

## Drivers, barriers and incentives to implementing environmental management systems in the food industry: A case of Lebanon

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### ABSTRACT

The shift in policy towards prevention and towards making producers responsible for the pollution they cause has lead corporations to limit environmental liabilities through the improvement of environmental performance. The implementation of an Environmental Management System integrates the precautionary and polluter pays principles into a firm's operations and demonstrates commitment to sustainable development. This research aims at assessing the factors influencing the implementation of ISO 14001 Environmental Management System in developing countries taking the Food Industry in Lebanon as a case example. For this purpose, primary data were collected using a field survey questionnaire that was administered to a representative sample of facilities. The results revealed that the food industry is generally more concerned with safety and quality issues rather than environmental issues. Following international food sector trend, improving environmental performance and enhancing company image are the most salient drivers to adopt ISO 14001. The lack of government support and stakeholder demand as well as the fact that ISO 14001 is not a legal requirement constitute the most salient factors hindering the adoption of the standard. Economical and organizational factors are the most significant incentives required to motivate the food industry to adopt ISO 14001. The industry is less likely to voluntarily consider adopting ISO 14001 before acquiring a quality management certification or until ISO 14001 certification gain more recognition in the international food sector. The study defines the foundations for developing strategies, policy reforms and incentive schemes to reduce the barriers of implementing ISO 14001.

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### 1. Introduction

The evolution of a harmonized voluntary Environmental Management System (EMS) is being driven by international market forces, regulatory shifts, demand for quality management and public awareness. The World Trade Organization (WTO) negotiations in 1986 to minimize non-tariff barriers to trade and the 1992 Rio Earth Summit which emphasized commitment to environmental quality have stimulated the development of the EMS [52]. The ISO 14001 process standard is one of several structures within which a facility may develop an EMS. The main purpose of the EMS is to organize environmental work in such a way that an organization's environmental performance improves continuously [11]. It allows organizations to be systematic in the evaluation of their processes and activities with regard to interaction with the environment. Hence, the EMS controls these activities and ensures that

established objectives and targets are being met. It follows the Deming's well known Quality Management approach of "Plan, Do, Check and Act". ISO 14001 is a process standard and accordingly it specifies the characteristics of the components of a management system. It requires that adopting organizations create an environmental policy, set objectives and targets, implement a program to achieve those objectives, monitor and measure the program's effectiveness, correct problems, and conduct reviews aimed at improving the EMS. As such, the EMS is a tool that allows the continual improvement of the environmental behavior and performance [11,16,25,29].

Since the introduction of the ISO 14000 series in 1996, companies seeking the certification have been increasing worldwide. It is anticipated that registration with ISO 14001 will become a norm rather than an exception. Nonetheless, the adoption of the standard in developing countries has been slow as compared to developed countries. Table 1 presents the total number of ISO 14001 certified firms in selected countries. Evidently, firms from developing countries and transitional economies of Central and Eastern Europe account for an insignificant proportion. Latin America, Africa and

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**Table 1**  
Number of ISO 14001 certified firms in selected countries [23].

Country	ISO 14001	Country	ISO 14001
<i>Africa/West Asia</i>		<i>Central and South America</i>	
Bahrain	18	Brazil	2447
Bangladesh	17	Venezuela	51
Egypt	379	North America	
India	2016	Canada	1679
Iran	780	Mexico	409
Jordan	39	USA	5585
Kuwait	11	Austria	553
Lebanon	7	<i>Europe</i>	
Morocco	37	Belgium	521
Oman	8	Cyprus	59
Pakistan	77	Czech Republic	2211
Palestine	5	Denmark	995
Qatar	11	France	3047
Saudi Arabia	30	Germany	5415
Syria	53	Italy	9825
UAE	172	Spain	11,125
<i>Far East</i>		Sweden	4411
China	18,842	Turkey	1423
Japan	22,593	UK	6070
Korea	5893	<i>Australia/New Zealand</i>	
Singapore	716	Australia	1964
Thailand	1369	New Zealand	182

the Middle East together account for less than 3% of ISO 14001 certified enterprises worldwide.

The main motivations, benefits, incentives and challenges for acquiring ISO 14001 vary with location with no explicit prioritization (Table 2). This may be attributed to the several independent variables that influence decisions and priorities whereby the demands for acquiring the certification are fundamentally market driven particularly in industrialized countries [3,24,26,49]. Many firms in Asia are adopting the ISO 14001 standard foreseeing that their European-based customers will require it. Globally, the trend of certified companies refusing to do business with non-certified companies is increasing. Thus, exporters in developing countries will face more pressure from their trading partners in industrialized countries to implement an environmental management system in compliance with ISO 14001. While the adoption of ISO 9000 quality management standards has become a requirement for industries in many sectors globally, ISO 14001 EMS standard may become a necessary condition of international trade.

