way. This was particularly apparent in a study made by us. Textile firms viewed strategy from a financial perspective; sales and marketing executives took a customer perspective; operations people looked at quality, cycle time, and other process perspectives; human resources professionals focused on investments in people; and get new technology. No general way to describe strategy seemed to exist. Without a shared understanding of the strategy, companies cannot create alignment around alliance. For example, partners contributing financial resources when they perceive the relational risk to be high are likely to exhibit a lower level of trust toward their partners. This lack of trust results in a desire to achieve control over the decision-making process. Thus, the partner contributing financial resources often seeks an equity interest in the other partner.

Figure 1: ABS strategy map (Dadashian, Shakibfar 2007)



One way of creating a shared understanding of the strategy is to use a strategy map. This is based on the four-perspective model in the Balanced Scorecard, which provides a language where the executives can describe their firms' value-creating strategy in alliance.

The strategy map (Figure 1) provides a framework to illustrate how strategy links intangible assets to improve core competencies and value-creating processes (Dadashian, Shakibfar 2007).

The customer focus describes the value proposition, which provides context for the intangible assets to create value, for targeted customers. If for instance customers value consistent quality and timely delivery, then the skills, systems, and processes that are involved in this, should be highly valuable to the organizations. If the customer values innovation and high performance, then the partners needs to take high value on processes that are involved in that. Hence, consistent alignment of actions and capabilities with the customer value proposition is essential of strategy execution.

While the financial and customer perspectives describe the desired outcomes from the strategy, the Trusted Business Partner and Value Chain Optimization perspective describes how the partners ought to create these desired outcomes. The Value Chain Optimization perspective identifies the critical few processes that are expected to have the greatest impact on the strategy. A company may for instance want to increase its R&D investments and reengineer its product development processes, so that it can develop high-performance, innovative products for its value chain partners. This identifies the intangible assets that are most important to the strategy. The objectives in this perspective identify which jobs, which systems, and what kind of climate is required to support the value-creating processes.

The objectives in the four perspectives are thus linked together by cause-and-effect relationships. From the top it starts with the hypothesis that financial outcomes can only be achieved if targeted customers are satisfied. It then moves on to the customer value proposition that describes how to generate sales and loyalty from targeted customers. Further, the Trusted Business Partner and Value Chain Optimization describe how to create synergy through partner and deliver the customer value proposition. Lastly, the intangible assets that support the Trusted Business Partner processes provide the foundation for the strategy. This cause-and-effect linking of the four perspectives is the structure around which a strategy map is developed. By building a strategy map one forces an alliance to clarify the logic of how it will create value and for whom.

5 Fuzzy Analysis

The key benefits of the balanced scorecard framework is that the measures are balanced and related, and there is less likelihood of dysfunctional behaviour designed to meet singular objectives. So those objectives illustrated in table 1 are to develop a process to evaluate the alliance making among textile firms.

However, the evaluation of a firm's capability for strategic alliance is not an easy task, involving a host of complex interactions. In such cases, decision-making information is hard to come by and is often vague. Fuzzy set theory was designed to sort through the uncertainties of vague linguistic terms and helps generate a single possible outcome. We provide FMCDM as a means to evaluate alliance making in terms of the balanced scorecard framework.

The first publication in fuzzy set theory by Zadeh (1965) shows: "The notion of fuzzy set provides a convenient point of departure for the construction of a conceptual frame-work which parallels in many respects the framework used in case of ordinary sets, but is more general than the letter and, potentially, may prove to have a much wider scope of applicability, particularly in the fields of pattern classification and information processing. Essentially, such a framework provides a natural way of dealing with problems in which the source of imprecision is the absence of sharply defined criteria of class membership rather than the presence of random variables".

This paper proposes the utilization of the fundamental principles encompassed in the fuzzy set theory to analyze and consider a multiplicity of complex criteria based on the ABS which defined in previous sections and determines the partner's potential for strategic alliances making.

The fundamental emphasis of the current fuzzy multiple criteria decision-making (FMCDM) methodology is the determination, definition, testing and comparison of complex multi-level criteria used in the ABS. The tools and formulas employed are triangular fuzzy numbers and method of ranking them and also the concepts of ideal and anti-ideal solutions.

