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A UNIFIED MODEL OF QUALITY ASSURANCE SYSTEM FOR ISO-CERTIFIED HIGHER EDUCATION INSTITUTIONS

Abstract: *The purpose of this research is to develop a unified model of quality assurance system for ISO-certified higher education institutions, by integrating Accreditation of The BAN-PT and ISO 9001:2008. BAN-PT is National Accreditation Board of Higher Education in Indonesia has a standard for quality academic process improvement for higher education institutions. ISO 9001 is a standard for quality management systems. There are two issues need to be resolved when an ISO-certified higher education institutions implement Accreditation of BAN-PT. First, it is not easy to identify reusable ISO clauses and requirements when applying for BAN-PT accreditation. Second, it is difficult for ISO-certified higher education institutions to implement BAN-PT Accreditation directly, due to the differences in language, structure, and detail of these two sets of documents. The results of this study, we present a unified model that solves these two problems and can support to implement the BAN-PT Accreditation.*

Keywords: *Unified Model, Quality Assurance System, ISO 9001:2008, Accreditation Standards of BAN-PT*

1. Introduction

Nowadays, the Quality Assurance System has a very significant role in Higher Education Institutions (HEIs) in various countries. Quality assurance in Higher Education has been an issue of much debate in these days. Quality has long been essential in education all over the world (Elgobbi, 2014). Until now, Higher Education Institutions start to looking at quality assurance and accreditation to provide quality education to address global developments, to provide output who meet demand in the labor market, locally and globally, with efficiency and high excellence in different fields (Hamdatu et al., 2013). According to Ryan (2015), in his study stated that quality assurance through Quality Management System (QMS) ISO 9001:

2008 on almost all types of production and service activities including higher educational Institution. On the other hand, to lift up higher education institutions through the upgrading of programs and performance, HEIs usually make their fame through accreditation standard by state-owned agency. The several countries have national accreditation bodies for higher education institutions. For example, The Council for Higher Education Accreditation (CHEA) in the US, The Quality Assurance Agency for Higher Education (QAA) in the UK, and The Hong Kong Council for Academic Accreditation (HKCAA). For the country in Africa, for example, ZIMCHE or Zimbabwe Council for Higher Education (Garwe, 2014). While in this study, Indonesian government institutions are the National Accreditation

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Board of Higher Education (BAN-PT, in Indonesia). Thus, Quality assurance system both ISO 9001:2008 and Standard of Accreditation can be a driver for HEIs to achieve excellence in higher education institutions. Hence, a need emerges for the cooperation of quality assurance agencies and acceptance of quality assurance review decisions.

ISO9001:2008 is a standard for QMS. The concept of ISO 9001:2008 called as Plan-Do-Check-Action (SNI, 2008). ISO9001:2008 requires that the organization process undergo continuous improvement even after ISO certification has been achieved. Accreditation Standards for Higher Education provide educational institutions with the means to achieve further improvements to the academic process. Higher Education Accreditation is a collection of documents consisting of highly detailed assessment elements that contain more basic concepts for improving the academic process in higher education than can be found in ISO9001:2008. Meanwhile, according to BAN-PT (2015) stated that the study program accreditation standard describes the standard of study program commitment to institutional capacity and commitment to the effectiveness of education programs. In Indonesia, the Accreditation of Study Programs and HEIs regulated in a Regulation of the Minister of Higher Education of the Republic of Indonesia, No. 32 of 2016 (BAN-PT, 2015). The difference stated that Study Program (SP) Accreditation is a process of evaluation and assessment to determine the quality and feasibility of the Study Program, Whereas, Higher Education Accreditation is a quality assessment process to determine the feasibility of Higher Education. According to BAN-PT (2015) as an interrelation process, it stated that the process of accreditation of higher education always is influenced by the results of the study program accreditation process.

The integration of two quality standard documents is a new philosophy in Higher Education today in some sectors with good

success rate is very important in achieving the quality standards of higher education institutions. The basic problem formulation in this study is how to integrate ISO 9001:2008 and Accreditation Standard of Higher Education, by developing a unified model for ISO certified Higher Education Institutions efficiently and effectively to plan improvement of Accreditation Standards. Problems will rise when the two sets of documents are to be integrated into a unified model of quality assurance system. However, there are two issues that need to be resolved when an ISO-certified organization implements accreditation standards of BAN-PT. First, it is not easy to identify any reusable parts of the ISO standards, and it would be advantageous to be able to reuse selected portions of the ISO standards during accreditation standards of BAN-PT adoption in order to use existing resources to their best advantage. Second, it is difficult for an ISO-certified organization to implement Accreditation of BAN-PT in a straightforward, easy manner because of the differences in the language, structure, and details of the two sets of document.

To solve this problem, first, a requirement of ISO 9001:2000 can be compared to many element of assessment from accreditation standards of BAN-PT. So based on that, comparison method has ever done Paulk's research (Paulk, 1993; 1995) tried to make comparisons between ISO requirements with elements of assessment that exist in accreditation standards. This Comparison Method is also used as in (Yoo et al., 2006). This study develops a unified model by comparing ISO as a quality management standard with Capability and Maturity Model Integration (CMMI), which is a quality standard for software development. Second, it is difficult for organizations to understand and apply these mappings during accreditation standards of BAN-PT implementation because they only describe the degree of the correlation between ISO and accreditation standards of BAN-PT without providing any explanation of these mappings.

Mapping methods from (Mutafelija & Stromberg, 2003) can be applied for this. Research by Yoo et al., (2006) used this method also in his research, in addition to comparison methods. Third, the mappings do not describe accreditation standards of BAN-PT from an ISO viewpoint. The structure and words that are used by accreditation standards of BAN-PT are not familiar to ISO-certified organizations, which makes it more complicated for an ISO-certified higher education Institutions to implement accreditation standards of BAN-PT. To find out the number of ISO clauses used in the implementation of other quality standards, eg., CMMI there is a Model Harmonization method by Pardo et al. (2012). This model refers to the basis of Set Theory. Research Legowo (2012) using a combination of the three methods for the case of integration of ISO 9001: 2008 with CMMI, and determine the effectiveness and efficiency of the integration result.