Small to medium-size enterprises (SMEs) in both developed and developing countries may face serious constraints in setting up and maintaining an EMS although they have a significant cumulative impact on the environment. SMEs account for an estimated 90% of the world's economic activity [52]. While several SME surveys and case studies have been conducted in Europe, relatively few studies have been carried out in developing countries. Generally, SMEs are often slow to respond to the challenge of improving their environmental performance due to the lack of financial and technical resources [18,22,37]. Hence, it is essential to identify effective and realistic incentives to encourage SMEs primarily in developing countries to implement environmental management systems. Building an understanding of the constraints to implementing and certifying to ISO 14001, especially SMEs in developing countries, is necessary.

The ISO 9001 quality management standards and 14001 environmental quality management standards are among the ISO's most widely known standards. While there are several studies worldwide with regard to ISO 9001, studies related to the implementation of ISO 14001 are scanty particularly in developing countries. In Lebanon, research studies related to the implementation of international voluntary standards among the industrial sector have so far focused on quality management systems.

**Table 2**  
Key factors, incentives and challenges for acquiring ISO 14001 [10,14,15,28–31,36,38,39,55].

Benefits	<ul style="list-style-type: none"> <li>• Clean/effective operations</li> <li>• Productivity improvement and cost savings</li> <li>• Profitability and competitive product/services</li> <li>• Market expansion</li> <li>• Improve company image and management</li> <li>• Enhance relationship with stakeholders</li> </ul>
Motivations	<ul style="list-style-type: none"> <li>• Customer requirements and stakeholder demands</li> <li>• Export barrier overcome</li> <li>• Accommodation of international regulations</li> <li>• Enforcement of fair competition</li> <li>• Company product/service recognition</li> <li>• Government encouragement or regulations</li> <li>• Cost reduction (reduction in operations and insurance)</li> <li>• Supply chain requirements</li> </ul>
Barriers	<ul style="list-style-type: none"> <li>• Not a legal requirement</li> <li>• No demand from customers or stakeholders</li> <li>• Lack of incentives</li> <li>• Lack of government support</li> <li>• Lack of resources</li> <li>• Cost/Duration</li> <li>• Creates competitive disadvantage</li> <li>• Lack of in-house knowledge/skills</li> </ul>
Challenges encountered during ISO implementation	<ul style="list-style-type: none"> <li>• Staff training</li> <li>• Management system documentation</li> <li>• Define company environmental policy</li> <li>• Identifying targets and objectives</li> <li>• Monitoring and measurement procedures</li> <li>• Time demand for certification</li> <li>• Cost of ISO 14001 certification and consultation fee</li> <li>• Management review</li> <li>• Language barrier</li> </ul>
Demands for government support/incentives	<ul style="list-style-type: none"> <li>• Special tax exemption for ISO 14001 certified firms</li> <li>• Encouraging Eco-labeling and rewards</li> <li>• Enhancing knowledge and advantages of ISO 14001 among non-registered companies</li> <li>• Establishing national institutes for technical advice and consultants services</li> <li>• Implement special soft loans to firms who are going to implement ISO 14001</li> </ul>

Invariably studies focused on analyzing the benefits of adopting such systems [17,42,43]. Studies related to ISO 14001 EMS are still lacking, incomprehensive and scattered [12,33].

Although not mandatory and not related to the existing national policies, few industries have voluntarily acquired the ISO 14001 certification [23]. Similarly, few attempts were made to streamline voluntary EMS among the industrial sector [51]. With the establishment of the "Euro-Mediterranean free trade area" by the year 2010 and Lebanon's undergoing accession to the Euro-Med Association Agreement and the WTO, more business opportunities will likely emerge. Yet, more competition and challenge will face the industrial sector to comply with the requirements of these agreements, particularly with regard to environmental protection [45]. Therefore, the sector needs to react quickly to these dynamic changes in the global market demands through promoting ISO 14001 EMS certification. The certification will assist the sector to overcome free trade barriers, maintain a viable relationship with the European Union market (one of Lebanon's major trading partners), demonstrate environmental commitment, and gain trade advantage over its competitors in the region.

Given that quality management standards are a priority to industries, particularly the food sector, promoting ISO 14001 will present a major challenge. Despite that ISO 14001 EMS could be implemented by any organization whether manufacturing, service provider or commercial, in addition to the existence of more environmentally polluting industries, the rationale behind the selection of the food sector is based on the following:

- It is the largest industrial sector in the country and has the highest permanent workforce.
- Food products are one of the top industrial exports.
- This research is conducted in parallel with an ongoing assistance program intended to support the food sector to acquire different ISO certifications.
- Food companies are well known to be influenced by public perception associating food quality with environmental quality [4].
- Even though, the majority of food industries are SMEs, the cumulative impact as a result of the large number of food industries is expected to be high.

