A NEW HYBRID MCDM MODEL FOR SME EXPORT FINANCING

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Abstract

The purpose of this study is to propose a new model for sme export financing . In this study of 11 experts in the field of finance and exports have been used. The first step is to identify the factors of the fuzzy Delphi method was used to obtain the eight factors. These factors are include the structural, financial resources, legislation, financial market, finance system, export strategy, competitiveness and investment. In order to structuring and prioritizing the factors of fuzzy DEMATEL method was used. The DEMATEL method can convert the relationship between the causes and effects of criteria into an intelligible structural model of the system.The result of this method is that the legislative in priority.

Keywords: SME export financing, Legislative, Hybrid MCDM model , Fuzzy Delphi, Fuzzy DEMATEL

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1.Introduction

For businesses, exporting generates funds for reinvestment and growth, spreads business risks across different markets, and exploits operating capacity(Shih & Wickramasekera,2010). International activity by small firms contributes strongly to higher levels of competition and economic growth.Thus, governments are concerned with generating greater export volume and increasing the focus on the competitiveness of SMEs in international markets(Doole, Grimes, & Demack, 2006). Small- and medium-sized enterprises (SMEs) have been playing a rather important role in both developed and developing economies. However, they often encounter more difficulties than do their large counterparts since they are more opaque and short of assets that can be used as collateral(Yifu & Xifang ,2006).From the perspective of a firm, export activity can be viewed as a learning process, where in firms gradually became familiar with overseas markets and operations. Acquisition of sufficient information on foreign markets and operations is crucial for a firm's export decision (Silvente & Gimenez, 2007). The ability of a business to participate in export markets is often seen as an indicator of its competitiveness and success. The evidence for this suggests that exporters are more productive than non-exporters.The benefits of internationalization that may accrue to SMEs confronted with their limited financial and non-financial resources pose an important challenge for policy design (Perez & Rodriguez, 2012). Finally, export activities can positively contribute to the achievement of family SME competitive advantage(Calabro, & Mussolino,2011). The global financial crisis, triggered by the massive number of non-performing subprime loans owned by financial institutions in the United States, plunged the export-led Japanese economy into a severe recession (Ogawa& Tanaka,2012). Understanding variables that affect the success or failure of growth are important, especially at the firm level. One variable that fundamentally affects how firms expand domestically and internationally is financing since it affects both the acquisition of resources and business operations (Smolarski &Kut, 2011). Given that small and medium enterprises (SMEs) are responsible for significant levels of employment, innovation and productivity, it is important that policy makers and advisers are well informed about the determinants of SME growth and, in particular, the various supply and demand-side issues surrounding the provision of growth funding for this sector(Mahuka,2009). The availability of financing for SMEs have the subject of growing attention in recent years based on the role SMEs

play in economics growth (Zhangliu, Lan&Kai,2012). One of the major bottlenecks to the growth of SMEs in India is access to finance (Thampy,2010). The focus of this study is to identifying , structuring and prioritizing the factors affecting sme export financing. As the purpose of this study, the following research questions are posed:

RQ1. What are the factors affecting sme export financing?

RQ2. What is the Systematic structure (Dyagraf) relationship between the factors?

RQ3. What are the priorities of these factors?

2. Literature review

Carbo, Rodrı´guez, and Udell (2008) argue that the issue of bank competition and credit availability may matter most to SMEs for two reasons. First, SMEs are more vulnerable to information problems. Second, SMEs are much more bank-dependent than large enterprises study of a large number of Spanish SMEs suggests that constrained firms with restricted access to the bank loan market may turn to the trade credit market to exploit their investment opportunities, while unconstrained firms would turn to the bank loan market. Additionally, they analyse the supply side of the trade credit market by testing whether the extension of trade credit is sensitive to bank lending. They find that there is a significant sensitivity of the extension of trade credit to bank lending for unconstrained firms, thereby, suggesting that these financially unconstrained firms may act as'lenders' due to their easier access to a less costly source of funding (Thampy,2010). Allan Riding an article by " Financing new venture exporters " Reviews, How can small and medium-sized exporting and non-exporting firms to finance their own deals. In this study, to conclude that small and medium enterprises exporter generally seek financing from external sources are , because the designs emerging small and medium enterprises is difficult to get a loan(Riding et al.2012). In other studies it was found that the growth opportunities , tax shield and internal resources influence the capital structure of small and medium enterprises are. Moreover, the empirical evidence obtained confirms that small and medium enterprises are clearly different behavior than large firms exert ,These firms often have concerns about their finances (Gracia&Mira,2008). Some studies show that less access to credit and lack of competitiveness of banks in order to finance Create constraints for small and medium enterprises in the field of finance (Valverde et al .2009).