Previous research related to model integration is a study that makes a unified model with a unified model of CMMI and ISO 9001 in (Yoo et al., 2006). CMMI is a quality model for software development process improvement, then Legowo (2012) completes the research that determines the efficiency and effectiveness of integrated models of CMMI and ISO 9001: 2008 in its thesis research. None of the previous studies mention the quality assurance system model based on integration ISO 9001:2008 and accreditation standards for HEIs, then develop to a Unified model of Quality Assurance Information System (QAIS). The studies revealed only the evaluation of Quality Assurance System in Indonesia many conducted by researchers. Study on improving the quality of universities through ISO 9001 (Soerjaningsih, 2004), Influence of ISO 9001: 2000 achievement toward improving the quality of distance learning service (Chandrawati & Puspitasari, 2009), and research related to a comparative analysis of ISO 9001, Total Quality Management and Accreditation Standard (Asy'ari, 2015). In

this research, we intend to develop it from previous research (Yoo et al., 2006; Legowo, 2012), but specifically for an integrated model of quality assurance system based on Accreditation Standard and ISO 9001: 2008. The expected results are the conceptual framework of the integration of the two sets of quality documents with the Plan-Do-Check-Action concept in ISO 9001:2008 (Brkljač, 2017; Sokovic et al., 2010).

The purpose results of this research is to build the unified model of quality assurance information systems to implement in accreditation standard from BAN-PT for ISO certified-Higher Education Institutions. The objective of this paper:

- to define the concepts of the quality assurance systems for higher education institutions
- to identify the requirements of ISO 9001: 2008 and BAN-PT Accreditation Standard documents, and how to integrate them into a unified model of the Quality Assurance System for ISO certified Higher Education Institutions,
- to determine the effectiveness and efficiency of a unified model of Quality Assurance System in the implementation of accreditation of higher education institutions.

This study attempts to highlight two documents of the quality of ISO-certified higher education institutions, where different quality documents must be identified to apply the accreditation standards from BAN-PT. The contributions of this study provide valuable insights for higher education institutions that will implement the ISO 9001: 2008 standards and accreditation simultaneously. And, how ISO-certified Higher Education can utilize their limited organizational resources to implement the accreditation that is most likely to achieve the quality of a higher level for their institution. Thus, this unified model will have a very significant benefit for ISO certified higher education institutions planning to implement Accreditation Standards of BAN-PT.

2. Literature Review

Quality assurance is one modern concept in total quality management (Hamdatu et al., 2013). Quality Assurance Higher Education is a multi-stakeholder concept (BAN-PT, 2015). Quality Assurance System for Higher Education is absolutely necessary to guarantee the quality of education, especially the courses it has. Another possible quality management system that Higher Education may be willing to consider is ISO 9001: 2008 standard which is probably the most process improvement of the referred quality system. This standard sets the requirement for implementing a quality management system in an organization, independently of its dimension or type of activity.

2.1. Quality Management System in Higher Education

Quality management, in the higher education context covers quality control, quality assurance and quality improvement (Mekić & Göksu, 2014). In 1987, ISO published the

ISO 9001, ISO 9002, and ISO 9003 standards which defined the requirements for a QMS and then, in 2008, a new version of ISO 9001 was created to clarify the requirements of ISO 9001:2000 (Abbadi et al., 2009). William Edwards Deming statement in 1978, was the first who developed a philosophy of quality that is based on the assumption (hypothesis), 'everything begins and ends with the customer/user, which is the most important factor in the production line (Brkljač, 2017). He made a significant contribution to the development of statistical governance processes and other methods for determining the validity of the process.

ISO 9001:2008 sets out the criteria for QMS. It can be used by any institution, company or organization, large or small, regardless of its field of activity (Elgobbi, 2014). The concept of cycles Japanese scientists called the "Deming cycle" or methodology that is known in the literature as *Plan-Do-Check-Act* (ISO, 2018).

Figure 1 shows the depiction of the PDCA cycle or Deming cycle (Sokovic et al., 2010; Vietze, 2013).

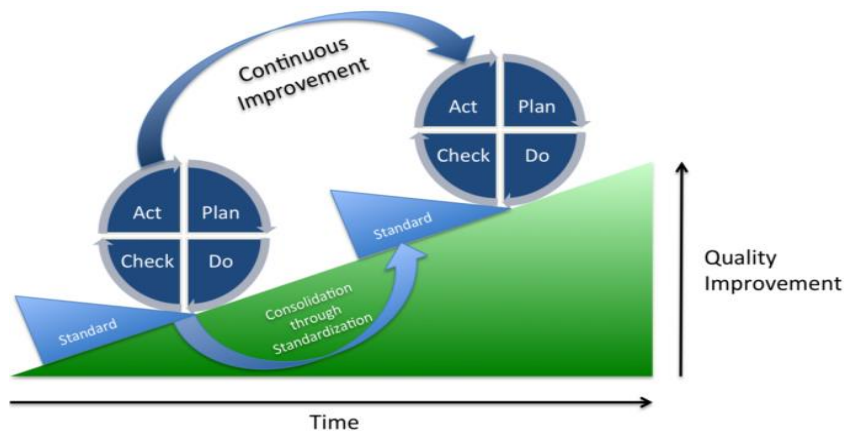


Figure 1. Continuous Improvement of ISO 9001: 2008 (Vietze, 2013)

Continuous improvement is achieved by iterating cycles and consolidating progress achieved through standardization (Vietze, 2013). According to Brkljač (2017), PDCA concept through a cycle of four steps briefly

describe: *Plan*: Identify objectives and establish the processes necessary to obtain results in accordance with customer requirements and the organization's policies.

