



Investigating Environmental Management and Quality Management Issues in the Libyan Food Industry

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Authors' contributions

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ABSTRACT

Aims: Investigates environmental and quality management issues in the Libyan food industry (LFI). In order to achieve a better level of environmental and quality management to develop modern managerial techniques. In particular, this investigation will help LFI to increase the success of environmental protection (i.e., the reduction in waste, pollution prevention, and the recycling of materials).

Study Design: The questionnaire was conducted with 62 managers at three levels (top, middle, and low) and 518 employees from three companies in LFI.

Place and Duration of Study: The study was carried out in Libya, the fieldwork was conducted in 2013.

Methodology: Adopting existing measures in environmental management systems and total quality management systems revealed in the literature and developing new ones specifically for this research. Also, a set of items was produced to explore issues relating to the cost of quality process, statistical process control, quality technique and information system. In order to satisfy the

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requirements of the statistical test, all questions were based on Likert 5-point scale (5 is the best, while 1 is the lowest).

Results: The results revealed that the LFI do not make sufficient efforts to improve their environmental performance and quality. Further, it is found that LFI is still in a quite low level of achievement for EM. Low compliance with environmental and quality standards was also demonstrated. It is concluded that such results can be ascribed to that the majority of managers in the LFI have a remarkable lack of motivations to environmental and quality management approach.

Conclusion: This study contributes to identifying the key issues of environmental and quality management implementation in the LFI. This paper serves as a point of departure for future research to establish a framework model for total quality environmental management (TQEM) implementation in the Libyan context.

Keywords: Food industry; environmental management; quality management; Libya.

1. INTRODUCTION

Organisations are facing challenges to seek competitive advantages so as to survive in a rapidly changing worldwide business environment [1,2]. Many seek to achieve this by optimising their performance and their ability to deliver high-quality products punctually, reduce waste, enhance the recycling of materials, minimise operating costs, protect the environment, conserve resources, and to promote economic feasibility. Such tasks can be achieved through the adoption of new working philosophies relating to quality and environmental management [1,3]. These philosophies are beneficial to organisations in a number of ways, such as changing environments that threaten food security and economic growth, increasing efficiency and productivity, helping companies to develop new ways of working with customers and suppliers, and improving employees' confidence, skills, and performance. Moreover, these contribute to increasing their competitiveness, and offering better methods with which to improve the quality of the goods and services they provide. Furthermore, any industrial company or governmental or service organisation can create a new environmental and quality culture [4–7]. In the body of the literature on environmental and quality management, significant focus and investigation has been directed towards the implementation of such philosophies in developed countries [8,9].

In contrast, only a few studies exist concerning the advancement of ideas such as these in developing countries [10]. However, these countries have suffered from a lack of environmental governmental control, poor cost management, high storage risks, low productivity levels, and are burdened by less developed technologies, the combination of which consequently resulting in negative environmental

effects [11,12,13]. This therefore demonstrates the need to give greater consideration to environmental protection and increased efforts to improvement products and services [14]. Such measures would result in an increase in the generation of revenue, and enable them to control and be more accountable for the future production impact [15].

Some studies have been conducted on developing countries in the Arab world [12,16–18]. However, these investigations have mainly been small-scale and country specific. In these countries, study of environmental and quality management issues within companies has largely been neglected. In this context, this paper investigates environmental and quality management issues in the Libyan food industry (hereafter LFI). This investigation seeks to accelerate the success of environmental management protection, such as the reduction of waste, the prevention of pollution, and the recycling of materials. The development of quality management, which will also increase efficiency and productivity, creates new ways of working with both customers and suppliers and improving the quality of the goods and services provided.

The application of Environmental Management Systems (EMS) and Total Quality Management (TQM) in the food industry sector has a clear effect on the improvement, support, and enhancement of the competitive position of companies [8,19]. Accordingly, this research was conducted in a Libyan strategic productive sector, namely the food industry. Furthermore, as Libya moves from a traditional and closed economy to more modern, collaborative methods, it is a good opportunity to begin changing the management methods of the key industrial sectors into more modern managerial thinking, based on the participation of all

organisational units. In doing so, better levels of quality and environmental management can be created, and the development of modern managerial techniques can improve the quality of production and protection of the environment. Whilst the problems of environmental protection and improvement of product quality have received significant attention in many countries, Libyan food industry sector appear to have been somewhat slower in modernizing concepts that combine quality and environmental management. According to the reports produced by the Ministry of Libyan Industry (MLI), the problems faced by this sector have arisen from the lack of employees' confidence, skills and productivity, and the implications that these have in terms of production quality in the Libyan industrial sector [20]. These reports show that Libyan industry has suffered from a number of problems that act as barriers to progress. This has meant that Libyan products are less able to compete with foreign products in both local and international markets. In Libya, the level of implementation has suffered from a decline in production efficiency as well as inefficient management.

