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Modeling Factors Affecting the Application of Management Accounting Techniques in Small and Medium Enterprises Using Fuzzy Cognitive Mapping

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ABSTRACT

Management accounting emphasizes managers' using of accounting information in organizations in order to make informed business decisions. The main objective of this study was to determine the factors affecting the application of management accounting techniques in small and medium industrial units. In this regard, using the content analysis method, an inclusive set of factors affecting the application, based on Institutional and Contingency Theories, was recognized, and factors appropriate to the nature of small and medium- sized enterprises were selected via measuring expertise and screening method. Finally, using fuzzy cognitive mapping technique, the causal relationships between the effective variables and the intensity of the relationships were examined. The findings indicated that from the viewpoint of the financial experts in the present study, such variables as in-service training of employees, spirit of cooperation among managers and their collectivism, type of industry and corporate activity, level of production technology, intensity of competition in industry and environmental uncertainty were found to have the highest impact. on small and medium-sized companies; thereby by strengthening these factors, the process of applying management accounting techniques can be improved in these enterprises.

Keywords: Management Accounting Techniques, Small and Medium Enterprises, Institutional Theory, Contingency Theory, Fuzzy Cognitive Mapping.

1. Introduction

Managers require management accounting information to perform managerial duties such as planning, control, responsibility measurement, budgeting and decision making because using financial accounting information alone is not enough (Namazi, 2006). On the other hand, in the direction towards privatization, changes in the competition pattern, production, corporate structures, technology expansion and world trade have added to the importance of management accounting in large economic enterprises. These changes have mounted pressures on managers to direct their own trade decisions to maximize corporate financial performance. Therefore, considering these developments, managerial accounting instruments can no longer be ignored (Khodamipour & Talebi, 2010).

Small and medium-sized enterprises (SMEs) are no exception to this rule, as the majority of businesses are comprised of small and medium-sized enterprises, thus they have a substantial role and serve as a driving force for economic growth in the economies of other countries. On the other hand, numerous studies have been conducted on small and medium-sized businesses, especially their failure and collapse. Therefore, considering the contribution and potential of such enterprises, policymakers in most countries have greatly focused on this part of the economy, and as a result, various incentives have emerged to improve the efficiency and capacity of small and medium enterprises (Michelle & Reid, 2000).

However, despite the many researches done in the area of management accounting in the past decade with emphasis on large companies, scant research has been performed on the formation and effectiveness of these techniques among small and medium enterprises in Iran; the reason for this has been a lack of research. One can argue that in Iran, the research on management accounting techniques has been focused on large listed companies and in this regard, little attention has been paid to small and medium-sized enterprises. Therefore, in developing countries, including Iran, small and medium-sized enterprises may risk not using sufficient management accounting techniques as they are small-sized and lack support and protection, thus failing to take benefit of its advantages. Under these circumstances, they will not be able to cope with the changes and face problems in order to survive and ultimately improve their performance.

Therefore, considering the substantial importance of small and medium-sized enterprises in the economics of societies as well as the existing gap between the literature and research, and also given the potential of small and medium enterprises for research on management accounting techniques and factors, the present research aimed to explain the most important factors that may be effective for the acceptance and application of these techniques by experts, to measure how these factors may relate to each other through fuzzy cognitive map and to weight them in accordance with the level of importance, so that these enterprises can benefits from using management accounting instruments as the institutional and contingency factors affecting the application of management accounting techniques are improved. In this way, while maintaining the position and survival of this group of enterprises in the market, it will be made possible to improve their development and competitiveness at the national and international levels.

2. Theoretical foundations and literature review

Management accounting is a measurement system to gather financial and operational information that directs management operations. However, an examination of the evolving management accounting indicates that despite the significant advances this branch of accounting knowledge has had in the theoretical field, it has failed to expand in line with the economic and technological progress in practice (Barzegari & Sarvari, 2014).

Based on the theoretical basics related to the present study to identify the drivers of management accounting techniques, two theories, i.e., Institutional Theory and Contingency Theory have been introduced both with their own limitations and shortcomings. Therefore, to obtain the best result from this study, the researcher decided to combine both theories and to provide an integrated framework based on institutional and contingency variables, in order to identify the factors affecting the application of management accounting techniques.

The institutional approach used in this research is the New Institutional Sociology (NIS). This approach mainly seeks to answer the question: Why do organizations follow similar procedures in certain areas?" (Scapen, 2006). Yazdifar concluded in a study

in 2004 that NIS concentrates on changes at the non-organizational (or macro) level while primarily focusing on legitimizing organizational processes in the community. Moreover, Johansson and Siverbo (2009) argue that NIS shows how management accounting procedures are introduced, accepted, and applied in an organization. Thus, when an organization adopts a specific management accounting procedure, this application must be established on the need to respond to pressure from an external environment (Moll, Burns & Major, 2006). As a result, the policies, operations, procedures and structure of the organization are affected by the institutionalized rules existing in the external environment (DiMaggio & Powell, 1983).