The hypotheses of the study are that (1) industries' motivation to market pressures (customers demand and export to foreign countries) and economical interest are positively associated with the adoption of ISO 14001 and that (2) financial constraints, lack of government support and knowledge are negatively associated with the industries adoption of the ISO 14001 standard. Accordingly, the specific objectives of this research include:

- Investigating the drivers, barriers and incentives to implement a voluntary EMS following ISO 14001 standards in the Lebanese Industrial sector taking the food industry as a case example.
- Exploring the relationship between the various influences and the actions related to environmental activities and practices within the firm.
- Suggesting appropriate measures/solutions to overcome the potential barriers and challenges of implementing an EMS in the Lebanese industries.

## 2. Research methodology

### 2.1. Description of the studied sector

About 60% of food establishments in Lebanon are SMEs. Geographically, the majority of these industries are located in Mount Lebanon followed by North Lebanon and Beirut [45]. The most important areas of production are processed foods (such as jam, packed food, pickles, etc.), bakery products, beverages, vegetable oil and dairy products [20]. Over the past decade, export growth rate of the Lebanese industrial sector has increased by 200% between the years 1996 and 2006. According to the 2006 statistics of the Higher Customs Council, the main export markets are the Arab Countries (43%) followed by the European Countries (32%). As indicated by the customs statistics, total exports from the food industrial sector ranked 4th among the top ten industrial exports between 2005 and 2007 accounting for about 12 and 11%, respectively of the total country's exports [34].

The industrial sector affects the local environment significantly. The poor environmental performance of this sector is attributed to the lack of industrial zones and adequate infrastructure [45]. The main environmental issues associated with food processing activities include high water consumption, the discharge of high-strength effluent and the consumption of energy. Noise, odor and solid waste generation may also be issues of concern for some food

processing activities. Although the heavy organically loaded effluent is not toxic, if not managed properly, may result in the degradation of the aquatic marine environment and fresh water resources. The significance of the environmental impacts is also associated with the quantity generated. Food processing activities and hygiene standards necessitate the use of large quantities of fresh water. Likewise, they require high levels of thermal energy consumption in process heating, cooling, and refrigeration. Depending on the raw material, food processing activities may generate significant quantities of organic solid waste in the form of inedible material, expired food products and rejected products from sorting and grading. The generated solid waste may present a risk from pesticide residues, strong leachate and offensive odor generation. Another commonly generated solid waste is damaged packaging material. Air emissions from food processing plants are mostly attributed to energy consumption, cooking and decomposition of organic waste.

### 2.2. Study design

Firstly, an assessment of information sources was conducted to review existing data and conditions pertaining to the food industry in Lebanon. While primary data constitute the main source of information for the study, secondary sources were also relied upon for information related to the evolution, process definition, areas of implementation, international trend, motivations, barriers and future development of ISO 14001. Background data about the status of the Lebanese industrial sector, exports and trade regulations and environmental policies were collected from the Ministry of Environment, Ministry of Industry, Ministry of Economy and Trade, Lebanese Cleaner Production Center, Lebanese Standards Institution (LIBNOR), United Nations Industrial Development Organization (UNIDO), Beirut Chamber of Commerce, ISO consulting firms and variety of industrial syndicates and associations.

### 2.3. Instruments

Primary data were acquired using a bilingual (Arabic and English) questionnaire targeting food industries. The questionnaire was designed following the structured questions method to provide useful insights into management issues and to investigate the potential drivers, barriers and incentives to implement an EMS following ISO 14001 standards. The questionnaire was pre-tested to ensure that the questions are understandable and clear to respondents and that the exact meaning of the questions was captured in the English-to-Arabic translation. Participants were requested to provide general information regarding their industry (type of production, number of employees, market...) and their perception of environmental performance. They were also asked to select from a given list the three most important drivers and barriers to adopting ISO 14001. Moreover, they were asked to identify possible incentives for implementing ISO 14001. The questionnaire was distributed to selected enterprises via mail, e-mail, fax, and mostly face-to-face to respondents who would be more knowledgeable to answer the survey questions, alike previous survey-based studies on environmental management [25,27]. The response rate of comparable studies addressing already certified firms ranged between 17 and 81% [11,30,32,44].

### 2.4. Population and sampling

There is no single universal or standard definition of food industry, as the sector is very diverse in nature which defies any attempt to apply a boundary. For the purpose of this study, the food industry sector is defined principally by its role as secondary or

final processor of agricultural raw material and livestock into food and beverage products [50]. The target population in this study covered food companies registered in the Association of the Lebanese Industrialists (ALI), Syndicate of Lebanese Food Industries (SLFI) and the Lebanese Chamber of Commerce. A list of 121 food companies was compiled covering different food processing sub-sectors. The distribution of the selected food industries according to geographic location is presented in Table 3.

### 2.5. Data management and analysis

The collected data was numerically coded to facilitate the use of statistical programs, namely the Statistical Package for Social Science (SPSS) software version 16.0. Following the coding process, the data was subjected to statistical analysis on the premise of which conclusions were drawn. The data (mostly categorical) was divided into independent variables (i.e. size of industry, market, ownership type and previous certifications) and dependent variables (e.g. drivers, barriers, incentives, etc.). Frequencies of various responses were worked out and interpreted in terms of the general trends that emerged from the analysis. Correlation percentage distribution, statistical significance and strength of association were determined to determine the correlation between the different categorical variables. Bivariate cross tabulation matrices were constructed to explore patterns of associations between the two variable categories. The chi square significance value was used to define the statistical significance of the results. A statistical significance value limit of  $P < 0.05$  was used in the analysis.