The purpose of the article is to consider the importance and potential benefits of the food industry to the economy of Libya, the creation of international market partner and the subsequent need for quality and environmental control improvements, and the need of introducing management techniques of which EMS and TQM are particularly pertinent examples. This research is intended to assist LFI companies to increase production volume and quality and to attend to resultant environmental problems, whilst enabling and facilitating competitiveness with external competitors. In doing so, this study contributes to the ongoing identification of key issues relating to quality and environmental utilisation in the LFI. As such, this study is amongst the first that investigates the implementation of TQEM in the Arab world in general, specifically in Libya, and is the first to address to food sector. The overall aim of this article is to confront quality and environmental problems faced by the examined company so as to help them achieve better performance and support their competitive position in the market.

The research objectives are follows:

1. Identification of environmental management issues in the LFI;
2. Identification of quality management issues in the LFI;

3. Proposal of practical suggestions and recommendation to resolve the environmental and quality management issues and to aid LFI preparations for TQEM implementation.

2. ENVIRONMENTAL MANAGEMENT

In contrast to external requirements imposed on firms by government and other regulatory bodies, EMS is effectively a voluntary, self-regulatory structure or system. EMS is a framework through which an organisation protects, enhances, or reduces the impact of its activities on the environment by providing a system sets objectives, measure targets, develop programs and activities, audit and evaluate its operation [4]. ISO 14001 is one of the most widely used voluntary environmental initiatives, devised as an international environmental management standard that provides firms with a systematic framework of compliance and continual improvement in production. ISO 14001 is applicable to a range of operations, including manufacturing and service provision, and can also be used by government agencies [21].

In recent years, the importance of EMS has been recognised by organisations in all sectors of industry. EMS has greatly benefited organisations, but it has also presented a number of challenges [10]. Many companies would accept that the environment is of concern to them. Indeed, many organisations actively seek to demonstrate their good environmental practices. To this end, many organisations engage in a number of activities in order to do so, such as environmental reporting, the provision of end user information relating to environmentally sound practices with their products, the use of certification (e.g. ISO 14001; EMS) to demonstrate their environmental management system standards, and the publication of environmental policies [2]. Due to a general worldwide awareness of global environmental problems such as global warming and the depletion of the ozone layer, many companies have normalised management and control strategies so as demonstrate that they are addressing environmental issues in order to gain or retain global customers and succeed in the increasingly competitive, critical global economy [22]. EMS seeks to minimise adverse environmental effects throughout the operations of a company. To enable companies to achieve this, EMS provides an organised approach for managing environmental issues. The main benefits of ISO 14001 lie in the economic gains

potentially derived by the company, ranging from cost savings on elements as energy consumption, raw material input and waste management, the reduction or reversal of environmental impacts, and the improvement of public image. EMS works to help organisations improve their economic and environmental performance [23]. ISO 14001:2004 defines EMS as 'a framework that allows an organisation to consistently control its significant impacts on the environment, reduce the risk of pollution incidents, ensure compliance with relevant environmental legislation and continually improve its processes and operations' [24].

Maier and Vanstone [25] proposed the idea that an organisation benefits from having an EMS in place in several ways by:

- Promotion of a better understanding and awareness of the various legislative requirements, in turn lead to the development of compliance plans;
- Identification of potential ways to save costs through efficiency improvements;
- Provision of a better understanding of production processes so that greater control can be exerted, in turn leading to a reduction in emissions and a lowering of the risk of pollution incidents;
- Enhancement of the public image of a company by enabling more detailed reporting and transparency, which is important as part of the public image of the company as other stakeholders, such as customers, insurers, and local residents, feel they have access to information concerning the operation and practices of the company [25].

An EMS therefore formally establishes the commitment of a company to environmental management and includes goals such as waste reduction, pollution control, and energy and resource use. In setting objectives and targets which require a system of environmental performance reviews and the formulation of clear, coherent policies, the EMS enables companies to publish an environmental report. In turn, this report documents and enables the comparison of company progress in line with its internal policies and against the performance objectives and targets laid out in the EMS.

3. QUALITY MANAGEMENT

In recent decades, quality has become of increasing importance to organisations. This has

driven many companies to engage at a high level with quality issues and to develop Total Quality Management (TQM) as a new management philosophy and practice. This has been used to underpin an organisation's quality strategies. Based on TQM, this philosophy has generated significant interest in several economies across the world. Rather than being regarded as costly to an organisation, good production and high quality have come to be seen as a competitive advantage for firms. There is a general consensus that TQM is a way of managing an organisation so as to improve overall effectiveness in competing globally [4]. The benefits are having fewer defects, enhanced leadership skills, reduced costs, enhanced business competitiveness, and a resultant increase in market share and profit. The improvement of skills amongst employees and the achievement of greater customer satisfaction are also considered to be associated effects [26].

It is widely accepted that it is the customers who define quality and that the term TQM is therefore a body of practice defined by both quality theorists and practitioners so as to produce a quality product. TQM is, therefore, also a philosophy enables an organisation to consistently meet the needs of its customer, a notion accepted worldwide by manufacturing executives as a strategic concept for organisation survival. However, many authors continue to produce their own definitions of the term. Subsequently, TQM has many definitions, of which one of the most widely used is that presented by Oakland (2003):

'[TQM is] a comprehensive approach for improving competitiveness and flexibility through planning, organising and understanding each activity, and involving everyone at each level. TQM ensures that the management adopt a strategic overview of quality and focus on prevention rather than inspection' [27].

