Exploring the Reality of Implementing the Integrated Quality Management System for Construction Projects in Iraq

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Abstract: *An integrated **quality** management system (IQMS) includes many of management systems grouped together to form a single system such as, quality management system (ISO 9001), environmental management system (ISO 14001), and Health and safety management system (ISO 18001). Other management systems can also be integrated but these three standards have been reconsidered and found more suitable to integrate. The main aim of integration is to restructure and simplify processes and avoid duplication when the implementation of several standards at same time may be cumbersome. With the revisions and new versions of the different standards, the management systems have an increased number of similarities. The main objective of this research is to evaluate the current quality management systems in the construction companies in Iraq and to explore the reality of implementing the integrated quality management system in the construction sector. The practical part of the research includes personal interviews with sample of engineers and quality experts at construction companies and using a questionnaire consists of three axes that include questions covering clauses of the quality standards mentioned above. Statistical analysis is used to find out the level of development in the quality system required in construction companies. The results of the survey have shown that the conformance ratio of quality management system requirements in accordance with (ISO9001) version 2015 is (2.94). On the other hand, the conformance ratio of the environmental and occupational health and safety management systems are (0.24) and (0.27) respectively.*

Keywords: Quality management system (ISO 9001`:2015), Environmental management system (ISO 14001:2015), Occupational health and safety management system (OHSAS 18001:2007) and Integrated quality management system

1. Introduction

Construction is one of the essential industrial sectors for any economy but, in the public view, construction is an untidy, strident and time consuming process disturbing everyday life. In terms of health and safety the industry has the highest rate of fatal accidents. Industry is also one of the major contributors to the reduction of natural resources and a main cause of unwanted side effects, in addition affects on environment at different ways [5]. In order to satisfy stakeholders' requirements and so find competitive advantages and achieve sustainable development, many organizations have applied quality (ISO 9001), environmental (ISO 14001) and occupational health and safety (OHSAS 18001) management systems, which has become a general practice around the world in recent years[9].The idea of an integrated management system is to facilitate offer a clear image of all the characteristics of your respective management system parts, to explain how their relationship helps in managing the relevant management systems risks of the organization [10]. The adoption of one or the other of these management systems depends on several parameters, in particular, the mode of management, corporate culture and its challenges[7]. Integrated management systems are the reasonable extension of the rapid development of management standards [4].The integrated management systems are viewed as a transverse connection between the different standards, where the standards have a number of similarities and common activities (policy, planning, documentation, evaluation, etc.) [8]. An IMS requires to be ordered to facilitate the organization to effectively and efficiently administer its operations and will based on the organization's size, the number and difficulty of operations, products and services, and associated risks, level of regulation and whether it is national or worldwide etc [6] . Additionally, the integration process should be started from the initial stage of product design and improvement to its disposal (cradle - to- grave approach) in a try to discover the opportunities to reduce environmental impact [11].

2. Research Objective

The objective can be summarized as the following:
To investigate the current management systems which applicable in construction companies and determine gap between current systems and standards requirements, then to reduce gap and achieve compatibility with international standards requirements for quality (ISO 9001:2015) ,environmental (ISO 14001:2015) and occupational health and safety (OHSAS 18001:2007) by suggesting recommendations.

3. Field Study

Field survey represents the practical side of the research; the goal is to stand up to the implementation reality of quality, environment and occupational health and safety management systems within construction companies.

3.1 Closed Questionnaire

A questionnaire was conducted to collect the data about the implementation extent of quality, environment and occupational health and safety management systems within construction companies in Iraq.

3.2 Questionnaire Form Design

A questionnaire form design was conducted in two stages:
1) Preparing the questionnaire questions: Questions were regulated by depending on the international standards for quality management system (ISO9001:2015), environmental management system (ISO14001:2015) and occupational health and safety management system (OH&SAS18001:2007).
2) Formulating the questions: Questions were put to cover two main parts:
   a) The first part it includes personal and public data for the questionnaire sample members.
   b) The second part (building an integrated quality management system for construction companies): It contains three main axes listed in the closed questionnaire. Every axis consist of set from checklists as follows blew : -
   - The first axis: It contains checklists for the conformity with the standard requirements (ISO 9001: 2015) of quality management system.
   - The second axis: It contains checklists for the conformity with the standard requirements (ISO14001: 2015) of environmental management system.
   - The third axis: It contains checklists for the conformity with the standard requirements (OH&SAS 18001: 2007)of occupational health and safety management system.

