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Organizational Memory System Model for Higher Education Internal Quality Assurance

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Abstract. Internal Quality Assurance (IQA) is essential for universities because it improves quality and develops a quality culture, actualizes vision and mission, obtain external accreditation ratings, and meets stakeholders' needs. Universities still have many problems implementing IQA because they still have an informal and non-continues procedure to conduct IQA. This study aims to propose an IQA business process model using a cycle of Determination, Implementation, Evaluation, Control, and Improvement (DIECI). The model uses organizational memory synchronized for external accreditation purposes and can record and store organizational knowledge assets resulting from the performance of IQA business processes. This study uses a combined research method, namely action research and case study. The procedure for data collection was through observations and interviews with leadership elements at private universities in Semarang city, Indonesia. The current study uses soft system methodology as an action-oriented approach to deal with internal quality assurance problems, from recognizing to formulating and taking action to fix the problem. The results indicate that creating a quality culture in a university requires commitment from all stakeholders in the university, particularly the commitment of top management. Also, a reward and punishment mechanism is essential. The current study contributes a different approach to conducting a business process model for internal quality assurance by utilizing organizational memory to control and improve the implementation of sustainable quality assurance in a university.

Keywords: Internal quality assurance, internal quality audit, DIECI cycle, organizational memory, soft system methodology.

1. Introduction

Most organizations face the difficulty of finding or recovering knowledge assets owned by the organization (Widyaningsih, 2014). For instance, a service manual document is vital for engineering companies because it provides guidance and knowledge to service technicians (Chong et al., 2021). Documentation and storage of organizational knowledge assets in the form of hardcopy and softcopy are not well organized and difficult to find when needed. It takes a long time to find, so it is not efficient. Therefore, organizations must ensure that knowledge assets have become significant and essential for organizational development. Organizations need to identify, collect, classify, declare and disseminate knowledge. Therefore, knowledge needs proper classification for easier access. An organization's ability to record, store and reuse knowledge assets is known as organizational memory.

Stein & Zwass (1995) consider three main reasons for developing the concept of organizational memory: firstly, organizational memory is a helpful metaphor that has provided new insights into organizational life; secondly, organizational memory has been integrated into many theories; thirdly, organizational memory is associated with managerial experience. Organizational memory records and stores organizational knowledge assets such as expertise, experience, unwritten rules, critical events, and academic skills (Basaruddin & Haron, 2011). According to Shirsavar (2015), organizational memory as a part of knowledge management results from current and past organizational performance. Organizational memory is essential in decision-making to deal with recent and future competition.

Esmaeli & Saeidabadi (2016) show that individual knowledge and organizational culture, organizational technology, organizational communication, organizational background, organizational change and transformation, and organizational structure are components of building organizational memory management models in the education system. Martín & Diván (2017) present a case-based ontology of organizational memory that aims to contribute to the design of case-based organizational memory to be used for learning, reasoning, problem-solving, and as a better decision supporter. Saleh & Abel (2018) discuss the role of information systems as support for organizational memory where information systems increase precision, recall, completeness, and feedback. De-Cuffa et al. (2018) identified organizational memory systems to carry out daily activities in organizations, primarily used to store explicit knowledge. Nafei (2019) analyzes the effect of organizational memory on organizational performance; the result shows the highest impact occurs on management and administration performance.

Academics have to carry out academic work (i.e., teaching, research, and community service), including administrative work, to increase the university's ranking in the list of the world's top university rankings (Mutahar et al., 2021). In this case, higher education institutions have to improve organizational performance to meet the required quality standards. As a result, higher education needs to develop a

solid Internal Quality Assurance (IQA) system. The system must be able to map processes within the organization, integrate process interactions, and document them (Prakosa, 2009 in Widyaningsih, 2014). According to the Directorate General of Belmawa Kemenristekdikti, Among the IQA problems in higher education institutions are informal procedure, non-sustainable, non-continues monitoring and evaluation, lack of feedback follow up, and lack of complete documentation (Direktorat Penjaminan Mutu, 2016b). The 2018 non-vocational higher education clustering by the Ministry of Research shows that 80.85% of universities in Indonesia were in the cluster of low and very low performance (Kemenristekdikti, 2018).

Law number 20 of 2003 concerning the national education system states that universities need to independently establish, implement, manage, and improve higher education quality assurance activities. Systematic quality assurance activities aim to monitor and improve the implementation of higher education in a planned and sustainable manner and ensure the fulfillment of higher education standards systematically and sustainably so that the higher education quality culture grows and develops. Systematic quality assurance activities are through a cycle of determination, implementation, evaluation, control, and improvement (DIECI) of higher education standards (Direktorat Penjaminan Mutu, 2016a).

Previous research has emphasized the importance of IQA. Sulaiman & Wibowo (2016) states that implementing IQA is an effort to improve the quality of education in higher education. Anane & Addaney (2016) presents how to manage quality assurance to produce continuous improvement in teaching and learning. In addition, Fitrah et al. (2018) argue the urgency of IQA in improving the quality of higher education institutions. Anggarawati (2019) states the importance of IQA in implementing higher education quality improvement policies. Putra et al. (2019) emphasize that IQA is essential for universities to face industry revolution 5.0. Previous studies cover topics related to IQA, such as system management (Arifudin, 2019), leadership (Namawi & Rudini, 2020), and the effectiveness of IQA (Paputungan et al., 2021). Likewise, some other studies focus on applying platforms in supporting IQA of higher education institutions, such as a quality information system (Wicaksono & Al-Rizki, 2016), a website-based internal academic quality audit information system (Luhukay & Prastyo, 2017), and a responsive website-based IQA information system (Safi'i & Vidy, 2017).

IQA is essential to improve the performance of higher education organizations (Fitrah et al., 2018). IQA can map and integrate process interactions in the organization and document them as organizational memory (Prakosa, 2009 in Widyaningsih, 2014). Therefore, there is a significant relationship between organizational memory and performance, particularly in management and administration (Nafei, 2019). According to Shirsavar (2015), organizational memory results from current and past organizational performance and becomes a part of the organization's knowledge assets. Organizational memory can record and store

organizational knowledge assets (Basaruddin & Haron, 2011). Recording and storing current organizational knowledge assets can be used in the future as a critical element of organizational memory (Nissen, 2002). Based on the studies mentioned above, it is essential to conduct a study that provides solutions to internal quality assurance problems by utilizing organizational memory in internal quality assurance business processes.