It can here be noted that TQM is an approach that aims for continuous improvement so as to increase the competitive advantage, efficiency, and flexibility of the organisation as a whole, and not of individual parts. TQM is an approach that adopts the philosophy of mistake prevention rather than mistake detection. TQM can be defined in relation to the production of a company culture, characterised by reaching customer satisfaction through continuous improvements.

Hellsten and Kldfsjo [28] defined TQM as 'a continuously evolving management system consisting of values methodologies and tools, the aim of which is to increase external and internal customer satisfaction with a reduced amount of resources'. This definition frames TQM as a management approach aimed at creating an organisational culture that depends on both internal and external customer needs. It also aims to develop employees, encouraging creativity and innovation, through creating a culture between management and the workforce of working together, which helps responds to customer needs (internal and external), requirements and expectations.

4. LINKING ENVIRONMENTAL MANAGEMENT WITH QUALITY MANAGEMENT

The literature identifies the similarities and differences in the evolution of environmental management and quality. Environmental management has been driven by a combination of alterations in the law and changes in general attitudes to preventative and proactive approaches. Quality management has developed a sophisticated set of tools for utilisation in both driving improvement and preventing defective production. Quality management was initially developed to meet customers' requirements and arose from the realisation that quality improvement could reduce costs. Similarities between quality management and environmental management practices regarding managerial tools and underlying philosophies have also been noted [1,4]. Quality management programs and practices have been conspicuous features of operational management research [5]. The critical link between environmental management and quality management have been identified and connected, as environmental management requires active management and should be integrated into all aspects of the manufacturing process, from design to production, delivery, usage, customer service, and, ultimately, post-use disposal [26].

A company instigating an environmental management protocol will have undergone a philosophical, as well as a practical, shift in thinking and operation, thus considering its organisation both in parts and as a whole. This has striking parallels with quality management that results in environmental and quality management complementing each other. These are introduced together with increasing

frequency [1]. Links have been identified between what is currently accepted to be 'best practice' and the improvement of environmental performance by companies, with the environmental management of operations acquiring a number of natural parallels with quality management. This also applies to environmental management. Quality management is regarded as a means by which to enhance the environmental performance of companies, and is a step towards environmental excellence [2].

The implementation and integration of environmental management and quality management has been analysed in previous studies. The implementation of the two management systems in terms of the order of operations can be conducted in three ways [29]: First establishing the quality management system, then the environmental management; first establishing the environmental management, then the quality management system; or establishing the environmental management and quality management simultaneously. Whatever the choice, the firm must seek the level of integration between the management systems that they desire. This can be represented as a continuum ranging from low integration, with two independent systems at one end, to full integration at the other, implying the existence of a single system. Firms are situated somewhere between these two extremes, with varying degrees of integration [30]. Firms consistently strive to establish synergy between integrated total quality and environmental management (TQEM) system and, in so doing, to go beyond what are simply integrated systems for quality and environmental standards.

The concept of TQEM was suggested by the Global Environmental Management Initiatives [31] and the Council of Great Lake Industries [32]. TQEM consists of four paradigms: (a) Total: Which involves the entire organization, supply chain, and/or product life cycle, (b) Quality: Designed to drive up quality through 'zero defect' definitions, (c) Environmental: Strategic environmental management approach (d) Management: The system of managing through steps such as Plan, Organize, Control, Lead, Staff, provision and organize. As defined by the International Organization for Standardization, TQEM is a total applied system approach and an integral part of high-level strategy.

TQEM means that the firm will be better equipped to develop a philosophy of continuous

improvement, rather than other less ambitious strategies that are based on simply meeting certain requirements [1]. TQEM combines the two management concepts of TQM and EMS, bringing the two approaches together so as to support a company's business. In so doing, TQEM aims to resolve the conflict between the independent operation of EMS and TQM, which can lead to competitive decisions within organisations as they seek to achieve quality and cost efficiencies whilst minimising their environmental impact. TQEM provides a mechanism for more effective interaction between TQM and EMS. The integration of environmental management and quality management has therefore become a popular topic for research and practice [4].

It is important to note that a greater understanding of environmental management and quality management will not only provide greater productivity or profitability in itself, but will also embed the culture within the operating philosophies of firms. This will involve changes in understanding and practice at all levels of the organisation and require the training of the workforce, the recognition by senior management that the workforce can contribute and are essential to gaining quality enhancement, and the recognition that customers are important stakeholders who must be satisfied by all aspects of the operation. To date, notable, but also limited, advances in the implementation of TQEM have been seen in Libya. Whilst limited, these small changes are nonetheless significant, and it is expected that these will become more widely diffuse in the Arab world. However, the goal remains to find ways to implement TQEM that will be acceptable and therefore successful in Arab operational culture.