Do: Implement processes. *Check:* Monitor and measure processes and product, comparing them with the policies, objectives and requirements for the product and report the results. *Act:* Take action to continually improve the effects (of performance) process. The ISO 9001: 2008 Quality Management

System has its contents and description section, can be seen in Table.1.

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Table 1. ISO 9001: 2008 Clauses and Requirements (SNI, 2008; ISO, 2018)

ISO 9001:2008 Clauses	Description of Clause	Content of Clauses
1	Scope	General and applications
2	Normative Reference	Reference issues for using documents
3	Terms and definitions	Terms and definitions in ISO 9001:2008
4	Quality management system	General requirements and Documentation requirements
5	Management responsibility	Management Commitment, Customer Focus, Quality Policy, Planning, Responsibility and Authority, Management Review
6	Resource management	General, Competence, Training and Awareness, Infrastructure and Work Environment
7	Product realization	Product Realization Planning, customer related processes, Design and development, Purchasing, Production and provision of equipment and monitoring and measurement equipment
8	Measurement, analysis and improvement	General, Monitoring and measurement, Control of nonconforming products, Data analysis and improvement

Table 2. Standard of Accreditation from BAN-PT (BAN-PT, 2015)

Standard of Accreditation	Descriptions
Standard 1	Vision, Mission, goals and objectives and achievement strategies.
Standard 2	Governance, Leadership, Management system, and Quality assurance
Standard 3	Students and Graduates
Standard 4	Human Resources
Standard 5	Curriculum, Learning and Academic Atmosphere
Standard 6	Financing, Facilities and Infrastructure and Information System
Standard 7	Assessment and Service / Community Service and Cooperation

2.2 Accreditation Standards for Higher Education Institutions

It is one of the activities that lift up higher education institutions through the upgrading of programs and performance. HEIs usually make their fame through certificates (Hamdatu et al., 2013). This will ensure the quality of their products (graduates) provided to the labor market. Theorists hold different concept of accreditation, but they all agree on the elements that clearly define this concept. Accreditation has been defined as: a corporate scientific oriented event directed to the advancement and upgrading of higher education institutions universities, colleges and programs. Then accreditation in this sense is together a supervisory and legal process that gives the educational institution or a program recognition certificate to indicate that an institution does possess specific criteria of quality education. So accreditation in education is the recognition that a particular educational program or institution has reached a specific required standard.

Meanwhile, National Accreditation Board of Higher Education (BAN-PT, in Indonesia), defined the accreditation of the study program is a comprehensive evaluation and assessment process of the study program's commitment to quality and capacity of 3 main programs in higher education: education, research and community service (*Tri-Dharma Perguruan Tinggi*, in Indonesia) to determine the feasibility of academic programs (BAN-PT, 2015). Table 2 shows the Quality Standards in the BAN-PT accreditation standard. Standard Accreditation consists of seven accreditation standards.

BAN-PT is an institution that has the authority to evaluate and appraise and establish status and quality rating of study program based on the predetermined quality standard. The study program accreditation standard describes the standard of study program commitment to institutional capacity

and commitment to the effectiveness of education programs. The performance assessment of the study program refers to the accreditation standard of BAN-PT.

2.3 Unified Model of Quality Assurance System

Our model unifies ISO requirements and Accreditation Standards of BAN-PT content. Our unification is accomplished by adding elements of assessment from Accreditation Standards of BAN-PT to ISO requirements or by adjusting ISO requirements so that they better represent the contents of Accreditation Standards of BAN-PT. Our unified model overcomes the following limits of existing methods:

(1) Comparison Method

The comparison method by Paulk (1993;1994;1995), understanding and comparing the processes associated with the quality assurance system of the two standards, with the aim of synergizing to develop an integrated quality assurance model based on BAN-PT Accreditation and ISO 9001: 2008. The drawback of this comparative model is the existence of objectivity in comparing the two sets of documents.

(2) Mapping Method

By (Mutafelija & Stromberg, 2003) Mutafelija and Stromberg (2003), based on previous comparative results. Aims to facilitate any ISO clauses associated with the BAN-PT Accreditation standard. The disadvantage is that the link between the two sets of documents is not based on a particular purpose and links the existing process subjectively.

(3) Model Harmonization

The model harmonization method is intended to know the intersection of the relation between both documents (Pardo et al., 2012). Furthermore, it also determines the Accreditation Standard document of BAN-PT which cannot synergize with ISO 9001: 2008 document. The disadvantage of this

method is that this method is done depending on the two previous methods.

2.4 Conceptual Framework

In this study developed a Conceptual Framework that links the problems that arise with approaches of methods relevant to problem-solving, as shown in Figure.2

As shown in Figure 2, Comparison methods by Paulk (1993;1994;1995), mapping methods Mutafelija and Stromberg (2003), and model harmonization (Pardo et al., 2012) are used to integrate the two standard quality documents.

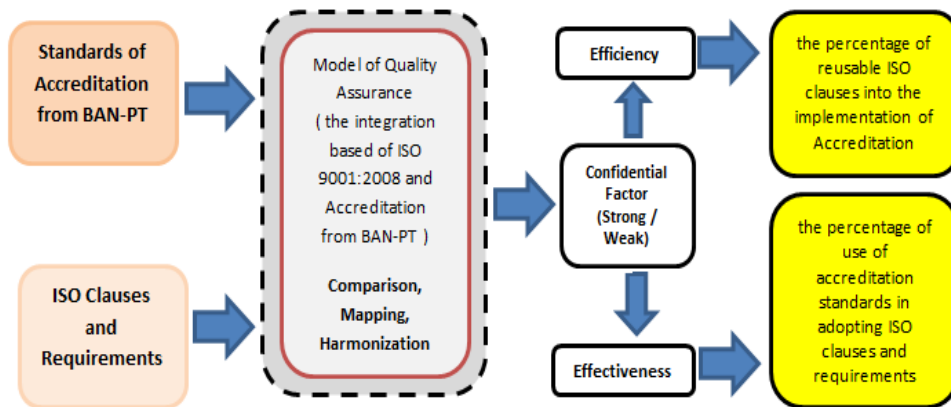


Figure 2. Conceptual Framework for Unified Model of Quality Assurance System

Furthermore, we conduct an evaluation phase to confirm and declare the reliability and validity of the model, this type of evaluation is named the confirm ability test (Creswell, 2015). Later, to complete the test we invited the ISO practitioners as ISO Auditor experts in accreditation of BAN-PT as academic quality assessor, which addresses to confirm a unified model which have to develop and have a comprehensive understanding of quality assurance system.