2. Literature Review

2.1. Quality assurance of higher education

Higher education institutions can determine, implement, control, and improve their higher education quality assurance activities autonomously or independently. The Law of the Republic of Indonesia Number 12 of 2012 concerning Higher Education states that the Higher Education Quality Assurance (HEQA) consists of Internal Quality Assurance (IQA), External Quality Assurance (EQA), and the Higher Education Database (HED). Fig. 1 shows The HEQA mechanism as follows:

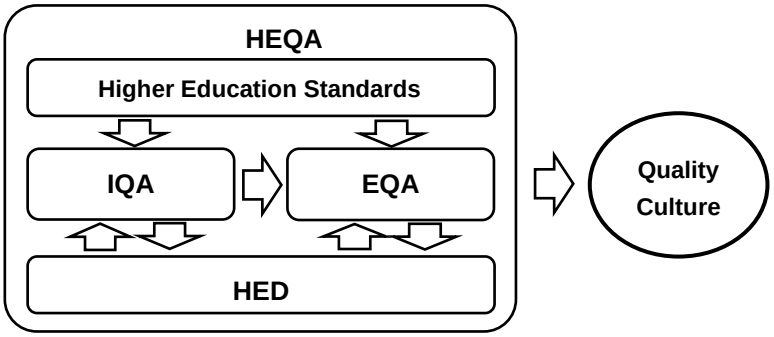

Fig. 1: HEQA mechanism

A university conducts its Internal Quality Assurance (IQA) for meeting higher education standards in a planned and sustainable manner through five main steps: determination, implementation, evaluation, control, and improvement. IQA aims to improve the quality of higher education institutions by fostering a culture of quality, actualizing the vision and mission, obtaining accreditation ratings, and meeting the needs of its stakeholders (Direktorat Penjaminan Mutu, 2018). Meanwhile, EQA or accreditation is an assessment activity that aims to determine the adequacy of a study program or college. In particular, an evaluation of the IQA implementation becomes a critical performance metric in the EQA to justify a study program's adequacy. The final assessment of EQA determines the eligibility of a given study program or university to deserve the accreditation rating. The assessed areas include implementing teaching/learning, research, and community service.

2.2. Internal quality assurance business process

The success of IQA implementation depends on how university leaders, lecturers, administrative staff, and students have the same understanding of the importance of the IQA. The commitment to implement IQA needs to be carried out by compiling quality assurance instruments and implementing them at the various structure levels such as university, faculty, and study program to build institutional capacity and competence. These efforts must be accompanied by strengthening or facilitating activities related to IQA, such as dissemination, workshops, technical guidance, mentoring, coaching, and seminars. A university conducts Internal Quality Audit (IQ-Audit) to obtain evidence and evaluate how a university implements the established quality standards and procedures. In addition, benchmarking is also critical n IQA's business processes, where a university conducts a self-evaluation comparing with other best organizations to identify, adopt, and implement better practices.

2.3. Organizational knowledge

Knowledge is stored in various formats such as databases, knowledge bases, document archives, and tacit knowledge (Md. Daud, 2005 in Basaruddin & Haron, 2011). Knowledge generated by organizational activities often resides within the laboratory or research team and rarely crosses disciplinary boundaries (Cuilan, C. (2015). It resides within individual knowledge pools; so it is a challenge for institutional leaders to motivate their staff to share (Norris et al., 2003). An organization still has difficulty integrating best practices (i.e., decisions and reasons) in organizational decision-making across functions and levels into a repository. Such knowledge is critical for making future problem-solving efficiently and effectively. Organizational memory centralizes the repositories within the organization so that there is only one repository in an organization containing the most up-to-date and reliable cross-knowledge.

Organizational memory lives and grows with the organization. Organizational members must support the knowledge management process of knowledge creation, organizing, filtering, and transferring (Awad & Ghaziri, 2004). Learning is the ability of each team member to imagine the alignment between individual skills and the team's vision to produce results that are better than what can be delivered (Wasileski, 2005). An organization must overcome individual/team learning barriers to become a learning entity. An organization must achieve a common understanding of the company's goals and known organizational problems and demonstrate a certain level of fault tolerance (e.g., improper learning or learning from wrong/critical experiences) (Irani et al., 2009). Organizational memory should not only include specific individual characteristics, but also it is independent of any member. Organizational memory is knowledge from the past where experience becomes the basis for the current activities, thereby resulting in higher levels of organizational effectiveness (Bencsik et al., 2009).

2.4. Organizational memory system

Organizational Memory (OM) is one of the main components of the organizational learning environment, which is organized from cognitive and structural artifacts. Mental includes data, information, and knowledge, while structure involves the creation process of knowledge. OM as a knowledge repository can store raw data or information and meaning. Information technology allows for better utilization of OM by providing information automatically in a shorter and more precise time. With the support of information technology, organizational memory is called Organizational Memory Information System (OMIS) (Wijnhoven, 1999). OMIS refers to a system that provides a means of bringing knowledge from the past to support current activities, thereby increasing the level of effectiveness of the organization (Stein & Zwass, 1995). Some other authors use the term Organizational Memory System (OMS), a system that becomes part of an organization's knowledge base with the help of information and communication technology; and support tasks, functions, and procedures connected to the use of organizational knowledge (Lehner & Maier, 1998).

Ackerman (1996) explains that OMS offers the possibility that computer systems can better serve organizations' information storage and memory retrieval needs by providing technical and social methods. Some researchers see OMS as a component of organizational memory. The elements of OMS, according to Jennex et al. (1998), are as follows:

(1) Physical documents are organizational-wide references located in central repositories such as corporate libraries.
(2) Computer documents include all computer-based information maintained at the workgroup level or beyond.
(3) Individual memory includes all paper and computer documents maintained by an individual.
(4) Other documents are typical components, including files, notes, collections of writings, and other archives. These usually do not have an official format basis.

2.4.1. OMS taxonomy and metadata

Taxonomy is a hierarchy of categories used for classification purposes with appropriate subject titles and descriptors (Basaruddin & Haron, 2011). Sharma et al. (2010) suggest that the components of a growing corporate taxonomy are best understood by reviewing the research literature and industry efforts, i.e., major standards, metadata, classifiers, skill finder, and taxonomy tools available to automate what can be a huge undertaking. When dealing with explicit knowledge bases stored in electronic format, any taxonomy used is closely coupled with the body of metadata used to define, identify, designate, describe, and characterize the knowledge base's

content (Barquin, 2001). Knowledge taxonomy for OMS, individual knowledge lies as the initial stage of knowledge.

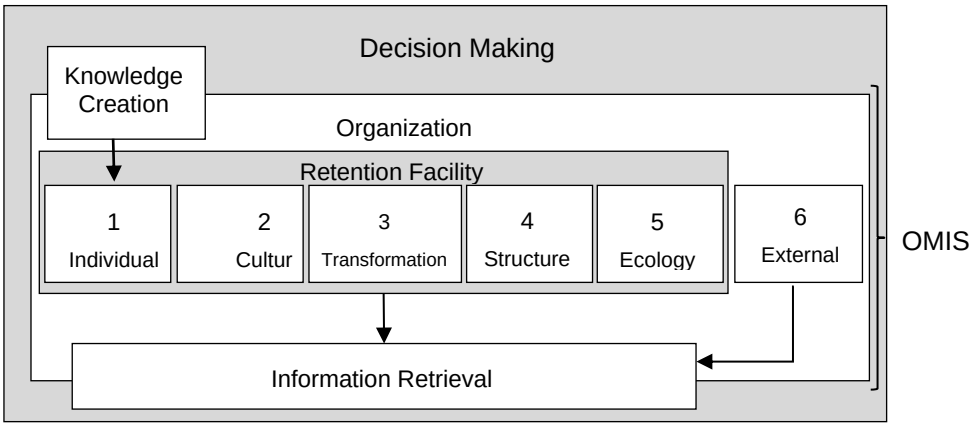

Fig. 2: OM Framework

Metadata is the lower layer of the OMS taxonomy. It plays an essential role as the core of knowledge and simplifies information about it, leading to better content identification (Basaruddin & Haron, 2011). Metadata describes the knowledge stored and should be shared among selected components in the OMS taxonomy. It can also be included as part of a search engine component that encourages specific knowledge groupings. Metadata forms knowledge values worthy of being transferred into the internal quality assurance memory. Sharma et al. (2010) noted that standard descriptive metadata with network objects could substantially improve resource discovery capabilities. Metadata enables field-based tracing, indexing of non-textual objects, and access to content substitutes distinct from access to the resource content itself.