5. METHODOLOGY

The adopted research design of this paper is consisted of deductive approach, quantitative method and variables oriented strategy, which focuses on any links between limited numbers of attributes across many cases. Such measurements are commonly conducted by gathering questionnaire data, a frequent or method in the social sciences. The reliability of the questionnaire was confirmed using Cronbach Alpha measurements. In line with these measurements, achieving a score of 0.70 or more for a reliability coefficient is considered 'good' [33]. In this research the reliability 'alpha'

measured 0.80, as a result the method developed to measure the quality management and environmental management elements was considered to have high reliability and to be an acceptable instrument for this test. The validity of the questionnaire was tested by a review carried out by academics and research staff in university of Benghazi (Abu baker Buera, Izzudin Busnaina, and Omar Gnieber), and by 12 managers and 60 employees in the LFI. This rigorous testing was conducted before the circulation of the questionnaire in order to ensure accurate assessment. The Arabic version of the questionnaire was then given to a sample of individuals. The back translation method (English-Arabic-English) was used so as to ensure that the Arabic version of the questionnaire conveyed identical meaning to the respondents. The questionnaire was hand-delivered to LFI managers and employees and was conducted between April and June 2013.

5.1 Research Context in this Study

The empirical research was conducted on one of the important sectors in Libyan industry (LFI)—which consists of 15 companies. The sector was selected because (1) the food industry in Libya represents about 25% of the total income of Libyan industry; (2) some sectors have received investigative treatment, such as the Oil, Electricity, and Cement industries, whilst food industry has not been researched significantly comparing with oil and heavy industrial sectors; (3) the importance of this sector as Libyan government support non-oil industry; (4) the originality and uniqueness of the research means that results will contribute to the development of both Libyan managers and organizations. Previous study investigations have neglected environmental management and the impact on the environment of such industry production [11]. As such, in developing countries approaches are characterised by the use of methods that are no longer followed in TQEM practice, and that have become normalised in those countries.

It is important to note food industry companies are distributed across the four geographic regions of Libya (northern, eastern, western, and southern), subsequently posing implications in terms of time schedule and field work costs. Therefore, food industry companies were selected in the eastern region of Libya. Furthermore, given the focus of the research, only the large companies in this region were studied, given that environment and quality

management in larger companies, as a process and as departments, are more established than in smaller companies [34]. Table 1 shows the characteristics of the three selected LFI companies in eastern Libya, covering six main features: Company name, ownership, type, standardisations, and manager and employee numbers.

5.2 Research Measurement

The measurements adopted in this research are, mainly, existing measures. Similarly, the questions and scales were developed through the selection and adoption of those used elsewhere in the literature [35]. These measurements fall into three categories in terms of developmental level: (1) *existing measures*, which are items and scales that have been developed by previous studies; (2) *composed measures*, which are existing in the literature, but the items and scales of which have been adopted according to the current research; and (3) *new measures*, which are items and scales that have been developed ad hoc for the purpose of this research.

Accordingly, the measurements adopted in the questionnaire are reviewed. Part one of the questionnaire investigated the EMS issues in the LFI, and consisted of nine questions concerning pollution, emissions, raw materials, environmental performance, environmental aspects, and relationship with stakeholders. Part two investigated TQM issues in the LFI, and consisted of eight questions concerning cost of quality process, statistical process control, quality technique, reward for employees, information system, and framework needed.

5.3 Research Sample

The research sample was conducted within 62 manager levels (top, middle, and low) and

employees (518) of three companies in the LFI. The data was collected in July 2013 immediately preceding the civil unrest in Libya. And, all respondents were actively occupied their positions in LFI. Given the small number of managers in the three levels (12, 15, and 35), the questionnaire was delivered to them all in person (comprehensive survey). Purposive sampling was used with the employees. The respondents selection criteria were (1) ≥ 3 years' experience within the industry (2) involvement in quality training programme and/or quality activity in the company. The table of Kregcie and Morgan [36] was used in order to draw a sample those meeting these criteria. The use of a questionnaire was selected so as to facilitate the collection of information from a large number of employees concerning responses and reaction towards the implementation of TQEM. Table 2 shows the sample distributional breakdown for the three selected LFI companies.

5.4 Questionnaire

In this paper, a quantitative method (a questionnaire) was used to collect data in order to investigate environmental and quality management issues in the LFI. Such a methodology has been approved by many researchers in the fields of environmental and quality management. Existing measures in EMS and TQM literature have been adopted and new ones developed specifically for this research [1,7,12]. A series of questions were identified in order to investigate pollution, emissions, raw materials, environmental performance, environmental aspects, and relationships with stakeholders. A set of questions was also produced so as to explore issues relating to the cost of quality process, statistical process control, quality technique, and information system. To satisfy the requirements of the statistical test, all questions were based on Likert five-point scale.