Figures and tables should not be placed at the end of the current section. It is recommended that footnotes be avoided. Instead, try to integrate the footnote information into the text.

3. Research Methodology

The researchers have conducted in Indonesia by taking one of Higher Education Institutions, namely the Perbanas Institute, as a case study. This study using a qualitative approach as its main of research methodology (Creswell, 2015). A unified model of quality assurance system has developed by the several integration methods. Primary data directly from the Head of Study Programs as respondents. In this study, in-depth interviews with the Head of Study Programs which the result of research by using the qualitative analysis.

4. Experimental section - the integration results

The integration result of this research can be explain in the experimental sections as follows.

4.1 Comparison Method

For example, in this study comparative standard -1 and accreditation standard -4 will be carried out, which is based on the specificities possessed by these two standards.

Standard of Accreditation – 1:

Vision, Mission and Goals and Achievement Strategies

This standard is a reference to the excellence of the quality of implementation and the strategy of the study program to achieve the future. Regarding a good Vision (EP-1) and the Mission of the Study Program related to (EA-1.2), according to ISO, there is a quality manual that is not possessed by the Study Program. The vision and mission of the study program are in the Self Evaluation document. Good goals and objectives are realistic, unique, and focused. Their mission and vision implementation measured clearly and relevant timeframes (EA-1.3), in accordance with ISO Clauses (5.1). Whereas, good vision, mission, goals, and objectives must be owned, understood and supported by all stakeholders of the course only available in the Institution Quality Manual (EA-1.4). A good target achievement strategy demonstrated with written evidence and facts in the field (EA-1.5) that adjusted to ISO requirements (5.1) on setting quality objectives.

Standard of Accreditation – 2:

Governance, Leadership, Management system, and Quality Assurance

Overall the Accreditation Standards (SA-2) are related and according to the ISO clause (5.0) Management Responsibility and (8.0) Measurement, Analysis and Improvement. Elements of Assessment, EA-2.1 can also be adjusted to ISO (5.1) requirements. The Governance system according to EA-2.2 was harmonized by subclause (5.5). Related to Governance supported by an organizational culture that must also be evaluated and monitored with clear rules and procedures in EA-2.3 according to sub-clause (8.2) regarding monitoring and measurement In EA-2.4 Effective Leadership is also able to make the right decisions according to sub-clause (5.5.1) of Responsibility and authority with the requirements of the top leadership to define responsibility. Furthermore, EP-2.5 complies with sub-clause (5.6.2b). The

quality assurance system in EA-2.7 can adopt the ISO subclause (5.4.2) regarding Quality Management System Planning. Finally, on EP-2.8 regarding external Quality Assurance is harmonized with sub-clause (5.6.2), namely the input of Management Review in providing audit results (5.6.2a).

Standard of Accreditation – 3:

Students and Graduates

This standard is a reference for the quality excellence of students and graduates. The conduct of a good study program will produce good quality students (customers) and graduates (products). Then (EA-3.1) according to the ISO (7.1) and (7.2) clauses. The effectiveness of the implementation of prospective student recruitment and selection systems produces quality students (EA-3.2) in line with ISO that focuses on customers (5.2) and processes related to customers; clause (7.2), (7.2.1) and (7.2.3). The study program must make students as a key of stakeholders, also as actors of value-added with quality profiles (EA-3.3) harmonized with the ISO clauses of customer requirements (5.2) and (7.2.1). The study program must strive for ease of access to services and access to student services (EA-3.4) and utilization of graduates (EA-3.6). That aligned with the ISO clause (7.2.1) regarding requirements relating to product and product reviews. Graduate Tracking and data recording's that is important for study programs (EA-3.7), where tracking and traceability are in ISO (7.5.3) and data recording in clause (5.6.2). The study program must actively participate in the empowerment and utilization of alumni (EP-3.8), which is related to the suitability of products in the ISO clause (8.1).

Standard of Accreditation – 4:

Human Resources

This standard is a reference to the excellence of reliable human resource quality able to guarantee the quality of the implementation of study programs. Overall Standards Akreditasi-4 (SA-4) can adopt Clause 6.0 from ISO 9001: 2008, which is about Management

of Resources, especially in clause 6.2 of Human Resources. In (EA-4.1), can be adapted to the ISO clause (6.1) in order to provide resources in accordance with the application of the Quality Management System and increase student satisfaction as a customer, and clause (6.2.1) where the requirement is that staff must require skills. At (EA-4.2) in accordance with clause (6.2) in particular (6.2.2) are competence, training and human resource awareness. In EA-4.3 Related reputation and breadth of lecturers' networks in academic and professional fields (EP-4.3) are also in accordance with clauses (6.2.2). Element of assessment (EA-4.4) is adjusted to the ISO clause (6.2.1) and (EA-4.5) can be adjusted with clauses (6.2.2) and (5.4.2) which should be in accordance with the planning according to quality objectives. Meanwhile, (EA-4.6) monitoring and evaluation system is adjusted to ISO clause (6.2.2) related to evaluation of effectiveness and maintenance of recording and clause (8.2.3) monitoring and measuring process.