From a management accounting perspective, NIS assumes that specific management accounting procedures may be adopted to gain legitimacy or, as a result, isomorphism. DiMaggio and Powell define isomorphism as a concept from which the best homogenization process arises. Moreover, they stated that isomorphism is a process that compels units in a similar society to operate under similar environmental conditions. Therefore, according to the goal of the present study, such institutional variables involve political and economic variables, environmental uncertainty, national culture, mandatory pressures from laws and regulations, pressures from management accounting professionalization, seminars, conferences and management accounting research (Prihastiwi & Sholihin, 2018).

However, NIS has shortcomings that do not describe the changing management accounting process completely. NIS only focuses on an examination of environmental pressures while ignoring organizational factors. Accordingly, using NIS as a single theory faces criticism for its limitations. Thus, since the mid-1970s and for five consecutive years, widely published studies emphasizing the behavioral and organizational aspects of management accounting, were influenced by Contingency Theory as the concept of Contingency Theory emerged after several studies to explore the contingency nature of accounting. Contingency Theory assumes that there is no such globally-appropriate accounting system that applies to all organizations equally in all circumstances, arguing that the specific features of an appropriate accounting system depends on the specific circumstances in which an organization manifest (Otley, 1980).

In 1996, Fisher pointed out that some contingency factors may influence using management accounting techniques as they can be categorized into such factors as corporate environment (simple or complex, static or dynamic), production technology and information technology, organization's competition strategy and mission (cost reduction or innovation), industry's features (corporate size, diversity, company structure, etc.), and managerial knowledge protection and human resources.

As research on the Contingency Theory develops, Ketokivi and Schroeder (2004) investigated the way specific methods using contingency and institutional perspectives were implemented. They reported that the contingency approach alone could not offer an inclusive explanation of why some organizations select specific methods. In yet another different study, Williams and Seaman (2001) found out that several variables not referred to in the Contingency Theory may influence the changing and applying management accounting techniques. Accordingly, they claimed that Contingency Theory provided a narrow explanation of the process of change and the use of management accounting procedures.

Based on the Institutional Theory, Yazdifar (2004) stated that NIS concentrates on the macro-impact of the external environment; therefore, not providing an inclusive explanation of the process of change in management accounting.

According to Volberda et al. (2012), it is quite important to integrate the contingency and institutional perspectives because neither of them alone can explain the corporate success and its relationship with its environment. In this connection, Heugens and Lander (2009) maintained that based on contingency theory, managers analyze their corporate working environment considering the internal characteristics of the organization, accordingly matching their own methods with it. On the other hand, according to the Institutional Theory, the environment mounts a lot of pressure on institutional-adapting procedures or the acceptance of "adaptation-enhancing patterns".

Following conflicts of opinion in the mid-1980s, many studies have demonstrated that management accounting has lost its importance and relevance. These studies investigated the factors affecting the development of management accounting. Table 1 examines some domestic and foreign research on the factors affecting the application of management

accounting techniques. As seen from Table 1, each of the foreign and especially domestic researches, only the effect of one or more variables on the application of management accounting techniques was examined.

Moreover, research in this domain in Iran is limited, as they are completely focused on large companies listed in stock exchanges, and that small and medium enterprises have not received much attention. Therefore, one can argue that in the present study, comprehensive modeling of factors affecting management accounting emphasizing small and medium-sized enterprises was examined through fuzzy cognitive mapping method. Some of them are provided in Table 1 and 2 and via the content analysis method, an inclusive list of variables was obtained, which will be described in detail in the next section.

Table 1: Foreign-based researches on factors affecting management accounting procedures

Researchers	Factors studied in applying management accounting techniques
Innes and Michel, (1990)	Existence of a competitive market, organizational structure, level of production technology and information system, loss of market share, organizational changes, presence of capable accounting employees, accounting unit independence, legal requirements
Joshi, (2001)	Organizational size, managers' leadership style, organization strategy
Brown, Booth and Giacobbe, (2004)	Support by senior management, internal support, using consultants, complexity and variety of products, high volume of overhead costs, presence of a competitive market
Askarany and Smith, (2004)	Employees' awareness of employment benefits, access and competency of the organization for implementation, management commitment in implementation, use of management consultants
Waweru et al., (2004)	Existence of competitive market, level of technology, sufficient financial resources, lack of resistance and fear of change
Abulghasim, (2006)	Books and publications on Management Accounting, management accounting training programs, presence of competent operational and executive managers, presence of active management accounting associations, sufficiency of financial resources, support from senior management
Alkizza, (2006)	Existence of a competitive market, organizational structure, state laws and rules, type of organizational strategy, loss of market share, access to elite and competent accountants, power of corporate information system, accounting unit independence, using consultants and auditing services
Wu et al., (2007)	Type of joint ownership and investment by foreign companies
Leftesi, (2008)	Existence of active professional management accounting associations, training programs, up-to-date journals, employees' skills, sufficient financial resources, decision-making independence at lower levels, type of corporate ownership, support by senior management, trust in the value of management accounting techniques, adaptation with the existing corporate accounting system, complexity of management accounting techniques, corporate size
Allahyari and Ramazani, (2011)	Competent accounting staff, existence of competitive market, management stability, accounting unit independence, legal requirements
Nasser et al., (2011)	Management consultants, management accounting training at schools and universities, professional management accounting institutions, training seminars and workshops, cooperation between academics and experts
Al-Baddad and Nasser, (2018)	Existence of competitive market, corporate life, type of industry, quality of ownership, corporate size
Parihastiwi and Sholihin, (2018)	Accounting employees' competence, participation by managers and owners, company size, environmental uncertainty, competitive market
Shahzadi et al., (2018)	Environmental uncertainty, existence of a competitive market, type of corporate competitive strategy, organizational structure, production technology