5.1 Definition of Triangular Fuzzy Number

Among the various types of fuzzy sets, of special significance are fuzzy sets that are defined on the set R of real numbers. Membership functions of these sets, which have the form $A : R \to [0,1]$ clearly have the quantitative meaning and may, under certain conditions, be viewed as a fuzzy numbers or fuzzy intervals. To qualify as a fuzzy number, a fuzzy set A on R must possess at least the following three properties:

1) A must be a normal fuzzy set;

2) A_α must be a closed interval for every $\alpha \in (0,1]$;

2) A_α must be a closed interval for every $\alpha \in (0,1]$;

3) The support of A must be bounded.

A fuzzy number A(a,b,c) in real line R is a triangular fuzzy number if its membership function $f_A : R \to [0,1]$ is

$$f_A(x) = \begin{cases} (x-a)/(b-a), & a \le x \le b \\ (x-c)/(b-c), & b \le x \le c \\ 0 & otherwise \end{cases} \quad (1)$$

where $-\infty < a \le b \le c < \infty$.

5.2 Method of Ranking Triangular Fuzzy Numbers

In a fuzzy decision making environment, ranking the alternatives under consideration is essential. Murakimi et al. (1983) proposed a ranking method which is to find the geometric center (X_o,Y_o) for each fuzzy number. The ordering of fuzzy numbers is performed using both X_o and Y_o values. The centroid point (X_o,Y_o) for fuzzy number A is defined as:

$$X_o = \int_0^1 x.\mu_A(x)\,dx \Big/ \int_0^1 \mu_A(x)\,dx \quad (2)$$

$$Y_o = \int_0^1 x.\mu_A(x)\,d\mu_A(x) \Big/ \int_0^1 \mu_A(x)\,dx \quad (3)$$

According to Murakimi et al. the optimal choice is the fuzzy number that attains the maximum value of either X_o or Y_o. The centroid point $Y_o \in [0,1]$ is always 1/3 for a triangular fuzzy number.

Thus, the ordering of triangular fuzzy numbers performs by comparing X_o values. According to Eq (2) the value of X_o for triangular fuzzy number is calculated by Eq(4).

$$X_o(a,b,c) = \frac{a+b+c}{3} \quad (4)$$

5.3 The concepts of ideal and anti-ideal solutions

They are employed to calculate the relative closeness of the various alternatives versus ideal solutions to rank their priorities, and finally, to determine the best alternative. The main contribution of this paper is that the definition, conversion, and treatment of vague and complex multi-level criteria as set memberships under the fuzzy set theory are employed to develop a practical model for business purpose.

6 Calculations

This paper proposes a systematic approach for the evolution of strategic alliance partners using the concepts of fuzzy set theory, and ideal and anti-ideal solutions. The steps to be taken are described below.

Step1: Let m and n respectively denote the numbers of alternatives and the sub-criteria above the alternative level.

Allow X_{ij}^{k} i=1,2,…,m , j=1,2,…,n , k=1,2,…,r , to be triangular fuzzy number evaluation value of i_{th} alternative under j_{th} sub-criteria according to the opinion of k_{th} decision maker. In this paper we have tested the algorithm on a real world example in textile industry with 33 sub-criteria, 3 companies and 2 decision makers. The importance of decision makers ideas are not the same, so we considered weight 0.7 for the first DM and 0.3 for the second DM.
The resulting fuzzy number and its representative value for the i_{th} fuzzy number under j_{th} sub-criteria are shown in Equations (5) and (6).

$$X_{i,j} = 0.7 * X_{i,j}^{1} + 0.3 * X_{i,j}^{2} = (0.7a_{i,j}^{1} + 0.3a_{i,j}^{2}, 0.7b_{i,j}^{1} + 0.3b_{i,j}^{2}, 0.7c_{i,j}^{1} + 0.3c_{i,j}^{2}) \quad (5)$$

$$R(X_{i,j}) = 0.7 * (a_{i,j}^{1} + b_{i,j}^{1} + c_{i,j}^{1}) + 0.3 * (a_{i,j}^{2} + b_{i,j}^{2} + c_{i,j}^{2}) \quad (6)$$

