DYNAMIC SYSTEM MODEL: THE EFFECT OF CAMPUS FACILITIES ON THE QUALITY OF SCIENTIFIC PUBLICATIONS OF GRADUATE STUDENTS

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ABSTRAK

Bermula dari edaran Dirjen Dikti Nomor: 152/E/T/2012 tentang publikasi karya ilmiah mahasiswa, pemerintah Indonesia mendorong mahasiswa untuk berperan aktif dalam melakukan publikasi penelitian. Kuantitas publikasi ilmiah yang dilakukan oleh mahasiswa harus diikuti juga dengan mutu yang baik. Dalam dunia pendidikan kualitas publikasi ilmiah tampak dari kategori hasil luaran penelitian dan bagaimana faktor pengaruhnya pada bidang penelitian tersebut. Fasilitas kampus disebut sebagai salah satu faktor penting dalam menunjang mutu publikasi penelitian mahasiswa. Karena bukan hanya secara fisik, fasilitas nonfisik dianggap sangat penting untuk meningkatkan Kompetensi dan kapabilitas mahasiswa, misalnya dalam bentuk pelatihan.
Analisis sistem dinamik merupakan salah satu metodologi penelitian yang bisa memotret kondisi suatu sistem mutu manajemen. Dalam penelitian ini Sistem dinamik digunakan dalam melihat kondisi mutu publikasi penelitian yang dilakukan oleh mahasiswa pascasarjana, melihat bagaimana fasilitas dapat memengaruhi mutu publikasi penelitian mahasiswa.

Kata-kata kunci: fasilitas kampus, pendidikan tinggi, mutu publikasi ilmiah, sistem dinamik, mahasiswa pascasarjana.

ABSTRACT

Starting from the circular of the Dirjen Dikti Number: 152/E/T/2012 concerning the publication of student scientific work, the Indonesian government encourages students to play an active role in conducting research publications. The quantity of scientific publications carried out by students must also be followed by good quality. In the world of education, the

quality of scientific publications can be seen from the categories of research outputs and how the factors affect the field of research. Campus facilities are said to be one of the important factors in supporting the quality of student research publications. Because not only physically, non-physical facilities are considered very important to improve student competence and capabilities, for example in the form of training.

Dynamic system analysis is a research methodology that can capture the condition of a quality management system. In this study the dynamic system was used to look at the quality of research publications conducted by postgraduate students, to see how facilities could affect the quality of student research publications.

Keywords: campus facilities, dynamic systems, higher education, research publications quality, postgraduate students.

INTRODUCTION

Indonesia is one of the countries that has experienced a significant increase in the productivity of scientific publications. On its journey, among the six countries in the Southeast Asian region with the highest number of scientific publications.

An increase in the number of scientific publications in Indonesia can occur, one of which is by involving all students to play an active role in publishing scientific papers from the results of their research. Sitepu (2010) stated that universities are considered as one of the institutions that are expected to contribute to new research and science through research conducted by lecturers and students. Research itself is part of the Tridharma of Higher Education which must be carried out by lecturers and students in universities in Indonesia (Istambul, 2019). Research that has been done must be published or documented, because publications play an important role in the evolution of modern science and professional progress (Singhal, 2021).

The issuance of the circular letter of the Director General of Higher Education Number: 152 / E / T / 2012 concerning the publication of student scientific papers is the basis for universities to determine the publication of scientific papers to be one of the graduation requirements that should be enforced after August 2012.

In line with the development of the world of research, the government strives to continue to improve the scientific and intellectual level of domestic universities as the spearhead of scientific development (Matveeva, 2021). The Director General of Higher Education continues to regulate the publication of scientific papers in Indonesia to ensure the quality of scientific publications produced.

The quality of scientific publications carried out by students is influenced by several factors. Mizany, et al (2012). In addition, Rahimah and Satrya (2018); and Dhillon et al (2015) mentioned that personal enthusiasm is also needed in students to conduct research, support from lecturers and supervisors, adequate facilities and a supportive campus atmosphere.

Campus facilities, according to Burns, K. (2010) and Whiteman, et al (2013) are one of the important supporters in the success of students conducting research and publishing their research results. Marhamah, et al (2021) said that the facilities in question are physical facilities (equipment), namely facilities and infrastructure as well as non-physical facilities such as training.

In conducting research, of course, a researcher, in this case students need rooms, reference media, as well as other infrastructure services, but also the existence of training is felt to be very important for students as researchers according to Falah (2019), Saman (2018) and Pramiastuti (2020).

Based on the literature review above, research was conducted on the effect of facilities on the quality of scientific publications of graduate students. The research was conducted by taking secondary data in one of the PTN Postgraduate Programs. By using a dynamic system to be able to produce a model of the influence of campus facilities on the quality of scientific publications of graduate students.

In general, Sterman (2015) states that models are imitations of the real world created virtually. The model must have a resemblance to existing reality, while modeling (modeling) is an activity of making models.

