INDONESIA DIGITAL GOVERNMENT AUDITING MODEL USING RULE BASED AND CLOUD CASE-BASED REASONING

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ABSTRACT

This paper explores the possibility of combining process model of Digital Government auditing, Rule Based and Cloud Case-Based Reasoning. Digital Government and Digital Government Auditing definition retrieve from Indonesia Presidential Regulation number 95-year 2018. consist two goals that the regulation aims, the first was to realize good governance clean, effective, transparent, and accountable as well as quality and reliable public services an digital government system is required; and second was to improve cohesiveness and efficiency of the electronic-based government system governance and management required national digital government; The existence variation of regulations and auditing standard creating complex reference database and hard to find solution for assessment and auditing Indonesia Digital Government. Rule-based and Case-based reasoning could help auditor in searching and documenting unsolved and solved auditing problem. The result shown that there is possibility to enhance audit process to create better audit result and more efficient in audit working time.

Keywords: Indonesia digital government audit, rule based, cloud-based reasoning.

1. INTRODUCTION

Indonesia Digital Government regulation which is Presidential Regulation number 95 year 2018, in the consideration section, consist two goals that the regulation aims, the first was to realize good governance clean, effective, transparent, and accountable as well as quality and reliable public services an digital government system is required; and second was to improve cohesiveness and efficiency of the electronic-based government system governance and management required national digital government [1]

Indonesia Digital Government Audit Definition stated in chapter 1 article 1 item 25, Information and Communication Technology Audit is a systematic process for obtaining and objectively evaluate evidence against assets information and communication technology with the aim of to determine the degree of correspondence between information and communication technology with criteria and/or established standards [1].

Although the Presidential Regulation stated the audit definition and audit general process comprehensively, but not technically state the audit process [1]. The regulation request that for the technical aspect of auditing will be regulate from Technical Auditing Regulation published by National Ministry and National Body regulation such as BPPT (National Body of Technology Research and Implementation) and BSSN (National Body of Cyber and Cryptic) for national level, and also by local government regulation.

The existence of variation of regulations and auditing standard creating complex reference database and hard to find solution for assessment and auditing Indonesia Digital Government. Government internal auditor (BPK, National Body of Finance Audit and BPKP, National Body of Finance and Development Audit) need help to solve specific auditing problem effectively and efficiently. Rule-based and Case-based reasoning could help auditor in searching and documenting unsolved and solved auditing problem.

2. LITERATURE REVIEW

Digital Government is governance that utilizes technology information and communication to provide service to its Users [1], it also stated that Information and Communication Technology Audit is a systematic process for obtaining and objectively evaluate evidence against assets information and communication technology with the aim of to determine the degree of correspondence between information and communication technology with criteria and/or established standards [1]. The audit consisted of Infrastructure Audit, Application Audit and Security Audit that covers implementation of governance and technology management information and communication; information technology functionality and communication; information and communication technology performance generated; and other aspects of information and communication technology [1]. It also stated that Information and Communication

Technology Audit carried out by the audit implementing agency Government Information and Communication Technology or Information Technology Audit implementing agency and Communications accredited in accordance with the provisions of the legislation4.

Gun Ho Lee [2] found that when auditor try to identify suspicious problems in a databased is a time and effort consuming process. Gun Ho Lee [2] also state there also have been auditor's inconsistent judgments even for same problems as the previous cases in the existing audits. Gun Ho Lee [2] state that rule-based reasoning uses induction rules to determine whether a new problem should be inspected further or not. Gun Ho Lee [2] also state, case-based reasoning performs similarity-based matching to find the most similar case in case base to the new problem. Figure 1 were the model introduce by Gun Ho Lee [2].
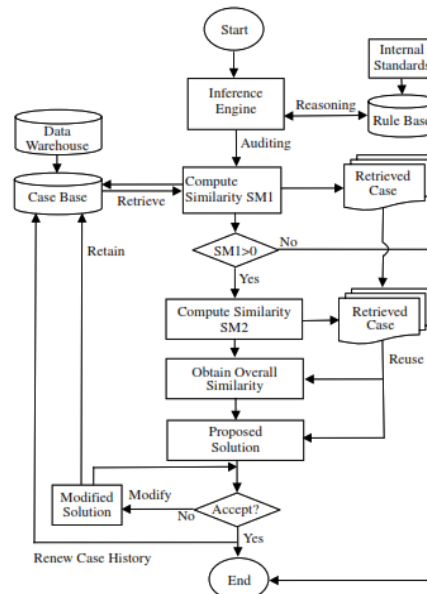