Allow w_i and $w_{i,j}$ to be fuzzy weights given to criteria $C_1, C_2, \ldots, C_i$ and j_{th} sub-criteria under i_{th} criteria $C_{11}, \ldots, C_{1n_1}, \ldots, C_{i1}, \ldots, C_{in_i}, \ldots, C_{k1}, \ldots, C_{kn_k}$ for i=1,2,…,k and j=1,2,…,n_i

So the integration weight of sub-criteria $C_{i,j}$ denoted by $w_{i,j}^{*}$ can be obtained as follows:

$$w_{i,j}^{*} = \frac{R(w_i)}{\sum_{i=1}^{k} R(w_i)} \cdot \frac{R(w_{i,j})}{\sum_{j=1}^{n_i} R(w_{i,j})} \quad (7)$$

In this research, weighting set W = {VL, L, M, H, VH} and rating set S = {VP, P, F, G, VG}, where VL = Very Low, L = Low, M = Medium, H = High, VH = Very High, VP = Very Poor, P = Poor, F = Fair, G = Good, and VG = Very Good is considered. Both sets are used to evaluate the importance weights of all criteria and sub-criteria as well as the fuzzy ratings of alternatives versus various sub-criteria above the alternative level, respectively. Define VL = (0, 0, 0.3), L = (0, 0.3, 0.5), M = (0.2, 0.5,0.8), H = (0.5, 0.7, 1), VH = (0.7, 1,1), VP = (0, 0, 0.2), P = (0, 0.2, 0.4), F =(0.3, 0.5, 0.7), G = (0.6, 0.8, 1), and VG = (0.8, 1, 1).
The results obtained from evaluate importance weights of all criteria and sub-criteria as well as the superiority of alternatives versus various sub-criteria are shown in tables (2) and (3).

Table 2. The importance weights of all criteria and sub-criteria

criteria/sub-criteria	Decision Maker	Linguistic Values	Fuzzy Weights	A	B	C	Representation value	Subjective integration weights
C1	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	
	DM2	VH	(0.7,1,1)	0.7	1	1		
C1,1	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	0.07490
	DM2	VH	(0.7,1,1)	0.7	1	1		
C1,2	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.337	0.04596
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C1,3	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.267	0.00849
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		
C1,4	DM1	VL	(0,0,0.3)	0	0	0.3	0.100	0.00329
	DM2	VL	(0,0,0.3)	0	0	0.3		
C1,5	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.217	0.00407
	DM2	VL	(0,0,0.3)	0	0	0.3		
C1,6	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.337	0.00995
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C1,7	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	0.02354
	DM2	VH	(0.7,1,1)	0.7	1	1		
C1,8	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	0.06079
	DM2	VH	(0.7,1,1)	0.7	1	1		
C1,9	DM1	VL	(0,0,0.3)	0	0	0.3	0.150	0.01465
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		
C2	DM1	H	(0.5,0.7,1)	0.5	0.7	1	0.733	
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C2,1	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.407	0.02137
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C2,2	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	0.04055
	DM2	VH	(0.7,1,1)	0.7	1	1		
C2,3	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.570	0.04131
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C2,4	DM1	VL	(0,0,0.3)	0	0	0.3	0.220	0.01550
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C2,5	DM1	VH	(0.7,1,1)	0.7	1	1	0.850	0.03780
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C2,6	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	0.11922
	DM2	VH	(0.7,1,1)	0.7	1	1		
C2,7	DM1	H	(0.5,0.7,1)	0.5	0.7	1	0.733	0.07510
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C2,8	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.570	0.04536
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C2,9	DM1	VL	(0,0,0.3)	0	0	0.3	0.150	0.01250
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		
C3	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.500	
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C3,1	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.217	0.00960
	DM2	VL	(0,0,0.3)	0	0	0.3		
C3,2	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.500	0.01417
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C3,3	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.337	0.01513
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C3,4	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.570	0.02301