Table 2: Domestic researches on factors affecting management accounting techniques

Researchers	Factors to be studied in applying management accounting techniques
Ehyaaei and Roodposhti, (2015)	Academic training and research system, information technology, culture and cultural components, organizational factors, economic variables, requirements and business variables
Dianti Deilami et al., (2016)	Environmental uncertainty
Hajiha and Taghizadeh, (2016)	Organizational culture
Valipour and Kaviani Fard, (2017)	Industry features and industry-specific regulations and standards
Kashanipour et al., (2018)	Corporate economic risk, competitive market, company facilities and competency, information requirements for decision making, cost-benefit considerations, management use of accounting information, employee participation

3. Research methodology

This research was applied in terms of goal and descriptive / exploratory in terms of data collection. Table 3 summarizes the stages of the present study.

Table 3: Research stages

First stage	A thorough investigation of the literature review and surveys as well as interviews with financial experts to identify the factors affecting the application of management accounting techniques using content analysis
Second stage	Modification and screening of factors taken from the first stage with emphasis on small and medium production enterprises through measuring expertise using a questionnaire tool
Third stage	Modeling the factors affecting the application of management accounting techniques in small and medium enterprises using selected factors in the second stage and fuzzy cognitive mapping technique to examine the type and intensity of causal relationships between variables

In sum, the method was as follows: first, according to the steps referred to in Table 2, as the first step using the content analysis method, and an in-depth examination of the literature review and a of financial experts, a comprehensive list of factors and variables affecting the application of management accounting techniques taken from studies by other researchers was obtained. As shown in Table 3, these factors included 43 effective factors that were refined and integrated through a questionnaire and measuring the relevant expertise as they were identified and extracted; this is while repetitive, multidimensional variables and the ones not corresponding to the nature and structure of small and medium-sized enterprises were removed via a fuzzy screening method. Therefore, in the second phase of the research, a questionnaire of 7-point Likert scale was provided and distributed among the experts of the present study in order to screen the items. They were asked to provide their opinions on the way each component affected the application of management accounting techniques in small and medium-sized enterprises. After the received answers were gathered, fuzzy screening of variables was performed and finally the number of 22 factors were selected. in this connection, in order to observe the volume of the article, calculations and tables of this section were omitted, with only a final list of variables was presented shown in Figure 1. As the final step, fuzzy cognitive mapping (FCM) method was used to outline a causal map and to investigate the causal relationships and the intensity of relationships between variables, which will be described in the following steps.

In Iran, like other countries, there is no single definition of small and medium-sized enterprises (Nategh, 2015). By small and medium-sized enterprises in the present study, it is meant the definition provided by the Ministry of Industries and Mines and the Ministry of Jihad Agriculture, i.e., industrial units with less than 50 people as the workforce. Experts in this study were also selected by snowball sampling method and financial professionals with at least a master's degree in accounting and a useful history of at least 10 years of activity in the accounting profession from among university professors and professionals were invited. Therefore, as shown in Table 4, concerning the identification of the factors affecting the application of management accounting techniques in companies, 43 factors (components) were taken in 5 groups as follows.

Table 4: Variables extracted from content analysis

Group	Component	Sources
Environmental and extra-organizational	Environmental uncertainty	Dianti Deilami et al. (2016), Shahzadi et al. (2018), Asgarnejad (2017)
	Industry specific requirements and standards	Askarany and Smith (2004), Ehyaei and Rahnam (2015)
	Cross-period and short-term government policies	Khodamipour (2010)
	Availability of management accounting standards	Ehyaaei and Rahnama (2015)
	Joint venture with foreign companies	Wu et al. (2007), Abulghasim (2006), Boukr (2018)
	Existence of research, conferences and workshops	Nasser et al. (2011), Abulghasim (2006), Clarke, Thorley and Stevens (1999)
	Existence of professional management accounting organizations	Leftesi (2008), Nasser et al. (2011), Abulghasim (2006)
	Code of professional management accounting behavior	Moghadaspour and Ebrahimi (2014)
	Political, economic and business variables	Joshi et al. (2011), Ehyaei and Rahnama(2015),