3.3 Questionnaire Sample Selection

The success of the field survey process which aims to collect and analyze the information depends on the success of the selection of the sample, So it was emphasized that the selection of the sample from set of quality, environment and occupational health and safety managers and internal auditors of various engineering disciplines and other specialties, where it characterized by features that will provide as much accurate information as possible. The researcher distributed (50) questionnaire forms to a number of construction companies of the government sector in Baghdad of Iraq and then receive (32) questionnaire forms as shown in the Table .1.so that the natural distribution is realized.

Table 1: Questionnaire sample distribution

Ministry	The Company or Office Name	No.
The Ministry of Construction and Housing	The Ministry Center	4
	General Office Works and Maintenance	2
	Al Mansur Contracting Company	3
	Directorate of Housing	1
	Directorate of Building	2
	Saad State Company	2
	Al Mutasim Contracting Company	3
	General Authority for Roads and Bridges	2
	Construction Engineering Department	2
Ministry of Industry and Minerals	Rehabilitation and Test Engineering Company	2
	Al-Rasheed Public Company	1
	Al- Fida Public Company	2
Oil Ministry	The Ministry Center	3
The Ministry of Science & Technology	The Ministry Center	3
Total		32

4. Statistical Analysis

In order to interpret the answers which have been obtained from the questionnaire forms to the expressions of quantity and greater precision get in the data analysis contained therein, likert scale have been used to measure the extent of conformity the actual implementation of the requirements in the research sample with standards requirements by identifying weight for each class of answer contained in the questionnaire checklists.Table.1. shows likert scale which ranging from completely applied and fully documented (4 weight) to did not applied (zero weight), in order to detect the current gap between the quality, environment and occupational health and safety management of existing systems in the construction companies and the requirements of standards.

Table 2: Likert scale for answers [3]

Weight	Class of answer
Zero	Not applied

1	Primarily applied
2	Partially applied and undocumented
3	Completely applied and partially documented
4	Completely applied and fully documented

The results of the field survey were analyzed by some simplified statistical methods for the purpose of results display including histogram method as well as Pie-Chart method, in addition has been used some common statistical standards which can be explained as follows:-

1. Weighted Arithmetic Mean of the answers is the evaluate rate of answers and uses in analysis each clause of questionnaire axes clauses and calculated from the following equation **[1][2]**:

$$M = \sum_{n=1}^{i} \frac{Xi * Fi}{N} \qquad (1)$$

Where:
M: Weighted Arithmetic Mean of answers for questionnaire   clause
Xi: Evaluation degree of response class (i) for questionnaire clause
Fi= Response frequency of class (i) for questionnaire clause
N= Sample size

Analyzing and evaluating the results of the questionnaire for each clause in the questionnaire depends on the extraction of median value (m) for values of weighted average for answers, which represents middle value between (0-4) thus (m=2).And then extract the value of the upper quartile of the evaluation rate of answers that represents value of 75% out of (0-4) thus (Uq=3). Then the weighted average for each clause of questionnaire was analyzed according to the approaching from above limits as follow:

a) If (M< 2) then the evaluation of the clause is (poor) thus the required development should be (must).
b) If (3$\geq$M$\geq$ 2) then the evaluation of the clause is (accepted- Fair) thus the required development should be (wanted).
c) If (M> 3) then the evaluation of the clause is (good – very good) thus the required development should be (desired).

2. Conformance ratio used in evaluation of each axis of questionnaire that represents the suitable extent of requirements conformance for each axis of perfect status and calculated from the following equation **[3]**:

$$Cr = \frac{M}{X \max} \qquad (2)$$

Where:
Cr = Conformance ratio of axis
M = Arithmetic mean of responses of weighted mean
X max= The maximum evaluation degree which represents   the maximum class for the response evaluation (4)

Analyzing and evaluating of the questionnaire results for each axis depends on conformance ratio calculated for each axis which value range between (0-4) and has been extracted median value and upper quartile value.
M = 2/4 = 0.5
Qu = 3/4 = 0.75
Questionnaire axes have evaluated according to the following:
a) If (Cr< 0.5) then the axis evaluation is (poor) thus the required development should be (must).
b) If (0.75$\geq$Cr$\geq$ 0.5) then the axis evaluation is (accepted-Fair) thus the required development should be (wanted).
c) If (Cr> 0.75) then the axis evaluation is (good – very good) thus the required development should be (desired).