2.4.2. OMS success factors

The researchers confirmed the need to identify the success factors when implementing OMS in an organization. These factors include system architecture, program architecture, functional architecture, database architecture, and interface architecture. Firstly, system architecture relates to operational characteristics that an organization must design. Secondly, program architecture relates to the quality of information as an output of OMS. The following architecture is function architecture that relates to the required OMS elements. Database architecture refers to how an individual performs productivity to IQA. Finally, interface architecture refers to organizational impact factors from implementing OMS as a whole.

3. Research Method

The current study uses a combined research method: action research and case study. The scope of the present study is private universities in Semarang, that is: a) higher education accreditation rating C (Good) as case studies of business processes; b) higher education accreditation rating A (Superior) as a benchmark for business process. Interviews with several informants are a chosen data collection tool. Informants who participated in the present study are the head of the faculty (HF), the head of the study program (SP), the head of the quality assurance institution (QAI), and the head of the unit of information and communication technology (ICT) with using the personal interview method.

In addition to interviews, the current study conducted observations to collect data that complement data obtained from the interviews—observing and interacting with QAI in implementing internal quality assurance, such as discussing DIECI functional designs, program planning, implementation processes, and documentation of outputs. The document study was also conducted by analyzing organizational documents supporting IQA's business processes: quality policy documents, quality manuals, quality standards and forms, statutes, strategic plans, operational plans, performance reports, IQA guidelines, and accreditation instruments.

3.1. Soft system methodology

Soft System Methodology (SSM) is an approach to solving problems in complex unstructured situations. The process is carried out using holistic analysis and based on systems thinking (Sensuse & Lukman, 2012). According to Checkland and Poutler as quoted from Hardjosoekarto (2012), the definition of SSM is an action-oriented process of finding out about problematic situations from real everyday life. SSM users carry out learning that starts from recognizing the problem for formulating and or taking action to improve the problematic situation. According to Wilson as cited by Hardjosoekarto (2012), The SSM process consists of seven steps as follows:

(1) To define problematic situations;
(2) To describe the problematic situation in the form of a rich picture;
(3) To formulate the root definition uses the PQR formula, that is, doing P with Q to realize R, where PQR answers the questions of what, how, and why, then a declaration of 'purposeful activity' is made into CATWOE (Customers, Actors, Transformation, World View, Owners, and Environmental Constraints);
(4) To make a conceptual model, where the model is relevant to the situation, not representative of the problem, the substance of the root definition is related to what the system is, while the conceptual model is related to what the system must do to be the one defined;

(5) To compare a conceptual model with the real world and manage discussions about real-world situations so that it is possible to emerge various points of view;
(6) To plan a change based on problematic situations by formulating suggestions for corrective actions, improvements, and changes to real-world problems with the arguments that are acceptable and culturally possible;
(7) To implement the change process and take action on the proposed changes identified as a result of a thorough discussion and analysis.

3.2. Software development life cycle

Building an OM-based IQA information system uses the Software Development Life Cycle (SDLC) method, considering easy identification of problems and designing systems as needed to solve problems. The SDLC method used in system development is the Waterfall SDLC method. The Waterfall method is a method in software development where the process must be carried out sequentially, starting from the analysis, design, implementation, testing, and maintenance stages.

4. Results and Discussion

4.1. IQA business process

Observations, document studies, and interviews with several participants were conducted to collect data on the business processes of the HE case and the HE benchmark. The participants were the Faculty Leaders (FL), Quality Assurance Institute (QAI), Study Programs (SP), and Information and Communication Technology units (ICT). Table 1 compares two business process settings (HE Case and HE Benchmark).

Table 1: IQA Business Process Comparison

IQA Business Process	IQA Indicator	HE Case	HE Benchmark
QAI compiles complete IQA documents	Complete document	No	Yes
QAI, SP, ICT conduct self-evaluation, inventory program results, achievement of strategic plans	Do : Self-evaluation Inventory Achievement	 No No No	 Yes Yes Yes
QAI, SP, ICT coordinate to formulate strategic plans (5 years), plan work programs (1 year), and refer to related documents	Coordination Formulated Planned Referring to related documents	No coordination Not formulating Planning No referrals	Coordinate Formulate Planning Using related documents references
QAI, SP, ICT implement a work program (1 year)	Implemented	Yes	Yes

IQA Business Process	IQA Indicator	HE Case	HE Benchmark
QAI conducts IQ-Audit: Monitoring and Evaluation every year	Doing IQ-Audit: Monitoring Evaluation	One year one time Five years one time	One year two times One year one time
QAI makes an IQ-Audit Report and Recommendations Findings	Make: Report IQ-Audit Recommended Findings	 Yes Yes	 Yes Yes
FL, QAI, SP, ICT follow up on the Recommendation Findings	Follow-up: Recommended Findings Management Review Meeting	QAI, SP, ICT have to follow up FL does not follow up	QAI, SP, ICT have to follow up FL has a follow-up
QAI, SP, ICT keep documents on the formulation, planning, implementation, and results of work programs	Save document: Formulation Planning Implementation Results	 No Yes No Yes	 Yes Yes Yes Yes
QAI conducts control/monitoring of IQA business process implementation	Carry out monitor and control.	No	Yes
QAI proposes increasing IQA standards based on the achievement of previous quality targets	There is an increase in quality standards	No	Yes

The IQA business process comparison between the HE case and the HE benchmark encourages the need to apply the soft system methodology approach to solve problems faced by the HE case. The soft-system methodology consists of seven steps: defining problematic situations, depicting problematic situations in rich pictures, formulating the root definition, conceptual modeling, comparing conceptual and real-world models, planning for change from problematic situations, and implementing the change process.

4.2. IQA business process discussion

4.2.1. Defining problematic situations

Based on the phenomena and collected field data and previous research, problems in the quality aspects of IQA's business processes are as follows:

(1) There is no IQA Strategic Plan (IQA-SP) document. If there is an IQA-SP, it is not based on performance results, self-evaluation, and accreditation instruments. Therefore, the making of IQA-SP is unstructured;

(2) The results of the implementation of the IQA-SP work program are not measurable, and the document records are incomplete, which results in difficulties when preparing for accreditation applications;
(3) The HE case did not monitor and evaluate the program implementation of the IQA-SP continuously. Therefore, the control of IQA implementation (recommendation findings) does not work correctly.
(4) Control in the implementation of the IQA-SP work program related to recommendations for findings from monitoring and evaluation results was not follow-up (ignored);
(5) Improvement of IQA-SP did not occur due to the unsystematic implementation of IQA. IQA-SP is unstructured and unmeasured.