The measure of association was conducted to assess the strength of association between the two nominal variables using Cramer's contingency coefficient (V). Generally, values  $< 0.1$  indicate "weak" and uninteresting relationship, between 0.1 and 0.3 indicate "moderate" and worth mentioning, whereas above 0.3 are considered as evidence of a strong relationship. Correlations showing statistical significance with  $P < 0.05$  and strong association values ( $> 0.3$ ) were selected and discussed. Finally, a list of recommended measures was suggested in light of the findings and conclusions drawn from the survey results. The proposed measures were based on applicable economic incentive tools, policy reforms, regulatory instruments, public awareness and capacity building needs.

## 3. Results

### 3.1. Profile of responding industries

Nearly 40% of firms contacted (45 out of the 121) responded and filled the questionnaire. The majority of respondents are located in the Mount Lebanon region which is consistent with the industries geographic distribution at the national level. The alcohol/beverage and confectionery/sweets sub-sectors represented each 20% of the total 45 respondents. The processed food/canning and mineral water sub-sectors comprised 15.6% and 11.1%, respectively. The dairy, oil/fat, coffee/nuts, salts/herbs and meat/poultry sub-sectors

**Table 3**  
Geographic distribution of selected food industries.

Location	Number	%
Beirut	22	18
Mt. Lebanon	51	42
Bekaa	19	16
North Lebanon	22	18
South Lebanon	7	6
Total	121	100

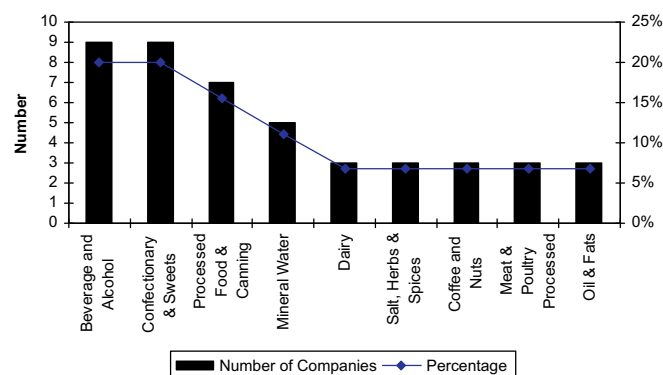
comprised equally 6.7% of the total respondents as illustrated in Fig. 1. The survey revealed that the number of employees (permanent and seasonal) among the sampled industries vary widely between 11 and 500 workers. The mean value of the workforce is about 121 employees. In the absence of a standard and national definition or categorization of industries according to size, the industries 120 or less employees are considered as SMEs. As such, about 62% of all sampled industries are considered SMEs. The majority of the surveyed industries (84.5%) are exporters, either to regional (Gulf, Syria, Egypt, etc.), international (EU, USA, Asia, etc.) or both markets. About 15.5% of the respondent's rely solely on the national Lebanese market.

The results showed that the majority of respondents (71%) don't have a department or personnel dedicated to environmental issues. About 58% of respondents consider that their operation does not have any impact on the environment while 11% have no idea. Almost 68% of respondents reported to have taken initiatives to improve their environmental performance. Some of the initiatives cited include organic waste composting, packaging waste reduction and recycling, water and energy conservation measures.

### 3.2. Industries perception about quality and environmental management systems

The survey revealed that 57.8% of respondents do not perceive ISO 14001 certification to have any added value in enhancing their competitiveness in the national market. About 18% do not have an idea if it will enhance their competitiveness and only 24.4% perceive positive influence as a result of ISO 14001 certification. Nearly all respondents (97.8%) claim that none of their suppliers, customers or business partners ever requested from them to acquire the certification. The majority of respondents (86.7%) consider that current national regulations do not support or motivate them to adopt a voluntary EMS. Only 6.7% consider otherwise or have no idea. Moreover, the survey revealed that 46.7% of respondents consider that their current environmental performance could be a barrier to exporting their products to international markets. Approximately 51% consider that ISO 14001 certification will facilitate their product export to international market, 27% are critical about it and 22% have no idea.

The highest adopted quality management system among the sampled industries is the ISO 9001 (36.8%) followed by the recently issued ISO 22000 food safety standard (31.6%). Only two ISO 14001 EMS certifications were reported within the sampled food industry. Yet, 62.2% of all respondents would consider future certifications compared to only 6.7% who are not interested and 31.7% who have no idea. The respondents were asked to rate the level of priority for ISO 9001, ISO 22000 and ISO 14001 EMS



**Fig. 1.** Distribution of respondents by sub-sector.



certification on a four-point Likert scale where, 1 = Lowest priority, 2 = low priority, 3 = medium priority and 4 = highest priority. The results indicated that ISO 22000 food safety certification is the highest priority for respondents (mean score 3.16). The majority of respondents perceive the level of difficulty to acquire the ISO 14001 certification to be “medium”. Only 11.1% perceive ISO 14001 adoption to be “difficult” while 6.7% consider it to be “easy”. Regarding the cost of acquiring ISO 14001, 31% perceive it “high” and only 4.4% perceive it “low”.