5. Analyses of the Main Axes for Questionnaire

By using the statistical criteria described above (Weighted Arithmetic Mean) and (Conformance Ratio) to transform the results of qualitative questionnaire to the quantitative for the purpose of comparison and conclusion in a scientific and proper way.

5.1 First Axis: QMS Requirements (ISO 9001:2015)

Tables.3. shows evaluation results for the requirements of the international standard (ISO 9001: 2015) in the construction companies

Table 3: Evaluation results for the requirements of the international standard (ISO 9001: 2015) in the construction companies

Clause	Mean	Evaluation	Development
Understanding the organization and its context	2.09	(accepted-Fair)	wanted
Understanding the needs and expectations of interested parties	2.78	(accepted-Fair)	wanted
Determining the scope of the quality management system	3.17	(good- very good)	desired
Quality management system and its processes	3.06	(good- very good)	desired
Leadership and commitment	2.97	(accepted-Fair)	wanted
Policy	3.16	(good- very good)	desired
Organizational roles, responsibilities and authorities	3.03	(good- very good)	desired
Actions to address risks and opportunities	1.72	Poor	must
Quality objectives and planning to achieve them	2.97	(accepted-Fair)	wanted
Planning of changes	2.82	(accepted-Fair)	wanted
Resources	2.97	(accepted-Fair)	wanted
Competence	3.15	(good- very good)	desired
Awareness	3.07	(good- very good)	desired
Communication	2.92	(accepted-Fair)	wanted
Documented information	3.11	(good- very good)	desired
Operational planning and control	3.16	(good- very good)	desired
Requirements for products and services	3.04	(good- very good)	desired
Design and development to products and services	2.8	(accepted-Fair)	wanted
Control of externally provided processes ,products and services	2.7	(accepted-Fair)	wanted
Production and service provision	2.71	(good- very good)	desired
Release of Products and services	3.09	(good- very good)	desired
Control of nonconforming outputs	3.09	(good- very good)	desired
Monitoring, measurement ,analysis and evaluation	3.12	(good- very good)	desired
Internal audit	3.24	(good- very good)	desired
Management review	2.92	(good- very good)	desired
General	3.04	(good- very good)	desired
Nonconformity and corrective action	3.44	(good- very good)	desired
Continual improvement	3.03	(good- very good)	desired
Average of axis	2.94		

5.2 Second Axis: EMS Requirements(ISO14001:2015)

Tables.4. shows evaluation results for the requirements of the international standard (ISO 14001: 2015) in the construction companies.

Table 4: Evaluation results for the requirements of the international standard (ISO 14001: 2015) in the construction companies

Clause	Mean	Evaluation	Development
Understanding the organization and its context	0.92	poor	must
Understanding the needs and expectations of interested parties	0.95	poor	must
Determining the scope of the environmental management system	0.95	poor	must
Environmental management system	0.78	poor	must
Leadership and commitment	0.88	poor	must
Environmental policy	1.16	poor	must
Organizational roles, responsibilities and authorities	1.05	poor	must
Actions to address risks and opportunities	0.93	poor	must
Environmental objectives and planning to achieve them	0.93	poor	must
Resources	0.97	poor	must
Competence	1.18	poor	must
Awareness	1.06	poor	must
Communication	0.99	poor	must
Documented information	0.99	poor	must
Operational planning and control	0.85	poor	must
Requirements for products and services	1.09	poor	must
Emergency preparedness and response	0.8	poor	must
Monitoring, measurement ,analysis and evaluation	0.92	poor	must
Internal audit	0.87	poor	must
Management review	0.92	poor	must
Improvement	0.93	poor	must
Average of axis	**0.95**		

5.3 Third Axis: OH&SMS Requirements (OHSAS 18001:2007)

Tables.5. shows evaluation results for the requirements of the standard (OHSAS 18001: 2007) in the construction companies

Table 5: Evaluation results for the requirements of the standard (OHSAS 18001: 2007) in the construction companies

Clause	Mean	Evaluation	Development
General requirement	0.79	poor	must
OH&S policy	0.94	poor	must
Hazard identification, risk assessment and determining controls	1.02	poor	must
Legal and other requirements	0.9	poor	must
Objectives and programs	1	poor	must
Resources, roles, responsibility, accountability and authority	1.66	poor	must
Competence, training and awareness	1.33	poor	must
Communication, participation and consultation opportunities	0.9	poor	must
Documentation	0.99	poor	must
Control of documents	0.94	poor	must
Operational control	0.9	poor	must
Emergency preparedness and response	1.52	poor	must
Performance measurement and monitoring	0.79	poor	must

