

Case Report

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The Small and Medium-sized Iranian Enterprises' Challenges and Concerns for Benefiting from Standards

(A Case Study in Industrial Towns and Technology Parks in Tehran and Alborz Provinces)

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Abstract

Today, Small and medium enterprises (SMEs) play a pivotal role as key drivers of economic growth and innovation in both developed and developing countries. The role of standardization is acknowledged as a robust link between research, innovation and the market, serving as an effective tool for enhancing and disseminating knowledge. Consequently, the standardization process can significantly contribute to economic growth, prosperity and improvement of the performance of these companies. However, a limited number of small and medium-sized companies express interest in participating in the standardization process. Many stakeholders and company executives perceive the standardization system as overly intricate and lack awareness regarding the benefits and importance of standardization in their business operations. In this research, the effective factors affecting lack of standardization of SMEs have been identified using a questionnaire tool. The ordinal weighted average operator and the Shannon entropy method were used in the ranking process to analyze the gathered data. The results reveal that the most substantial constraint in implementing standards is the constrained availability of resources, while the least significant factor is the lack of access to specialized standards. The reasons behind these findings and the recommended solutions are thoroughly discussed.

Keywords Standardization, Small and Medium Enterprises (SMEs), Quality Management, Weighted Average Operator.

1. Introduction

It can be clearly seen that standards as the technical and comprehensive documents facilitate business processes by creating an atmosphere of mutual trust in business processes and have a very strong and constructive role on the growth and economic productivity of a country [1-2]. The ability to easily access specialized information, increasing the speed of technology transfer, improving the penetration rate of technology in products and services, increasing their safety and quality, improving productivity

and finally improving the indicators of national economic development are among the most important benefits of standards [3].

In the contemporary global economy, the success of an economy is profoundly reliant on the number and dynamics of small and medium-sized companies in the market. Small and medium companies cover a wide range of activities from home to production and services. In this regard, there are different definitions of small and medium companies among countries. Some of the criteria that are



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usually used in the definition of small and medium companies are the number of employees, the amount of capital and assets, the total volume of sales and the production capacity. Among these criteria, the most common criteria for defining small and medium-sized companies are the number of employees [4-5]. SMEs are defined by European standards bodies as enterprises with a workforce of fewer than 250 individuals, encompassing a diverse group ranging from small-scale artisanal operations to cutting-edge high-tech companies [6].

To secure more market share in today's unpredictable economic landscape, companies must discern critical success factors. Recent studies illuminate how SMEs not only create but also sustain superior business performance and competitive advantage through their development processes. Various studies have used conventional statistical approaches such as structural equation modeling and multiple regression analysis to determine the key dimensions of enhancing business performance [7-8]. Studies have shown that small and medium-sized companies, in comparison to their larger counterparts, are more susceptible to cost factors, market conditions, and organizational barriers. These factors directly influence the intensity of their investment in innovation [9]. Numerous studies have consistently demonstrated the positive impact of standard in promoting and fostering the growth of small and medium-sized companies [10-12]. However, Veris, et al have pointed out a notable gap in awareness among small and medium-sized companies regarding the benefits of standardization, despite the evident advantage [13].

There are some standard organizations that have recently conducted many studies to help promotion of SMEs performance through standardization process. International Standards published by ISO help small to medium sized enterprises reduce costs, increase productivity and access new markets, build customer confidence, meet regulation requirements, reduce costs. ISO provides a wide range of tips to help SMEs get started with standards to enhance brand recognition and give customers the guarantee that their technology is tested and reliable [14]. The recommendations presented by the European standards bodies CEN and CENELEC pertain to the promotion of accessibility to European standardization for small and medium-sized enterprises (SMEs). The primary aim is to provide solutions that enhance the importance of standardization and standards for SMEs while mitigating their financial consequences. This project focuses on European standards, including their development and standardization, and establishes links between these standards and the business objectives of SMEs.

