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Integration Of Quality, Occupational Safety And Health, And Environmental Management Systems In PT XYZ's Testing Laboratory

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ABSTRACT
The Separate Management System implemented in PT XYZ's testing laboratory required a lot of resources. This research aims to integrate the requirements of quality management systems (ISO 9001 and 17025), occupational safety and health (ISO 45001 and PP50/2012), and the environment (ISO 14001). A risk assessment was carried out and found 10 risks, consisting of 9 operational risks and 1 financial risk. Six risks require further mitigation with the TOPSIS method. PT XYZ can implement a partially Integrated Management System (SMT) strategy with 45 procedures, 20 fully integrated procedures, and 25 partially integrated procedures. The effectiveness evaluation showed a decrease in certification costs by 34.55%, a decrease in third-party audit findings by 71.43%, and a minimization of the amount of documented information by 33.48%. The results of this study are expected to help medium to large businesses that implement various separate management systems to switch to management system integration.

INTRODUCTION

The growth in the number of accredited testing laboratories that have emerged in Indonesia has been quite significant since 2020. This is one of the proofs that the testing laboratory service business is attractive to business actors. As a business actor engaged in testing laboratories, PT XYZ needs to maintain and even improve the company's image, expand market reach, and continue to innovate to be able to compete among the many existing testing laboratories. PT XYZ is a privately owned laboratory, accredited by the National Accreditation Committee (KAN) that provides a wide range of industrial chemical analysis, monitoring, testing, and consulting. PT XYZ's services include testing of petroleum, lubricants, fuels, transformer oil, environmental, *bio-hygiene industry, and instrument calibration.* Founded in 2002, PT XYZ Services is a fast-growing analytical laboratory with clients in various industry sectors including energy, manufacturing, oil, mining, transportation, lubricating oil blending plants, and more.

On the other hand, to maintain the existence of a professional, reliable, and capable laboratory management that continues to publish valid test results, it is necessary to implement

several management systems according to customer requirements and the internal needs of the organization. The management system in question includes a quality management system (Sumpono & Hasibuan, 2016), environmental management system (Standardization, 2013), occupational safety and health management system (ISO 45001:2018 and Government Regulation No. 50 of 2012). The use of multiple management systems in an organization can be integrated to a certain extent. Table 1.1 shows the survey data from the *International Organization for Standardization* (ISO) related to the number of organizations that implement quality, occupational safety and health, and environmental management systems (MK3L). In recent years, integrated management systems (SMTs) have been discussed and written by professionals and researchers. Among them discussed are the types of integration, the various benefits of integration, and the obstacles of integration. The types of integrations are available in several different categories depending on the approach used by the organization. Kafel (2016) defines 3 (three) different types of integration, namely addition, merging, and temporary integration. Seghezzi (1997) named these types as separate, harmonious, and integrated types. Some authors describe the type of integration at a simple level such as partial or total integration (Bernardo et al., 2012a; Karapetrovic, 2002) or document harmonization, partial integration, and full integration (Century *et al.* 2013).An integrated management system is a management system that combines all business components into one system. According to Worldwide Quality Assurance Asia Pacific (2018), the benefits of an integrated management system are: i) reducing duplication of work, reducing risks, and increasing profits, ii) aligning organizational goals, responsibilities, and authority, iii) more focus on solving problems, creating consistency, and iv) increasing organizational effectiveness. Meanwhile, Douglas and Glen (2000) said that the benefits of management system integration are: i) fewer procedures and records, ii) auditors can be multifunctional, iii) easier management, iv) more effective systems internally and externally, v) better communication between staff, vi) improved company image, and v) reduced costs. With increasing competition, companies are required to act carefully not only in maintaining quality and customers but also in environmental pollution factors as well as the occupational safety and health of employees and *stakeholders.* The implementation of the quality, occupational safety, and health management system, as well as the testing laboratory environment of PT XYZ, refers to ISO 9001, ISO 17025, ISO 45001, and ISO 14001 standards.

Integrated management systems for quality, occupational safety and health, and the environment (MK3L) in various industrial sectors are increasingly increasing and being adopted by several companies. The adoption was carried out either on the company's internal motivation in anticipating improvements and streamlining their processes or because there were customer requirements that set the rules for the implementation of the MK3L management system. There is also the marketing aspect as the customer market now needs recognition related to the MK3L which has not been previously considered. This new paradigm encourages businesses to adopt integrated management systems and seek certifications that support their business processes. The implementation of a separate management system can lead to an organization or company being ineffective and inefficient (Rebelo et al., 2014). Regarding the definition of an Integrated Management System, the author agrees with the opinion of The British Standard Institution (2012). Various benefits of SMT have been widely felt by organizations such as lowering operational costs (Bernardo et al., 2012a), lowering management costs, time efficiency, increasing productivity, and also reducing management complexity internally (Olaru et al., 2014). The implementation of a separate management system partly causes considerable management complexity, large operational costs because the certification or assessment process of each has not been integrated, and the existence of quite a lot of documents, as well as repeatability in each activity or business process of the company. The business process chain of PT XYZ's testing laboratory has many series, starting from the process of receiving samples to distributing test result sheets. Each of these processes has different characteristics of potential risks and each process is also specific. Therefore, the right integration model will be sought to implement SMT