Figure 1. Rule based and Case Base Reasoning Model for Auditing3

Gun Ho Lee [2] mention that bank audit approach integrates RBR, which automatically detects abnormal, irregular, risky, and violated transactions from the standards at the first screening stage, and CBR, which scrutinizes the detected transactions and provides the punishment levels at the second stage. It takes much effort and time for audits to scrutinize numerous transactions one by one. Gun Ho Lee3 further explain that RBR performs a detecting part of suspicious transactions using induction rules of a data mining technique, which determine whether a specific item should be inspected further or not and for the regulations and guidelines of bank employees to observe are easily formulated into rules that corresponding to items can be represented independently.

Gun Ho Lee [2] in general states that the CBR approach provides a good reasoning method for decisions based on intuitions and experiences. The CBR has benefits such as a reduction in knowledge-elicitation effort from complex and complicated transaction situations, the ability to learn by acquiring new cases over time without having to add new rules or modify existing ones, and the ability to provide justification by offering past cases as precedence rather than justifying a solution by showing a trace of the rules that led to decision.

The integrated reasoning approach that Gun Ho Lee [2] proposed, makes use of both the existing knowledge and the past experiences and makes the problems that only limited experience and knowledge are available become solvable and eliminates the drawbacks of each method and provides a better way to handle problems, which combine both inductive and deductive information Rule-based reasoning (RBR) to screening out process determining whether a transaction should be scrutinized further or what level of punishment should be given to the employee in accordance to any defaults or non-observance of standards, then a further auditing process proceeds for the transaction with clues detected.

I. Nkisi-Orji et al. [3] mention that several case-based reasoning (CBR) development frameworks and toolkits have been introduced and extended for recommender systems and textual CBR and more recently for self-management systems. However many of these CBR systems are mostly implemented with monolithic architectures such as desktop standalone applications, with heavy demands due to siloed in-memory batch processing. This is not compatible with recent software development trends, which are increasingly using REST APIs for communication with cloud computing platforms [3]

I. Nkisi-Orji et al. [3] also mention that cloud computing is a term used to describe the use of remote hardware and software to deliver on-demand computing services through a network (usually the Internet). In the past, applications or programs were run from software downloaded on to a physical computer or server. He further stated that in contrast cloud computing lets users access these applications through the internet, implementing software applications in the cloud offer several benefits which include efficient/cost reduction, scalability, mobility, and disaster recovery [3].

I. Nkisi-Orji et al. [3] concept was to introduce Clood CBR, a novel microservices-oriented CBR framework which leverages the serverless architecture for CBR operations and a distributed data storage service for CBR knowledge persistence as visualize in figure 2. I. Nkisi-Orji et al. [3] demonstrated the robustness of Clood on a CBR project of half a million cases and showed how Clood is scalable for different project sizes.
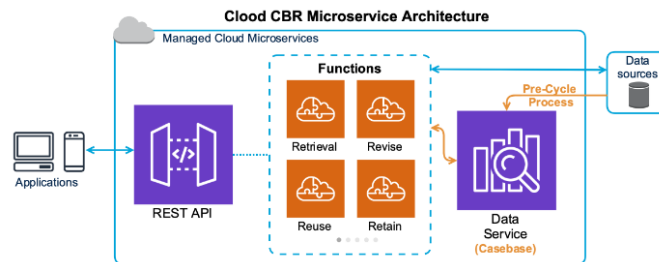

Figure 2. Cloud Case-based Reasoning

Individual microservices are independently scaled and developed such that the overall system architecture is a scalable distributed application [4, 5]. Importantly, the computation of services are stateless since they are automatically provisioned only when needed and then stopped when no longer required. This is particularly advantageous to CBR in situations where there is in-memory demand due to its inherent nature of being a lazy learner [4, 5]. A microservice is considered efficient when the system is loosely coupled and highly cohesive [4, 5].

