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# An Application Performance Measurement Model for Higher Education in Indonesia

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## ABSTRACT

These problems are certainly not in accordance with the various efforts that have been made by the government to achieve higher quality standards, which have been carried out including through the accreditation and clustering process. In addition to the efforts made by the government as a policy maker, universities need to make internal efforts so that their quality can be in accordance with the quality standards that have been set. For this reason, the achievements of Tri Darma activities must be monitored and evaluated periodically so that universities can always improve their performance. The Indonesian government has issued a government regulation Decree of the Minister of Education and Culture of the Republic of Indonesia Number 754/P/2-2020 concerning Main Performance Indicators of State Universities and Higher Education Service Institutions which consists of 8 indicators, namely graduate criteria off-campus students activity, lecturer qualifications, lecturer research implementation, study program partnerships, classroom learning, international accreditation. The purpose of this application is to be able to measure the achievement of these 8 criteria.

**Keywords:** higher education, performance, measurement, key performance indicator, national standard education.

## 1. INTRODUCTION

Higher education is rapidly developing around the world. According to UNESCO data, the number of new students of tertiary education has doubled in less than two decades, reaching 221 million students in 2017. Most countries are in the state of transitioning from an open and free centralized higher education system to a more autonomous that guarantees quality based on law, regulation, and requirements [1]. The concept of quality in higher education has become an increasingly important issue for institutions, as well as in public debate and policy on education [2]. Higher Education is expected to provide graduates with high-quality education relevant to the labor market and to contribute to economic growth through research and innovation [3].

In Indonesia, there are 4,670 national public and private universities. The result of research conducted by Prabowo, Ghozaly, & Vidayanti (2017) on 105 private universities in Indonesia shows that most private universities did not have standard documents set by the government. Most private universities (54%) have started to complete the standard quality documents required by the government according to the Regulation of the Minister of Research and Technology of Higher

Education Number 44 of 2015. There are still private universities that do not have standard documents at all (11%).

The use of information technology is needed to help evaluate various activities and internal processes in Higher Education. Various studies on the concept of monitoring and evaluation of the higher education quality assurance system have been carried out. [4] developed an Executive Information System database architectural model to assist top management in making decisions based on the performance of 24 National Higher Education Standards.

Chakarlis (2011) developed an information system to evaluate the quality assurance of higher education that included educational staff, students, services, and external systems using the Balanced Scorecard technique. A similar venture was also done by [5], who proposed a conceptual framework for evaluating and measuring higher education performance. Aspects that were measured include aspects of Customers, Financing, Internal Process, and Learning. [6] developed a big data-based system architecture to evaluate and monitor the quality of higher education. The assessed aspects were the quality of learning and

evaluation of the impact of learning and the development of learning processes.

The research conducted by [7] proposed a conceptual framework for higher education quality assurance that includes aspects of administration, academics, and quality relations involving the government, market, and higher education institutions. The development of a framework was conducted by Izhar, Torabi, & Ishaq Bhatti (2017) to evaluate the achievement of higher education goals using an ontology-based method that refers to the dashboard shown. The proposed prototype framework for the evaluation process and monitoring the quality of higher education was also developed by [8] with graduates and publications as the aspects that were controlled. Šehidić & Junuz (2016) also researched the University Business Intelligence System as the proposed model which uses an example of an analysis of the student enrollment process using SQL Server Data Tools.

A higher education assessment model using the Fuzzy markup language was developed by [9]. The aspects that were assessed include; Higher Education Objectives, administration and management, teaching and learning resources, performance and social responsibility, and improvement and quality assurance systems..

This study aims to propose an application performance measurement model for higher education based on the Decree of the Minister of Education and Culture of the Republic of Indonesia Number 754/P/2-2020.

## 2. LITERATURE STUDY

In connection with globalization in higher education, education quality assurance has become the concern of the government, industry, and other stakeholders. Each institution tries to get a bigger market share and has a competitive advantage. This requires serious attention, especially concerning the quality assurance system of higher education. When discussing quality assurance, it cannot be separated from the standards used. To be able to guarantee the quality of higher education, a technology tool or program is needed to evaluate if the practices carried out meet the criteria. Various evaluation models have been developed in various universities, based on data mining, data warehouses, and big data. Some of the research that has been carried out in the evaluation of higher education performance, proposed an integrated framework for better university management, such as the one conducted by [10]. This becomes an important aspect in the process of extracting the transfer load which is used to integrate academic data from different sources according to the needs of higher education. The Business Intelligent approach was also put forward by [11] through the process of monitoring and forecasting education system trends using indicators that were processed through OLAP using data dimensions from the data warehouse.