### 3.3. Drivers, barriers and incentives

Industries are motivated to implement ISO 14001 for three main reasons: follow international food industry trend and improve environmental performance, enhance company image, and reduce operational cost. Fig. 2 depicts the drivers perceived by respondents to adopt ISO 14001. Based on the analysis of barriers to adopting ISO 14001, the top three reported factors include: lack of government support and incentives, benefits of certification are not clear or justifiable, and the certification is not required legally for export in addition to the fact that there is no customer demand (Fig. 3). The results show that the main incentives to encourage industries to adopt ISO 14001 are the provision of special tax exemption, capacity building and soft loans, and the establishment of regulations and policies (Fig. 4).

## 4. Discussion

### 4.1. Perceptions

Given that food products constitute the highest industrial exports in Lebanon, it is expected that the majority of the surveyed industries are exporters, either to regional and/or international markets. The existence of an environmental department or specialist strongly correlated ( $P < 0.05$ ) with internationally affiliated industries which may be attributed to the pressure exerted by mother companies on local subsidiaries to address environmental issues [16]. The majority of respondents consider that their industries have no major impact on the environment which may be attributed to the low level of environmental knowledge and awareness. Discussions with respondents clearly reflect the common misconception between hygienic practices (e.g. cleansing activities, pest control measures, etc.) and environmental management practices. Furthermore, respondents who are more aware of environmental issues tend to think that their impacts are

negligible and that their current environmental management practices (mostly package material recycling, and organic waste composting) are acceptable and sufficient measures to protect the environment.

A business can lose its competitive position in its domestic as well as international markets by failing to pay attention to environmental issues [6]. This argument is supported by almost half of the respondents who agree that their current environmental performance is a barrier for accessing international markets. Fryxel and Szeto (2002) [15] and Studer et al. (2006) [47] corroborated the benefits of acquiring ISO 14001 as facilitating export barrier overcome and enhancing competitiveness. Our findings reveal that ISO 14001 certification is mostly desirable to overcome international trade barriers rather than enhancing competitiveness in the national market. This is mainly attributed to the low demand from local customers who are less interested in the environmental performance of food companies compared to quality, safety and price of food products. Such an argument is confirmed by many authors who reported that environmental certification of food products is not an influencing factor in the purchasing decision of customers [5,21,46].

Having ISO 9001 as the highest adopted quality management certification may be attributed to the fact that the certification is required by many customers as a condition for doing business, especially with European firms. Likewise, ISO 22000 food safety certification is progressively increasing in the Lebanese food sector which may be attributed to its export advantages. In addition, the ongoing European-Lebanese Center for Industrial Modernization (ELCIM) supports programs for assisting the Lebanese food industries to overcome export barriers and is acted as a catalyst for this rapid adoption of the ISO 22000 certification [51]. It is expected that more food industries will get ISO 22000 certification to differentiate themselves from competitors and meet export requirements.

The lack of incentives and the absence of a mechanism in the national environmental strategies and regulations that promote EMS result in the low number of ISO 14001 certified industries in Lebanon as compared to other countries in the region. In fact, our findings confirm that “lack of government support and incentive” is the most significant barrier for acquiring the certificate. While Grolleau et al. (2006) [19] and Curkovic et al. (2005) [8] reported that firms with previous experience in quality management certification are more willing to acquire ISO 14001, our findings do not confirm this argument. In fact, the results show that the ISO 14001 certification is the least priority for the Lebanese food

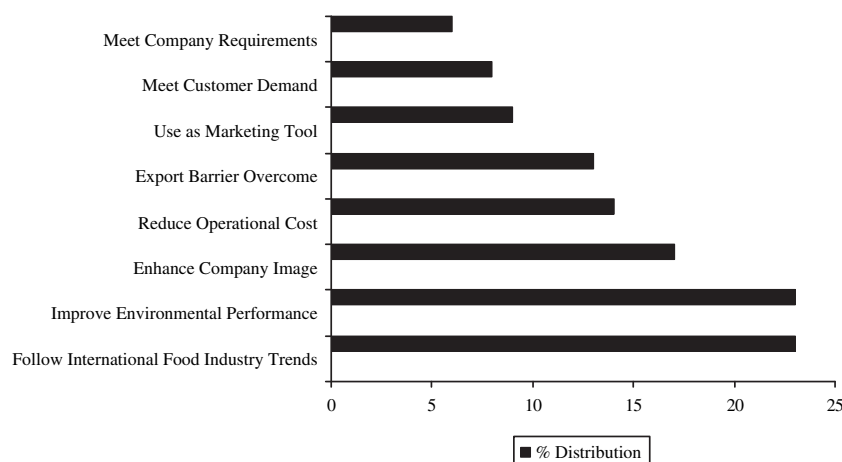


Fig. 2. Perceived drivers to adopt ISO 14001 by the Lebanese food industry.