3. Building a new hybrid MCDM model for sme export financing

This research uses the fuzzy Delphi method and fuzzy DEMATEL technique to establish a new hybrid MCDM model to structuring and prioritizing the factors affecting sme export financing. The research processes are illustrated as Fig. 1.

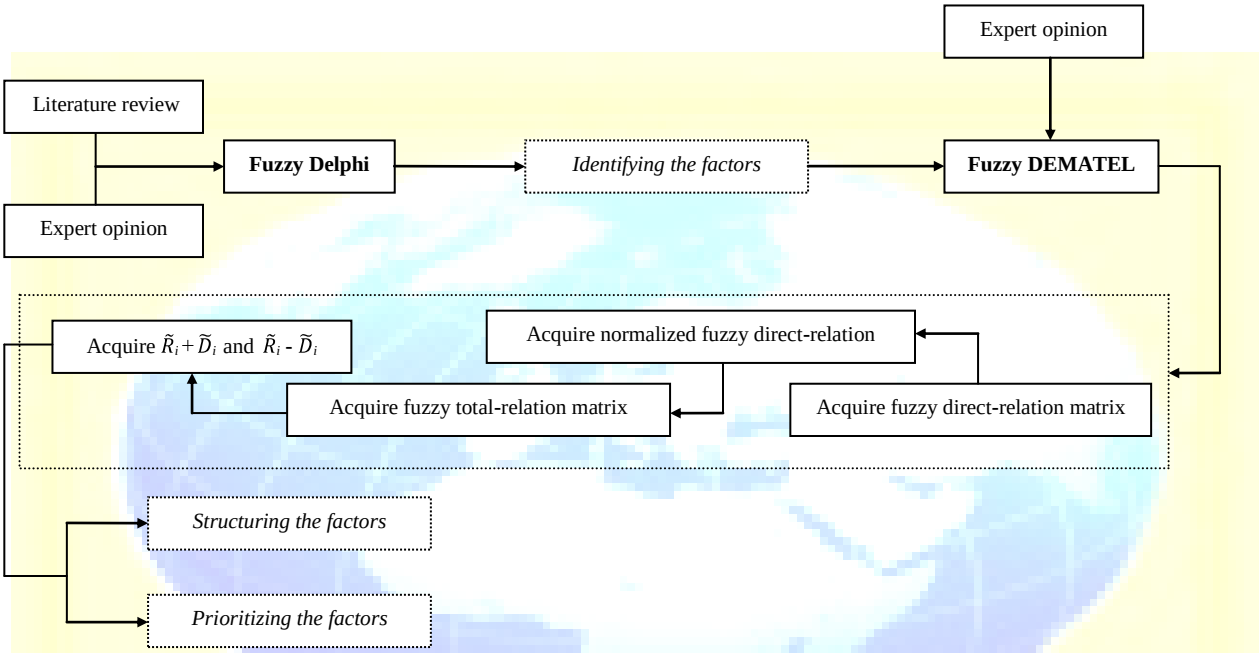

Fig. 1. Model procedure of the current research.

3.1. Fuzzy Delphi Method (FDM)

The Delphi Method was first developed by Dalkey and Helmer (1963) in corporation and has been widely applied in many management areas, e.g. forecasting, public policy analysis, and project planning. However, the conventional Delphi Method does not converge very well. Thus, the fuzzy set theory was applied in the Delphi Method to improve the effect (Chang&Wang,2006). Fuzzy Delphi Method was proposed by Ishikawa et al. (1993), andit was derived fromthe traditional Delphi technique and fuzzy set the ory(Hsu, Lee & Kreng,2010). The FDM steps are as follows:

Step 1: Select Expert : In the first phase the fuzzy Delphi method , the choice of experts on the subject , method and period of the study are explained.

Step 2: Mining and explaining the proposed options.