4.2.1. Depicting a problem situation in the form of a rich picture

Based on the results of interviews and observations, the authors show the situation of the implementation of internal quality assurance in a rich picture.

IQA business process problem situation:

(1) SP and ICT in formulating IQA-SP are not based on performance results, self-evaluation, and accreditation instruments. So, the IQA-SP is not structured (only routine and spontaneous). The results of the implementation of the IQA-SP work program are not measurable, and the document records (reports) are incomplete, which results in difficulties when preparing for accreditation applications;
(2) QAI did not continuously monitor and evaluate the results of the implementation of the IQA-SP. QAI only carried out the procedure during accreditation preparation. This situation indicates the control of IQA implementation does not function properly;
(3) The management team did not follow the recommendation from QAI, who conducted monitoring and evaluation. There is a reluctance to improve the IQA-SP work program.

The goals achievement situation of IQA's business process:

(1) SP and ICT expect the implementation of IQA in a systematic, measurable manner with complete reports. QAI expects IQA business processes to follow the DIECI cycle. The management team expects the implementation of IQA to be continuous, sustainable, and improved;
(2) QAI requires that the organization's memory system support the implementation of IQA used by SP, ICT, QAI, and the management team. Among initiatives are as follows: To determine the IQA-SP in a structured and systematic manner; implement measurable IQA-SP work programs with complete records; monitor and evaluate IQA-SP continuously; control the follow-up recommendations for IQA-SP implementation, and continuous

improvement of IQA-SP. The expected result is that IQA business processes run according to the DIECI cycle, outputs and outcomes are recorded and stored as knowledge assets that are in line with the accreditation requirement, and they contribute to the achievement of the university vision, mission, and objectives;

(3) To overcome obstacles related to management commitment and change of habits to successfully implement QAI in a continuous, sustainable, and increased manner.

Management Commitment:

(a) QAI emphasizes that the management team as policymakers should implement continuous, sustainable, and increased IQA due to its importance for accreditation assessment;

(b) QAI invites the management team of the university to hold management review meetings to discuss the results of the IQ-Audit implementation assessment and follow up on the results relating to controlling and improving the achievement of quality standards;

(c) QAI proposes to the management team to give rewards and punishments to all elements involved in implementing IQA based on their performance.

Change of Habits:

(a) QAI conducts a gathering event to generate a common understanding of the importance of regularly implementing IQA for all academicians.

(b) QAI implements IQA business processes gradually, continuously, and increases quantity and quality from the established standards.

(c) QAI conducts performance assessments for all elements involved in the implementation of IQA, and proposes the results as a basis for reward and punishment.

Fig. 3 shows four roles in implementing internal quality assurance. Roles marked with blue boxes are for Study Programs (SP), Information and Communication Technology (ICT), Quality Assurance Institute (QAI), and Faculty Leaders (FL). The yellow box describes the problems that each role experiences and the required goals, and the red box is the solution to the issues to be fixed.

4.2.2. Formulation of root definition

Compiling the root definition uses PQR analysis and CATWOE (Customer, Actors, Transformation, Worldview, Owners, Environmental Constraints) analysis. PQR analysis has the following formula: "The system to perform (X) in (Y) order (Z)" (Checkland & Scholes, 1999). The rich picture describing the problematic situation and the results of the interviews generate activities in the PQR analysis (Table 2) and elements in the CATWOE analysis (Table 3).

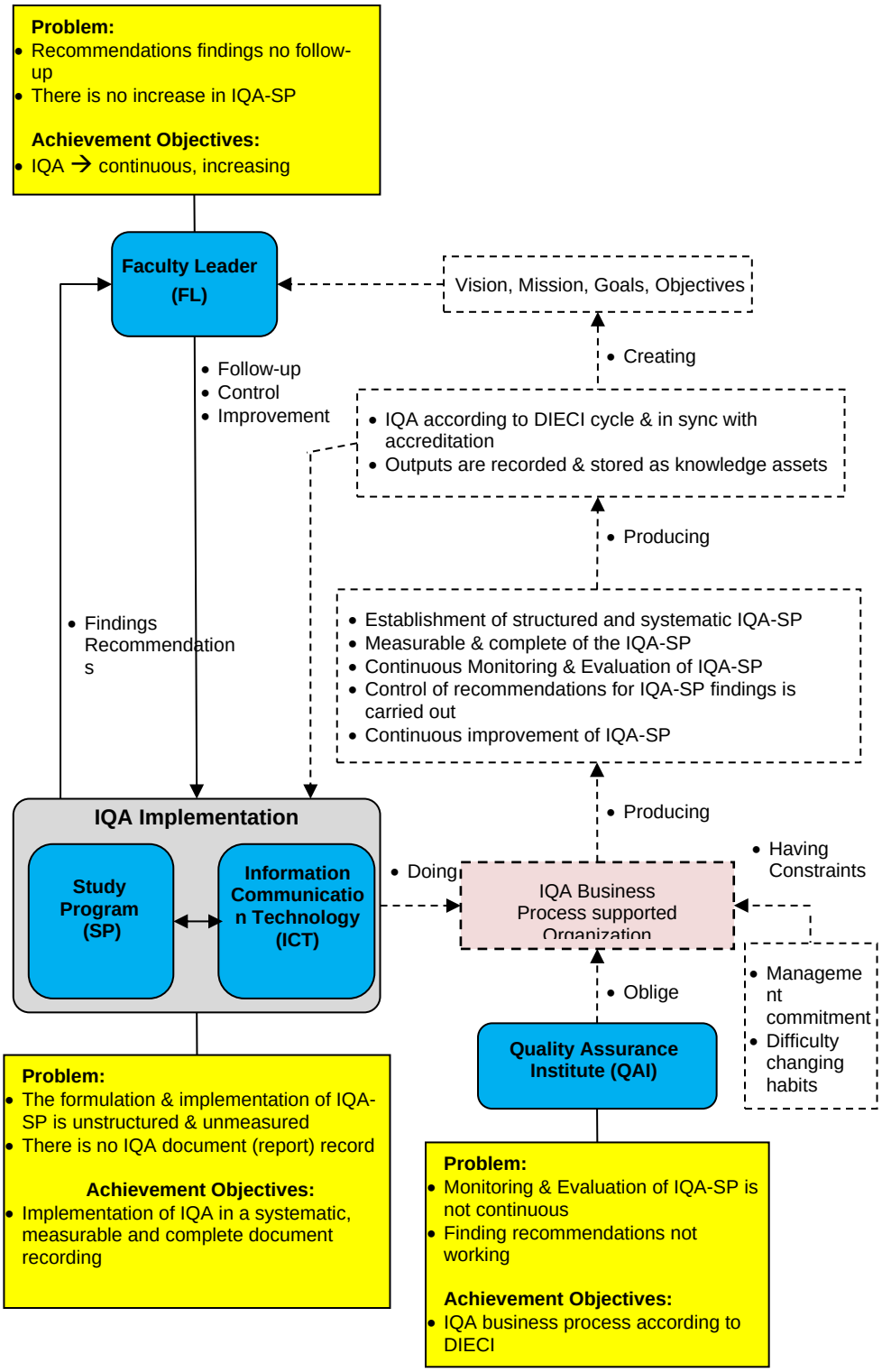

Fig. 3: Rich picture

The merge of PQR analysis and CATWOE analysis results in one formula as follows: A system owned by (O) and operated by (A), to do (X) by (Y) to customers (C) to achieve (Z) within the constraints (E) (Wilson, 2001). Thus, the root definition statement becomes:

The system is owned by the Faculty (O) and operated by the Study Program, Information Communication Technology, Quality Assurance Institute, and Faculty Leaders (A). All the elements carry out IQA business processes starting from the stages of formulation, determination, implementation, evaluation, control, and improvement of IQA-SP (X). Implementing IQA is supported by an organizational memory system (Y) at the Quality Assurance Institute (C). Therefore, the IQA business processes run continuously, improving, including recording and storing documents/reports completely (Z) despite organizational obstacles such as difficulty changing management habits and commitments: budget, reward, and punishment, human resources for IQA as well as IQ-Audit (E).