Standard of Accreditation – 5: *Curriculum, Learning and Academic Atmosphere*

This standard as a reference for excellence in curriculum quality, learning, and academic atmosphere in the level of a study program. The curriculum must include graduate competency standards that support the achievement of the mission and the realization of the vision of the study program (EA-5.1). The curriculum must contain competency-supporting subjects (EA-5.2), and relevant to the objectives that encourage the formation of hard skills and soft skills (EA-5.3). All three are in line with the ISO (7.1) clause of product realization planning. The curriculum must be reviewed by the study program to suit the stakeholders for a certain period (EP-5.4) then suitable for the requirements related to the product in the ISO (7.1) and (7.2.2) clauses. Learning systems must be built on planning (EA-5.5), and carried out based on challenging strategies and techniques (EA-5.6). Then, it will be suitable with the ISO (7.3) and (7.3.1)

clauses. In (EA-5.7) it is stated that the implementer of learning has a mechanism to monitor, review and improve periodically in ISO clause (7.3.4). Trusteeship and effectiveness systems (EA-5.8) align with design and development expenditures in the ISO clause (7.3.5). The final assignment guidance system (EA-5.9) aligned with the design and development output in the ISO clause (7.3.6). It is about design and development validation. Efforts to improve the learning system that has been carried out in (EA-5.10) is in harmony with the ISO clause (7.3.7). Contains control over design and development changes. Meanwhile, clause (8.5.1) concerning continuous improvement. In (EA-5.11), efforts to improve the academic atmosphere will be suitable for improvement in the ISO clause (8.5). Clause (8.5.2) concerning corrective actions and Clause (8.5.3) concerning preventive measures.

Standard of Accreditation – 6:

Financing, Facilities and Infrastructure and Information System

The study program is directly involved in planning performance targets and planning allocation and management of funds. There must be written evidence and responsibility to stakeholders through a transparent and accountable mechanism (EA-6.1) is in line with ISO clauses (4.1) and (4.2). In (EA-6.2) states that operational funds and grants to support academic programs must meet the eligibility amount and on time. In line with ISO clause (6.1). Lecturer workspace that meets feasibility and quality (EA-6.3) is in line with ISO clauses (6.3). Access and utilization of facilities (EA-6.4) and facilities (EA-6.5) are used in the implementation of learning and are feasible and used effectively, related to ISO clause (6.3). In (EA-6.6) access and utilization of information systems in managing data and information in the study, programs are also related to ISO clauses (6.3).

Standard of Accreditation – 7:

Assessment and Service / Community Service and Cooperation

The management education system, research, community service, and cooperation must be with the quality assurance system of study program to support the realization of the vision, the implementation of the mission, the achievement of objectives, and the success of the relevant university strategy (EP-7.1). Clarity, transparency, and accountability of the management system including the monitoring process, evaluation, and review by the study program can be continuously improved (EA-7.2). The organization must review and commit in the ISO clause (7.2.2). Lecturer and student participation in activities (EP-7.5) align with Communication and product information to customers (ISO clause 8.2.1). Whereas, this also supports the learning process (EP-7.6) in harmony with monitoring and measuring process activity in the ISO clause (8.2.3). Productivity and research quality of lecturers and students are

authorized by the community (EP-7.7) in line with ISO clause (8.2.1) community service activities must provide benefits to the community (EA-7.8), and the amount and quality of effective cooperation (EA-7.9) align with the ISO clause (8.2.1).

4.2 Mapping Method

After integration with the comparative method as Paulk (1995), then it will be easier to do the Mapping method (Mutafelija & Stromberg, 2003). Based on the results of the comparison, a mapping is made like Mutafelija and Stromberg (2003) for CMMI mapping into ISO 9001 or vice versa. Furthermore, given the results of mapping the BAN-PT Accreditation Standards into ISO 9001: 2008 in Table 3.

That mapping results can be summarized, as in Table 4.

Table 3. Mapping Standard of Accreditation to ISO 900:2008

Standard of Accreditation (SA)	Description	Elements of Assessment (EA)	ISO 9001:2008 Clauses
SA-1	Vision, Mission and Goals and Achievement Strategies	EA-1.1; EA-1.2; EA-1.3; EA-1.4; EA-1.5	Quality Manual; and 5.1
SA-2	Governance, Leadership, Management system, and Quality Assurance	EA-2.1; EA-2.2; EA-2.3; EA-2.4; EA-2.5; EA-2.6; EA-2.7; EA-2.8.	5.0; 5.1; 5.5; 8.0; 8.2; 5.5.1; 5.6.2; 5.6.3; 6.2.2; 5.4.2; 5.6.2
SA-3	Students and Graduates	EA-3.1; EA-3.2; EA-3.3; EA-3.4; EA-3.5; EA-3.6; EA-3.7; EA-3.8.	7.1; 7.2; 7.2.1; 7.5.4; 7.2.2; 7.5.3; 7.2.3
SA-4	Human Resources	EA-4.1; EA-4.2; EA-4.3; EA-4.4; EA-4.5; EA-4.6	6.1; 6.2; 6.2.1; 6.2.2
SA-5	Curriculum, Learning and Academic Atmosphere	EA-5.1; EA-5.2; EA-5.3; EA-5.4; EA-5.5; EA-5.6; EA-5.7; EA-5.8; EA-5.9	7.1; 7.2.2; 7.3.1 7.3.4; 7.3.5; 7.3.6
SA-6	Financing, Facilities and Infrastructure and Information System	EA-6.1; EA-6.2; EA-6.3; EA-6.4; EA-6.5; EA-6.6;	5.4; 5.5.1; 6.1; 6.3;
SA-7	Assessment and Service / Community Service and Cooperation	EA-7.1; EA-7.2; EA-7.3; EA-7.4; EA-7.5; EA-7.6; EA-7.7; EA-7.8; EA-7.9	7.1; 7.2.2; 8.4; 5.1; 7.2.3; 8.2.1; 8.2.3;

Table 4 Summary of Results: Mapping Standard of Accreditation to ISO 9001: 2008

Standard of Accreditation	The number of link Elements of Assessment	The number of Elements of Assessment use of Standard of Accreditation in adopting ISO clauses and requirement
SA-1	5	2
SA-2	8	8
SA-3	8	8
SA-4	6	6
SA-5	11	11
SA-6	6	6
SA-7	9	9
Total	53	50

In Table 5, the second mapping method, ISO 9001: 2008 Mapping into the BAN-PT Study Program Accreditation Standards must use the confidence factor. If the confidence factor is worth 100, it means that its suitability is

appropriate and if it is not complete, worth 60 even 30.