MK3L which maximizes the benefits in a testing laboratory.Currently, PT XYZ has implemented and has a Quality, K3, and Environmental management system certificate. The Management System is still not fully integrated into its business processes. Therefore, companies need to develop an integration model of the Quality, Occupational Safety and Health, and Environment Management System (MK3L) so that the level of integration implemented increases

Previous research related to the list of key risks and benefits in the management system integration process has been conducted. One of the risks identified is the inadequate harmonization of standards between the ISO 9000 and ISO 14000 series, as expressed by (Karapetrovic & Willborn, 1998).

In addition, differences in general elements and special requirements between standards are also a problem, as explained by (Beckmerhagen et al., 2003; Karapetrovic & Willborn, 1998). To overcome this challenge, a careful PDCA (Plan-Do-Check-Action) approach is needed, which must be tailored to the specific needs of each organization, as exemplified by (Rebelo et al., 2014).

LITERATURE REVIEW

Risk

According to ISO Guide 73 and ISO 31001, risk is the effect of uncertainty in the achievement of goals or objectives, which can be positive, negative, or deviation from expectations. Risk is often described as an event, change of circumstances, or consequence. Meanwhile, the Institute of Risk Management (IRM) defines risk as a combination of the likelihood of an event and its consequences, which can include a positive to negative range. The Institute of Internal Auditors states that risk is the uncertainty of an ongoing event that may have an impact on the achievement of objectives, as well as a measure of consequences and possibilities. Meanwhile, according to HM Treasury's Orange Book, risk is the uncertainty of the outcome, within the range of exposure, arising from a combination of impacts and the likelihood of potential events.

From some of these definitions, it can be concluded that risk is an unplanned event that produces unexpected consequences. In another approach, Frame (2003) classifies risk into 6 (six) things which include: pure risk (uninsurable risk), business risk, project risk, operational risk, technical risk, and political risk. Organizations that carry out coordination activities to direct and control risks according to ISO guide 73 are called risk management.

Topsis Method

The TOPSIS (*Technique for Others Reference by Similarity to Ideal Solution*) method is one of the multi-criteria decision-making methods that was first introduced by Yoon and Hwang in 1981. TOPSIS uses the principle that the chosen alternative must have the closest distance from the positive ideal solution and the furthest from the negative ideal solution from a geometric point of view According to Susanto (2020), more factors that must be considered in the decision-making process, the more difficult it will be to decide on a problem. Such a problem is known as *the problem of multiple criteria decision-making* (MCDM). In other words, MCDM can also be referred to as a decision to choose the best alternative from some alternatives based on certain criteria.

Management System

According to ISO 9000:2015 Quality Management System, a management system is a collection of organizational elements that are interconnected and interact to be able to set policies, goals, and processes to achieve these goals. Specifically, Daft (2005) states that the management system focuses on effectively and efficiently achieving organizational goals based on the function, planning, organization, leadership, and control of organizational resources.

Integrated Management System (SMT)

An integrated management system in the business world shows the balance and alignment of strategy and operations in an organization (De Oliveira, 2013). The integration of management systems is generally expected to contribute to the simplification, optimization of resources, and the cross-system benefits of similarity as well as audit processes (Simon et al., 2011). Worldwide Quality Assurance Asia Pacific (2018) also states that if an organization implements several ISO Standards and Management Systems, it is very necessary to integrate these management systems with the *Integrated Management System.*

ISO 9001, ISO 14001, and ISO 45001 are internationally recognized and have been adopted by more than 150 countries worldwide (Bernardo et al., 2012b). The MK3L Management System, also called SMT, is an international standard that establishes guidelines for the simultaneous implementation of quality, health, safety, and environmental management (PAS 99 Standard). ISO 17025 as a general requirement for testing and calibration laboratory competencies is also referred to as a special quality management system for laboratories, so ISO 9001 is a quality management system that is intended for all types of organizations, while ISO 17025 is specifically for laboratory quality management. Next, Government Regulation (PP) No. 50 of 2012 related to the K3 Management System is a mandatory requirement of the national management system in Indonesia so that companies with more than 100 employees to implement the K3 Management System as ISO 45001.

METHODS

This research method is a *desk research* and case study to conduct and evaluate the integration process of the requirements of the MK3L management system standards ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, Government Regulation of the Republic of Indonesia No. 50 of 2012 (PP 50/2012), and ISO/IEC 17025:2017. Desk research is carried out to obtain study data from previous research which is then re-inferred by the author. The case study was carried out because there was a focus on the object being studied, namely the PT XYZ testing laboratory. The process of implementing the integration of the management system in the PT XYZ testing laboratory will be carefully observed and analyzed.