Table 1. The characteristics of the LFI

Companies	Ownership	Type	Standardisations	Top	Mid	Low	Employees	Total
Al Rehan	Private company	National	ISO 9001 & Libyan quality award (LQA)	4	10	300	187	
Bou Attane	Public company	National	ISO 9001 & LQA	4	6	10	650	260
National Mills	Public company	National	LQA	5	5	15	150	133
Total	One private & Three two public	national companies	Two companies have ISO 9001 & LQA. One company LQA	12	15	35	1100	1162

Table 2. The sample of management staff and employees in the LFI

Management level	Top management (staff number)	Middle management (staff number)	Low management (staff number)	Employees
Companies				
1. Al Rehan	3	4	10	170
2. Bou Attane	4	6	10	240
3. National mills and fodders	5	5	15	108
Total	12	15	35	518

The questionnaire was designed to make it easy for the Libyan respondents to answer. A five-point rating scale was considered to be the most suitable by which provide the information needed. This approach was suitable for dealing with factors critical to environmental management [37] and for investigating production challenges faced by the Libyan industry [15]. The respondents were asked to score each of the questions using a five-point rating scale (1 = never, 2 = rarely, 3 = I don't know, 4 = sometimes, 5 = always) relating to perceived extent of quality and environmental management in the respective organisations. The average of the rating scale is 3, derived from the following calculation: $(1+2+3+4+5)/5=3$. A mean above 3 shows a positive feedback with the statements, while a mean below 3 shows an overall negative feedback [38].

6. DATA ANALYSIS

To process the data collected from the questionnaire, the questionnaires were coded and entered into a pre-set Statistical Package for the Social Sciences (SPSS) software. Descriptive analysis was used (i.e., the observation of frequencies, percentages, means, and standard deviations) as a method for data examination. As mentioned previously, the research data were collected from managers and employees in the LFI. The data collected were measured by questions built on five points of the rating scale. The participants were asked to answer by marking the scale for the given statements.

6.1 Environmental Management Issues in the LFI

Table 3 presents the results that are related to environmental management and the responses from each company. This was measured by nine questions on a five-point rating scale.

Table 3 shows the results gained from measuring environmental management. All respondents were asked about support for the prevention of

environmental pollution and emissions wherever possible and in their company's management of such emissions in environmentally friendly ways. Two hundred eighty-four responses were 'never' or 'rarely', 121 were 'I don't know', and 145 were 'sometimes' or 'always'.

The descriptive analysis of hazardous materials disposed of in an environmentally suitable manner shows that 281 responses said 'never' or 'rarely', 148 were 'I don't know', and 121 were 'sometimes' or 'always'. According to this, the LFI is not used to, or disposed to, acting in an environmentally friendly manner to protect the environment.

Descriptive analysis of the questionnaire shows the results relating to progress towards reducing the pollution emitted by the companies. Three hundred twenty-eight responses said 'never' or 'rarely', 117 said 'I don't know', and 105 said 'sometimes' or 'always'. With regard to focusing on the environmental aspects, 336 responses said 'never' or 'rarely', 120 were 'I don't know', and 94 were 'sometimes' or 'always'. This indicated that the LFI has not taken responsibility to protect the environment, which has caused risk to human health, safety, and the environment. The LFI has not given enough support to green products to assist environmental preservation.

Table 3 shows that 340 answered 'never' or 'rarely', in regard to attending courses to address the problem of dust and pollution, while 93 said 'I don't know', and 117 'sometimes' or 'always'. From the above, managers in the LFI know that pollution could have a detrimental impact on the environment; 302 responses were noted as being 'sometimes' or 'always', 114 were 'I don't know', and 134 were 'never' or 'rarely'. According to this, the main problem is that planning strategies for training in environmental protection are not available in the LFI. The LFI does not encourage employees to protect the environment. Managers in the LFI are not concerned with the aspects of production that could have negative environmental impacts.

Table 2. The results of data analysis for environmental management issues in the LFI

Questions	Never	Rarely	I don't know	Some times	Always	Total	Mean	Std. deviation
Your company supports prevention of pollution and emissions?	124	160	121	84	61	550	2.59	1.277
Are hazardous materials disposed of in an environmentally suitable manner?	172	109	148	52	69	550	2.45	1.216
Do you have the desire to work towards reducing pollution emitted by the company?	94	234	117	70	35	550	2.42	1.081
Do you think focusing on the environmental aspects would reduce the pollution emitted by the company?	198	138	120	80	14	550	2.26	1.087
Do you attend courses that would be beneficial to addressing the problem of dust and pollution?	199	141	93	69	48	550	2.24	1.256
Do managers in your company know pollution could badly affect the environment?	75	59	114	168	134	550	3.47	1.294
The company has procedures to check and revise the environmental performance?	146	135	192	63	14	550	2.43	1.026
The company has a relationship of cooperation with stakeholders (government, clients, suppliers, etc.) for environmental protection?	235	133	114	57	11	550	2.08	1.112
Environmental audit is primarily a means of identifying opportunities for improving environmental performance?	54	75	133	184	104	550	3.37	1.186

As shown in Table 3, 281 answered 'never' or 'rarely' to the question concerning LFI environmental performance check and revision procedures, while 192 said 'I don't know', and 77 'sometimes' or 'always'. Regarding relationships with stakeholders, 368 responses said 'never' or 'rarely', 114 were 'I don't know', and 68 were 'sometimes' or 'always'. This suggests that the LFI does not have good relationships with stakeholders (government, clients, suppliers, etc.) in dealings relating to environmental protection.