Furthermore, the whole results can be summarized, as in Table 6.

Table 5. Mapping ISO 9001:2008 to Standard of Accreditation of BAN-PT

ISO 9001:2008 Clauses	Description	Standard of Accreditation (SA)	Elements of Assessment (EA)	Confidential Factor (%)
4.0	Quality Management System	SA-2; SA-4; SA-5; SA-7	EA-2.7; EA-5.5; EA-5.6; EA-7.6; EA-2.6; EA-4.5;	100 100 100
5.0	Management Responsibility	SA-1; SA-2; SA-3; SA-4; SA-5 SA-6; SA-7	EA-2.5; EA-2.7; EA-1.3; EA-2.3; EA-4.1; EA-3.3; EA-3.4; EA-1.4; EA-1.5; EA-2.8; EA-2.4; EA-2.6	100 100 100 100
6.0	Resource Management	SA-4; SA-3; SA-5	EA-4.1; EA-4.4; EA-4.5; EA-4.6; EA-3.4; EA-3.6; EA-5.11	100 100 100
7.0	Product Realization	SA-7; SA-6; SA-5; SA-4; SA-3; SA-2	EA-7.1; EA-5.5; EA-3.6; EA-3.7; EA-3.8; EA-1.3; EA-2.7; EA-3.4; EA-5.1; EA-7.6; EA-7.4; EA-7.2; EA-7.7; EA-7.8; EA-7.9; EA-5.6; EA-5.4; EA-5.3; EA-5.2; EA-3.1; EA-5.7; EA-4.1; EA-5.8; EA-5.9; EA-5.10;	100 100 100 100 100 100 100 100 100 100
8.0	Measurement, Analysis and Improvement	SA-1; SA-2; SA-3; SA-4; SA-5 SA-6; SA-7	EA-7.7; EA-1.3; EA-2.7; EA-3.1; EA-4.5; EA-5.10; EA-6.1; EA-7.2; EA-2.3; EA-5.4; EA-3.8; EA-4.6; EA-7.9; EA-2.8; EA-5.7	100 100 100 100 100

Table 6. Summary of Results: Mapping ISO 9001: 2008 Clause to Standard of Accreditation

ISO Clause	The number of link Clauses and sub-clauses	The number of ISO clauses and requirement reusable into implementing Accreditation of BAN-PT
4.0	5	4
5.0	11	11
6.0	5	5
7.0	20	20
8.0	10	10
Total	51	50

4.3 Harmonization Model

Based on the result of the comparison and the previous mapping, we use a harmonization model based on set theory (Lipshutz, 1998). The objective is to collect the Accreditation Standard Assessment Elements that can adopt ISO parts or reusable clauses when the course will apply for BAN-PT accreditation.

Operation Difference in the set theory is also able to state which Accreditation Standards are not able to adopt the requirements of ISO 9001: 2008, as shown in Figure 3a.

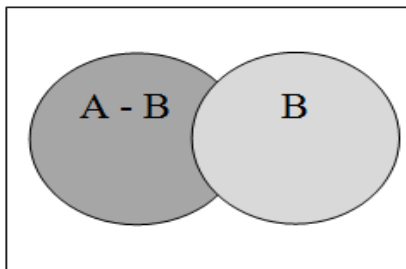


Figure 3.a. Difference Operation (A-B)

Expressed by:

$$A - B = \{ x \mid x \in A \text{ and } x \notin B \} \quad (1)$$

$$A - B = \{ EP-1.1, EP-1.2, EP-1.4 \} \rightarrow n(A - B) = 3$$

Thus, the Element of Accreditation of BAN-PT which cannot adopt ISO 9001: 2008 requirement is SA-1, especially on EA-1, EA-2, and EA-4.

Another difference operation, in the theory of this set, is also to declare an ISO900: 2008 clause that cannot reuse in the application of accreditation standards. It can be seen in Fig 3(b). This operation is expressed by:

$$B - A = \{ x \mid x \in B \text{ and } x \notin A \} \quad (2)$$

$$B - A = \{ (4.2.2) \} \rightarrow n(B - A) = 1$$

Thus, an ISO 9001: 2008 clause that cannot be re-used in BAN-PT Accreditation Standards is a clause (4.2.2) of a Quality Manual not owned by a study program. The Quality Manual in ISO 9001: 2008 becomes the full authority of the Higher Education Institution

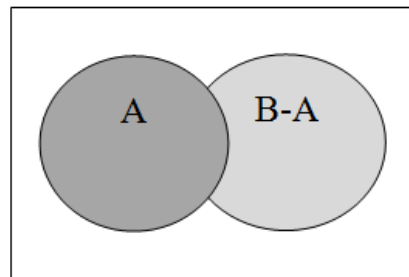


Figure 3.b. Difference Operation (B-A)

In set theory, there is a Union operation, where the aim is to represent a unified model of quality assurance system for ISO-certified higher education institutions, as shown in Figure 3 (c).