Zulkefli et.al (2015) proposed a BI concept whose components consist of the University Vision and Mission, University Strategy, Key Performance Indicator, and Key Business Processes. [12].[13] developed a predictive classification model to predict student academic performance using the Support Vector Machine (SVM), KNN, and Random Forest methods. The result of model testing can predict precisely whether a student needs intervention or not in his or her academic performance. The model will also help deans and departments to make better decisions.

A framework for measuring academic quality was proposed by [14] which covers academic qualification, external attachment, teaching and learning, academic supervision, research and innovation, personal character, and leadership and management, which are important elements that indicate academic quality. [15] developed a Quality Assurance Information System measurement framework to support academic evaluation and strategic management. Furthermore, Aziz et al., (2014) proposed a framework based on Educational Data Warehouse (EDW) that allows access to student information based on student achievement, which is then carried out by analytic processes that produce reports and dashboards.

Research on the design of the Monitoring and Evaluation System in Higher Education based on the big data platform was conducted by [16] developed a business intelligence-based tool to support internal quality assurance and appropriate decision-making processes for the tertiary institutions.

In addition to Data warehouse technology, Big Data technology is widely used to evaluate the performance of a university. Various studies have been conducted to ensure the implementation of educational standards in tertiary institutions. [17] proposed a framework using the concept of big data which consists of Institutional Analytics, Information Technology (IT) Analytics, Academic/Program Analytics, and Learning Analytics. The framework is used to assess performance, predict future performance, and identify potentially related problems.

The Apriori algorithm to analyze student learning outcomes data, and monitor the development of academic achievement so the academic planners can make effective decisions implemented by [18]. This led to better results, thereby increasing the profitability of educational institutions, especially private institutions. The dynamic changes in the higher education landscape and the challenges that are bringing about these changes in the 21st century, when big data technology and data analytics help the world of education adapt to a changing environment described by [19]. Various data mining techniques can be used for the processes of measuring and evaluating performance in higher education as shown in Figure 1.

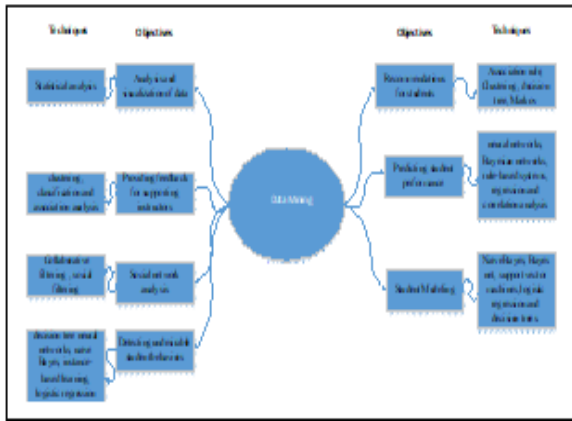


Figure 1. Data Mining Technique (Romero and Ventura, 2010)

### 3. PROPOSED MODEL

There are many approaches to developing new information systems where different strategies, methodologies, modeling techniques or life cycles can be used. In designing the initial application model using UML which consists of the following elements:

#### 3.1. Use Case Diagrams

As shown in Figure 2. This use case diagram describes the main functions of the system and the actors involved. Consists of 10 use cases and 11 actors. Each use case has an association with a different actor, it illustrates that the data source of each KPI will be different. Actors involved in the system are mostly other systems that will communicate using web services that have been provided by other systems (actors) involved.

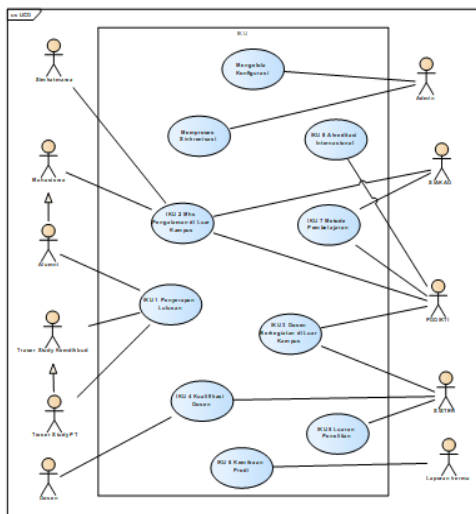


Figure 2. Use Case Diagram

#### 3.2. Activity Diagram

Activity diagram is used to describe the sequence of activities of the system that is being created. As can be seen in Figure 3. The activity diagram created consists of several activities associated with other activities and data stores. For example, activity key performance education employability, associated with activity Pull data from tracer, data store ds\_tracer and ds\_key performance education. Activity pulls data from the tracer containing procedures for communicating with the tracer system actors of the Ministry of Education and Culture and the tracer of universities, the data from the system tracer will be retrieved and then stored in the data store ds\_key performance education1. All data stored in the ds\_key performance education data store will be used as report material on the dashboard.