Step 3: Definition of linguistic variables: In this study, the variables are defined as trapezoidal fuzzy numbers.

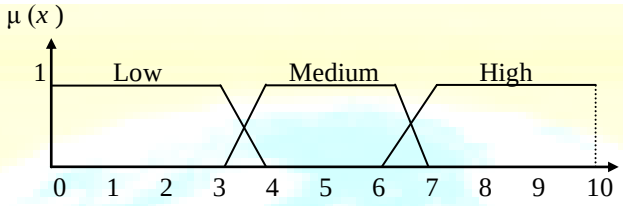

Fig. 2. Schematic diagram of Fuzzy Delphi Method threshold.

Step 4: Distribution of questionnaires: Mean experts is calculated by the formula :

$$A^{(i)} = (a_1^{(i)}, a_2^{(i)}, a_3^{(i)}, a_4^{(i)}) \ , \ i=1,2 \ldots ,n \qquad (1)$$

$$A_m = (a_{m1}^{(i)}, a_{m2}^{(i)}, a_{m3}^{(i)}, a_{m4}^{(i)}) = (1/n\sum a_1^{(i)}, 1/n\sum a_2^{(i)}, 1/n\sum a_3^{(i)}, 1/n\sum a_4^{(i)}) \qquad (2)$$

Step 5: The experts disagree with each of the mean is calculated according to the equation :

$$e =(a_{m1} - a_1^{(i)}, a_{m2} - a_2^{(i)}, a_{m3} - a_3^{(i)}, a_{m4} - a_4^{(i)}) = (1/n\sum a_1^{(i)} - a_1^{(i)}, 1/n\sum a_2^{(i)} - a_2^{(i)}, 1/n\sum a_3^{(i)} - a_3^{(i)}, 1/n\sum a_4^{(i)} - a_4^{(i)}) \qquad (3)$$

Step 6: Finally , using the following equations to calculate the distance between fuzzy numbers and the difference is less than the threshold (eg, 0.2) is less fuzzy Delphi process stops. And if this is not the process is repeated(Cheng&Lin,2002).

$$S (A_{m2} , A_{m1}) = | \frac{1}{4} [(a_{m21} + a_{m22} + a_{m23} + a_{m24}) - (a_{m11} + a_{m12} + a_{m13} + a_{m14})] | \qquad (4)$$

3.2. Fuzzy DEMATEL Method

The Decision Making Trial and Evaluation Laboratory (DEMATEL) method is presented in 1973, as a kind of structural modeling approach about a problem. It can clearly see the cause-effect relationship of criteria when measuring a problem. The DEMATEL method gathers

collective knowledge to capture the causal relationships between strategic criteria. The model is especially practical and useful for visualizing the structure of complicated causal relationships with matrices or digraphs. The matrices or digraph portrays a contextual relation between the elements of the system, in which a numeral represents the strength of influence. Hence, the DEMATEL method can convert the relationship between the causes and effects of criteria into an intelligible structural model of the system. (Jassbi, Mohamadnejad &Nasrollahzadeh,2011). Steps of this technique are as follows:

Step 1: Design fuzzy linguistic scale for evaluations. In this step, development of relationships within and among the attributes using experts' opinion through paired comparison analysis is needed. Firstly, for the purpose of measuring the relationships, it is required to design the comparison scale as shown in Table 1.

Table 1. Corresponding linguistic terms for evaluation.

Linguistic term	Abbrev.	Fuzzy scales
None	N	(0 , 0 ,0.1)
Very Low	VL	(0 , 0.1 ,0.2)
Low	L	(0.1 , 0.2 ,0.3)
Fairly Low	FL	(0.2 , 0.3 ,0.4)
More or less Low	ML	(0.3 , 0.4 ,0.5)
Medium	M	(0.4 , 0.5 ,0.6)
More or less Good	MG	(0.5 , 0.6 ,0.7)
Fairly Good	FG	(0.6 , 0.7 ,0.8)
Good	G	(0.7 , 0.8 ,0.9)
Very Good	VG	(0.8 , 0.9 , 1)
Excellent	E	(0.9 , 1 , 1)

The different degrees of influence are expressed with eleven linguistic terms and the equivalent fuzzy membership functions for linguistic values are shown in Fig. 3.