The new International Sustainability Standards Board

(ISSB) plays a pivotal role in addressing the issue of global reporting fragmentation, paving the way for more transparent and consistent reporting practices tailored for SMEs. These standards impart valuable insights to SMEs, illustrating how adherence to the established norms can significantly enhance their firm's credibility and efficiency in sustainability reporting [15].

While numerous studies have aimed to enhance the performance of small and medium enterprises, a comprehensive overview reveals a noticeable gap in direct investigations into the impact of standards and standardization on the performance and development of SMEs [16-18]. Consequently, the primary objective of this study is to discern the factors influencing the limited participation of small and medium-sized companies in the realm of standardization and standards. The ultimate aim is to propose effective solutions to enhance this participation, thereby aiding these enterprises in elevating their quality to meet customer requirements. By considering the factors hindering SMEs from experiencing the advantages of standardization, this study contributes valuable insights to enhance services and overall business operations.

The importance of standardization for SMEs

In the contemporary world, the standardization of goods and services stands as a critical factor influencing competition, driving innovation, and sustaining the continuous progression of production and technology. A successful and impactful presence in both domestic and international markets is entirely contingent upon standardization. Figure 1 illustrates this interactive cycle. This approach, applied to production processes, yields positive effects by ensuring a sustained market presence for capital owners and producers. Simultaneously, it enhances productivity and process effectiveness, resulting in cost savings derived from the reduction of waste and expenses related to after-sales services.



Fig 1. The cycle of standard, production, innovation, economic growth and social benefit

Additionally, it minimizes the need for rework by addressing defective or incomplete goods, parts, and processes [19-20].

Standards can provide a system thinking in management approaches and a structure based on test and knowledge in improving all operational processes of a company, including improving product and service quality, improving customer satisfaction and increasing new customers. From this point of view, the use of standards can be considered as one of the inseparable components of the strategies of companies to be present in the competitive field of the market. In an overview, these benefits can be summarized as following [19,21]:

- Improvement of the quality of products or service
- Demonstrating the company’s ability to produce products and provide high quality services
- Increasing intra-organizational trust towards business and manufactured products or services provided
- Improving the image of the company in the market
- Promotion of cooperation and specialized participation based on a common technical language
- Expanding the market and increasing exports
- Technology transfer and up-to-datedness of the products and services provided
- Upgrading the risk management system and improvement of planning
- Reducing costs
- Increasing competitiveness

Research methodology: tools and methods

In this article, the identification of the most significant obstacles and limitations in the utilization of standards by small and medium companies was conducted through data collection employing a questionnaire tool. The statistical population under investigation comprised small and medium companies situated in industrial towns and science and technology parks in Tehran and Alborz provinces. The sampling method employed in this research was deliberate random sampling.

The size of the sample population based on the statistical population of the research was determined by Cochran’s method and a questionnaire was distributed to collect information. 116 questionnaires were completed and collected by the senior managers or technical managers of the companies participating in the project and a number of experts from the Iran National Standards Organization. According to Cochran’s formula, with an error accuracy of less than 5%, the sample volume was 97, which showed the adequacy of the number of collected questionnaires.

First, the participation level of the SMEs in the field of standards and standardization was determined by asking questions on the two axes of their effective presence in

the corresponding international technical committees and participation in the formulation of national standards.

A specialized questionnaire was compiled with the help of a number of company managers and experts in the field of standardization and its tolerance was qualitatively evaluated. In addition to the factors mentioned in the questionnaire, those who completed the questionnaire could also state and record the factors affecting the ranking from their point of view. In the process of ranking and determining the degree of importance of the factors, the ordinal weighted average operator (OWA) was used.

In this article, the OWA operator is used to weight the factors. The weight coefficients were determined using the OWA operator and the Lagrange coefficients method. In the OWA operator, weights are attached to positions, not to values, and this allows the decision maker to fuse different types of information in the process.