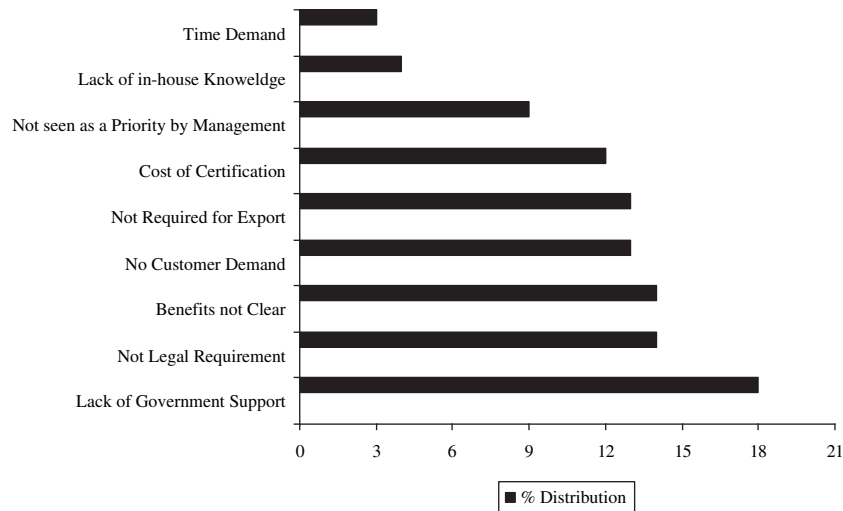


Fig. 3. Perceived barriers hindering ISO 14001 adoption by the food industry.

industry. This is consistent with the findings reported by many authors confirming that food quality and safety are the main priorities for the food sector rather than environmental issues [5,21,46]. Evidently, Lebanese food industries are unlikely to consider voluntary adoption of the ISO 14001 EMS before acquiring a quality management certification or achieving satisfactory product quality and safety compliance. Implementing ISO 14001 is most likely to be adopted by larger industries than SMEs. This may be attributed to the significant correlations ( $P < 0.05$ ) identified between the size of industry and the existence of an environmental unit, initiatives taken to improve environmental performance and quality management certifications acquired which are reported more in larger industries as compared to SMEs. The benefits resulting from ISO 14001 certification are more appealing to larger firms that are more publicly known and more regulated as compared to SMEs [6,8,19].

#### 4.2. Drivers, barriers and incentives

The results of the study revealed that the most salient drivers to motivate the Lebanese food industry to adopt voluntary ISO 14001 certification are “following international food industry trend” and “improving environmental performance”, with equal importance. This finding is inconsistent with those reported by Mezher and

Zreik (2000) [33] who indicated that the main driver for obtaining the ISO 14001 certification among the Lebanese manufacturing industries is achieving access to international market. While improving environmental performance is similarly identified as a major driver by many authors [13,15,35], following the international sector trend is uniquely identified in the food sector [46]. Cost saving has been found in other studies to be a comparatively strong driver [7,16,35]. Yet, cost reduction is not perceived as the primary driver in our study despite that high operational cost being one of the main challenges facing the Lebanese food sector [50]. This finding suggests that food businesses do not fully realize the financial benefits from adopting an EMS either due to their lack of knowledge or failure by regulators to promote environmental improvement as a way to reduce costs. The cost saving factor is perceived more as a driver by certified industries than non-certified industries ( $P < 0.05$ ). The international environmental standards already hinder export opportunities for developing countries [16]. While the majority of surveyed industries are exporters, overcoming export barriers is not perceived as a major driver. Such a weak perception may be attributed to the destination of the export markets. Exporting to eco-sensitive countries such as EU countries, as compared to other countries in the Middle East and Africa, may have a strong impact on the decision of being ISO 14001 certified. This factor is significantly perceived as a driver by SMEs as

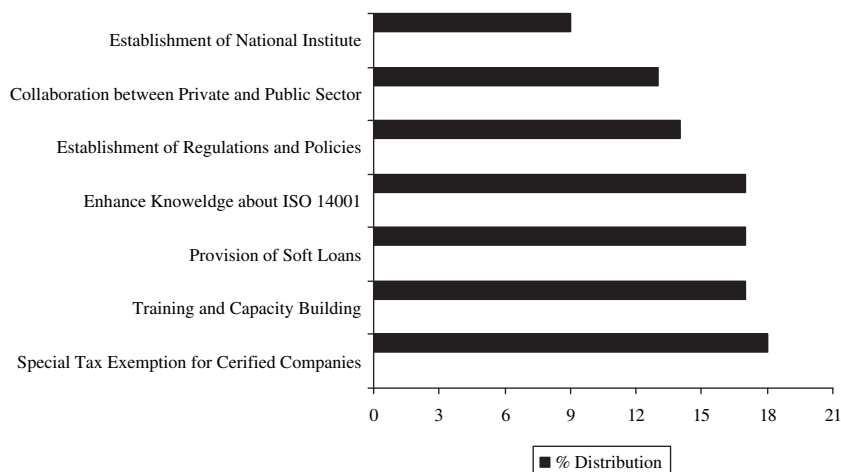


Fig. 4. Perceived incentives to assist the Lebanese food industry adopt ISO 14001.