Data collection techniques are carried out by several methods such as FGD and interviews to answer the first research question. The data from the FGD and interviews were made into a consequence/probability matrix so that risk identification and analysis were obtained. Risks with high assessments are included in the primary data to collect the next data, namely the distribution of questionnaires so that they can be processed using the TOPSIS method so that the ideal integration method for PT XYZ is selected. The main advantages of the TOPSIS Method are its simplicity of use, considering all types of subjective and objective criteria, rational and understandable, the calculation process is efficient, and the concept allows finding the best alternative criteria with simple mathematical calculations (Bhutia & Phipon, 2012). With the TOPSIS method, an ideal alternative was obtained, namely the type of integration that was selected to be applied at PT XYZ. Meanwhile, the last research question was answered using primary data obtained through document and record studies.

RESULTS

Sources Of Risk

The testing laboratory of PT. XYZ in developing the MK3L management system integration model is faced with several difficulties and challenges that arise from sources of risk, both external and internal. This technique includes grouping the types, severity, and likelihood of each risk to be evaluated. Finally, risk identification with high-risk assessment results will be a criterion in the selection of the ideal company management system model with the TOPSIS method. The standard guidelines for determining the Risk Value are as follows: for Probability or the

possibility of occurring, a value of 3 is given which means it occurs frequently (*frequent),* 2 which means it happens occasionally (*occasional),* and 1 which means it does not occur (*improbable).*

Table 1 Severity Assessment Standards (Severity)

Nilai	1	2	3	4
Dampak Financial	0-30 Juta (Negligible)	31-75 Juta (Marginal)	76 - 150 Juta (Significant)	>150 Juta (Critical)
Reputasi Organisasi	Publisitas tidak baik diinternal atau di media lokal	Publisitas tidak baik di media propinsi	Publisitas tidak baik di media nasional	Publisitas tidak baik di media internasional
Operasional	Operasional normal dengan gangguan yang dapat segera diatasi	Operasional tidak normal, adanya sebagian proses yang berhenti beroperasi	Operasional berhenti dengan adanya perbaikan yang membutukan perbaikan selama maksimal 5 hari	Operasional berhenti dengan adanya perbaikan yang membutukan perbaikan lebih dari 5 hari

After obtaining the probability and severity values, the next step is to determine the risk level. The determination of the risk level is obtained from the result of multiplying the probability and severity numbers. The matrix used in Table 1 is a 3 x 4 matrix.

Table 2. Determination Of The Risk Level (Total) Of The Result Of The Multiplication Of Probability And Severity

	Critical	Significant	Marginal	Negligible
	4	3	2	1
Frequent – 3	High (12)	High (9)	Serious (6)	Medium (3)
Occasional – 2	High (8)	Serious (6)	Medium (4)	Low (2)
Improbable – 1	Serious (4)	Medium (3)	Low (2)	Low (1)

From the results of the grouping, it was obtained that there were 10 risks identified. The identification includes 9 operational risks and 1 financial risk. Furthermore, 3 of the identified operational risks come from external sources such as the reference standards used, *stakeholders* or stakeholders, and accreditation/certification bodies, and 7 others are internal sources of risk. For more details, please see Table 3.

Table 3. Results Of Risk Identification Of MK3L Management System Integration

Risk Register	Type Risk	Risk Identification	Source of Risk	Risk Analysis		Initial Risk Assessment		Total (LR) P X S
				Potential Risks	Impact Risk	P	S	
O1	Operational Risk	Integrated standards	External	Confusing ISO language	Misinterpreting the true meaning of standards	3	3	9
O2	Operational Risk	Stakeholder insistence	External	Companies are in a hurry to implement without understanding	Not benefiting from SMT	2	3	6
O3	Operational Risk	Certification and Accreditation Bodies	External	Assigned auditors are less competent	The certification/accreditation process is not running optimally	2	1	2
O4	Operational Risk	Manual SMT	Internal	SMT manual is not understood by employees	SMT is not running well	2	2	4
O5	Operational Risk	SMT Procedure	Internal	SMT procedures are not understood by employees	SMT is not running well	2	2	4
O6	Operational Risk	Kompetensi Personil Management Representative (MR)	Internal	Origin of appointment MR	MR is incompetent in carrying out his duties	3	2	6
O7	Operational Risk	Enterprise Process Business	Internal	Business Process is not understood by employees	SMT is not running well	2	2	4
O8	Operational Risk	Internal Control (Internal Audit)	Internal	Implementation is only small talk for *compliance.*	Not benefiting from SMT	2	2	4
O9	Operational Risk	Management Commitment	Internal	Lack of management commitment	SMT is not running well	2	3	6
F1	Financial Risk	Costs incurred	Internal	The total cost is more expensive than the previous system implementation	The flow of corporate expenditure funds increased	2	3	6

From the results of risk identification, if the total risk value is ≥ 3 (medium), mitigation measures need to be taken. Mitigation measures are carried out as a form of control over risk identification that has been carried out previously. Of the 10 risks identified, 9 of them are mitigation measures and 5 of them are by making them a criterion in selecting the ideal company SMT model.

