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Design of Integrated Risk Management Model as A Core for Integrated Management System (Case Study: in Chemicals Industry)

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ABSTRACT

ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 are standards to be used in chemical industrial processes. An Integrated Management System (IMS) includes integrated processes, integrated risk, and integrated audits; each of these must be integrated for additional organizational efficiency. According to ISO 31000:2018, Risk-based thinking is a critical ingredient to all modern management system standards (ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018). The application of each system risk separately consumes a lot of time, effort, and, money and infrastructure. ISO 9001:2015 helps management to develop better products with minimal quality risk, ISO 14001:2015 includes environmental risk and ISO 45001:2018 is dealing with OH&S risk. In all these cases, the nature of risks is different, but the way to manage the risks is similar. Our suggested integrated risk model is described that illustrates the core elements of integrated risk management in the chemical industry as a part of an integrated management system (IMS) and how they are linked with each other. This model includes such things as an incident investigation and risk assessment.

Keywords: ISO 9001:215; ISO 14001:2015; ISO 45001:2018; chemicals industry; integrated management system; integrated risk; Risk-based thinking; integrated management systems.

الملخص

يـــتم تطبيـــق مواصـــفات الإدارة الثلاثـــة (أيـــزو ٢٠١٥:٩٠٠١ – أيـــزو٢٠١٥:١٤٠٠١ وأيـــزو ٢٠١٨:٤٥٠٠١) فـي الصـناعات الكيميائيـة. يعتبـر التفكيـر القـائم علـى المخـاطر مكونًـا جوهريـاً لجميـع معـايير

نظـام الإدارة الحديثـة (أيـزو ٩٠٠١:٢٠١٥ – أيـزو١٤٠٠١:٢٠١٥ و أيـزو ٤٥٠٠١:٢٠١٨). تطبيـق مخـاطر كـل نظـام أيـزو علـى حـدة يسـتهلك الكثيـر مـن الوقـت والجهـد والمـال والبنيـة التحتيـة لـذلك يمكـن أن يـتم دمـج مخاطر الأنظمة الثلاثة في نظام واحد متجانس لتحقيق فوائد لشركات صناعة المواد الكيميائية.

مواصـفة أيـزو ٩٠٠١:٢٠١٥ تسـاعد علـى تطـوير منتجـات جيـدة مـع الحـد الأدنـى مـن مخـاطر الجـودة ، ومواصـفة أيـزو١٤٠٠١:٢٠١٥ تسـاعد علـى إدارة المخـاطر البيئيـة وتتعامـل مواصـفة أيـزو ٤٥٠٠١:٢٠١٨ مـع مخـاطر الصـحة والسـلامة المهنيـة. فـي كـل هـذه الحـالات ، تختلـف طبيعـة المخـاطر ولكـن طريقـة إدارة المخـاطر للأنظمـة المختلفـة متشـابهة. تـم تصـميم نمـوذج متكامـل لإدارة المخـاطر والـذي يوضـح العناصـر الأساسـية لـلإدارة المتكاملـة للمخـاطر فـي الصـناعات الكيميائيـة كجـزء مـن أنظمـة الإدارة المتكاملـة (Integrated Management systems) وكيفيـة ارتباطهـا ببعضـها الـبعض حيـث يتضـمن هـذا النمـوذج القـدرة علـى التحقيق في الحادث وتقييم المخاطر.

الكلمـات الدالـة : أيـزو ٩٠٠١:٢٠١٥- أيـزو ١٤٠٠١:٢٠١٥ –أيـزو ٤٥٠٠١:٢٠١٨ – صـناعة المـواد الكيميائيـة - دمج المخاطر - التفكير القائم على المخاطر- نظام الإدارة المتكامل.

1. INTRODUCTION

Many chemical products are potentially harmful at some stage during their manufacture and transport. These chemicals are liquids or gases, solids, flammable, explosive, corrosive, and toxic. The manufacturing cycle often involves high pressures, high temperatures, and reactions that can be dangerous unless carefully controlled. Because of this, the industry operates within the safety limits demanded by national and international legislation **(Waly, 2017)**.