Regarding the notion that an 'environmental audit is primarily a means of identifying opportunities for improving environmental performance', 129 answered 'never' or 'rarely', 133 'I don't know', and 288 'sometimes' or 'always'. Although Libyan

managers and employees know that an environmental audit is primarily a means by which to identify opportunities to improve environmental performance, the LFI does not encourage staff to conduct duties in a manner conducive to the improvement of environmental performance.

The results regarding 'managers in LFI know that pollution to the environment could have a bad impact on the environment' and 'environmental audit is primarily a means of identifying opportunities for improving environmental performance' show positive feedback, with environment in the LFI showing a mean average of 3.47 and 3.37. While company support prevents pollution and emissions, hazardous materials disposed of in an environmentally

suitable manner, works towards reducing pollution, focuses on environmental aspects, attending courses, procedures to check and revise the environmental performance, and the relationship with stakeholders have a mean average of below 3. This has indicated that all these elements show overall negative engagement with the environment by the LFI.

6.2 Quality Management Issues in the LFI

As stated in the previous section, quality management issues in the LFI were important elements of the survey. In this paper, quality management is measured through eight questions. Table 4 shows the results of the analysis for quality management.

Table 4 indicates that 246 responses considered work towards reducing the cost of the quality process as ‘never’ or ‘rarely’, and also, 170 respondents did not know if their companies worked toward reducing the cost of the quality process. However, 134 of the responses were ‘sometimes’ or ‘always’. This result is has certain similarities to that of understanding the product

cost during product development. It can be seen that 285 respondents answered ‘never’ or ‘rarely’, 150 ‘I don’t know’, and 115 ‘sometimes’ or ‘always’. Descriptive analysis of ‘applies statistical process control’ shows that 199 responses said ‘never’ or ‘rarely’, 98 replied ‘I don’t know’, and 253 ‘sometimes’ or ‘always’.

This result indicates that the LFI believed that reducing costs resulted in a reduction in quality. Some of the LFI companies use statistical process control and other systems, such as Libyan standards, to help them control quality in their products.

The quality management methods implemented in the LFI were investigated by asking the following question: Does your company use ISO 9000 as a technique to drive quality improvement? Of the 550 respondents, 188 said as ‘never’ or ‘rarely’, whereas 45 did not know. Three hundred seventeen answered ‘sometimes’ or ‘always’ on whether they knew if the company had formally implemented ISO 9000: 2000 as the quality management system.

Table 3. The results of data analysis for quality issues in the LFI

Questions	Never	Rarely	I don't know	Some times	Always	Total	Mean	Std. deviation
Reduce cost of quality process for continuous improvement is prioritised	154	92	170	89	45	550	2.60	1.27
Managers in your company understanding the product cost during products development	178	107	150	67	48	550	2.45	1.296
Your company applies statistical process control	76	123	98	175	78	550	3.10	1.286
Does your company use ISO 9000 as a technique to drive quality improvement?	127	61	45	136	181	550	3.33	1.579
There is a system that links reward to employees' quality achievement	197	122	116	91	24	550	2.31	1.236
Your company uses a good information system to improve performance	172	159	159	45	15	550	2.27	1.054
The employees have appropriate qualifications and experience required for the improvement of employees' work	110	141	218	54	27	550	2.55	1.048
Has framework needed for environmental and quality management implementation?	51	75	123	129	172	550	3.6	1.260

Descriptive analysis of the item on rewarding employees' quality achievement in improvement initiatives shows that 319 answered this question as 'never' or 'rarely', 116 as 'I don't know', and 115 as 'sometimes' or 'always'.

In responding to the question 'Does the company use a good information system to improve its performance', 331 responses said 'never' or 'rarely', and also, 159 respondents 'did not know' if their company used a good information system. Descriptive analysis shows that 251 responses said 'never' or 'rarely', 218 'did not know', and 81 replied 'sometimes' or 'always' in relation to the qualifications and experience required to improve employees' work. This indicates that the LFI has to compete with foreign products in the Libyan market because of their high quality and competitive prices. The LFI has not paid sufficient attention to external and internal customers and clients.

To understand the need for a framework for the implementation of quality and environmental management, the questionnaire asked the following question: 'Can quality and environmental management problems be solved by a clear framework for the LFI?' In responding to this question, 126 said 'never' or 'rarely', whereas 123 'did not know', and 301 answered 'sometimes' or 'always'.

In Table 4, we can see that the questions that were negatively worded showed means of less than 3. In general, participants indicated negative attitudes towards reducing the cost of the quality process, understood the product cost during product development, rewarded employees for their quality achievements, used good information systems to improve its performance, and required qualifications and experience to improve employees' work in the LFI. Positively worded items have mean values greater than 3; these items relate to the application of statistical process control, the use of ISO 9000 as a quality technique to drive quality improvement, and the need for a framework to implement quality and environmental management.

7. RESULTS AND DISCUSSION

Environmental management and quality management problems in the LFI have been presented in sections 5.1 and 5.2. It is important to note that the problems in the two discussed in this paper are interrelated and not independent. This is because, today, impact of products on the environment is an important measure of a

company's performance, and should therefore be assimilated and included in the company's quality management framework. On the other hand, environmental management has to be implemented within the quality management framework of a company, without which environmental management cannot be achieved, be it sufficient or thorough.