Table 2: PQR analysis

Activities	Activity Description	Resources
X	The IQA business process starts from the formulation, determination, implementation, evaluation, control, and improvement stages of IQA-SP	Head of SP, Head of ICT, Head of QAI
Y	The organization's memory system supports the implementation of IQA	Head of QAI
Z	IQA business processes run continuously, improving, recording, and storing complete documents/reports	Head of QAI, Faculty Leader

Table 3: CATWOE analysis

Element	Element Description	Resources
Customer	Quality Assurance Institute	Head of QAI
Actors	Study Program, Information Communication Technology, Quality Assurance Institute, Faculty Leaders	Head of SP, Head of ICT, Head of QAI, Faculty Leaders
Transformation (X + Y)	The IQA business process starts from the formulation, determination, implementation, evaluation, control, and improvement stages of IQA-SP, where the organization's memory system supports the implementation	Head of SP, Head of ICT, Head of QAI
Worldview (Z)	IQA business processes run continuously, improving, recording, and storing complete documents/reports	Head of QAI, Faculty Leaders
Owners	Faculty	Faculty Leaders

Environmental Constraints	Changing habits and commitment or management support	Head of QAI

4.2.3. Conceptual modeling

The authors use a more in-depth CATWOE analysis to prepare the conceptual model. The analysis begins with elements T and W, then continues by adding elements C, A, then E, and ends by adding element O. The results of the CATWOE analysis into the conceptual model of the PMI business process can be seen in Fig. 4.

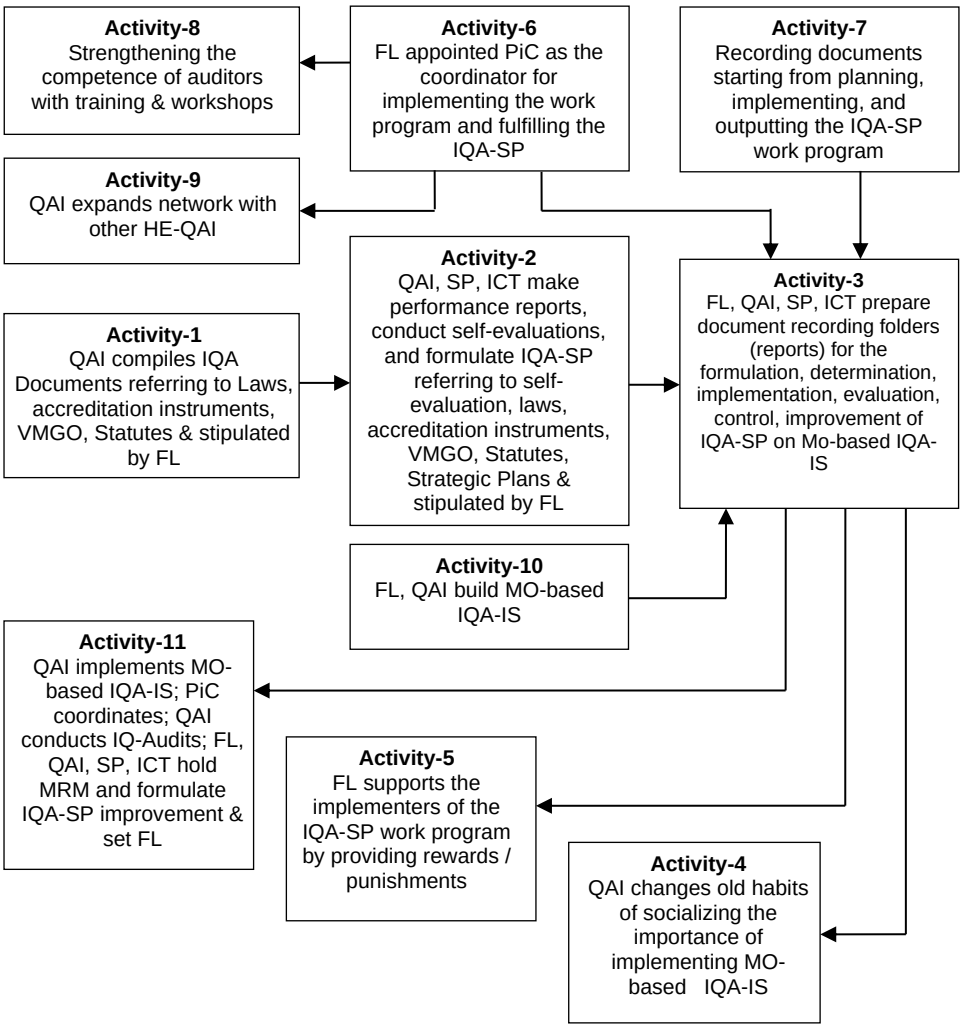

Fig. 4: IQA Business Process Conceptual Model

4.2.4. Comparison of conceptual models and real world

After developing the conceptual model, the next step is to compare the conceptual model with the real world. The results are the recommendations on what to maintain, improve or create new ones, as shown in Table 4 below:

Table 4: Recommended comparison of conceptual models with the real world

DIECI Cycle	Recommendation
Determination Stage	QAI prepares IQA documents (policies, manuals, standards, and forms) referring to VMGO and UU, stipulated by FL; QAI, SP, ICT conduct self-evaluation of previous performance results; QAI, SP, ICT formulate IQA-SP, referring to self-evaluation, laws, and accreditation instruments stipulated by FL; QAI appoints and establishes a PIC who is responsible for the implementation of the work program and the fulfillment of the IQA-SP; QAI, SP, ICT store, and record documents at the determination stage by each implementer on the MO-based IQA-IS.
Implementation Stage	QAI organizes socialization, training/workshops on the implementation of MO-based IQA-IS; QAI implements MO-based SI-PMI; PIC coordinates the implementation of work programs and the fulfillment of IQA-SP; FL gives reward/punishment to the implementers of the IQA-SP work program; FL, QAI, SP, ICT store and record documents at the implementation stage by each implementer on the MO-based IQA-IS.
Evaluation Stage	QAI sends prospective auditors to participate in IQ-Audit training/workshops; QAI carries out monitoring and IQ-Audit activities on the results of the work program implementation and the fulfillment of IQA-SP continuously; QAI, SP, ICT store and record documents at the evaluation stage by each implementer on the MO-based IQA-IS.
Control Stage	FL, QAI, SP, ICT held a Management Review Meeting (MRM) to follow up on the recommendations on the findings of the IQ-Audit on the implementation of the work program and the fulfillment of the IQA-SP; FL, QAI, SP, and ICT carry out document storage and recording at the control stage by each implementer on the MO-based IQA-IS.
Improvement Stage	QAI, SP, ICT formulate an increase in IQA-SP, referring to the Act & accreditation instruments stipulated by FL; QAI establishes cooperation or comparative study related to IQA with other HE-QAI; FL, QAI, SP, and ICT carry out document storage and recording at the upgrade stage by each implementer on the MO-based IQA-IS.
IQA-IS Development	F, QAI, SP, ICT prepare document recording folders (reports) according to the DIECI cycle on the MO-based IQA-IS; FL, QAI build MO-based IQA-IS.