Quality management, as part of a management system with regard to quality aiming the increasing level of satisfying customer needs about organization's outputs (ISO 9001:2015), Environmental management, as part of a management system that seeks to provide organizations with an outline to protect the environment and respond to changing environmental conditions (ISO 14001:2015), Occupational health and safety management, as part of a management system aiming to enable organizations to enable a safe and healthy work environment by prevention injuries and ill health, as well as by proactively upgrading occupational health and safety performance (ISO 45001:2018).

Integration of multiple management systems, rather than implement and maintain them separately, could have significant benefits for an organization (ISO 2018).

The research aims to apply integrated risk management (IRM) in ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 in chemicals industrial processes in one homogeneous system. The application of risks in each system separately consumes a lot of time, effort, and money. Therefore, the integration of the three systems in one

homogeneous system can be very useful for the company (Zutshi and Sohal 2005; Salomone 2008; Asif et al. 2009; Giesen 2015; Nagel-Piciorus et al, 2016; Waly, 2017; Muthusamy et al. 2018).

Important standards for **the chemical industry:**

Chemical industries can benefit from any of the following management systems certifications including:

1. **ISO 9001:2015** is for the quality management system, the basic standard for all types of industries to make their process inline with the international system requirements.
2. **ISO 14001:2015** is for environmental management systems, this certification helps in preventing pollution from a particular industry. It helps to establish management of the system that helps to create such a system to create a minimum impact on the environment.
3. **ISO 45001:2018** This standard focuses on the development of a safe and secure environment for the occupants. It helps to make sure of following the legal and statutory requirements related to the health and safety of all the people in the workplace.
4. **ISO 31000:2018** is providing guidelines on managing any type of risk faced by organizations. The application of these guidelines can be customized for any organization and its context.
5.

2. MATERIALS AND METHODS:

The main purpose of the study is:

The main purpose of this study is to understand the methodology and its requirement for establishing and design an Integrated Chemical Risk Management Based on the standards (ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018) within the Chemical Manufacturing Industry by:

i. Identify internal and external issues influencing the organization system.
ii. Identify the needs and expectations of interested parties.
iii. Establishing chemical risk Models Identify integrated chemical risk and environmental aspects.

3. RESULTS AND DISCUSSION

Risk-based thinking is required by IMS but there are no formal requirements for a risk management system or risk register; it does not formally require a certain methodology for applying risk management and an organization can decide for itself whether and how to develop a more extensive risk management methodology than required as long as the principles from clause 6.1 are maintained; formal risk analysis can be very useful for many processes; ISO 31000:2018 recommend the next process for implementing risk-based thinking.

According to **(Kymal et al, 2015);** an Integrated management system state that the first stages in the integrated risk management process are:

1- Understanding the organization and its context;

According to new management standard (NMS); ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018); the context is the set of those internal and external issues that are relevant to its purpose influence our organization and its ability to achieve the intended results of its management standard (MS). This clause of the standards requires identifying these issues and getting a clear picture of them.

2- Understanding the needs and expectations of interested parties.

The organization shall determine (Abuhav, 2017):

a) The interested parties, that is relevant to the integrated management system;

b) The relevant needs and expectations (requirements) of interested parties;

c) Which of these needs and expectations are or could become legal requirements and other requirements.

Risk assessment has three components: Risk identification, risk analysis, and risk evaluation of all three should be done in a systematic manner (Popov et al., 2016).

Practically, a risk assessment in the workplace is to identify any objects, situations, processes, or other items that may cause failures (to quality, environment, or people) in the specific site. After identification, the likelihood and severity of risk should be evaluated, and decisions will be made for the preventive or control measures for the risk. The assessment should be recorded and documented.

3- Suggestion risk management model:

A risk management model is described that illustrates the core elements of risk management and how they are linked with each other. This model includes such things as an incident investigation and risk assessment; our suggestion Framework Hazard Analysis and risk assessment process model of organization (Figure 1).

4- Analysis of the total number of repetitions of the word Risk for each clause in the ISO standard:

When reviewing the ISO specifications, we find (By the authors):

1. Increasing the number of repetitions of the word Risk or what indicates risk (Hazard, Aspect, or Impact) in the ISO standard (ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018) gives clear evidence of the importance of the wrist during the application and activation of the ISO standard.
2. Increasing the number of repetitions of the word Risk or what indicates risk (Hazard, Aspect, or Impact) in each clause in the ISO standard (ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018) gives clear evidence of the increasing importance of implementing and activating this item in ISO standard (Figure 2).
3. Conducting a study and statically analysis of the total number of repetitions of the word the risk for each clause in the ISO standard (ISO 9001:2015, ISO

14001:2015, and ISO 45001:2018) from clause 4 to 10, in order to identify its importance to focus on the application of the ISO standard (Table 1).