	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C3,5	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.267	0.03055
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		
C3,6	DM1	H	(0.5,0.7,1)	0.5	0.7	1	0.783	0.03123
	DM2	VH	(0.7,1,1)	0.7	1	1		
C3,7	DM1	H	(0.5,0.7,1)	0.5	0.7	1	0.733	0.06307
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C3,8	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.217	0.01909
	DM2	VL	(0,0,0.3)	0	0	0.3		
C3,9	DM1	H	(0.5,0.7,1)	0.5	0.7	1	0.663	0.02582
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C4	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.500	
	DM2	M	(0.2,0.5,0.8)	0.2	0.5	0.8		
C4,1	DM1	VL	(0,0,0.3)	0	0	0.3	0.150	0.01333
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		
C4,2	DM1	VH	(0.7,1,1)	0.7	1	1	0.900	0.04061
	DM2	VH	(0.7,1,1)	0.7	1	1		
C4,3	DM1	M	(0.2,0.5,0.8)	0.2	0.5	0.8	0.570	0.17905
	DM2	H	(0.5,0.7,1)	0.5	0.7	1		
C4,4	DM1	VL	(0,0,0.3)	0	0	0.3	0.150	0.09492
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		
C4,6	DM1	VL	(0,0,0.3)	0	0	0.3	0.100	0.03934
	DM2	VL	(0,0,0.3)	0	0	0.3		
C4,6	DM1	L	(0,0.3,0.5)	0	0.3	0.5	0.267	0.06977
	DM2	L	(0,0.3,0.5)	0	0.3	0.5		

Table 3. The superiority of alternatives versus sub-criteria

		company A			company B			company C		
		Linguistic value	fuzzy score	Reprentation value	Linguistic value	fuzzy score	Reprentation value	Linguistic value	fuzzy score	Reprentation value
C1,1	DM1	P	(0,0.2,0.4)	0.160	P	(0,0.2,0.4)	0.160	VP	(0,0,0.2)	0.107
	DM2	M	(0,0,0.2)		VP	(0,0,0.2)		P	(0,0.2,0.4)	
C1,2	DM1	VP	(0,0,0.2)	0.107	G	(0.6,0.8,1)	0.800	G	(0.6,0.8,1)	0.710
	DM2	P	(0,0.2,0.4)		G	(0.6,0.8,1)		F	(0.3,0.5,0.7)	
C1,3	DM1	VG	(0.8,1,1)	0.933	F	(0.3,0.5,0.7)	0.590	P	(0,0.2,0.4)	0.290
	DM2	VG	(0.8,1,1)		G	(0.6,0.8,1)		F	(0.3,0.5,0.7)	
C1,4	DM1	F	(0.3,0.5,0.7)	0.590	G	(0.6,0.8,1)	0.840	G	(0.6,0.8,1)	0.840
	DM2	G	(0.6,0.8,1)		VG	(0.8,1,1)		VG	(0.8,1,1)	
C1,5	DM1	F	(0.3,0.5,0.7)	0.500	G	(0.6,0.8,1)	0.710	VG	(0.8,1,1)	0.933
	DM2	F	(0.3,0.5,0.7)		F	(0.3,0.5,0.7)		VG	(0.8,1,1)	
C1,6	DM1	G	(0.6,0.8,1)	0.710	VG	(0.8,1,1)	0.933	F	(0.3,0.5,0.7)	0.590
	DM2	F	(0.3,0.5,0.7)		VG	(0.8,1,1)		G	(0.6,0.8,1)	
C1,7	DM1	P	(0,0.2,0.4)	0.160	G	(0.6,0.8,1)	0.800	F	(0.3,0.5,0.7)	0.500
	DM2	VP	(0,0,0.2)		G	(0.6,0.8,1)		F	(0.3,0.5,0.7)	
C1,8	DM1	F	(0.3,0.5,0.7)	0.500	F	(0.3,0.5,0.7)	0.370	F	(0.3,0.5,0.7)	0.410
	DM2	F	(0.3,0.5,0.7)		VP	(0,0,0.2)		P	(0,0.2,0.4)	
C1,9	DM1	G	(0.6,0.8,1)	0.800	G	(0.6,0.8,1)	0.620	F	(0.3,0.5,0.7)	0.500
	DM2	G	(0.6,0.8,1)		P	(0,0.2,0.4)		F	(0.3,0.5,0.7)	
C2,1	DM1	VG	(0.8,1,1)	0.803	G	(0.6,0.8,1)	0.800	G	(0.6,0.8,1)	0.840
	DM2	F	(0.3,0.5,0.7)		G	(0.6,0.8,1)		VG	(0.8,1,1)	
C2,2	DM1	G	(0.6,0.8,1)	0.840	P	(0,0.2,0.4)	0.290	G	(0.6,0.8,1)	0.840
	DM2	VG	(0.8,1,1)		F	(0.3,0.5,0.7)		VG	(0.8,1,1)	
C2,3	DM1	F	(0.3,0.5,0.7)	0.500	G	(0.6,0.8,1)	0.840	VG	(0.8,1,1)	0.803
	DM2	F	(0.3,0.5,0.7)		VG	(0.8,1,1)		F	(0.3,0.5,0.7)	