4.2.5. Planning for change from problematic situations

Based on the comparative analysis of the conceptual model with the real world, the proposed change plan is as follows:

(1) Determination stage
   (a) Prepare IQA documents: policy documents, manuals, standards, IQA forms, and IQ-Audit documents;
   (b) Conduct self-evaluation of previous performance: reviewing and documenting the practice of providing education; formulating strategy and tactics to solve the problems and improve the business process;
   (c) Formulate and determine the IQA-SP: formulate the IQA-SP for five years and plan a work program every year by referring to the self-evaluation results, vision and mission goals, strategic plans, operational plans, and accreditation instruments.
   (d) Appoint and assign PIC: PIC is a coordinator of the implementation of work programs following their respective fields to ensure that the process and results of implementing work programs comply with IQA standards.

(2) The implementation stage
   (a) Conduct socialization, training/workshops on OM-based IQA implementation: strengthening or facilitating activities related to IQA, such as dissemination, workshop, technical guidance, mentoring, and coaching;
   (b) Coordinate the work program implementation by PIC: PIC coordinates the implementation of the planned one-year work program by involving all available resources, facilities, and infrastructures to fulfill the predetermined objectives of IQA-SP.

(3) Evaluation stage
   (a) Assign prospective auditors to participate in IQ-Audit training/workshops: forming an audit executive team by requiring them to attend IQ-Audit training/workshops and submit a certificate of attendance;
   (b) Implement IQ-Audit to monitor and evaluate the implementation of the one-year work program. As the implementer of IQ-Audit, the audit team conducts meetings, documents audits, sets site visit schedules, conducts field audits, and makes audit reports.

(4) Control stage
   (a) Conduct a Management Review Meeting (MRM): the management team holds an MRM based on the recommendation of findings and discusses obstacles in implementing the work program, and plans the solutions to deal with obstacles;
   (b) Follow up on the results of the MRM decisions: the management team maintains the work program running as expected and follows up on the MRM decisions continuously.

(5) Improvement stage
   (a) Formulate and determine the improvement of IQA-SP: the management team coordinates to formulate and determine the progress of IQA-SP quality standards that have met the target;

(b) Establish cooperation or comparative studies related to IQA with other HE-QAI: self-reflection on why the results obtained are not good while other organizations are better. Identify organizations as a benchmark and determine partner organizations to conduct comparative studies.

(6) Build an Internal Quality Assurance Information System (IQA-IS) based on Organizational Memory.

4.2.6. Implementation of the change process

Three essential points in planning to change the problem situations, namely:

(1) IQA Business Process

IQA business process must be carried out step by step according to the DIECI cycle, carrying out change planning from problematic situations;

(2) IQA Information System

It is necessary to support an information system by developing an Internal Quality Assurance Information System (IQA-IS) based on Organizational Memory; it enables IQA business processes following the DIECI cycle.

(3) IQA Quality Culture

A high commitment from organizational actors is essential in implementing IQA that follows the DIECI cycle. The required commitment to creating a quality culture includes the management team, implementer, and supporting components.

4.3. OMS model discussion

The Organizational Memory System (OMS) is further called Internal Quality Assurance Information System based on Organizational Memory (OM-based IQA-IS). The system supports the implementation of IQA recording and storing IQA business process documents (reports) as organizational knowledge assets following the DIECI cycle. However, the discussion of the OMS model is limited to the analysis, design, and testing stages.

4.3.1. Analysis stage OM-based IQA-IS

Based on the previous discussion regarding IQA business processes according to DIECI, Figure 5 shows the proposed OM-based IQA-IS framework.

The OM-based IQA-IS framework to support IQA business processes begins with the IQA standard-setting and IQ-Audit guidelines by QAI. The next stage is to hold a meeting to formulate the IQA-SP (Internal Quality Assurance Strategy Plan), then compile a work program/activity plan to fulfill the IQA-SP in all work units involved in IQA. The following stage is the implementation of work programs/activities led by the person in charge (PIC) of the program. Subsequently, IQ-Audit Team conducts quality audits according to the agreed schedule to evaluate the plans, processes, and results of implementing work programs/activities in all work units involved in IQA.

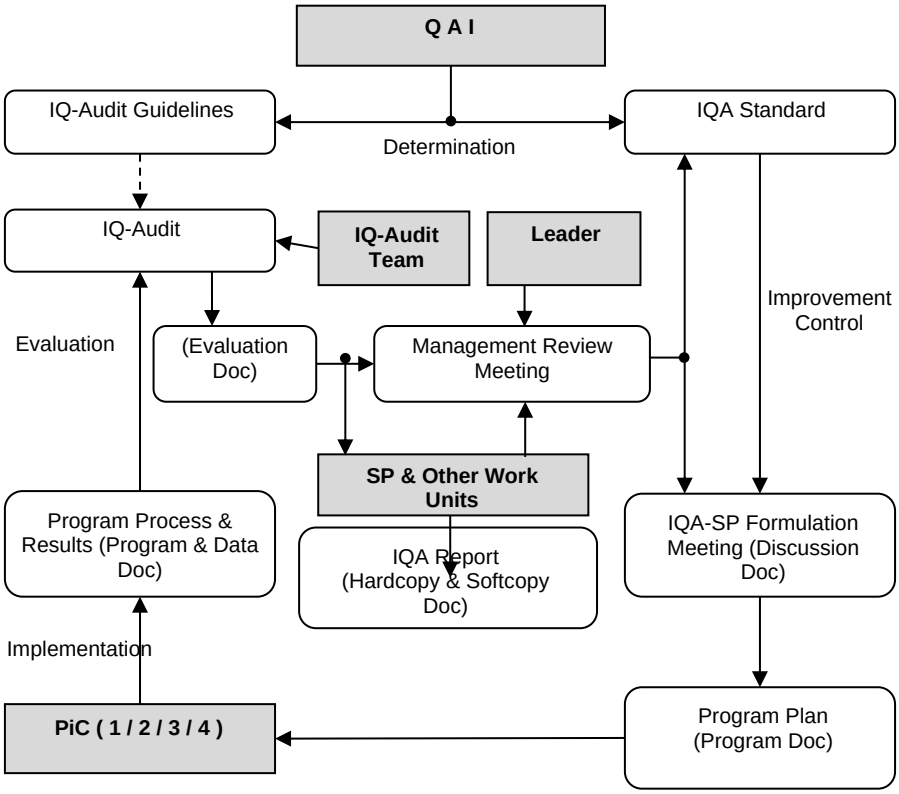

Fig. 5: OM-based IQA-IS framework

IQ-Audit result is a recommendation report on the achievement or non-achievement of the implementation of work programs/activities to be brought to the Management Review Meeting. The forum can control the gap following the IQA-SP or even improve IQA standards. All stages of IQA business processes are recorded and stored in discussion documents, program documents, data documents, evaluation documents, softcopy documents, and hardcopy documents in the OM-based IQA-IS database.