compared to larger industries ( $P < 0.05$ ). It is possible that SMEs are more sensitive to export challenges. Table 4 presents the distribution of the most perceived driving factors across the different industry characteristic variables.

The food sector is highly susceptible to consumer environmental concerns. Yet, our findings reveal that registration to ISO 14001 is not customer-driven. This contradicts the findings of several studies which point out that many companies are adopting EMS in response to pressure from their stakeholders, such as the suppliers, customers or local authorities [6]. Food industries may not be perceived as a significant environmental polluter when compared with other heavy manufacturing industries; hence it is less likely to be influenced by stakeholders interested in a company's environmental performance [2]. Furthermore, local customer awareness of environmental problems in Lebanon is still relatively low [9]. Considering ISO 14001 certification as a marketing tool is the least perceived driver which may be attributed to the weak perception of the certificate as a tool for enhancing competitiveness in the local market.

The lack of government support and incentives is perceived as the most salient factor that hinders the Lebanese food industries from adopting the ISO 14001 EMS which supports our second hypothesis. This is consistent with findings reported by Mezher and Zreik (2000) [33] whereby the lack of government cooperation, know-how, and experienced local consultants were the main challenges facing the Lebanese manufacturing industries in improving their environmental performance. The barrier is not restricted to developing countries, a similar finding confirmed that the lack of cooperation between industry and regulatory agencies in the US accounts for the slow pace of adopting ISO 14001 [8]. In the EU and Asia, regulatory agencies have laid important infrastructure for the industrial sector that led to improvement in environmental performance and have developed policies and incentives to promote EMS [53,54]. Certified industries perceive the factor as a significant barrier more than non-certified industries ( $P < 0.05$ ) which may be attributed to the fact that certified

industries are more aware of the potential technical and financial challenges that could face them. Table 5 presents the distribution of the most perceived barriers across the different industry characteristic variables.

The lack of relevant environmental laws and regulations is perceived as the second major barrier to adopting ISO 14001. Food industries may consider ISO 14001 certification if they face some sort of obligation, either through legislation or as a result of customers' or stakeholders' demand. Due to the lack of adequate infrastructure and organizational resources in Lebanon, even with the existence of laws and regulations it would be very difficult to achieve regulatory compliance. Moreover, enforcement remains often weak and ineffective as a result of low level of fines because the legislation has not been regularly updated, bribery and corruption. Hence, unless enforcement is carried through and regular checks that license conditions are being maintained, the legislation is ineffective. In addition, there is a lack of coordination among government agencies responsible for environmental protection and resource management. Effective enforcement of applicable laws and legislations should be coupled with financial incentives, education and increased awareness of environmental issues.

The "uncertainty of outcomes and benefits" is also perceived as a major barrier. This may be attributed to the respondent's lack of knowledge with respect to environmental impacts. Additionally, the lack of professional advice, government support and resources further aggravate the uncertainty and skepticism [6]. From a business point of view, the decision to invest in an international certification is more likely to be taken if the benefits outweigh the costs. Hence, without a clear understanding of the benefits, especially in the case of environmental benefits where financial returns are not easily or quickly quantifiable [41,48], the decision to adopt the standard might be unjustifiable.

The cost of certification in Lebanon could range between 15,000 and 20,000 USD, corresponding only to the consultancy and registration fees and notwithstanding the other investment costs

**Table 4**  
Most perceived driving factors based on industry characteristics.

Drivers	Ownership		Size		Quality Management System		Market	
	Inter-national	Local	SME	Large	Certified	Not certified	Export	Non-export
Follow international trend		√		√	√			√
Improve environmental performance	√			√	√		√	
Enhance company image		√	√			√	√	
Reduce operation cost	√			√	√		√	
Export barrier overcome		√	√			√	√	
Use as marketing tool		√	√			√		√
Meet customer demand		√	√			√	√	
Meet company requirements	√			√	√		√	

**Table 5**

Most perceived barrier factors based on industry characteristics.