Group	Component	Sources
		Moghadaspour and Ebrahimi (2014)
	Advice by consultants and independent auditors on application	Askarany and Smith (2004), Brown, Booth and Giacobbe (2004), Alkizza (2006)
	Position of competitors and the intense competition in the industry	Innes and Mitchel (1990), Allahyari and Ramazani (2011), waweru et al. (2004)
	Complexity of management accounting techniques	Leftesi (2008), Boukr (2018)
	Loss of market share	Innes and Mitchel (1990), Alkizza (2006), Boukr (2018)
	Mutual cooperation between academics and professionals	Clarke, Thorley and Stevens (1999), Nasser et al. (2011), Boukr (2018)
Organizational and industry	Corporate life	Al-Baddad and Nasser (2018)
	Organizational culture	Hajiha and Taghizadeh (2015), Hajiha and Kharatzadeh (2014), Asgarnejad (2017)
	Type of corporate ownership	Moghadaspour and Ebrahimi (2014), Leftesi (2008), Al-Baddad and Nasser (2018)
	Corporate size	Brown, Booth and Giacobbe(2004), Joshi (2001), Parihastiwi and Sholihin (2018)
	Type of strategy governing the organization	Ehyaei and Roudposhti (2015)
	Adequate and available financial resources	Askarany and Smith (2004), Waweru et al. (2004), Khodamipour (2010)
	Type of industry and operation of the company	Valipour and Kavianifard (2017), Al-Baddad and Nasser (2018), Asgarnejad (2017)
	Organizational structure and effective intra-organizational communication	Moghadaspour and Ebrahimi (2014), Shahzadi et al. (2018), Alkizza (2006)
	Variety and complexity in products and production processes	Brown, Booth and Giacobbe(2004), Asgarnejad (2017)
	Managers' awareness and willingness to use tools	Asgarnejad (2017), Yigitbasioglu (2017)
	Managers' trust-making in the value of using tools	Leftesi (2008), Boukr (2018)
Manpower	Presence of adept manpower and financial specialists	Allahyari and Ramazani (2011), Innes and Mitchel (1990), Perihastiwi and Sholihin (2018)
	Spirit of partnership and teamwork among employees	Ehyaei and Rahnama (2015)
	Decision-making independence at lower levels	Leftesi (2008), Alkizza (2006), Boukr (2018)
	In-service training and education programs for employees	Khodamipour (2010), Yigitbasioglu(2017)
	Spirit of acceptance in employment	waweru et al. (2016)
	Employees' awareness of the benefits of implementation	Askarani and Smith (2004), Boukr (2018)
Management	Expertise and knowledge of corporate management	Abulghasim (2006), Yigitbasiglou (2017)
	Managers' protection of the financial management team	Yazdifar and Askarani (2010), Abulghasim (2006), Asgarnejad (2017), Boukr (2018)
	Managers' commitment and responsibility	Ehyaei and Rahnama (2015), Askarani and Smith (2004)
	Level of managers' reliance on personal judgment in decision making	Rahnama, Nikomram and Jalili (2013), Khodamipour (2010)
	Managers' spirit of innovation, entrepreneurship and confidence in making changes	Askarani and Smith (2004), Khodamipour (2010), Boukr (2018)
	Managers' awareness and willingness to use tools	Asgarnejad (2017), Yigitbasiglou (2017)
	Managers' trust-making in the value of using tools	Leftesi (2008), Boukr (2018)
	Managers' leadership style	Joshi (2001)
	Spirit of cooperation and collectivism by managers	Ehyaei and Rahnama (2015), Parihastiwi and Sholihin (2018)
Technology	Advanced production technology	Boukr (2018), Granlund and Lukka (1998),
	Corporate comprehensive information system	Waweru et al. (2004), Yigitbasiglu (2017), Granlund and Lukka (1998)
	Information system flexibility and adaptability	Leftsi (2008), Yigitbasiglou (2017), Asgarnejad (2017)

Also, as the output of the second phase of the research, as shown in Figure 1, as many as 22 factors influencing the application of management accounting techniques in small and medium-sized enterprises were identified and used as the input of the third phase of the research.