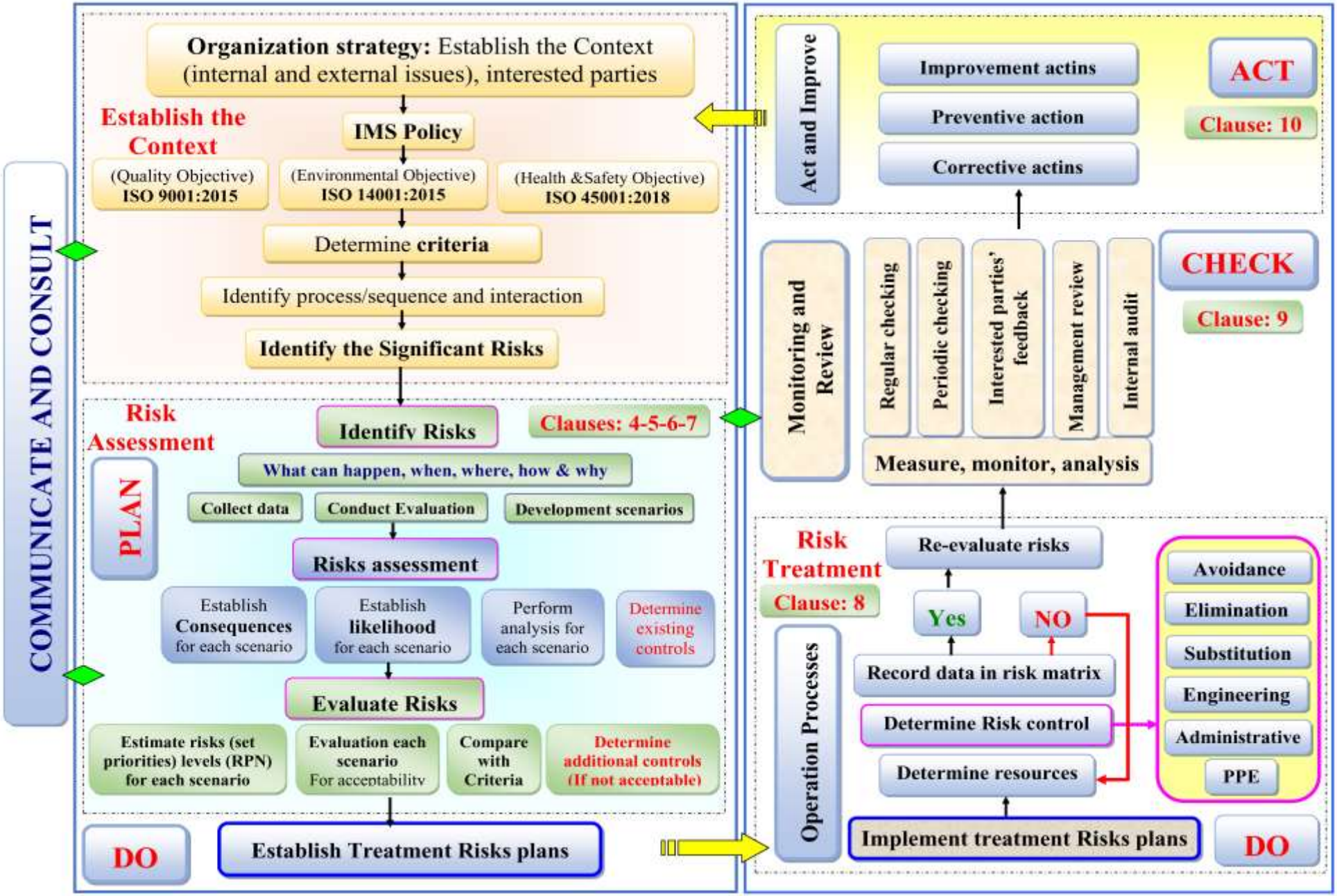
COMMUNICATE AND CONSULT
Organization strategy: Establish the Context (internal and external issues), interested parties
Establish the Context
IMS Policy
(Quality Objective) ISO 9001:2015
(Environmental Objective) ISO 14001:2015
(Health &Safety Objective) ISO 45001:2018
Determine criteria
Identify process/sequence and interaction
Identify the Significant Risks
Risk Assessment
PLAN
Identify Risks
Clauses: 4-5-6-7
What can happen, when, where, how & why
Collect data
Conduct Evaluation
Development scenarios
Risks assessment
Establish Consequences for each scenario
Establish likelihood for each scenario
Perform analysis for each scenario
Determine existing controls
Evaluate Risks
Estimate risks (set priorities) levels (RPN) for each scenario
Evaluation each scenario For acceptability
Compare with Criteria
Determine additional controls (If not acceptable)
DO
Establish Treatment Risks plans
Act and Improve
Improvement actins
Preventive action
Corrective actins
ACT
Clause: 10
Monitoring and Review
Regular checking
Periodic checking
Interested parties' feedback
Management review
Internal audit
CHECK
Clause: 9
Measure, monitor, analysis
Risk Treatment
Clause: 8
Re-evaluate risks
Yes
NO
Record data in risk matrix
Determine Risk control
Determine resources
Avoidance
Elimination
Substitution
Engineering
Administrative
PPE
Operation Processes
Implement treatment Risks plans
DO