Table 4. Mitigation Or Control Of Risk Identification In Table 4

Risk Register	Risk Control / Mitigation	Final Risk Assessment		Total (LR)	Risk Evaluation
		P	S	P x S	
O1	ISO understanding training implemented by the company	2	1	2	It needs to be a criterion in the selection of the ideal enterprise management system model
O2	Looking back at the company's vision and mission and the goals and objectives of the program	1	2	2	It needs to be a criterion in the selection of the ideal enterprise management system model
O3	Background checks for certification bodies and assigned auditors	-	-	-	-
O4	Conduct periodic socialization of SMT manuals	1	1	1	The periodic socialization period is made at least once a year
O5	Conduct periodic socialization of SMT procedures	1	1	1	The periodic socialization period is made at least once a year
O6	MR appointment based on competencies and qualifications	2	1	2	It needs to be a criterion in the selection of the ideal enterprise management system model
O7	Clarify the Business Process, and conduct periodic socialization.	1	1	1	The periodic socialization period is made at least once a year
O8	*System awareness* to all employees, especially auditors, and auditees.	1	1	1	The range of the system awareness period is made periodically at least once every 1 year
O9	Determination of SMT Top Management, Middle Management, and Implementers	1	2	2	It needs to be a criterion in the selection of the ideal enterprise management system model
F1	Compare cost forecasts before and after the implementation of an integrated management system	1	2	2	It needs to be a criterion in the selection of the ideal enterprise management system model

Analysis Of Alternative Selection Of Ideal Enterprise Management System Model

Determining the ideal enterprise management system model alternative for PT XYZ's testing laboratory, is based on several criteria. The criteria used were obtained through literature review, FGD, and obtaining information through the TOPSIS questionnaire. The TOPSIS

questionnaire was given to PT XYZ employees from *top management, middle management, lower management*, to staff/analysts.

Table 5 Alternative Enterprise Management System Models

It	Alternative types of enterprise management system models
1	Separate
2	Full Integration
3	Partial Integration

The criteria for influencing factors needed in determining the company's management system model are 6 (six), consisting of (1) top management commitment, (2) personnel competence, (3) competitive advantage, (4) the influence of stakeholders, (5) the number of standards applied/integrated, and (6) the total costs incurred. Criteria 1 to 5 are positive criteria (more is better) while criteria 6 are negative (less is better). For the company management system model to be selected, there are 3 (three) alternative models as shown in Table 5.

Stages Of Completion With the TOPSIS Method

In prioritizing the selection of a management system model for PT XYZ, six criteria were used with three alternatives. Of the six criteria used, there is one criterion that is a negative direction criterion, namely the total cost incurred.

Table 6 Decision Matrix And Weights Of Each Criterion

No	Criterion	Alternative Models			Weight
		Separate	Full	Some	
1	Top management commitment	3.700	4.100	4.350	0.308
2	Personnel competence	3.550	3.750	4.100	0.214
3	Competitive advantage	3.200	3.750	4.250	0.136
4	Stakeholder influence	3.550	3.850	4.000	0.094
5	Many standards applied	2.700	3.650	4.300	0.133
6	Total cost required	3.700	3.200	2.700	0.114

Table 6 shows the decision matrix and weights of the six criteria for the three groups of integration model types studied. Based on the results of the analysis using the TOPSIS method, criterion number 1 (peak management commitment), received the most weight, namely: 0.308, followed by criterion number 2 (personnel competence in implementing the company's management system) with a weight value of 0.214. These results show that the respondents prefer the commitment of top management in implementing the company management system as the most important criterion to consider in choosing the type model of enterprise management system integration.

Table 7 Quadratic Result Matrix From Decision Matrix

No	Criterion	Alternative Models			Sum	Want
		Separate	Full	Some		
1	Top management commitment	13.690	16.810	18.923	49.423	7.030
2	Personnel competence	12.603	14.063	16.810	43.475	6.594
3	Competitive advantage	10.240	14.060	18.063	42.365	6.509
4	Stakeholder influence	12.603	14.823	16.000	43.425	6.590
5	Many standards applied	7.290	13.323	18.490	39.103	6.253
6	Total cost required	13.690	10.240	7.290	31.220	5.587

Table 7 shows the quadratic result matrix of the decision matrix, which is obtained by squaring all the values in Table 7 Each element in the matrix analyzed by the TOPSIS method is normalized to obtain the matrix R.