4.3.2. IQA-IS taxonomy and metadata

The knowledge taxonomy of IQA-IS in the context of higher education focuses on internal quality assurance knowledge located within the organization. Developing a self-taxonomy in the environment is an advantage because it is not affected by unnecessary or non-existent classifications within the organization. Based on observations, an initial description of internal quality assurance conditions in a university identified things needed in the knowledge taxonomy. Observation of document archives in universities reveals that knowledge resources can be presented in three primary forms: paper documents, computer documents, and individual memories (Jennex et al., 1998). The three forms of the organizational memory system

are mapped into the six types of organizational memory proposed by Dieng et al. (1999): non-computing, document-based, knowledge-based, case-based, distributed construction, and a combination of techniques. The type of knowledge has been adjusted to the internal quality assurance available in universities.

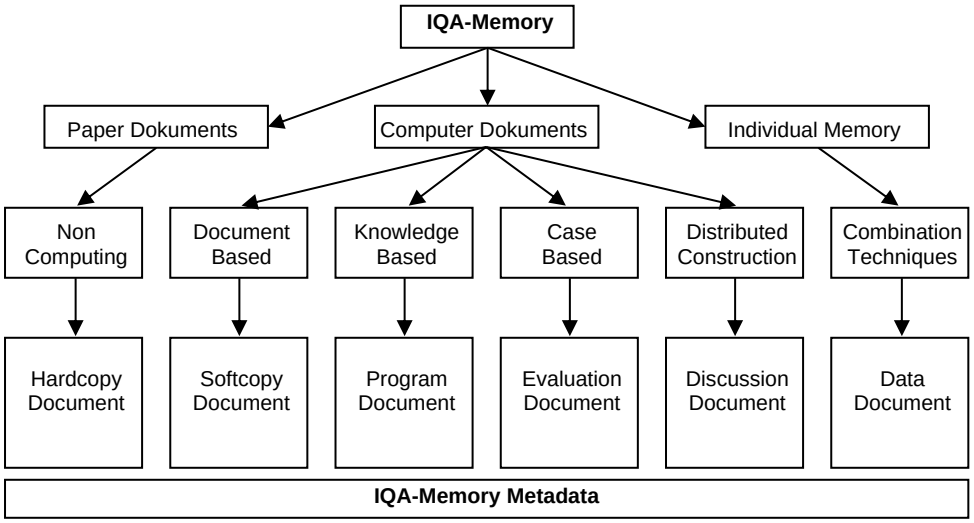

Fig. 6: IQA-Memory taxonomy

Because the object of this research is a quality assurance agency, the memory of a quality assurance agency is the top layer in the taxonomy. The knowledge resource will serve as a knowledge feeder to the organization's memory system. In this study, the researchers identified the internal quality assurance metadata through previous observations, that the metadata to the internal quality assurance taxonomy is as follows.

Table 5: IQA-memory taxonomy and metadata

Knowledge Resources	Taxonomy	Metadata
Non-Computing (Hardcopy)	Documents Statutes, Policies, Regulations, Guidelines, Standards, Indicators, Outcomes, Forms, Audio, Photos, Videos, and more	Unit Name, Hardcopy / Softcopy Code, Document Title, Document Type, Update Date, Summary of Document Contents, Save Location, Responsible Person
Document-Based (Softcopy)		
Knowledge-Based (Program)	Development Master Plan, Strategic Plan, Operational Plan, Activity Plan, Activity Report, Budget Plan, Budget Usage Report	Unit Name, Program Code, Program Name, Activity Date, Activity Location, Activity Implementer, Activity Person in Charge, Program Plan, Program Report

Case-Based (Evaluation)	Quality Standards, Performance Indicators, Performance Monitoring, Performance Evaluation, Recommendations, Management Reviews, Follow Up	Unit Name, Subject Code, Name of Subject Checked, Check Date, Checklist, Name of Audite, Name of Auditor, Check Report, Recommendation
Distributed Construction (Discussion)	Program FGD, Budget FGD, Quality Monitoring, and Audit Report FGD, Quality Standard Control and Improvement FGD	Activity Name, Activity Title, Activity Date, Activity Location, Attendance, Minutes, Activity Person in Charge, Activity Report, Activity Results
Combination of Techniques (Data)	Information System: New Student Admission, Academic, Personnel, Infrastructure, Finance, Libraries, Study Tracer, User Satisfaction, etc	Unit Name, SI Code, Data Title, Data Type, Collection Date, Data Contents, Person in Charge

4.3.3. OM-based IQA-IS architecture

The OM-based IQA-IS architecture proposed in this study at the HE Case is shown in Fig. 7.

USERS										
Actors										
University	Faculty	Study Program	RCSI	Other Work Units	QAI	IQ-Audit Team	Admin			
PiC-1	PiC-2	PiC-3	PiC-4	PiC-1/2/3/4	PiC-5	PiC-6	PiC-7			
INTERFACE										
IQA Criteria										
Vision, Mission, Goals, Objectives	Governance, Cooperation	Student	Human Resources	Finance, Infrastucture	Education	Research	Community Service	Achievement Output	IQA Document	IQ-Audit Document
MEMORY										
Taxonomy										
Hardcopy Document	Softcopy Document	Program Document	Evaluation Document	Discussion Document	Data Document					
Documents Statutes, Policies, Regulations, Guidelines, Standards, Indicators, Outcomes, Forms, Audio, Photos,	Documents Statutes, Policies, Regulations, Guidelines, Standards, Indicators, Outcomes, Forms,	Development Master Plan, Strategic Plan, Operational Plan, Activity Plan, Activity Report, Budget Plan, Budget Usage Report	Quality Standards, Performance Indicators, Performance Monitoring, Performance Evaluation, Recommendations, Management	Program FGD, Budget FGD, Quality Monitoring and Audit Report FGD, Quality Standard Control and Improvement FGD	Information System: New Student Admission, Academic, Personnel, Infrastructure, Finance,					

Videos and more	Audio, Photos, Videos and more		Reviews, Follow Up		Libraries, Study Tracer, User Satisfaction, etc
Metadata					
Unit Name, Hardopy Code, Document Title, Document Type, Update Date, Summary of Document Contents, Save Location, Responsible Person	Unit Name, Softcopy Code, Document Title, Document Type, Update Date, Summary of Document Contents, Save Location, Responsible Person	Unit Name, Program Code, Program Name, Activity Date, Activity Location, Activity Implementer, Activity Person in Charge, Program Plan, Program Report	Unit Name, Subject Code, Name of Subject Checked, Check Date, Checklist, Name of Audite, Name of Auditor, Check Report, Recommendation	Activity Name, Activity Title, Activity Date, Activity Location, Attendance, Minutes, Activity Person in Charge, Activity Report, Activity Results	Unit Name, SI Code, Data Title, Data Type, Collection Date, Data Contents, Person in Charge

Fig. 7: OM-based IQA-IS Architecture

The University, Faculty, Study Program, Research & Community Service Institute (RCSI), QAI, IQ-Audit Team, and the Other Work Units become actors/users of OM-based IQA-IS. The System Administrator (Admin) manages actors/users' access rights and system maintenances. IQA business process documents are sources of knowledge. Organizational knowledge assets are recorded and stored in the organization's memory in the form of an IQA-Memory database through the MO-based IQA-IS interface.