C2,4	DM1	P	(0,0.2,0.4)	0.160	G	(0.6,0.8,1)	0.800	G	(0.6,0.8,1)	0.620
	DM2	VP	(0,0,0.2)		G	(0.6,0.8,1)		P	(0,0.2,0.4)	
C2,5	DM1	G	(0.6,0.8,1)	0.800	VP	(0,0,0.2)	0.197	P	(0,0.2,0.4)	0.290
	DM2	G	(0.6,0.8,1)		F	(0.3,0.5,0.7)		F	(0.3,0.5,0.7)	
C2,6	DM1	P	(0,0.2,0.4)	0.160	G	(0.6,0.8,1)	0.580	F	(0.3,0.5,0.7)	0.590
	DM2	VP	(0,0,0.2)		VP	(0,0,0.2)		G	(0.6,0.8,1)	
C2,7	DM1	G	(0.6,0.8,1)	0.840	G	(0.6,0.8,1)	0.710	G	(0.6,0.8,1)	0.840
	DM2	VG	(0.8,1,1)		F	(0.3,0.5,0.7)		VG	(0.8,1,1)	
C2,8	DM1	F	(0.3,0.5,0.7)	0.410	P	(0,0.2,0.4)	0.200	P	(0,0.2,0.4)	0.200
	DM2	P	(0,0.2,0.4)		P	(0,0.2,0.4)		P	(0,0.2,0.4)	
C2,9	DM1	P	(0,0.2,0.4)	0.200	P	(0,0.2,0.4)	0.290	P	(0,0.2,0.4)	0.200
	DM2	P	(0,0.2,0.4)		F	(0.3,0.5,0.7)		P	(0,0.2,0.4)	
C3,1	DM1	VP	(0,0,0.2)	0.197	G	(0.6,0.8,1)	0.840	G	(0.6,0.8,1)	0.840
	DM2	F	(0.3,0.5,0.7)		VG	(0.8,1,1)		VG	(0.8,1,1)	
C3,2	DM1	VG	(0.8,1,1)	0.933	F	(0.3,0.5,0.7)	0.590	F	(0.3,0.5,0.7)	0.590
	DM2	VG	(0.8,1,1)		G	(0.6,0.8,1)		G	(0.6,0.8,1)	
C3,3	DM1	VG	(0.8,1,1)	0.893	F	(0.3,0.5,0.7)	0.500	P	(0,0.2,0.4)	0.290
	DM2	G	(0.6,0.8,1)		F	(0.3,0.5,0.7)		F	(0.3,0.5,0.7)	
C3,4	DM1	P	(0,0.2,0.4)	0.160	VP	(0,0,0.2)	0.067	F	(0.3,0.5,0.7)	0.590
	DM2	VP	(0,0,0.2)		VP	(0,0,0.2)		G	(0.6,0.8,1)	
C3,5	DM1	G	(0.6,0.8,1)	0.840	VG	(0.8,1,1)	0.893	F	(0.3,0.5,0.7)	0.590