The OWA operator was introduced by Yager in 1988 [22]. In a classical definition, an n-dimensional OWA operator is a mapping from

$$F: R^n \rightarrow R \tag{1}$$

which has a weight vector w .

$$W = [w_1, \dots, w_n]^T \tag{2}$$

where

$$w_i \in [0, 1]$$

$$\sum_{i=1}^n w_i = 1 \tag{3}$$

and

$$F(a_1, \dots, a_n) = \sum w_i b_i \tag{4}$$

where b_i is the largest element of the combined set of objects a_1, \dots, a_n . The value of $F(a_1, \dots, a_n)$ can determine the aggregation of the value of $F(a_1, \dots, a_n)$ objects. The weight w_i is associated with a particular sorted position i . The famous feature of OWA operators is that they include the minimum, maximum and average operators for the appropriate selection of the W vector as follows:

$$W = [0, 0, \dots, 1]^T, F(a_1, \dots, a_n) = \text{Min}(a_i)$$

$$W = [1, 0, \dots, 0]^T, F(a_1, \dots, a_n) = \text{Max}(a_i)$$

$$W = [1/n, 1/n, \dots, 1/n]^T, F(a_1, \dots, a_n) = \text{Mean}(a_i)$$

OWA operators satisfy commutability, uniformity, and repeatability properties and are limited by maximum and minimum operators as following:

$$\text{Min}(a_i) \leq F(a_1, \dots, a_n) \leq \text{Max}(a_i) \quad (5)$$

Since the OWA operator is limited by the maximum (or) and minimum (and), Yager introduced a scale to specify the type of aggregation for a specific value of the weights vector called Orness scale, which is defined below:

$$\text{orness}(w) = \sum_{i=1}^n (n-i)w_i / (n-1) \quad (6)$$

This scale measures the degree to which aggregation behaves like an “or” operator and is considered a measure of the decision maker’s optimism.

$$\begin{aligned} \text{orness}(w) &= ([1/n, 1/n, \dots, 1/n]^T) = 0.5 \\ \text{orness}(w) &= ([1, 0, \dots, 0]^T) = 1 \\ \text{orness}(w) &= ([0, 0, \dots, 1]^T) = 0 \end{aligned} \quad (7)$$

Another measure used by Yager is the Shannon entropy. Entropy is a famous operator in information theory, by maximizing it you can make sure that the maximum amount of available information is used.

$$\text{Disp}(w) = \sum_{i=1}^n w_i \ln(w_i) \quad (8)$$

According to the above equation, it can be concluded that in order to obtain the weights related to OWA, the following relations should be solved, whose objective function is to maximize entropy, considering constraints (3) and (6):

$$\begin{aligned} \text{MaxDisp}(w) &= - \sum_{i=1}^n w_i \ln(w_i) \\ \text{orness}(w) &= \alpha = \sum_{i=1}^n (n-i)w_i / (n-1) \quad \cdot \leq \alpha \leq 1 \end{aligned} \quad (9)$$

Results and Discussion

The analysis of the answers shows that about 96.8% of small and large companies are not familiar with the corresponding technical committees of international standards and less than 10% of the respondents have participated and played an effective role in the development of national standards.

The obtained results lead to the conclusion that the importance and benefits of standards and standardization may not be adequately understood within the framework of management strategy and development for SMEs. Table 1 provides a comprehensive list of six factors contributing to the limited benefits derived from standardization by SMEs, by using OWA operator weights to aggregate preference rankings.

Our findings show that limitation of resources in the implementation of standards and the lack of knowledge of standardization in the small and medium-sized companies are of the most important factors and obstacles in their use of standards. In some cases, it has been seen that these companies are struggling to get this specialized information, but they are not aware of its existence in the standard documents. This lack of awareness can be caused by two important factors: a) the low level of specialized knowledge of the company’s employees b) the lack of effective positioning of the company in the interaction and communication network in its specialized field.

In many cases, these companies are not aware of the potential hidden in standards for the manufactured product or the service provided by them. This issue is more visible especially for companies whose senior managers have participated only with the investment approach and have less knowledge in the technical field. In some cases, due to limited resources, companies emphasize more on short-term strategies, and this short-term view leaves no room for planning and implementing long-term strategies.