Table 8 Matrix Rij Model Selection Type Of Enterprise Management System Integration

No	Criterion	Alternative Models			Weight
		Separate	Full	Some	
1	Top management commitment	0.526	0.583	0.619	0.308
2	Personnel competence	0.538	0.569	0.622	0.214
3	Competitive advantage	0.492	0.576	0.653	0.136
4	Stakeholder influence	0.539	0.584	0.607	0.094
5	Many standards applied	0.432	0.584	0.688	0.133
6	Total cost required	0.662	0.573	0.483	0.114

The results of the calculation at this stage are to calculate the normalized matrix of model alternative selection using vector normalization. The results of the normalized matrix calculation can be seen in Table 8. The following stage is the stage of calculating the weighted normalized matrix for the selection of model alternatives, where v_{ij} = weighted normalized matrix wj = weighted criterion rij = normalized matrix.

Table 9 Vij Matrix Model Alternative Selection

No	Criterion	Alternative Models		
		Separate	Full	Some
1	Top management commitment	0.162	0.180	0.191
2	Personnel competence	0.115	0.122	0.133
3	Competitive advantage	0.067	0.079	0.089
4	Stakeholder influence	0.051	0.055	0.057
5	Many standards applied	0.057	0.078	0.092
6	Total cost required	0.075	0.055	0.065

Positive Ideal Solution (A^+) and Negative Ideal Solution (A^-) Results

The next stage to determine the type of preferred integration model is to calculate the positive ideal solution (A^+) and the negative ideal solution (A^-), so that A^+ represents the most preferred alternative and A^- is less preferred. The calculation of the positive ideal solution matrix (A^+) and the negative ideal solution matrix (A^-) is carried out at this stage, where J = *benefit attribute* and J' = cost attribute, can be seen in Table 10 and Table 11. *Benefit* or profit attributes are attributes that when the value is higher, it is considered better. On the other hand, the *cost* attribute is an attribute that when the value is higher, is considered worse.

Table 10 Positive ideal solution (A+)

No	Criterion	Alternative Models			Positive ideal solution (A^+)
		Separate	Full	Some	
1	Top management commitment	0.162	0.180	0.191	0.191
2	Personnel competence	0.115	0.122	0.133	0.133
3	Competitive advantage	0.067	0.079	0.089	0.089
4	Stakeholder influence	0.051	0.055	0.057	0.057
5	Many standards applied	0.057	0.078	0.092	0.092
6	Total cost required	0.075	0.055	0.065	0.055

The A^+ determination of the positive (+) criterion is sought from the largest value in each criterion. Meanwhile, from the criterion (-) it is sought from the smallest value in the criterion. So that the results are as follows:

A+ = {0.191 0.133 0.089 0.057 0.092 0.055}

Table 11 Negative ideal solutions (A-)

No	Criterion	Alternative Models			Negative ideal solution (A-)
		Separate	Full	Some	
1	Top management commitment	0.162	0.180	0.191	0.162
2	Personnel competence	0.115	0.122	0.133	0.115
3	Competitive advantage	0.067	0.079	0.089	0.067
4	Stakeholder influence	0.051	0.055	0.057	0.051
5	Many standards applied	0.057	0.078	0.092	0.057
6	Total cost required	0.075	0.055	0.065	0.075

The negative ideal solution is the opposite of the positive ideal solution. The determination of A^- is from the positive (+) criterion sought from the smallest value in each criterion. Meanwhile, the criterion (-) is sought from the largest value in the criterion. So that the results are as follows:

A^- = { 0.162 0.115 0.067 0.051 0.057 0.075 }

At this stage of analysis, the S^+ and S^- values of each element are calculated. The S^+ and S^- values in question are the difference *values (separation)* from the positive ideal and the negative ideal. Determining the distance between the value of each alternative and the positive ideal solution matrix (Si^+) and the negative ideal solution matrix (Si^-) is carried out in the following stages, which can be seen in Table 12 and Table 13.

Table 12 S+ Grades From Each Criterion

No	Criterion	Alternative Models		
		Separate	Full	Some
1	Top management commitment	0.0008	0.0001	0.0000
2	Personnel competence	0.0003	0.0001	0.0000
3	Competitive advantage	0.0005	0.0001	0.0000
4	Stakeholder influence	0.0000	0.0000	0.0000
5	Many standards applied	0.0012	0.0002	0.0000
6	Total cost required	0.0004	0.0001	0.0000
Sum		0.0032	0.0007	0.0000
S+		0.0568	0.0257	0.0000

The S+ value is obtained by calculating the difference from the positive ideal one, then each alternative is summed. At the final stage, the result of the addition is rooted. Likewise, the acquisition of the S^- value, which is by calculating the difference from the negative ideal, then adding up each alternative. In the final stage, the sum of each of these alternatives is rooted.

Table 13 S- Grade Of Each Criterion

No	Criterion	Alternative Models		
		Separate	Full	Some
1	Top management commitment	0.0000	0.0003	0.0008
2	Personnel competence	0.0000	0.0000	0.0003
3	Competitive advantage	0.0000	0.0001	0.0005
4	Stakeholder influence	0.0000	0.0000	0.0000
5	Many standards applied	0.0000	0.0004	0.0012
6	Total cost required	0.0001	0.0000	0.0001
Sum		0.0001	0.0009	0.0029
S-		0.0102	0.0302	0.0540

Ci+ *Value Results* and Alternative Ranking

The following stage calculates the proximity relative to the ideal solution. Ranking based on the alternatives with the largest to smallest Ci+ values. The alternative that has the *largest Ci+* value is the best (Table 14).