	DM2	VG	(0.8,1,1)		G	(0.6,0.8,1)		G	(0.6,0.8,1)	
C3,6	DM1	P	(0,0.2,0.4)	0.290	G	(0.6,0.8,1)	0.800	G	(0.6,0.8,1)	0.840
	DM2	F	(0.3,0.5,0.7)		G	(0.6,0.8,1)		VG	(0.8,1,1)	
C3,7	DM1	G	(0.6,0.8,1)	0.620	F	(0.3,0.5,0.7)	0.630	F	(0.3,0.5,0.7)	0.410
	DM2	P	(0,0.2,0.4)		VG	(0.8,1,1)		P	(0,0.2,0.4)	
C3,8	DM1	F	(0.3,0.5,0.7)	0.370	F	(0.3,0.5,0.7)	0.590	P	(0,0.2,0.4)	0.160
	DM2	VP	(0,0,0.2)		G	(0.6,0.8,1)		VP	(0,0,0.2)	
C3,9	DM1	G	(0.6,0.8,1)	0.710	G	(0.6,0.8,1)	0.800	G	(0.6,0.8,1)	0.710
	DM2	F	(0.3,0.5,0.7)		G	(0.6,0.8,1)		F	(0.3,0.5,0.7)	
C4,1	DM1	F	(0.3,0.5,0.7)	0.500	G	(0.6,0.8,1)	0.710	G	(0.6,0.8,1)	0.800
	DM2	F	(0.3,0.5,0.7)		F	(0.3,0.5,0.7)		G	(0.6,0.8,1)	
C4,2	DM1	P	(0,0.2,0.4)	0.290	G	(0.6,0.8,1)	0.840	G	(0.6,0.8,1)	0.800
	DM2	F	(0.3,0.5,0.7)		VG	(0.8,1,1)		G	(0.6,0.8,1)	
C4,3	DM1	G	(0.6,0.8,1)	0.840	G	(0.6,0.8,1)	0.620	G	(0.6,0.8,1)	0.840
	DM2	VG	(0.8,1,1)		P	(0,0.2,0.4)		VG	(0.8,1,1)	
C4,4	DM1	VP	(0,0,0.2)	0.067	P	(0,0.2,0.4)	0.290	VP	(0,0,0.2)	0.107
	DM2	VP	(0,0,0.2)		F	(0.3,0.5,0.7)		P	(0,0.2,0.4)	
C4,5	DM1	VG	(0.8,1,1)	0.803	G	(0.6,0.8,1)	0.620	G	(0.6,0.8,1)	0.840
	DM2	F	(0.3,0.5,0.7)		P	(0,0.2,0.4)		VG	(0.8,1,1)	
C4,6	DM1	F	(0.3,0.5,0.7)	0.590	G	(0.6,0.8,1)	0.840	G	(0.6,0.8,1)	0.800
	DM2	G	(0.6,0.8,1)		VG	(0.8,1,1)		G	(0.6,0.8,1)	