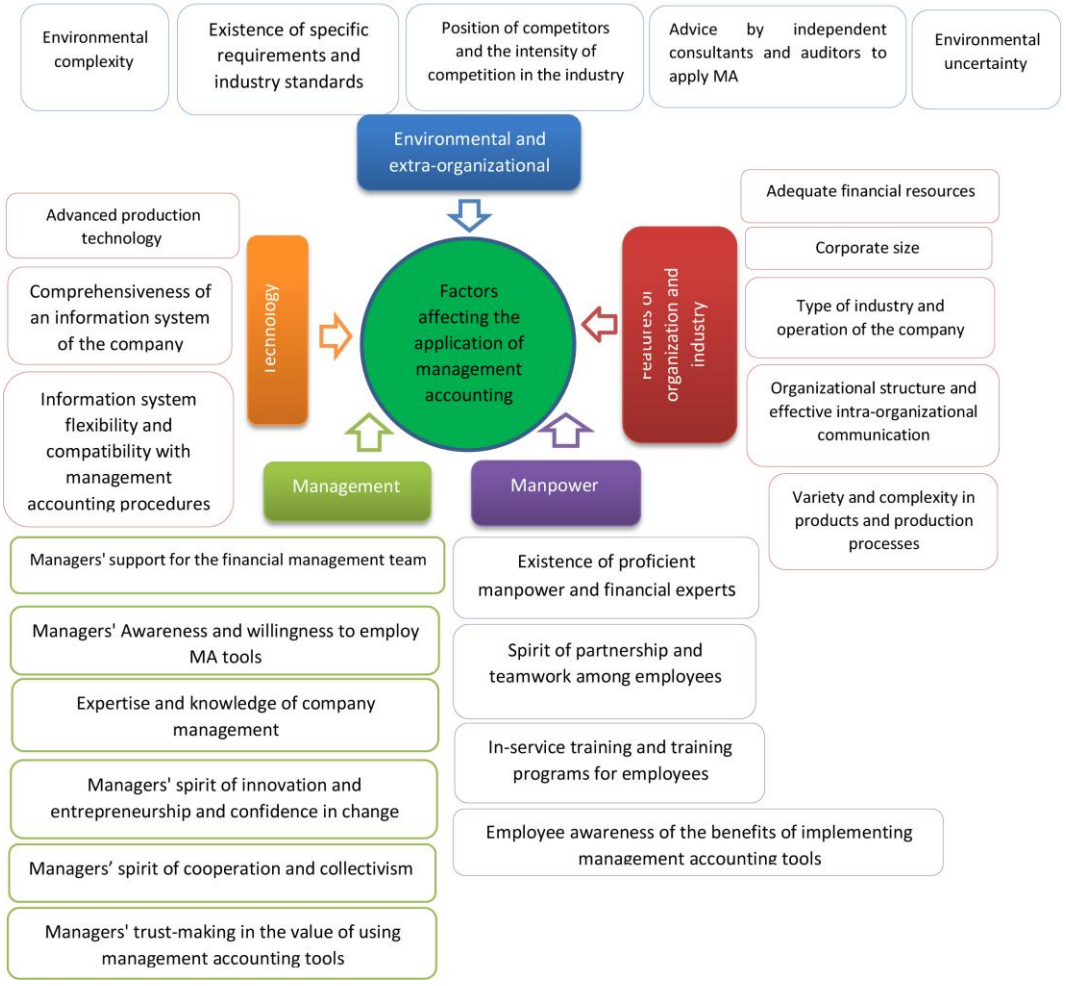

Figure 1: Variables extracted from measuring experts' views
(output of the results in the second phase of research: fuzzy screening)

4. Fuzzy Cognitive Mapping (FCM)

In 1986, Cusco used fuzzy tools for the first time to develop cause-and-effect graphical models and introduced the FCM models for the first time. The FCM model includes a number of concepts that demonstrates how the relevant elements of a phenomenon affect each other via defining the causal relationships between those concepts. Like other cognitive mappings, fuzzy cognitive mapping is derived from George Kelly's Graph Theory. Fuzzy cognitive mapping includes nodes or concepts (Ci) and relationships (eij) between concept Ci and concept Cj. Moreover, in FCM, the weight and quality of relationships between concepts is expressed in form of a fuzzy number in the range [+1, - 1] (Groumpos, 2010).

In Figure 2, the steps for constructing and plotting fuzzy cognitive maps are described in full (Rodriguez et al., 2007), each of which is described in detail below.

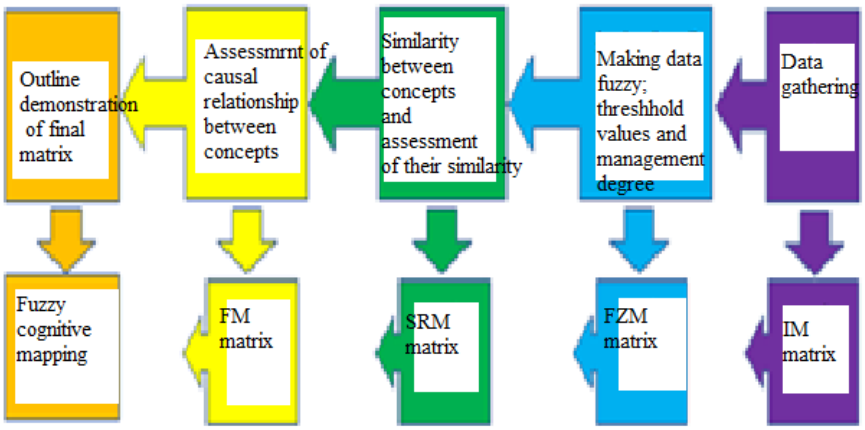

Figure 2: Steps for constructing and plotting fuzzy cognitive maps

Step one: Designing an interview process and questionnaire on measuring experts' attitude: In order to extract the causal relationships between various concepts of the model, first a semi-structured interview process was performed based on the conceptual model extracted from the literature and interviews with experts, and also for this purpose the second questionnaire was designed and distributed as a matrix in which the experts determined the causal relationships between the concepts.