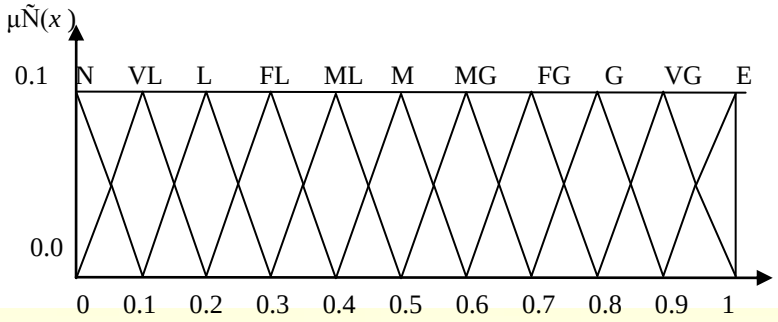

Fig. 3. Fuzzy membership functions for linguistic values.

Step 2: Acquire fuzzy direct-relation matrix. Experts make sets of the pairwise comparisons in terms of influence and direction within necessary criteria that is a $n \times n$ matrix $\tilde{A}$, in which $\tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij})$ is denoted as the degree to which the criterion i affects the criterion j for experts.

$$\tilde{A} = \begin{bmatrix} \tilde{a}11 & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \tilde{a}_{21} & \tilde{a}_{22} & \cdots & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & \tilde{a}_{nn} \end{bmatrix} \quad (5)$$

Step 3: Acquire normalized fuzzy direct-relation matrix. After producing the direct-relation matrix as the first step, we can continue with normalizing the direct-direction matrix as in DEMATEL method. On the base of the direct-relation matrix $\tilde{A}$, the normalized direct-relation matrix $\tilde{X}$ can be obtained through Eq. (6).

Let $\tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij})$ and $s = 1/\max 1 \ll i \ll n \ \sum_{j=1}^{n} u_{ij}$, then $\tilde{X} = s \times \tilde{A}$ (6)

Step 4: Acquire fuzzy total-relation matrix. As soon as the normalized direct-relation matrix $\tilde{X}$ is obtained, the total-relation matrix $\tilde{T}$, can be acquired by using the following formulas, in which the I is denoted as the identity matrix(Buyukozkan & Cifci,2012).

$$\tilde{T} = \lim k \to \infty \ (\tilde{X}^{1} + \tilde{X}^{2} + \ldots + \tilde{X}^{k}) \quad (7)$$

$$\tilde{T} = \begin{bmatrix} \tilde{t}_{11} & \tilde{t}_{12} & \cdots & \tilde{t}_{1n} \\ \tilde{t}_{21} & \tilde{t}_{22} & \cdots & \tilde{t}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{t}_{n1} & \tilde{t}_{n2} & \cdots & \tilde{t}_{nn} \end{bmatrix} \quad (8)$$

where $\tilde{t}_{ij} = (l'_{ij}, m'_{ij}, u'_{ij})$ then

$$[l'_{ij}] = X_l \ (I - X_l)^{-1} \quad (9)$$

$$[m'_{ij}] = X_m \ (I - X_m)^{-1} \quad (10)$$

$$[u'_{ij}] = X_u \ (I - X_u)^{-1} \quad (11)$$

Step 5: Acquire $\tilde{R}_i + \tilde{D}_i$ and $\tilde{R}_i - \tilde{D}_i$. By producing matrix $\tilde{T}$, $\tilde{R}_i + \tilde{D}_i$ and $\tilde{R}_i - \tilde{D}_i$ in which $\tilde{D}_i$ and $\tilde{R}_i$ are the sum of row and the sum of columns of $\tilde{T}$ respectively.To finalize the procedure, all calculated $\tilde{R}_i + \tilde{D}_i$ and $\tilde{R}_i - \tilde{D}_i$ are defuzified through suitable defuzification method. Then, there would be two sets of numbers: $(\tilde{D}_i + \tilde{R}_i)^{def}$ which shows how important the factors are, and $(\tilde{D}_i - \tilde{R}_i)^{def}$ which shows which factors is cause and which one is effect. Generally, if the value $(\tilde{D}_i - \tilde{R}_i)^{def}$ is positive, the factors belong to the cause group, and if the value $(\tilde{D}_i - \tilde{R}_i)^{def}$ is negative, the factors belong to the effect group(Jassbi, Mohamadnejad &Nasrollahzadeh,2011).