Step2:

Because values of $X_{i,j}$ are between zero and one it is no need to normalize the values of decision matrix.

If consider I_j^+, I_j^- as defined in equations (8) and (9) the ideal and anti-ideal solutions I^+, I^- determine respectively.

$$I_j^+ = \max_i \{X_{i,j}\} \quad (8)$$

$$I_j^- = \min_i \{X_{i,j}\} \quad (9)$$

Results are shown in table (4).

Table 4. The ideal and anti-ideal solutions

		Company A	Company B	Company C	I+	I-	Wj
c11	1	0.160	0.160	0.107	0.160	0.1067	0.0749
c12	2	0.107	0.800	0.710	0.800	0.1067	0.0280
c13	3	0.933	0.590	0.290	0.933	0.2900	0.0222
c14	4	0.590	0.840	0.840	0.840	0.5900	0.0083
c15	5	0.500	0.710	0.933	0.933	0.5000	0.0180
c16	6	0.710	0.933	0.590	0.933	0.5900	0.0280
c17	7	0.160	0.800	0.500	0.800	0.1600	0.0749
c18	8	0.500	0.370	0.410	0.500	0.3700	0.0749
c19	9	0.800	0.620	0.500	0.800	0.5000	0.0125
c21	10	0.803	0.800	0.840	0.840	0.8000	0.0214
c22	11	0.840	0.290	0.840	0.840	0.2900	0.0473
c23	12	0.500	0.840	0.803	0.840	0.5000	0.0299
c24	13	0.160	0.800	0.620	0.800	0.1600	0.0116
c25	14	0.800	0.197	0.290	0.800	0.1967	0.0447
c26	15	0.160	0.580	0.590	0.590	0.1600	0.0473
c27	16	0.840	0.710	0.840	0.840	0.7100	0.0385
c28	17	0.410	0.200	0.200	0.410	0.2000	0.0299
c29	18	0.200	0.290	0.200	0.290	0.2000	0.0079
c31	19	0.197	0.840	0.840	0.840	0.1967	0.0096
c32	20	0.933	0.590	0.590	0.933	0.5900	0.0221
c33	21	0.893	0.500	0.290	0.893	0.2900	0.0149
c34	22	0.160	0.067	0.590	0.590	0.0667	0.0252
c35	23	0.840	0.893	0.590	0.893	0.5900	0.0118
c36	24	0.290	0.800	0.840	0.840	0.2900	0.0347
c37	25	0.620	0.630	0.410	0.630	0.4100	0.0325
c38	26	0.370	0.590	0.160	0.590	0.1600	0.0096
c39	27	0.710	0.800	0.710	0.800	0.7100	0.0294
c41	28	0.500	0.710	0.800	0.800	0.5000	0.0133
c42	29	0.290	0.840	0.800	0.840	0.2900	0.0800

c43	30	0.840	0.620	0.840	0.840	0.6200	0.0507
c44	31	0.067	0.290	0.107	0.290	0.0667	0.0133
c45	32	0.803	0.620	0.840	0.840	0.6200	0.0089
c46	33	0.590	0.840	0.800	0.840	0.5900	0.0237

Step3:
Suppose that the integrated weight of j_{th} sub-criteria above the alternative level to be w_j^*, then the distance of different alternatives versus I^+, I^- which were denoted by S_i^+, S_i^- is calculated by equations (10) and (11).

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (w_j^*.X_{i,j} - w_j^* I_j^+}, \qquad i = 1,2,...,m \tag{10}$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} (w_j^*.X_{i,j} - w_j^* I_j^-}, \qquad i = 1,2,...,m \tag{11}$$

And the numeric results are as follows:

S1+	S2+	S3+
0.076681	0.045172	0.041125

S1-	S2-	S3-
0.106071	0.12936	0.112024

Step4:
Calculate the alternative closeness to the ideal solution. The alternative closeness of i_{th} alternative is defined as:

$$S_i^* = \frac{S_i^-}{S_i^+ + S_i^-}, \quad 0 \le S \le 1,\ i = 1,2,...,m \tag{12}$$

which m is the number of alternatives.
The final results of evaluating firms' capabilities to make alliance can be calculated as follows.

S1*	S2*	S3*
0.58041	0.741183	0.731469

Those firms with the maximum S_i^* value have the most potential to enter strategic alliances.

7 Conclusions

Several alternatives must be considered and evaluated in terms of many different conflicting criteria in an alliance making for textile companies, leading to a large set of subjective or ambiguous data, so developing ABS introduced the new approach for measuring Strategic Alliances performance. One of the key benefits of the balanced scorecard framework is that the measures are balanced and related, and there is less likelihood of dysfunctional behaviour designed to meet singular objectives. Another implication is that we have to expand our thinking on alliance "success." Traditional alliance success measures such as duration and financial-based metrics may be insufficient if the business strategy is to reduce exposure to risk or to develop industry standards. Alliance success measurement, therefore, should include a linkage to business strategy.

The paper provides guidance for selecting measuring for strategic alliances making in the four Balanced Scorecard perspectives, and described the emerging system for managing strategic alliances. In order to design a more effective decision-making process, we propose a fuzziness based MCDM approach for evaluating ABS criteria in strategic alliances making process for a Textile firm and the proposed approach has successfully accomplished our goal by developing a Strategic Alliances making model. These finding provide the rationale for a firm in alliance to develop a Strategy Map and Balanced Scorecard as part of the Strategic Alliance making integration process and evaluate a firm's capability for strategic alliances making with data analysis in fuzzy environment.

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