Step two: Calculating the initial matrix (IM): The initial matrix (IM) is an n×m matrix, which considered a 22 × 10 matrix in the present study. In this matrix, n is the number of concepts or variables and in other words, the factors affecting the employment of management accounting techniques (22 final variables) and m is the number of financial experts (10 experts) whose information was collected through interviews and distribution of questionnaires. Each of the Aij elements of this matrix suggests the degree of importance each person considers j for each concept or variable i. Then the values of this table change to the values of a fuzzy set with values 0 and 1. The elements Aim, ..., Ai2, Ai1 are vector elements of V_i (Rodriguez et al., 2007).

Step three: Calculating the Fuzzy Matrix (FZM): The numerical vectors V_i refer to changed fuzzy sets, where each fuzzy set demonstrates the degree of membership of element Aij of vector V_i to vector V_i itself. To convert numerical vectors to fuzzy sets with values [0, 1] to the upper limits of vector V_i, value one (MAX(A_{iq}) (A_{iq})=1), and to the lower limit of vector V_i, value zero (MIN(A_{ip}) (A_{ip})=0) is assigned. The ratio of other elements of vector V_i according to Equation 1 is converted to fuzzy values in the range [0, 1].

Equation 1:

$$X_i(A_{ij}) = \frac{A_{ij} - Min(A_{ip})}{Max(A_{iq}) - Min(A_{ip})}$$

Where (A_{ij}) Xi is the degree of membership of the element (A_{ij}) to vector V_i (Rodriguez et al., 2007). A direct estimation of values in the range [0, 1] may determine the extent of membership in a way that does not reflect the real-time membership and is not rational. Under such circumstances, upper or lower threshold values should be defined by analyzing expert data. Therefore, if V_i is the numerical vector of element m related to the concept of i and A_{ij} (j = 1, 2,…, m) is made of vector V_i, the upper and lower threshold values (α_1 and α_u), respectively) will be calculated by relation 2 and 3.

Equation 2:

$$\forall_j = 1,\ldots,m \qquad Aij(Aij \geq \alpha_u) \rightarrow X_i\ (A_{ij}) = 1$$

Equation 3:

$$\forall_j = 1,\ldots,m \qquad Aij(Aij \leq \alpha_1) \rightarrow X_i\ (A_{ij}) = 0$$

Vector elements are proportionally calculated in the range [0, 1]. All threshold values are proposed during the process to better calculate the fuzzy matrix (FZM) (Rodriguez et al., 2007).

Step four: Power Matrix and SRM relationship: The power matrix of relationships is an n×n matrix (in this study 22 × 22). The rows and columns of this matrix suggest the concepts or variables, in other words, the factors affecting the application of management accounting techniques in small and medium-sized enterprises, with each of the elements indicated by H_{ij} in this matrix representing the relationship between variable i^{th} and variable j^{th}. Each element of this matrix, i.e., H_{ij}, can take values in the range [-1, 1]. If H_{ij} >0, the causal relationship between the concepts i and j is direct (positive); in other words, an increase in the value of concept i increases the value of concept j, and a decrease in the value of concept i decreases the value of concept j. If H_{ij} <0, the causal relationship between the concepts i and j is inverse (negative); in other words, an increase in the value of concept i decreases the value of concept j, and an increase in the value of concept i decreases the value of concept j. Finally, if H_{ij} is equal to zero, it means that there is no causal relationship between the concepts of i and j (Rodriguez et al., 2007).

Concerning vectors directly related to each other and those inversely related, the distance (d_i) between element j^{th} of vectors ϑ_1 and ϑ_2 v is calculated through equations 4 and 5, respectively:

Equation: 4

$$d_j = \left| X_1(\vartheta_j) - X_2(\vartheta_j) \right|$$

Equation 5:

$$d_j = \left| X_1(\vartheta_j) - (1 - X_2(\vartheta_j)) \right|$$

The mean distance between vectors ϑ_1 and ϑ_2 v is:

Equation 6:

$$AD = \frac{\sum_{j=1}^{m} |d_j|}{m}$$

Proximity or similarity between two vectors is also calculated by Equation 7:

Equation 7:

S=1-AD

Table 5 - Graph indices of each variable

Variable	Symbol	Number of input paths to each node	Number of output paths from each node	Net input weight (node input degree)	Net output weight (node output degree)	Centrality degree
Presence of skilled manpower and financial experts	N1	3	3	0.27	0.27	0.53
In-service training for employees	N2	3	3	0.37	0.37	0.73
Employees' awareness of implementation benefits	N3	3	3	0.27	0.27	0.53
Spirit of partnership and teamwork among employees	N4	3	3	0.23	0.23	0.47
Management support for the corporate financial management team	N5	5	4	0.59	0.43	1.02
Managers' awareness and willingness	N6	5	4	0.48	0.37	0.85
Management's knowledge and expertise	N7	0	5	0	0.48	0.48
Spirit of innovation and entrepreneurship among managers	N8	5	4	0.48	0.42	0.9
Spirit of cooperation and collectivism among managers	N9	5	4	0.65	0.58	1.23
Managers' reliability	N10	5	4	0.55	0.47	1.02
Size of the company	N11	1	2	0.12	0.37	0.48
Type of industry and operation of the company	N12	1	4	0.18	0.73	0.92

Variable	Symbol	Number of input paths to each node	Number of output paths from each node	Net input weight (node input degree)	Net output weight (node output degree)	Centrality degree
Organizational structure and intra-organizational communication	N13	4	1	0.78	0.17	0.95
Variety and complexity in products and production processes	N14	1	2	0.18	0.38	0.57
Adequate financial resources	N15	3	1	0.55	0.17	0.72
Production technology level	N16	0	2	0	0.43	0.43
Comprehensive information system	N17	2	1	0.32	0.1	0.42
Information system flexibility and adaptability	N18	2	1	0.32	0.1	0.42
Position of competitors and the intensity of competition in the industry	N19	2	2	0.4	0.4	0.8
Environmental uncertainty	N20	1	2	0.17	0.47	0.63
Existence of specific requirements and industry standards	N21	0	2	0	0.33	0.33
Advice by independent consultants and auditors	N22	3	0	0.63	0	0.63

Step five: Forming a final matrix (FM): When the relationship power matrix is complete, some of the data in it will remain useless and misleading. Not all relationships displayed in the matrix are always met, and there is not always a causal relationship between all variables. Therefore, using expert opinions, the data were analyzed and the relationship power matrix (SRM) was converted into a final matrix (FM) (Rodriguez et al., 2007).

Finally, as seen from Table 4, if the output degree of the variable is positive with its input degree being zero, it indicates the variable is effective, and if the input degree of the variable is positive with the external degree being zero, it indicates the variable is also affected. A variable with a larger input and output degree is the most affected and the most effective variable, respectively (Ozesmi and Ozesmi, 2004).

Step six: Visual fuzzy cognitive map: The visual display of the final matrix helps create a fuzzy cognitive map (FCM) in the field intended. In the final map view, each arrow connects factors i and j has a weight represented by -+ wij. This value, which is placed in the final matrix at the place where rows and columns, i and j intersect, respectively, indicates the intensity or strength of the direct or inverse causal relationship between the two factors (Rodriguez et al., 2007; Gerogiannis et al., 2012). The following figure illustrates the fuzzy cognitive mapping.

5. Conclusions and suggestions

This study aimed to identify the variables affecting the application of management accounting techniques in small and medium-sized enterprises, to determine the way the above variables affect and is affected by each other and finally to present a comprehensive model of indicators affecting the application of management accounting techniques in the such enterprises. Various studies in the field of application of management accounting techniques, especially in the case of large companies, have mainly introduced one or more variables and examined its impact on the application. The method of the present study was that first, with an in-depth review of the literature and research on the factors affecting the application of management accounting techniques through the process of content analysis, a total of 43 factors and in the form of 5 categories such as manpower, management, organizational and industry features, Technology and environmental and extra-organizational factors were identified and in the next stage by distributing a questionnaire among 10 financial experts who were selected through the snowball sampling method and using fuzzy screening method, according to the nature of small and medium companies Screening, integration and refinement of effective variables were performed and a total of 22 factors entered the final stage of the research as the

output of the fuzzy screening process. In this paper, a comprehensive model of the 22 factors affecting the application of management accounting techniques to determine the type and intensity of relationships between influential variables by using fuzzy cognition mapping technique has been done for the first time and is an innovative aspect of the present study.