Table 1: The total number of repetitions of the word risk in ISO standards **(By the authors)**

Main clause of ISO Standard	Requirements										Total	%
	ISO 9001:2015		ISO 14001:2015				ISO 45001:2018					
	Risk	Impact	Aspect	Impact	Risk	Hazard	Risk	Hazard	Impact	Aspect		
4: Context of the Organization	1	0	0	0	0	0	0	0	1	0	2	1.5
5: Leadership and worker participation	2	0	0	1	0	0	5	4	1	1	14	10.8
6: Planning	10	1	14	6	7	0	21	9	0	0	68	52.3
7: Support	0	0	2	1	0	0	1	2	0	1	7	5.4
8: Operation	0	3	0	3	0	0	5	6	5	0	22	16.9
9: Performance evaluation	2	0	1	0	1	0	3	1	0	0	8	6.2
10: Improvement	1	0	0	2	0	0	4	2	0	0	9	6.9
Total:	16	4	17	13	8	0	39	24	7	2	130	100

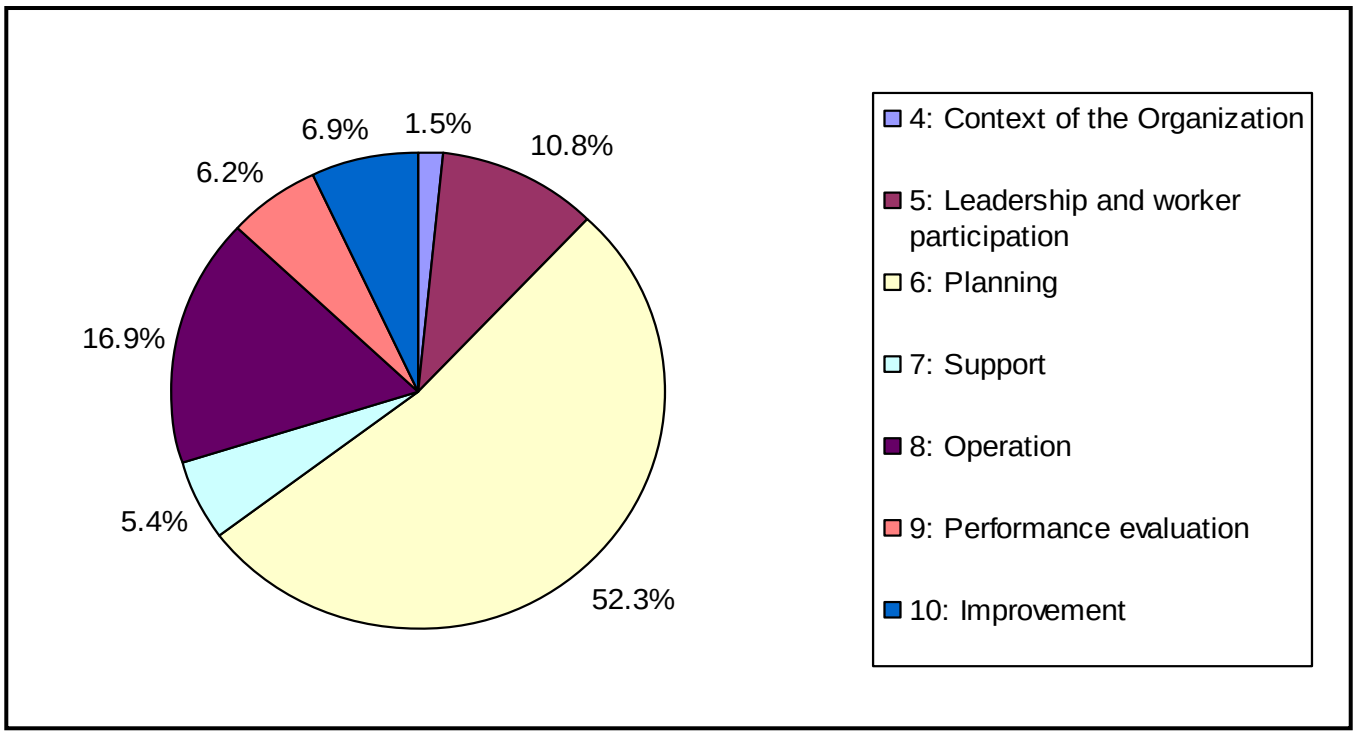

Figure. 2: Total numbers of repetitions of the word risk in ISO standard