4.Analysis and results

The results of fuzzy Delphi process analysis are presented in Table 2. The eight factors used in the analysis process will continue.

Table 2. The factors

Symbol	Factors	Symbol	Factors
A	Legislation	**E**	Finance system
B	Structural	**F**	Export strategy
C	Financial resources	**G**	Competitiveness
D	Financial market	**H**	Investment

$(\widetilde{D}_i+\widetilde{R}_i)^{def}$ which shows how important the factors are, and $(\widetilde{D}_i-\widetilde{R}_i)^{def}$ which shows which factors is cause and which one is effect. Generally, if the value $(\widetilde{D}_i-\widetilde{R}_i)^{def}$ is positive, the factors belong to the cause group, and if the value $(\widetilde{D}_i-\widetilde{R}_i)^{def}$ is negative, the factors belong to the effect group. As can be seen in Table 3, the most important factor influencing on the financing of small and medium enterprises is Legislation.

Table 3 . Prioritization of the factors

Factors	$(\widetilde{D}_i+\widetilde{R}_i)^{def}$	Priority	Factors	$(\widetilde{D}_i+\widetilde{R}_i)^{def}$	Priority
Legislation	3.470	1	Finance system	2.009	7
Structural	2.854	4	Export strategy	1.885	8
Financial resources	2.807	5	Competitiveness	2.192	6
Financial market	3.189	3	Investment	3.303	2

In Table 4, how the factors in causal group and , how the factors in effect group is shown.

Table 4 . Cause group and effect group

Symbol	Factors	$(\widetilde{D}_i-\widetilde{R}_i)^{def}$	Cause group	Effect group
A	Legislation	0.880	*	-
B	Structural	0.830	*	-
C	Financial resources	-0.002	-	*
D	Financial market	-0.807	-	*
E	Finance system	-0.274	-	*
F	Export strategy	-0.492	-	*
G	Competitiveness	-0.537	-	*
H	Investment	0.393	*	-

The Influential network relations map of the factors are shown in Fig. 4. As you can see in the figure, legislation (A) on the all factors that influence and the financial market (D) of all these factors is affected.

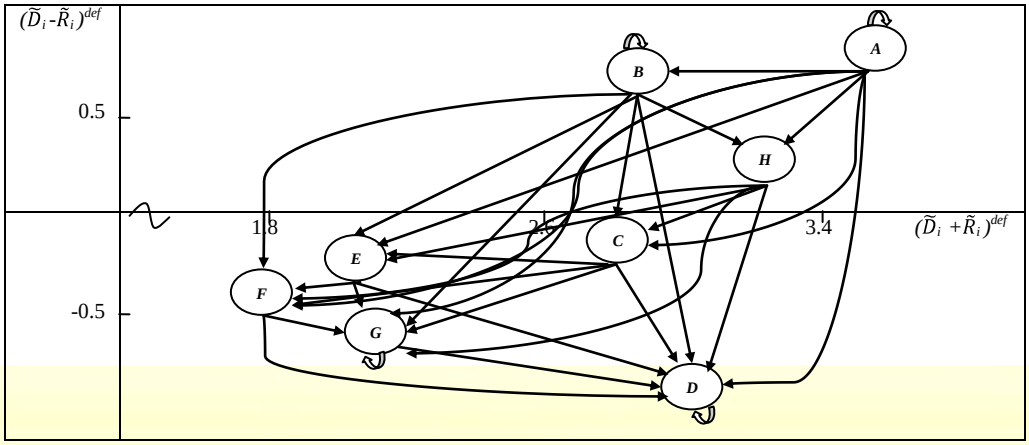

Fig. 4. Influential network relations map (INRM).

5. Conclusion

Today, one of the ways to reduce the economy's dependence on oil exports and support the development of small and medium-sized enterprises active in the field of exports. Therefore, research and development in this field is one of the initial steps. The purpose of this study is to propose a new model for sme export financing . First, the study was to identify factors that previous research and interact with experts through the implementation of fuzzy Delphi method, we identified eight factors. The eight factors are shown in Table 3. In order to structure and prioritize the factors of fuzzy DEMATEL technique was used. The results of this method, the legislation placed the highest priority.

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