The IQA-Memory metadata was extracted from the IQA-Memory taxonomy. The extracted metadata was used to structure the database in OM-based IQA-IS. Actors/users have different roles in using OM-based IQA-IS according to their work units. All actors/users are connected to the OM-based IQA-IS database using an interface to populate, modify, delete and view organizational knowledge assets on the OM-based IQA-IS database.

4.3.4. OM-based IQA-IS database

The OM-based IQA-IS database functions as a medium for recording and storing IQA business processes according to DIECI. The prepared database structure is divided into three groups: metadata database structure, business process database structure,

system administrator database structure, and OM-based IQA-IS actors/users access rights.

Table 6: OM-based IQA-IS database structure

Database	Description
Metadata database structure	
Tb_hardcopy_doc	Hardcopy Document Table
Tb_softcopy_doc	Softcopy Document Table
Tb_program_doc	Program Document Table
Tb_evaluation_doc	Evaluation Document Table
Tb_discussion_doc	Discussion Document Table
Tb_data_doc	Data Document Table
Business process database structure	
Tb_vmgo_base Tb_vmgo_contents	Vision, Mission, Goals, Objectives Table
Tb_govcoop_base Tb_govcoop_contents	Governance, Cooperation Table
Tb_student_base Tb_student_contents	Student Table
Tb_humres_base Tb_humres_contents	Human Resources Table
Tb_fininfra_base Tb_fininfra_contents	Finance, Infrastucture Table
Tb_education_base Tb_education_contents	Education Table
Tb_research_base Tb_research_contents	Research Table
Tb_comser_base Tb_comser_contents	Community Service Table
Tb_achievout_base Tb_achievout_contents	Achievement Output Table
Tb_iqassurance_base Tb_iqassurance_contents	Internal Quality Assurance Table
Tb_iqaudit_base Tb_iqaudit_contents	Internal Quality Audit Table
System administrator database structure	
Tb_admin_base	System Administrator Table
Tb_actor_contents	Actors / Users Table

The OM-based IQA-IS metadata database structure table was created based on the IQA Memory taxonomy and metadata. The database structure table is created based on the OM-based IQA-IS interface related to the OM-based IQA-IS metadata database structure. The table makes it possible to record and store IQA business process organizational knowledge assets according to the IQA taxonomy and memory metadata. The database structure table for system administrator and actors/users' access rights are created based on the OM-based IQA-IS interface and the responsibilities of each work unit in implementing IQA business processes.

4.3.5. OM-based IQA-IS model validation

The validation of the OM-based IQA-IS model is carried out by conducting Focus Group Discussions (FGD). The method involves the management team responsible for internal quality assurance's main tasks and functions, from Faculties, Study Programs, Quality Assurance Institutions, Information and Communication Technology. The validation results are in Table 7 as follows:

Table 7: Validation of OM-based IQA-IS Success Factors

Success Factor	Component	Description	Evaluation	Recommendation
System Quality	Technical Resources			
	Administrator	OM-based IQA-IS setup and maintenance capabilities	Good	Conducted training for users of OM-based IQA-IS
	Developer	Ability to build OM-based IQA-IS and network	Good	Strengthened by the expert staff of OM-based IQA-IS
	Infrastructure	Hardware and network availability	Good	The quality improvement in the future.
	Form			
	Computerized	Availability of computer-based data	Fair	Need to be provided immediately
	Integrated	Other Information System integration capabilities with OM-based IQA-IS	Fair	Need to be integrated soon
	Level			
	Interface	Ability to present information	Good	Already Good
	Mnemonic	Information exploration ability	Good	Already Good
Information Quality	Satisfaction	Information content and ease of use	Good	Following IQA's business processes
	Suitability	Suitability to the user's work	Good	Following the duties and responsibilities (access rights)

In Use	Frequency	Number of tasks and daily usage	Good	Following IQA's business processes
	Benefits	Long term use potential	Good	Can be developed and adjusted to needs
Individual Impact	Productivity	Performance improvement	Good	Already Good
Organizational Impact	Internal	Capacity building	Good	Following IQA's sustainable business processes
	External	Rank increase	Good	IQA's business processes are aligned with EQA

Value Scale: Poor <= 60 ; Fair <= 85; Good > 85

Based on the validation of the success factors of the OM-based IQA-IS, it can be seen that the four success factors, which are: information quality, use, individual and organizational impact, received a good rating. The results show that OM-based IQA-IS is feasible to use. However, it is necessary to pay attention to one factor in the success of the system's quality, which is divided into three operational characteristics: technical resources, form, and level of OMS. In particular, the form received fair ratings in the computerized and integrated components.

5. Conclusion

The current study has provided an approach to utilize organizational memory to implement IQA to control and improve the implementation of higher education in a planned and sustainable manner through the establishment, implementation, evaluation, control, and improvement of higher education standards. In contrast to previous studies which tried to find the factors causing the less successful implementation of IQA, this study provides an alternative success in implementing IQA in universities.

The current study proposes the IQA business process model using the DIECI cycle based on organizational memory (i.e., OM-based IQA-IS). The model consists of stages as follows:

(1) Determination stage: compiling IQA documents; conducting self-evaluation based on previous performance; formulate and determine IQA-SP by referring to the HEAI and SPAI accreditation documents; set PIC;

(2) Implementation stage: conducting socialization, training/workshop on IQA implementation supported by OM-based IQA-IS; implement the established IQA-SP; the PIC coordinates the implementation of the work program;

(3) Evaluation stage: sending prospective auditors to attend training/workshop on IQ-Audit; carry out an IQ-Audit;
(4) Control stage: holding Management Review Meeting (MRM); following up on the results of MRM decisions.
(5) Improvement stage: formulate and determine the improvement of IQA-SP; establish cooperations or comparative studies related to IQA with QAI from other universities.

Higher education in implementing IQA needs to build an OM-based IQA-IS to support the recording and storage of IQA business processes according to the DIECI cycle as an organizational knowledge asset. The implementation requires commitment from higher education institutions' leaders and a reward and punishment mechanism to create a quality culture in higher education institutions.

The limitation of the current study is that it only focuses on IQA business processes using the DIECI cycle and OMS as supporting tools used for recording and storing organizational knowledge assets. A more specific characteristic of the research environment, such as infrastructure, human resource capabilities, governance, funding, and others, has not been studied in-depth, so further research regarding environmental characteristics is needed to base the findings' generalization. IQA implementation policies may evolve from quantitative to qualitative models or both. Such evolution allows future research to study an intelligent system built using artificial intelligence techniques on OM-based IQA business processes in a planned and sustainable manner.

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