Barriers	Ownership		Size		TQM		Market	
	Inter-national	local	SME	Large	Certified	Not certified	Export	Non-export
Lack of government support	√			√	√			√
Not legal requirement		√		√		√		√
Benefits not clear		√		√	√		√	
No customer demand		√	√			√		√
Not required for export		√	√			√	√	
Cost of certification	√			√		√		√
Not CEO priority	√		√			√		√
Lack of in-house knowledge		√	√		√			√
Time demand	√		√			√		√

needed. This is beyond the financial capabilities of many Lebanese industries that are already facing financial challenges. This argument is highly supported by a number of Lebanese companies who initially started the ISO 14001 certification process and later chose to withdraw due to the associated investment costs needed to comply with the certification requirements. Given the expected high costs associated with acquiring the certification, inadequate infrastructure and lack of local professional advice, it is unrealistic to assume that local food industries, especially SMEs, would be able to get certified without financial and technical support. Furthermore, the lack of enforcement, political instability and security problems in the country made many industries reluctant or unwilling to make any investment [51].

The results revealed that top management and the lack of knowledge and skills are not considered important barriers. According to Saadeddine (1996) [40], decision making and planning in the Lebanese food industries are restricted to a single individual who is the owner and manager at the same time. Such centralized decision making coupled with the lack of environmental awareness results in less investment in training and upgrading the company's human resources on environmental issues. The provision of special tax exemption, training and capacity building, provision of soft loans and enhancing knowledge on ISO 14001 EMS are perceived as the most important factors to assist the Lebanese food industry to adopt ISO 14001. Table 6 presents the distribution of the most perceived incentive across the different industry characteristic variables.

Given their formal and direct role in the environmental and industrial development arena, the Ministry of Environment, international organizations, Ministry of Interior and syndicates/associations are considered the key organizations to support food industries in adopting ISO 14001 EMS. Private consulting firms are not viewed as major supporting organizations which may be attributed to the limited services provided due to low market

demand and the shortage in experienced ISO 14001 consultants. Companies which acquired the ISO 14001 certification in Lebanon have resorted to the services of foreign consultants to assist them develop the EMS. Without professional advice, organizations may not be able to start the process due to difficulty in interpreting the ISO standards [6]. Matouq (2000a) [30] and Babakri et al. (2003) [1] reported that the most difficult elements in implementing the ISO 14001 were the documentation, identifying environmental aspects/significance and staff training. A fairly low interest in educational institutions is cited among surveyed industries. This is mainly attributed to the weak or limited communication between academic institutions, the industrial sector and the government. This finding is confirmed by Mezher and Zreik (2000) [33] who reported that the educational sector in Lebanon is not providing the required environmental knowledge and know-how to the industrial sector. Hence, it is crucial that educational institutions promote research work that respond better to market trends and to disseminate the research findings to the local community.

As a result of the major public debt in Lebanon, environmental funding through government channels is unlikely to be achieved in the short term. While numerous micro-credit associations in the Lebanese market offer financial assistance to industries in the form of credit guarantees with soft loans (subsidized interest rates), the orientation of these financial products towards environmental investments is still lacking. Hence, financial instruments to adopt ISO 14001 EMS (e.g. subsidizing consultancy costs, reduction in insurance costs, etc.) could be designed in coordination between government agencies and financial institutions. Besides financial assistance, technical assistance through education, capacity building, training and implementation support are considered vital for the adoption of ISO 14001 EMS. Demonstration projects on the implementation of ISO 14001 EMS are needed to enhance the knowledge of the food industry sector on the standard, its applications and environmental and economic rewards.



**Table 6**  
Most perceived incentives based on industry characteristics.

Incentives	Ownership		Size		TQM		Market	
	Inter-national	Local	SME	Large	Certified	Not certified	Export	Non-export
Special tax exemption		√		√	√		√	
Training and capacity building	√		√			√	√	
Provision of soft loans		√	√			√	√	
Enhance knowledge	√		√			√		√
Establishment of regulation	√		√			√	√	
Collaboration between private and public sector	√			√	√		√	
Establishment of national institute		√		√	√			√

## 5. Conclusions and recommendations

The certification to ISO 14001 EMS is perceived as a tool to overcome international trade barriers more than enhancing competitiveness in the national Lebanese market. Food industries are less likely to voluntarily consider adopting ISO 14001 EMS before acquiring a quality management certification or until the ISO 14001 certification gain more popularity among the international food sector. Hence, policy makers and regulatory agencies should take a leading role in persuading industries to converge to voluntary environmental standards. Regulatory enforcement should be encouraged (i.e. penalties, fines, inspections, etc.) coupled with appropriate financial incentives such as low interest loans, tax deductions on environmental friendly equipments and subsidizing part of the ISO 14001 certification cost. The government should develop an environmental funding program in cooperation with micro-finance institutions and international funding organizations. Professional training and innovative diffusion principles such as pilot trials to disseminate success stories should be promoted. The major challenges that impede the implementation of the aforementioned strategies include but are not limited to:

- Outdated legislation which needs overall review.
- Lack of technical expertise and trained staff that requires scientific and legal competence.
- Lack of compliance policies that assist in implementing relevant laws and regulations.
- Paucity of economic resources and the fact that environmental issues are frequently low on the list of priorities as a result of the severe social, political, and economic problems that face most developing countries and Lebanon is no exception.

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