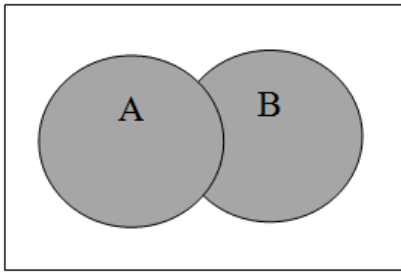


Figure 3.c. Union Operation (B-A)

The Union operation is expressed by:

$$A \cup B = \{ x \mid x \in A \text{ or } x \in B \} \quad (3)$$

Where, x represents the elements of assessment in the BAN-PT accreditation standard, ISO clause, and sub-clause that used in the Unified Model of the Quality Assurance System; A is representative of the set of Elements of Assessment in the BAN-PT accreditation standard, then $n(A) = 53$ or, there are 53 elements of assessment in BAN-PT accreditation standard. B represents of the set of clauses and requirements in ISO 9001:2008, thus $n(B) = 51$ or, there are 51 clauses along with the requirements of ISO 9001: 2008. The unified model is intended for ISO-certification and SP accreditation simultaneously it must ensure the collection of all necessary information on the status of all processes to be assessed. Based on the results of comparison and mapping, there are 50 elements of assessment from SP Accreditation which are strongly related to the ISO 9001: 2008 clauses. The previous difference operation results, only one ISO clause that cannot use in SP Accreditation. Meanwhile, there are three elements assessment in SP Accreditation that cannot use for ISO 9001: 2008. Therefore,

$$n(A \cup B) = n(\{ x \mid x \in A \text{ or } x \in B \}) = (3 + 50 + 1) = 54$$

It said that there are fifty-four clauses ISO or elements of assessment in SP-accreditation that needed for the Unified Model Quality

Assurance System. Quality assurance information system based on the usage of operation of set union will allow collecting and processing large volume of information and building different reports based on specified parameters. So it is possible to use one model, to collect all information one time, to use one information system and provide two reports: one for ISO-certification and - another for SP accreditation. This unified model can have three parts: (1) General section contained data for both types of accreditation; (2) SP accreditation section with the information on requirements of SP accreditation standard; (3) ISO-certification section based on the requirements of ISO standard.

5. Results

Our model unifies to ISO requirements and Accreditation of BAN-PT assessment elements. Our unified model is accomplished by adding Accreditation of BAN-PT assessment elements to ISO clauses, or by adjusting ISO and accreditation of BAN-PT. Our unified model overcomes the following limits of existing mappings. Development of the unified model of Integrated Quality Assurance System Based on BAN-PT Accreditation and ISO 9001: 2008 with the principle of the corresponding Plan-Do-Check-Action process. The Quality Assurance System Framework, as shown in Figure 4.

		SA-1	SA-2	SA-3	SA-4	SA-5	SA-6	SA-7
		Standard of Accreditation BAN-PT						
Plan	Resources Management			√	√		√	
	Management Responsibility	√	√			√		√
Do	Product Realization	√	√	√	√	√	√	√
Check	Measurement Analysis	√	√	√	√	√	√	√
Action	Improvement	√	√	√	√	√	√	√

Figure 4. Unified Model for the Quality Assurance System

The quality assurance system framework will have the main processes namely, Plan, Do, Check and Action. For each process will be done with the seven Quality Standards in BAN-PT Accreditation. The suitability between processes based on PDCA concepts in ISO 9001: 2008, as follows

5.1. ISO 9001:2008

In the **PLAN** process, it will be fulfilled by: clause 6 (Resources Management), i.e. resource provision (6.1), human resources (6.2), Infrastructure (6.3) and work environment (6.4). Clause 5 (Management Responsibility): management commitment (5.1), customer focus (5.2), quality policy (5.3), planning (5.4), responsibility, authority and communication (5.5) and management review (5.6).

In the **DO** Process, it is executed in accordance with Clause 7 (Product Realization), among others: planning of product realization with its various requirements (7.1) determination of requirements (7.2.1), objective requirements (7.2.2), communication with stakeholders / customers (7.2. 3), development design (7.3) and production and service provision (7.5).

In the **CHECK** process, it is fulfilled with sub-clause 8.2 (Measurement Analysis), i.e.: customer satisfaction (8.2.1), internal audit (8.2.2), monitoring and measurement (8.2.3), monitoring and product measurement (8.2.4).

In the **ACTION** process, it is executed in accordance with sub-clause 8.5(Improvement), i.e.: Continuous Improvement (8.5.1), Corrective Action (8.5.2) and preventive action (8.5.3).

5.2. Standard of Accreditation (BAN-PT)

In the **PLAN** process, it will be fulfilled by Management responsibilities in the program of study are SA-1 that is the objectives and targets relevant to the vision and mission (EA-1.3), the strategy to achieve the quality objectives (EA-1.5);

SA-2 namely EA-2.1, EA-2.2, EA-2.3, Management Commitments SA-2, namely EA-2.1, EA-2.2, EA-2.3, Customer Focus (EA-5.2), Quality Policy (EA-5.11), Planning curriculum (EA-5.5), Responsibility, authority and communication (EA-2.3) and Management Review (EA-5.4). Resource Planning (EA-4), namely qualifications, competence and number of lecturers (EA-4.1), lecturer achievement (EA-4.2), reputation and breadth of lecturer networks (EA-4.3) Number and qualifications of academic staff (EA-4.4), Financing (EA-6.1, EA-6.2), workspace (EA-6.3, EA-6.4) and infrastructure (EA-6.5) and information systems (EA-6.6)

In the **DO** Process, it is executed in accordance with Quality standards related to product realization include curriculum (EA-5.1, EA-5.2, EA-5.3) graduate (EA-3.5, EA-3.6) research (EA-7.1, EA-7.2, EA-7.3, EA-7.4, EA-7.5). Furthermore, processes related to learning, design and curriculum development and productivity (graduates and research (EP-7.7) and service delivery (EP-7.8) and collaboration (EA-7.9) and product monitoring and measurement controls (EA-2.7, EA-2.8) and Information systems (EA-6.6).

In the **CHECK** Process, then implemented according to the elements of assessment in the Quality Standard include: Customer Satisfaction (EA-3.4, EA-3.6, EA-7.8), internal audit (EA-2.8), monitoring and measurement (EA-1.3, EA-5.7) measurement of graduate products and research (EA-4.6).