As can be seen, the summary of the results obtained from Table 4 shows that from the group of factors related to manpower, the in-service training factor of employees with the highest coefficient (0.37) as the most influential factor in the field of manpower dependent factors. It is known that it can play a very important role in implementing management accounting techniques in small and medium enterprises.This suggests that in such groups of enterprises, since the number of skilled workers and their skill levels may be much less than that of large companies, planning and strengthening regular and frequent in-service training of employees in such enterprises can improve their level of awareness and provide a basis for more specialized staff performance. Moreover, due to the fact that the in-service training variable shows the highest impact factor in the group of manpower class variables, a very important point is that training, as much as it can be effective in the area of human resources, depends on the structure of human resources within the organization. Put it differently, the dynamic and agile nature of this component requires that the training system should be updated and agile. Therefore, in this vein, coordinating the two components of training and human resource structure can promote human resources in the organization. According to the expert views of this study, from the subgroups related to management, the factor of managers' spirit of cooperation and collectivism with the highest output coefficient of 0.58 was recognized as the most effective and managers' expertise and knowledge with a coefficient of 0.48 as the second most effective factors in this sector. Therefore, small and medium-sized enterprises are said to have united management or in other words, a vertical structure, if the management enjoys a spirit of cooperation and collectivism with other personnel; in the meantime, the process of applying management accounting techniques can be facilitated and accelerated, and if the management enjoys relative knowledge and expertise in this connection, it can be viewed as an effective tool to accelerate the process of applying management accounting techniques. Also, according to the results, the component of spirit of cooperation and collectivism in managers with a coefficient of 0.65 shows the highest degree of input among the variables of its class and is affected by the managers' characteristics in organizations. For example, one can refer to the factor of peoples' personality traits, which are known as the big 5. One of the 5 big personality types is made up of extrovert people. This group of people has a spirit of cooperation and collaboration, as they get their energy from communicating with others, and are interested in teamwork. Therefore, one may conclude that extrovert managers show more willingness and less resistance to applying management accounting techniques as they have a spirit of cooperation and interaction with others, and in general a manger's characteristics and the spirit of cooperation among managers will overlap each other. From the group of factors related to industry and organization, as results indicated, the factor of industry type and corporate operation was reported to be the most effective component of this sector as it held an output coefficient of 0.73. One can argue that the way companies operate and the type of industry will have the highest impact on the application of management accounting techniques because in some industries there may be the need to use management accounting techniques more than other industries because of their specific nature associated with that industry; thus, the implementation of management accounting techniques in this group of industries can be achieved faster. Also, according to the results, the factor of organizational structure and the existence of effective relationships within the organization compared to other factors in this group, indicates the highest input rate of being affected (0.78), suggesting the use and effectiveness of management accounting techniques in such enterprises requires coordination and substantial communication between units within the organization; this will certainly help achieve goals set by the companies faster and more easily. Therefore, the application and implementation of management accounting techniques as falling in the category of other organizational and industry variables will have the highest impact on the variable of organizational structure. Concerning technology-related factors, the level of production technology will have the highest impact on the application of management accounting techniques.

According to the experts, the higher the level of production technology and the more technology used in the production process, the more likely the company will use management accounting techniques. Also, the corporate information system, including inclusiveness, compatibility, adaptability and flexibility, will be most affected by the application of management accounting techniques in this sector. This is while management accounting techniques will be applied using the company's information system in order to provide relevant information and will need to be upgraded or adapted to the resulting changes in order to implement management accounting techniques.

As the last part of the studied variables, as shown by the results, the environmental uncertainty, status of competitors and the intensity of competition in the industry were determined as the most effective environmental and extra-organizational components affecting the application of management accounting techniques. Environmental uncertainty is the condition on which organizations adjust their framework and is due to environmental factors of the organization, which is related to the degree of change that environmental activities related to the organization's operations, including unforeseen activities related to customers, suppliers, Identifies competitors and legal entities. It is believed that the higher the environmental uncertainty and the level of competition in the industry, the more likely the enterprise is to use management accounting techniques.

Also, since any variable that has a higher centrality will be the most important factor in fuzzy cognitive mapping, so according to the results of Table 4, it can be concluded that from the group of factors related to manpower classes, management, organizational characteristics And industry, technology and environmental and external factors, respectively, in-service training of employees with a coefficient of 0.73, the spirit of cooperation and collectivism of managers with a coefficient of 1.23, organizational structure and effective intra-organizational communication with a coefficient of 0.95, production technology level with a coefficient of 0.43 and finally The status of competitors and the intensity of competition in the industry with a degree of centrality of 0.8 The most important factors related to each category of the above five groups for the use of management accounting techniques in small and medium industrial units were identified to facilitate and expedite the process of using management accounting techniques. In this group of companies, special attention should be paid to them in order to provide the ground for small and medium companies to benefit from the advantages of using management accounting techniques.

Therefore, according to the results, it is suggested that small and medium-sized companies should develop and implement regular and continuous training programs in the area of management accounting and control its activities in order that they can enjoy the advantages of using management accounting techniques. Corporate operations should be transferred to managers who are extroverts and enjoy the spirit of cooperation and interaction with others, because it is expected that positive and constructive interaction of the manager with other employees helps the process of implementing management accounting techniques be performed more effectively.

Corporate managers are also recommended to pay more attention to implement management accounting techniques appropriate to the field, considering the type of industry in which they operate and the intensity of competition in that industry, as well as the extent to which technology is used in the production process. In this regard, it is necessary to strengthen and improve the corporate information system and optimize intra-organizational relations and to use effective communication among units as a prerequisite; thus factors affected by the application of management accounting methods, and in this regard, proper planning should be managed greatly in order that management accounting techniques in companies be performed effectively.

The present research can be enhanced in many respects. In the first place, the findings of this research can be tested by surveying other experts with the outcomes being generalized. Also, the factors affecting the application of management accounting techniques can be investigated separately for each industry. As a final recommendation, the factors affecting the application of each of the management accounting techniques can be examined by recognizing and ranking the specific effective and affected factors related to each technique and matching it with the results from other techniques.

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