In general, environmental management and quality management strategies seek to increase the quality of operations and level of environmental protection. The cost-saving ambitions of quality management, seeking to minimise errors through the adoption of a 'right first time' approach, is considered to conflict with the philosophies of environmental management. Costs may be incurred for preventative measures intended to minimise environmental impacts, costs that will affect profitability. However, once a firm has made the philosophical change in thinking to the prevention of either error or environmental impact, the benefits of quality management and environmental management can be seen more clearly, and both have been incorporated into the philosophy of many companies globally. However, as yet many systems do not conform to the business environment in the Arab world, and some change in knowledge and benefits are necessary in order to enact positive effects.

7.1 Environmental Management Issues

The results confirm that environmental management in the LFI has not yet developed the necessary methods to drive environmental improvement within companies. Generally, Libyan managers and employees should know how to implement an approach that; protects the environment, achieves increase in sales and market shares and in cost reduction for materials, energy, and services; better distribution networks; better corporate management; and better risk management.

One of the results of this paper is that the LFI has not yet started to be more socially responsive in dealing with pollution and waste disposal, in beginning to develop environmental friendly packaging, or attempting to introduce numerous other improvements to bring the LFI in line with current thinking on environmental protection. Managers in the LFI also did not exhibit concern for the aspects of production that could have detrimental environmental consequences.

The results confirm that the LFI does not have any plans for environmental policy within the constituent companies, and that support for EMS is still very low. The LFI has also attached little importance to the reduction and recycling of waste. According to this research, the LFI is achieving only low levels of EMS including, for example, the reduction of environmental damage, regarding which these companies are particularly unsuccessful.

Analyses of the data highlight that green products are not known in the LFI as being ecological or environmentally friendly products. A green product is one that has more environmentally sound content or packaging so as to reduce environmental impact. Ensuring a balance between development and environmental sustainability is, in itself, a challenge [39]. However, the LFI must ensure environmental sustainability and resource management in production.

Based on answers to the questionnaire, there is no perceivable concern about environmental pollution. Waste, therefore, has an impact on the environment in the LFI. Reducing energy consumption will not be a priority for the companies in the foreseeable future. The reasons for this are the low price of energy and the high cost of green technology. This study found that there is a lack of training that would be beneficial to address the problems of dust and pollution. The LFI has a high level of dust pollution and its effect on the environment. As a result, the main problem is that planning strategies for training to environmental protection in the LFI are not available. The LFI does not encourage employees to protect the environment.

The environmental management issues relating to the LFI, identified through the questionnaire, can be summarised as follows:

- The LFI does not have a good control system for obtaining raw materials;
- Managers in the LFI are not supporting the planning of environmental management and have given little importance to reducing and recycling waste;
- The LFI has not provided support for green products to preserve the environment and reduce their negative environmental impact;
- Libyan managers do not attend enough training courses relating to environmental

management, and they do not have clear ideas about environmental management systems;

- There is no program with which to measure pollution and inspection procedures in the LFI;
- Reducing energy consumption will not be a priority for the companies in the foreseeable future;
- The LFI suffers from a lack of support from the Libyan government policy relating to environmental management;
- Employees in the LFI are not encouraged to accept responsibility for environmental protection, recognition, and appreciation of environmental effort or the success of individuals and teams;
- The LFI has a negative impact on society and culture through their environmental management implementation within the Libyan context;
- The main problem is that there are no planning strategies in companies' procedures in the LFI to check and revise environmental performance and training in environmental protection in the industry;
- The LFI does not have a good relationship with stakeholders (government, clients, suppliers, etc.) in regard to environmental protection;
- The LFI does not encourage employees to do their work correctly to improve environmental performance.

7.2 Quality Management Issues

The findings have revealed that managers and employees in the LFI have a fairly low level of understanding of the product cost during product development, which negatively affects the companies' productivity and, consequently, their competitive position. Clearly, under the effects of such problems, it might be difficult for their products to meet international standards. The impact on product quality and productivity was limited and had little to do with reducing or controlling defective product units. A reduction in costs resulted in a reduction in quality, and companies generally accepted the inevitability of this trade-off between quality and cost. Improved quality can be achieved without extra cost and, indeed, can be seen as a way to reduce costs [40]. As with most other emerging economy organisations, the LFI is generally run by managers with a lack of experience whose priority is to safeguard their existence.

The main findings of the questionnaire are the lack of sufficient support from top management in the LFI for the tracking of reworking, waste and rejects, and for continuing improvement. This has indicated that some of the greatest challenges that are faced by the LFI are associated with changing consumer taste, a poor consumer perception of green products, and the high cost of developing green products. An understanding of this issue is therefore essential for both sustainability and environmentally friendly products.

These responses confirmed that the LFI applies a statistical process, the ISO 9002:2000 system, and the Libyan quality standard, to control quality in some of LFI processes. This indicated that levels of quality in the LFI are poor. Although the LFI was using quality management systems (i.e., ISO 9000:2000), the whole program was simply a response to pressures from clients abroad who buy their products [11].