Table 14 Ci+ Value Of Each Criterion

No.	Alternative	Ci+
1	Separate Management System	0,1517
2	Fully Integrated Management System	0,5403
3	Partial Integration Management System	1,0000

From the above analysis process, in the selection of the most priority alternative model in the selection of company management system integration, it is obtained that the Partial Integration Management System is the best alternative compared to if the company applies other types of management system integration.

The Fully Integrated Management System is the second priority, which if the company implements it will certainly require a more in-depth discussion because it is necessary to fully integrate all existing standard elements. Meanwhile, the Separate Management System is no longer in demand because the level of duplication is too high, both in the preparation of documents and the recording of the management system.

Identify SMT Procedures And Correlation Matrices Of Clauses On All Five Management System Requirements

In the five management system requirements, the continuous improvement of PT XYZ is one of the goals that always exists in developing the integration of the company's management system. Therefore, PT XYZ needs to prepare each stage in *Plan, Do, Check, Action (PDCA)* activities to be carefully analyzed so that it can be effectively observed to the requirements of the management system based on the equivalent clauses involved.

From the results of *the focus group discussion,* PT XYZ determined a total of 45 mandatory SMT procedures which were compiled based on the identification of subclauses in the five management system requirements. The 45 procedural documents can be seen in the following table:

Table 15 Total 45 Mandatory Procedures Of SMT MK3L PT XYZ

Procedural Identity	Procedure Title
PS PROCEDURE 01	Organizational Context
PS PROCEDURE 02	Risk Management
PS PROCEDURE 03	Impact and Environmental Aspects
PS PROCEDURE 04	Hazard Identification and Risk Management
PS PROCEDURE 05	Chemical Health Risk Assessment
PS PROCEDURE 06	Compliance Obligations and Evaluation
PS PROCEDURE 07	K3L Quality Goals and Programs
PS PROCEDURE 08	Training and Competency Personnel
PS PROCEDURE 09	Participation in Communication and Consultancy
PS PROCEDURE 10	Equipment Management
PS PROCEDURE 11	External Provider Management
PS PROCEDURE 12	Natural Resources Control
PS PROCEDURE 13	Documented Information Control
PS PROCEDURE 14	Change Management
PS PROCEDURE 15	Product/Service Services
PS PROCEDURE 16	Design and Development
PS PROCEDURE 17	Emergency Preparedness and Response
PS PROCEDURE 18	Personal Protective Equipment (PPE)
PS PROCEDURE 19	*QHSE Sign*
PS PROCEDURE 20	Handling of Hazardous and Toxic Materials (B3)
PS PROCEDURE 21	Waste Management
PS PROCEDURE 22	Ijin Kerja *(Permit to Work)*
PS PROCEDURE 23	*Log Out Tag Out (LOTO)*
PS PROCEDURE 24	Dumbwaiter
PS PROCEDURE 25	Customer Feedback
PS PROCEDURE 26	Measurement Monitoring
PS PROCEDURE 27	Audit Internal
PS PROCEDURE 28	Management Review
PS PROCEDURE 29	Increased
PS PROCEDURE 30	Incident Reporting and Investigation
PS PROCEDURE 31	Transportation Management
PS PROCEDURE 32	*Medical Check Up*
PS PROCEDURE 33	Radiation Protection and Safety
PS PROCEDURE 34	Electronic Data Control and Security
PS PROCEDURE 35	Fund Application
PS PROCEDURE 36	Billing
PS PROCEDURE 37	Financial Reporting
PS PROCEDURE 38	Impartiality and Confidentiality
Procedural Identity	**Procedure Title**
PS PROCEDURE 39	Facilities and Environmental Conditions
PS PROCEDURE 40	Method Selection, Verification, and Validation
PS PROCEDURE 41	Sampling
PS PROCEDURE 42	Handling of Test Samples and Calibration UUT
PS PROCEDURE 43	Measurement Uncertainty Evaluation
PS PROCEDURE 44	Ensuring the Validity of Results
PS PROCEDURE 45	Results Reporting

After determining as many as 45 SMT procedures, the next step is to compile a correlation matrix between management systems.