3. METHODOLOGY

Study literature to search and compile knowledge about digital government, auditing, RBR and CBR. Combining Gun Ho Lee [2] audit architecture model and I. Nkisi-Orji et al. [3] cloud based CBR model to propose cloud-based Indonesia digital government audit model using rule-based and case-based reasoning.

4. RESULT AND DISCUSSION

Based on two model of cloud-based CBR [3] and RBR [2] explained above, we combined the models within audit cycle process [6, 7] and visualize it in figure 3. We propose that the cloud architecture engage with all cycle audit process using application interfaces to easy access and utilization of case based reasoning provided by cloud resource.
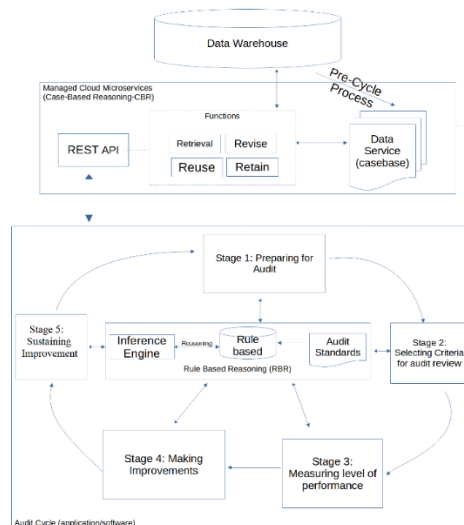

Figure 3. Combine model of Cloud case based reasoning and rule based reasoning in audit cycle.

Within the audit cycle application, we proposed to embedded rule based reasoning that provided the auditor in every step of audit cycle. The cloud-based CBR will interact with data warehouses that consists of cases from previous audit process that had finished and compiled for auditor. The location of data warehouse does not need to be in single location, since the data warehouse available through internet access across all physical server that Indonesian Government in national, local level and government other organization entity would already have.

The RBR within audit cycle application may be utilize in all process at any given time so auditor may screening out process to determine whether a transaction should be scrutinized further or what level of punishment should be given accordance to any defaults or non-observance of standards and regulations, then conduct further auditing process proceeds for the transaction with clues detected.

The knowledge base of a rule-based system comprises the knowledge that is specific to the domain of application with respect to the internal regulations, guidelines, etc. to observe as a form of rules or facts [2]. Auditor reviews and confirms the best case retrieved by CBR for adaptation or could modify and improve one of retrieved cases depending on the situation if necessary [8]. Even if the retrieved case is not an identical but a similar case, the similar case will be a basis or reference for auditors to judge new problem and modify the case. The modified case is stored in the case database once the modified case is adapted and confirmed by auditors [2].

The model facilitates digital government auditor as user by using audit application software. After auditor granted application access, they could use cloud-based CBR to review the current audit project to help searching for similar case that saved in data warehouse. If the previous result already saved and similar to the current project, then auditor could report the result and end the current audit project. If no similar case found, or if there are similar case found but there no conclusive evidence of audit results, then auditor may continue to take stage 1 (preparing for audit step) [6] and consult with build-in RBR system as references to identified key area to be audited.

The built-in RBR system within the application could be access as reference and help auditor making decision along the audit cycle process, this would improve the work quality and audit results. After auditor reach the stage 5 (sustaining improvement) [6], they can save the audit final report to cloud-based CBR for other auditor future audit result case.

The successive use of system and the output quality of the system mainly depends on a plenty of previous cases stored and how the case base and rule base are well con- structed and managed. An efficient internal audit system simplifies and improves the auditing process and enforces standards, which in turn contribute to organization [2].

5. CONCLUSION

The model propose in this paper are work in progress, there are still not enough data and results to validate the effectiveness of the model. The model will be create and evaluate in future research. After the model been created, there still work to validate the model using focus group discussion.

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