In the **ACTION** Process, then executed according to the assessment element in the Quality Standard), among others: Continuous improvement (EA-7.2) for Learning process, students, lecturers, education personnel), Corrective action (EA7.8) input from student and user ratings graduates) as well as preventive measures (EA-2.2) by accommodating all the elements.

The results of this study will be developed in the future to create a Quality Assurance Information System model for Study Programs in ISO-certified higher education institutions.

6. Discussion

6.1 A Unified Model Evaluation

The discussion in this study refers to the previous unification method. First, evaluate the effectiveness of BAN-PT Study Program Accreditation. Second, evaluation of efficient reuse of ISO clause in BAN-PT accreditation implementation, and finally, evaluate the result of the validity of the integrated model generated. Based on the result of integration of Accreditation Standard of BAN-PT Study Program into ISO 9001: 2008, evaluation of effectiveness of BAN-PT Accreditation Standard at ISO certified HEIs can be determined.

The effectiveness of the Accreditation Standards Assessment Element in adopting ISO clauses and requirement:

$$\text{Effectiveness (\%)} = (\sum x / \sum y) \times 100\% \quad (4)$$

where is $\sum x$ represents of the total the number of EA accreditation standards that can adopt the ISO clause, and $\sum y$ are the total number of EA accreditation standards BAN-PT. This can explain that the effectiveness of the Accreditation Standard Assessment Elements in adopting ISO Clause = $(50 / 53) \times 100\% = 94,34\%$

Based on Mapping results Standard of Accreditation from BAN-PT into ISO 9001:2008, then we evaluate the efficiency of reusable ISO clauses and requirement in implementing accreditation from BAN-PT for ISO-certified higher education institutions, as follows :

$$\text{Efficiency (\%)} = (\sum a / \sum b) \times 100\% \quad (5)$$

where is $\sum a$ represents the total number of ISO clauses that can be reused into Standard of Accreditation from BAN-PT and, $\sum b$ represents Total number of ISO clauses. Thus, the efficiency of reusable ISO Clauses into Standard of Accreditation from BAN-PT = $(50/51) \times 100\% = 98,04\%$.

The results of this calculation indicate that the unified model is useful to ISO-certified organizations that plan to implement Standard of Accreditation from BAN-PT documents efficiently and effectively. Based on this, the use of HEIs resources, especially the Study Program, will be more efficient when implementing accreditation.

The model evaluation using a confirm-ability test, where the test is used to test the reliability and validity of the model. Researchers invited ISO Auditor and Accreditation Assessor who know the problem of information systems and understand the field of quality assurance system in ISO-certified higher education institutions. The qualitative experiment showed that 80% of ISO Auditor and Accreditation Assessor confirm on the proposed a unified model for quality assurance system for ISO-certified higher education institutions, and 20% confirmed but with some notes.

Based on the research findings and referring to the objectives of this research, there can be a discussion in this study. First, Quality assurance in Higher Education Institutions (HEIs) has been essential in education all over the world (Elgobbi, 2014). Consequently, Higher Education Institutions start looking at quality assurance and accreditation to provide quality education to address global developments, with efficiency and high excellence in different fields (Hamdatu et al., 2013). ISO 9001:2008 requires that HEIs academic's processes undergo continuous improvement. Even after ISO-certification has been achieved by HEIs. Whereas accreditation standards also provide HEIs with means to achieve further and continuous improvement in quality processes. The

concept for process improvement that can be defined is the Plan-Do-Check-Action as in 9001: 2008. A Unified Model for The Quality Assurance System, it can be shown in Figure 4. The model unifies ISO requirements and Standard of Accreditation from BAN-PT content. This integration is carried out by adding assessment elements from the Accreditation Standards to ISO requirements. Or, by adjusting the ISO requirement into standard accreditation. The unified model overcomes the following limits of existing mappings. (1) The confusion of integration that is caused by “many-to-many” mappings. (2) The explanation of how to associate ISO and Standard of Accreditation from BAN-PT statements is useful for HEIs. However, HEIs are not easy to understand and implement practical integrated models. It is impossible to prove that the mapping is perfect because it is likely to be subjective according to individual’s interpretations of the ISO and Standard of Accreditation from BAN-PT documents. (3) The words and structures used in the Accreditation Standards from BAN-PT are different from those used in ISO documents, so this will become unfamiliar to institutions that use ISO documents.

6.2 Research Implication

Theoretical implications, a unified model of quality assurance system has implications for the contribution to the decision-making accurately. Theoretically also using the PDCA concepts in ISO can support to perform a unified model for quality assurance system.

Practical implications relate to the requirements of quality documentation. The higher education institution must provide the complete ISO 9001: 2008 document as required. On the other hand, the higher education institution while implement accreditation of BAN-PT can be reused their resources more efficient, later on, it is more effective in the institution's performance.

6.3 Limitations

This study has limitations: First, this study only integrates BAN-PT Accreditation Standard using ISO9001:2008. Second, we will not evaluate this model empirically to confirm its efficiency in the implementation process. Third, this unified model only applied to Higher Education Institutions in Indonesia.

However, with the same integration method, this integrated model of quality assurance system can be developed for accreditation standards in other countries outside Indonesia.

7. Conclusion

The purpose results of this research has presented a unified model of ISO 9001:2008 and Accreditation Standards of BAN-PT. A unified model has the potential to help ISO-certified higher education institutions implement Accreditation Standards of BAN-PT more effective and efficient. Furthermore, it gives explanations to help elucidate the application of a unified model for the implementation of Accreditation Standards of BAN-PT by ISO-certified higher education institutions. It assists higher education institutions to perform the necessary gap analysis and to maintain their quality documentation without any further difficulty when they implement the Accreditation Standards of BAN-PT. Finally, the higher education institutions will be able to implement ISO 9001:2000 and accreditation of BAN-PT simultaneously by applying our model, even if the higher education institutions do not have an ISO certification. In term of the future research, this unified model could be developed to design Quality Assurance Information System model and applied in computer program application.

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