Table 16 Correlation Matrix Of SMT MK3L PT XYZ Procedure In Management System Requirements

Procedural Identity	ISO 9001	ISO 14001	ISO 45001	ISO 17025	PP50/2012
Ps Procedure 01	V	V	V	-	V
Ps Procedure 02	VV	VV	VV	VV	VV
Ps Procedure 03	V	V	V	-	V
Ps Procedure 04	V	V	V	-	V
Ps Procedure 05	V	V	V	-	V
Ps Procedure 06	V	V	V	-	V
Ps Procedure 07	VV	VV	VV	VV	VV
Ps Procedure 08	VV	VV	VV	VV	VV
Ps Procedure 09	V	V	V	-	V
Ps Procedure 10	VV	VV	VV	VV	VV
Ps Procedure 11	VV	VV	VV	VV	VV
Ps Procedure 12	V	V	V	-	V
Ps Procedure 13	VV	VV	VV	VV	VV
Ps Procedure 14	V	V	V	-	V
Ps Procedure 15	VV	VV	VV	VV	VV
Ps Procedure 16	V	-	-	-	-
Ps Procedure 17	VV	VV	VV	VV	VV
Ps Procedure 18	V	V	V	-	V
Ps Procedure 19	VV	VV	VV	VV	VV
Ps Procedure 20	VV	VV	VV	VV	VV
Ps Procedure 21	VV	VV	VV	VV	VV
Ps Procedure 22	V	V	V	-	V
Ps Procedure 23	V	V	V	-	V
Ps Procedure 24	VV	VV	VV	VV	VV
Ps Procedure 25	VV	VV	VV	VV	VV
Ps Procedure 26	V	V	V	-	V
Ps Procedure 27	VV	VV	VV	VV	VV
Ps Procedure 28	VV	VV	VV	VV	VV
Ps Procedure 29	VV	VV	VV	VV	VV
Ps Procedure 30	V	V	V	-	V
Ps Procedure 31	VV	VV	VV	VV	VV
Ps Procedure 32	VV	VV	VV	VV	VV
Ps Procedure 33	VV	VV	VV	VV	VV
Ps Procedure 34	VV	VV	VV	VV	VV
Ps Procedure 35	V	V	V	-	-
Ps Procedure 36	V	V	V	-	-
Ps Procedure 37	V	V	V	-	-
Ps Procedure 38	V	-	-	V	-
Ps Procedure 39	V	-	-	V	-
Ps Procedure 40	V	-	-	V	-
Ps Procedure 41	V	-	-	V	-
Ps Procedure 42	V	-	-	V	-
Ps Procedure 43	V	-	-	V	-
Ps Procedure 44	V	-	-	V	-
Ps Procedure 45	V	-	-	V	-

The "VV" sign in the column above means that all management system requirements at PT XYZ refer to the procedure. The "V" sign means that only a part of the management system requirements refers to the procedure. While the "-" sign indicates that the management system requirements in question do not refer to the related SMT procedures. The table below is a quantitative data comparison of procedure documents between management systems

Table 17 Quantitative Data Comparison Of Procedural Documents Between Management Systems

Requirement	SMT	ISO 9001	ISO 14001	ISO 45001	ISO 17025	PP 50/2012
Total Procedure	45	45	36	36	28	33
Fully integrated procedure		20	20	20	20	20
Partially integrated procedure		25	16	16	8	13
SMT procedure is not referred to		0	9	9	17	12

The Effectiveness Of PT. XYZ

After the implementation of an integrated management system of quality, k3, and environment in part at PT XYZ, it is necessary to determine the level of effectiveness of the implementation. Evaluation of the effectiveness of the implementation of SMT MK3L was carried out using a quantitative method with 3 (three) integration benefit criteria, namely:

1. reduction in certification costs (Ivada et al., 2015);
2. a decrease in the findings of third-party audits (Ivada et al., 2015); and
3. a decrease in the amount of documented information (Douglas & Glen, 2000).

The calculation of cost reduction is calculated by comparing the cost (in rupiah) of certification assessment by the certification body before and after the implementation of SMT expressed in percentages. The calculation of the decrease in third-party audit findings is carried out by comparing the number of non-conformity findings before and after the implementation of SMT expressed in percentages. Finally, the calculation of minimizing the amount of documented information is carried out by comparing the total or all documents of PT XYZ when the management system is still separate from the conditions after the implementation of SMT expressed in percentages.

Table 18 Comparison And Percentage Of 3 Criteria Before And After The Implementation Of SMT MK3L

Benefit Criteria	**Year 2022 (Before the Partial SMT model is implemented)**				**Year 2023 (after implementation)**
	SML	SMM	SMK3	Total	
Reduced Certification Costs	IDR 15,000,000	IDR 59,000,000	IDR 36,000,000	IDR 110,000,000	IDR 72,000,000
Decline in 3rd-Party Audit Findings	3	0	4	7	2
Minimization of Jml Documentation Information	74	285	11	370	245
Percentage Reduction in Certification Fees (%)				**34,55**	
Percentage of Decrease in 3rd Party Audit Findings (%)				**71,43**	
Percentage of Minimization of Documented Information (%)				**33,78**	

Cost is often a major factor in a company's decision-making. Table 4.18 shows a percentage decrease in certification fees of 34.55%, from the original company needed to spend IDR 110,000,000 to IDR 72,000,000. The audit process from a third party is one of the important things that is the focus of implementing the integration of the management system in the testing laboratory of PT XYZ. Table 18 shows that the total findings of third-party audits after the implementation of SMT can be reduced by 5 findings (71.43%). In addition, referring to the

minimization of the amount of documented information in the company which decreased by 33.78%, it can be concluded that the implementation of SMT in PT XYZ's testing laboratory is fairly effective.