The main reason for implementation of a standard is to achieve the set goals of the business, which continuous performance monitoring shows the effectiveness of using these standards. In most small and medium-sized companies, it can be seen that due to limited resources, management is involved in executive and daily tasks most of the time and pays less attention to continuous monitoring and evaluation of processes.

One of the obstacles for small and medium-sized companies to benefit from standards is the lack of the level of specialized knowledge necessary to understand specialized standards and the technical information. This obstacle to the correct understanding of the standard can be caused by factors such as the high level of technical information of the standards, the lack of availability of the standard text in the native language, the lack of providing sufficient information in the preface of the standard regarding the subject matter of the standard and selection and lack of skills and knowledge necessary to understand the standards.

Maybe for some small and medium companies, the process of benefiting and accessing the standards does not seem simple and accessible, and maybe at first glance, the cost of buying these standards is considered as a factor

Table 1. Aggregated rank of factors affecting lack of standardization of SMEs

Factors	Aggregated OWA weight of factors based upon maximizing entropy	Ranks
Limitation of resources in the implementation of standards	0.845	1
Lack of knowledge of specialized standards and standardization processes	0.818	2
Lack of awareness of the importance and role of standards	0.807	3
Absence of evaluation processes and effectiveness of standards	0.790	4
Lack of scientific and professional ability to understand the standards	0.719	5
Lack of access to specialized standards	0.70	6

limiting their use. It should be noted that the price of preparing the standards is not a significant number compared to the quality of the information in them, which is the result of hours of specialized and expert work by a group of legal experts, and for companies it is not a cost, but an investment in the field of research and development.

Conclusions

The importance of small and medium-sized companies and their role in economic development becomes more evident, especially regarding to their impact on the innovation and technology. In this article, most important obstacles and limitations in the use of standards by small and medium companies using a questionnaire tool was studied and identified. The companies under investigation were small and medium companies in industrial towns and science and technology parks in Tehran and Alborz provinces. 116 questionnaires were completed by the senior managers or technical managers of the companies participating in the project and a number of experts from the Iran National Standards Organization. The results showed that 96.8% of small and large companies are not familiar with the technical committees of international standards and less than 10% of the SMEs have played an effective role in the development of national standards. The ordinal weighted average operator (OWA) was used to rank and determine the degree of importance of the factors. Our results introduced 6 factors that make obstacles for SMEs not to experiencing the benefits of standardization. The highest and lowest ranking related to resource limitations of SMEs in the implementation of standards and lack of access to specialized standards, respectively. From the obtained results, it can be concluded that the importance and benefits of standards and standardization are

not properly understood for the management strategy and development of the SMEs. So, it is necessary for small and medium-sized companies to find the awareness about the benefits and importance of using standards and participation in standardization processes. Finally, the culture of using standards is considered as a management and strategic requirement in the management system of these companies.

Suggestions

According to the presented results, the following are suggested in order to expand the culture of using standards and participate more in standardization processes. Promotion of communication activities and expansion of standardization culture at the national and regional level through different ways such as radio and television publications, Internet, preparation and distribution of information packages on the web, holding con specialized conferences by the organizations in charge of standards and standardization in the country can be the basis for raising the awareness of companies. Providing awards by organizations and bodies in charge of standardization, trade and industry to successful companies in applying standards can motivate other companies in determining their strategic goals based on standards. In addition, organizations in charge of standardization and national and local libraries should make standards available to applicants and interested parties at the lowest cost or even for free. Holding short-term and specialized training courses and workshops are considered as one of the most effective ways to promote standards. Nowadays, considering the speed of development of information technology, the training courses and specialized working groups in virtual space for information sharing are identified as an effective solution in promoting and increasing the society's

awareness of the benefits of standards. Finally, providing continuous education to promote the standard culture at all educational levels from school to university especially for the young generation as future entrepreneurs of the country, can be considered as a successful and long-term investment method.

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Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

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Competing interests

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