The results regarding the quality management issues that are identified from the questionnaire could be summarised as follows:

- The majority of managers in the LFI have a lack of motivation for quality management implementation, and there is little awareness of it;
- The LFI does not support and encourage employees to achieve quality and productivity improvement;
- Most managers have not received formal quality management training;
- Quality measurement systems and benchmarking are not clear in the LFI, and staff are not encouraged to attend training on these areas;
- The LFI does not have a good information system with which to improve its performance; the companies do not use information to make decisions within their company;
- The employees in the LFI do not have the appropriate qualifications and experience required to improve their work, and their companies do not provide them with sufficient resources to implement an educational plan;
- Top management in the LFI is encouraged to change within a new framework of quality implementation and environmental management;
- The development of a TQEM framework could be beneficial for LFI companies, and

that some quality and environmental management problems could be resolved by a clear framework in the LFI.

8. RECOMMENDATIONS

The authors' recommendations, below, are categorised into three levels—managers, the LFI authorities, and the Libyan government—to resolve the issues in environmental and quality management and to help the LFI prepare for TQEM implementation.

8.1 Libyan Managers

1. There should be training and workshop initiatives to qualify LFI managers and employees in awareness of the importance of the process of TQEM's development and implementation. Environmental and quality management training should be provided at all levels to managers and employees, as the training will enhance their environmental awareness and amend their knowledge through any new strategies and techniques adopted. These help to increase their skills for the program and to ensure the continual improvement that is required by a formal TQEM;
2. An environmental department should be established for the LFI, and the management structure should be improved to provide a higher level of authority for this department;
3. Good relations and communication should be established between the LFI's top managers and international EMS agencies so as to have more information about responsibility for the evaluation and improvement of management systems and to lead the environmental drive;
4. Managers at all levels should adopt new information systems in their departments to promote high-level TQEM planning and information for employees and to provide all the information needed by the customer about the products and services of a company.

8.2 The LFI's Authorities

1. The LFI needs to adopt a new system/network to sort out relationships with international and national suppliers, who should be evaluated and selected based on their capability and commitment to service quality;

2. The LFI should pay attention to their external and internal customers. This should be reflected in the overall planning of environmental and quality management efforts;
3. An impact assessment of the LFI needs to be carried out by using Life Cycle Assessment (LCA) models. This method's stages include the LFI's extraction, production, transportation, processing, and distribution. The LFI therefore needs to adopt the LCA method to control environmental impact;
4. The LFI must revise the ISO 9000 certification processes and apply the ISO 14001 requirements to guarantee an improvement in environmental performance;
5. The LFI needs to apply training programs to keep the employees up-to-date on a regular basis, so they can efficiently participate to the most recent strategies and approaches of environmental and quality management.
6. The Libyan Ministry of Industry should support Libyan factories in delivering the latest technology, which supports the local company's contribution to environmental protection.

9. CONCLUSION AND FURTHER RESEARCH

This paper has investigated both environmental management and quality management issues so as to help the LFI achieve a high level of quality and a sustainable environment. This study presented the results from a questionnaire survey that investigated environmental management and quality management issues in the LFI. It finds that the major issue regarding environmental management and quality management in the LFI is that top management in this sector does not provide sufficient support for new quality and environmental management, and also, that there is no concern about the pollution of the environment. The quantitative survey shows that quality management exists at modest and poor levels. There is also evidence from the LFI that showed that their machines were incapable of adhering to new quality programs that may have an impact on the environment. The LFI has little environmental awareness and has not given enough importance to the reduction and recycling of waste.

The opinions of the LFI's managers and employees are identified in relation to issues of environmental management and quality management. The investigation results will be used to establish a framework model for total quality environmental management (TQEM) implementation in the Libyan context, to improve quality and to provide more environmental protection. Further research will therefore propose a framework model for the implementation of the TQEM in the LFI. The successful implementation of TQEM will have a profound effect on the production system of countries such as Libya. However, TQEM will necessitate a shift in thinking about the environment. EMS itself requires attention to environmental impact, while TQEM requires responsible resource use and waste minimisation. The production systems must also incorporate sustainability into their philosophy as they seek to increase their output and their profitability. Achieving such a development without negatively affecting the environmental system requires the adoption of a philosophy of responsibility towards the environment.

8.3 Libyan Government

1. Libyan government agencies should raise awareness of the significance of quality production and services, environmental protection, sustainability, and global environmental issues to stakeholders and local people;
2. The Libyan government should establish new regulations that encourage Libyan managers to take strong responsibility for environmental issues that cause risks to health, safety, or the environment;
3. The Libyan government needs to review their legislative framework and environmental policies to ensure that they are current and provide a clear vision, mission, and strategy.
4. The Libyan government needs to produce manuals to provide training on the environment, seeking external advice and support from specialised environmental agencies. This can be achieved through the publication of handbooks and guidelines;
5. The Libyan government should allocate more funds to sponsor workshops, sessions, and training for TQEM implementation (economically, environmentally, and socially) nationally and internationally;

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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