Managerial Implications On PT XYZ

Based on the results of interviews and discussions with expert sources, the competence of personnel and also the commitment of top management are considered the most influential on the implementation process of PT XYZ's management system integration. According to (Zutshi & Sohal, 2005), people's attitudes, behaviors and attitudes can affect the success of the implementation of the management system.These difficulties include fear and resistance to change, communication problems, and loss of ownership of the system. Organizational changes involving employees will improve analysis and understanding related to the work environment. The right agent of change and the facilities or resources as well as the selection of the appropriate integration change model can maximize the success of the implementation of management system integration. In the process of change, good internal communication is needed for all elements in the company.

Currently, PT XYZ can start to review the risks and achievements of organizational change to the implementation of the SMT integration model that has been partially carried out and evaluate the roles and functions of the team or change agent that has been formed. PT XYZ can also conduct *a gap analysis* of the management systems implemented based on the subclauses in each standard or requirement referred to in the context of continuous improvement in the future, if possible, to implement the SMT full or full integration model.

DISCUSSION

PT XYZ's testing laboratory faced various difficulties and challenges in developing the MK3L management system integration model. These difficulties arise from external and internal sources of risk. The success in developing the MK3L management system integration model is highly dependent on the ability to assess the level of risk when planning the integration of the management system in the business process of the PT XYZ testing laboratory. Based on the results of the Focus Group Discussion (FGD), the data was analyzed using the risk assessment technique of the consequence matrix/probability. This technique involves grouping the types, severity, and likelihood of each risk to be evaluated. The risk with high-risk assessment results will be a criterion in the selection of the ideal company management system model with the TOPSIS method. The criteria for determining the risk value include probability (frequent, occasional, improbable) and severity (critical, significant, marginal, negligible). From the results of the grouping, there are 10 risks identified: 9 operational risks and 1 financial risk. Three of these operational risks come from external sources such as reference standards, stakeholders, and accreditation/certification bodies, while the other seven are internal risks.

After identification, if the total risk value is ≥ 3 (medium), then mitigation measures are needed. Of the 10 risks identified, 9 of them were mitigation measures and 5 of them became criteria for selecting the ideal company SMT model. Mitigation measures include ISO understanding training, review of the company's vision and mission, background checks of certification bodies, and regular socialization of SMT manuals and procedures. The selection of an ideal enterprise management system model alternative is based on several criteria: top management commitment, personnel competence, competitive advantage, stakeholder influence, the number of standards applied, and total costs incurred.

From the results of the analysis using the TOPSIS method, the top management commitment criteria have the most weight, followed by personnel competence. Based on this analysis, a Partial Integration Management System is the best alternative, followed by a Full Integration Management System as the second priority. PT XYZ also identified 45 mandatory SMT

procedures that are structured based on subclauses in the five management system requirements, including organizational context, risk management, impact and environmental aspects, hazard identification, and chemical health risk assessment. Each stage in Plan, Do, Check, Action (PDCA) activities is carefully analyzed to ensure that it is related to the requirements of the management system. With this approach, PT XYZ hopes to achieve continuous improvement in developing the integration of the company's management system.

CONCLUSION

This study shows that in integrating management systems, organizations need to conduct a risk assessment first before determining the integration model to be chosen. The results of risk identification are that there are 9 operational risks and 1 financial risk. Of the 10 risks identified, 5 of them are used as criteria in selecting the ideal company SMT model. The appropriate integration model for each organization will be unique depending on the characteristics of the organization itself. PT XYZ's testing laboratory is ideal if it applies a partial management system integration model where there are 5 integrated standards. The results of the evaluation of the effectiveness of the implementation of this partial integration model are a reduction in certification costs incurred by PT XYZ by 34.55%, a decrease in third-party audit findings by 71.43%, and a minimization of the amount of documented information by 33.48%. The findings in this report will be useful to a large group of *stakeholders.* Mainly for organizations similar to PT XYZ. A company or organization that has made a large investment in the implementation of SMT and obtained management system certification under the requirements will have undeniable proof that its customers are increasingly confident and satisfied because their suppliers are ISO certified such as 9001, 14001, 45001, 17025, and also PP 50 of 2012.

SUGGESTION

It is necessary to conduct research on the characteristics of the same industry with a larger number of respondents to get a more general conclusion. The next research, is expected to research the integration of management systems not limited to quality management systems (ISO 9001 and 17025), occupational safety and health (ISO 45001 and PP50/2012), and the environment (ISO 14001) only. However, it can also be applied to the integration of other management systems such as the anti-bribery management system (ISO 37001) and the information security management system (ISO 27001).

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