4- INTERNAL BENEFIT OF APPLYING INTEGRATION RISK:

The output of static analysis illustrated in (**Figure 3)**

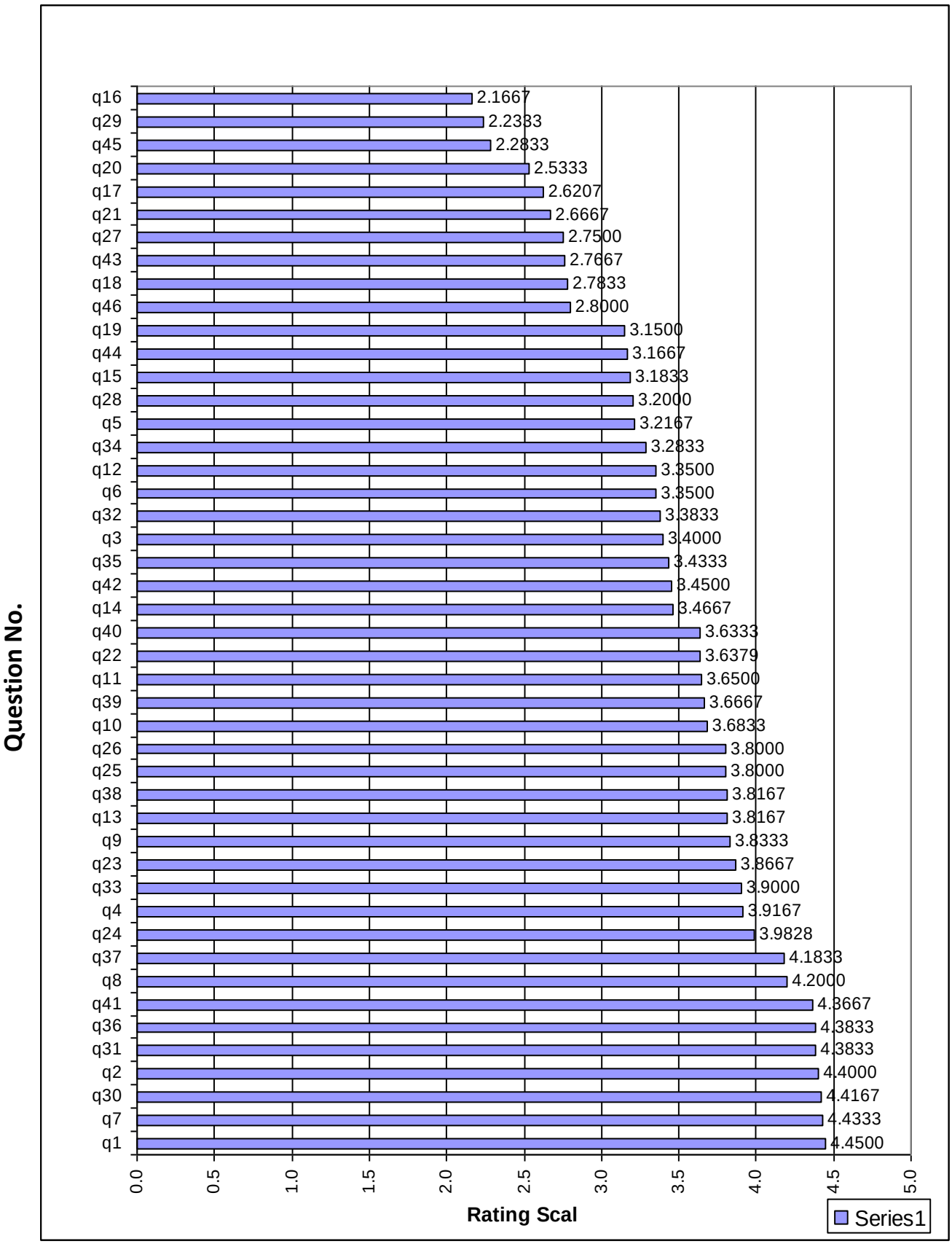
Question No.
q16 2.1667
q29 2.2333
q45 2.2833
q20 2.5333
q17 2.6207
q21 2.6667
q27 2.7500
q43 2.7667
q18 2.7833
q46 2.8000
q19 3.1500
q44 3.1667
q15 3.1833
q28 3.2000
q5 3.2167
q34 3.2833
q12 3.3500
q6 3.3500
q32 3.3833
q3 3.4000
q35 3.4333
q42 3.4500
q14 3.4667
q40 3.6333
q22 3.6379
q11 3.6500
q39 3.6667
q10 3.6833
q26 3.8000
q25 3.8000
q38 3.8167
q13 3.8167
q9 3.8333
q23 3.8667
q33 3.9000
q4 3.9167
q24 3.9828
q37 4.1833
q8 4.2000
q41 4.3667
q36 4.3833
q31 4.3833
q2 4.4000
q30 4.4167
q7 4.4333
q1 4.4500
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
Rating Scal
Series1