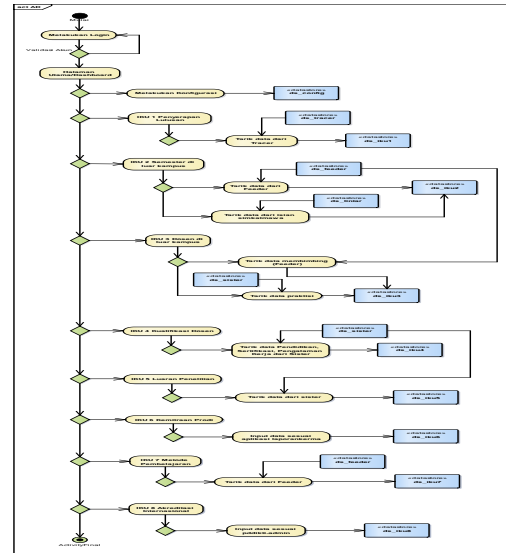


Figure 3. Activity Diagram

#### 3.3. Class Diagram

Class diagrams are used to describe the relationship between the main classes used in the system. The classes from Tracer, from Feeder, from Sister, from Simkatmawa, from ReportKerma and inputForm are derived from the GetData class and are associated with the Config class. Each derived class will contain functions/procedures to communicate with other systems using web services. The relationship between the main classes used in the system can be seen in Figure 4.

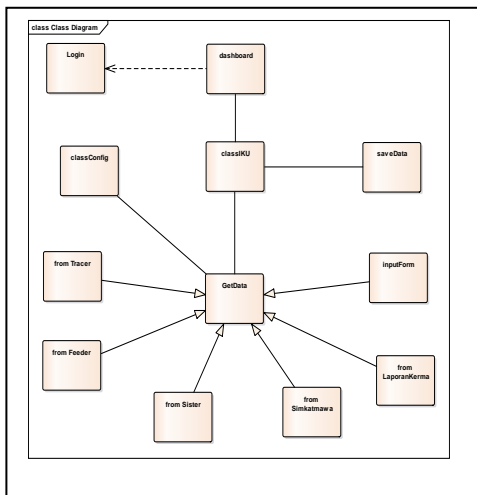


Figure 4. Class Diagram

After doing the design model stage, then the user interface model is made. The following is an outline of the design model between users which will be evaluated according to needs after the prototype and implementation stages to be adjusted to the real needs of users. Figures 5 and 6 show an illustration of an application model dashboard display.

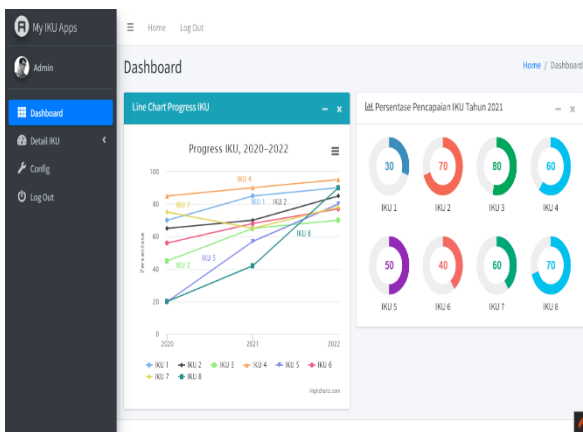


Figure 5. Dashboard

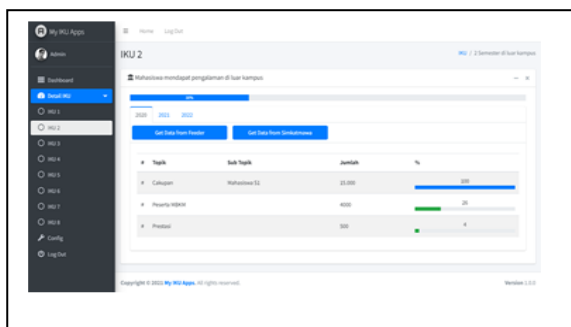


Figure 6, Illustration Key Performance Indicator

#### 4. CONCLUSION AND FUTURE WORK

This paper proposes aims to propose an application performance measurement model for higher education base on Decree of the Minister of Education and Culture of the Republic of Indonesia Number 754/P/2-2020, concerning Main Performance Indicators of State Universities and Higher Education Service Institutions which consists of 8 indicators, namely graduate criteria off-campus students activity, lecturer qualifications, lecturer research implementation, study program partnerships, classroom learning, international accreditation. There are many approaches to developing new information systems with different strategies. Designing the initial application model using UML which consists of the following elements: use case diagram, class diagram and transition diagram. In the future it can be applied with empirical data and apply data mining methods to be used to perform data analysis to produce various information to support decision making.

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