Evaluation of compliance	0.92	poor	must
Incident investigation, nonconformity, corrective action and preventive action	1.27	poor	must
Control of records	1.38	poor	must
Internal audit	1.18	poor	must
Management review	0.88	poor	must
Average of axis	**1.07**		

6. Evaluation of Questionnaire Axes

According to questionnaire results explained in Table (5) and Figure (1). Conformance ratio for axes of questionnaire as the following:

First Axis: QMS Requirements (ISO 9001:2015)
Conformance ratio for this axis (Cr = 0.74) is medium which indicates the construction companies attention of implementing quality management system, whereas that the resulting gap from the system implement according to ISO 9001 version 2008 so it must apply the system according to version 2015.

Second Axis: EMS Requirements (ISO 14001:2015)
Conformance ratio for this axis (Cr = 0.24) is poor. It indicates the resulting gap which due to absence of objectives, programs, policies and environmental performance indicators that contribute to improving the environmental performance of construction companies and most companies did not applied environmental management system only a few numbers applied the system according to standard ISO 14001version 2004 so it must apply the system according to version 2015..

Third Axis: OHSMS Requirements (OHSAS 18001:2007)
Conformance ratio for this axis (Cr = 0.27) is poor .It indicates the resulting gap which due to a few number of companies (research sample) applied the system according to the standard OHSAS 18001:2007 and most companies did not applied the system so must apply it.

Table 5: Conformance Ratio for Axes

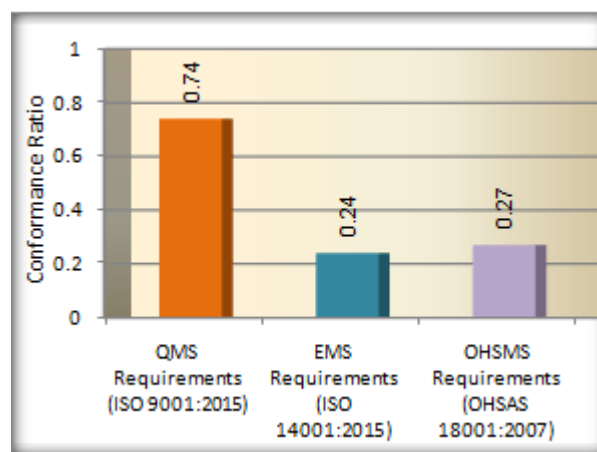| Axis	Mean	Cr	X max	Axis Evaluation	Develop-ment
QMS Requirements (ISO 9001:2015)	2.94	0.74	4	(accepted -fair)	wanted
EMS Requirements (ISO 14001:2015)	0.95	0.24	4	poor	must
OHSMS Requirements (OHSAS 18001:2007)	1.07	0.27	4	poor	must

Figure 1: Questionnaire axes

7. Conclusions

1) There is a weakness in the application of quality standards in construction companies represented by ISO 9001, ISO 14001, and OHSAS 18001.
2) All companies (research sample) have applied ISO 9001, while few of these companies have applied ISO 9001, ISO 14001, and OHSAS 18001.
3) All companies that have been used as a research sample need to be upgraded in the application of quality standards clauses.
4) There is inaccuracy in estimating budget for the division of environment and occupational health and safety. It is noticed that the financial allocation in recent years is not enough because of the situation that country is going through.
5) There are no actions for determine the internal and external factors that affect on the company which are relevant QM, EMS, and OHSMS.
6) Absence actions to identify the interested parties and their requirements that related to QMS,EMS and OHSMS.

8. Recommendations

1) A review of the current systems in the company and its formulating in accordance with requirements of the standard specifications (ISO 9001:2015, ISO 14001:2015&OHSAS 18001:2007).
2) The formulation of policy and objectives of the integrated quality management system and seek to its achieve.
3) Establishment of training courses to definition people of international standards for quality, environment and occupational health and safety.
4) Re-distribution the roles, responsibilities and authorities that relating of IQMS.
5) Deployment the system culture by increasing the awareness of workers and encourage them to carry responsibility through meetings, seminars and other.
6) The top management should be monitor and manage the quality systems and ensure its conformity with the standards requirements.

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