Figure 3: Internal benefit of applying integration Risk

The statistical analysis of the critical factors has shown questions No. 1, 7, 30, 2, 31, 36, 41, 8, 37, 24, 4, 33, 23, 9, and 13 are more effective in the Internal benefits of applying integrated risk management (IRM).

a. (q1) Good Rules and procedures
b. (q7) Harmonized documentation
c. (q30) High compliance with the standard and compliance with regulations
d. (q2) More document control
e. (q31) More effective management review

- According to a study the total number of repetitions of the word risk in ISO standards, The more effective clause in risk is:

a. Clause 6: Planning **(52.3%)**
b. Clause 8: Operation **(16.9%)**
c. Clause 5: Leadership and worker participation **(10.8%)**
d. Clause 10: Improvement **(6.9%)**
e. Clause 9: Performance evaluation **(6.2%)**

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 *Conclusions*

The results of the study indicate that the application of the integrated model for risk management in the chemical industry will achieve internal and external benefits for the organization and enhance the ability of industrial chemical companies to work more effectively and efficiently.

5.2. *Recommendations*

1. The researcher recommends the importance and necessity of applying the integrated model of risk management in the chemical industry to achieve internal and external benefits for the organization and to enhance the organization's ability to work more effectively and efficiently.
2. Applying the integrated model of risk management in the chemical industry should be initiated before or at design.
3. Applying the integrated model of risk management in the chemical industry should be continually updated as changes occur or additional information is obtained throughout the phases of product development.

6- List of abbreviations (Table 2):

Table 2: List of abbreviations:

No.	Abbreviation	Description
1	IMS	Integrated Management System
2	IRM	Integrated Risk Management
٣	ISO	International Organization for Standardization
4	MS	Management System
5	NMS	New management standard
٦	OH&S	Occupational Health and Safety
٧	RM	Risk Management

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