The system is stated by Prahasta (2018), Haraldsson (2000), Suryani, et al (2020) as a set of elements (components, elements) that are interrelated and influence each other with their respective functions and according to certain procedures in achieving a goal. It goes on to mention that the system must have: components/factors, environment, limitations, connecting media, inputs, outputs, procedures and objectives. In certain fields the phenomena that occur will be complex. With the system, these phenomena will be easier to identify.

In the field of education, Jakobi (2007) stated that dynamics are changes and movements in the field of education that occur continuously and affect many aspects of life. According to Soylu and Yelken (2014), phenomena occur in the world of higher education due to efforts in adapting developing issues. Even the dynamics in higher education occur in different portions in different parts of the world. Soylu and Yelken (2014) continued in their statement that there are new activities in universities such as continuing education, technology transfer and research exploitation that are expected to produce something new in the last decade. This shows that there are trends and reforms in higher education which in practice vary according to the situation and understanding of the institution. Development and changes in every aspect of science and technology will then affect the state of research in the world as revealed by Doyle (2018).

The system dynamic method was first invented by Jay Wright Forrester in the mid-1950s. The main concept is how all the components in a system interact with each other. Forrester (1968) states that dynamical systems are a method for studying changes in the time behavior of a complex system, this method can then be used to solve various problems in various fields. System dynamics aims to understand how each component works in building or strengthening a system so as to optimize work results, as well as predict system performance in the future.

RESEARCH METHODS

On research these, the method used in conducting the analysis is dynamical systems. The method was based on secondary data by taking the entire population of graduate students over a period of seven years, and modeling was carried out until 2035.

Data collection began with conducting a literature study, conducting in-depth interviews with six policy makers in the postgraduate program where the research took place. The stages of model processing are as follows:

1. Variable identification
2. Create a blackbox
3. Forming a Causal Loop Diagram (CLD)
4. Develop a Stock Flow Diagram (SFD) model
5. Simulate scenarios
6. Validate simulation results.

RESULTS AND DISCUSSION

In a problem (system) there are variables that are interrelated with each other, both affecting and influencing, Richardson and Pugh (1986). To facilitate these conditions,

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identification can be done based on its nature in a black box (Blackbox). *The compiled blackbox consists of inputs,* outputs*, evaluations, all of which focus on entering and exiting the model to be formed.*
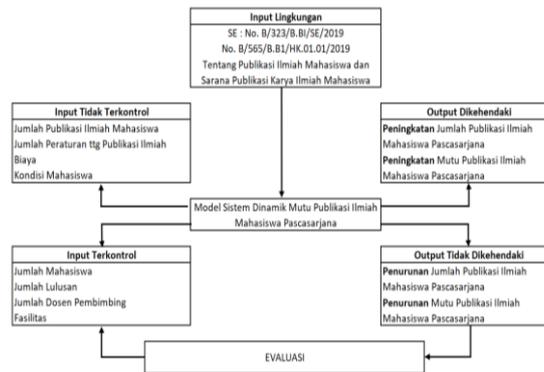

Figure 1. Blackbox chart

Once the Blackbox is formed, a causal loop diagram can be developed by selecting the factors to use and finding variable 2, variable 3, etc...

The following is a CLD that can be formed from facility variables to the quality of graduate student publications.
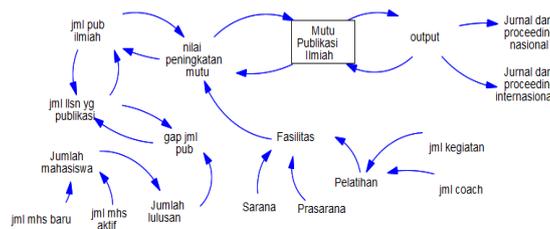

Figure 2. Causal loop diagram

In the developed CLD, other variables appear to be interrelated and influential. , is as follows :

1. The quality of scientific publications is influenced and affects the value of quality improvement (creating *a reinforcement loop* (R)), also affects and is influenced by the output of scientific publication products
2. The value of quality improvement is influenced and affects the number of scientific publications (Loop R), influenced by facilities, also influenced by the quality itself (Loop R).
3. Facilities influence the improvement of the quality of scientific publications. Influenced by facilities, infrastructure and training.
4. Training is influenced by the number of activities and the number of coaches.
5. The number of scientific publications is influenced by the number of graduates who make publications (loop R). The gap in the number of publications and graduates is also formed, influencing and influenced by this variable.
6. The gap in the number of publications is formed from the number of students who graduate with the number of students who publish
7. The number of graduates is influenced by the number of students and
8. The number of students is influenced by the number of new students and the number of permanent students.

The values on causal loop diagrams are usually not uniform, because there are units of people, fruits, and percentage numbers. To make SFD models, by equalizing unit units, it will be easier to simulate. The simulation will be performed by Vensim PLE x64 software.

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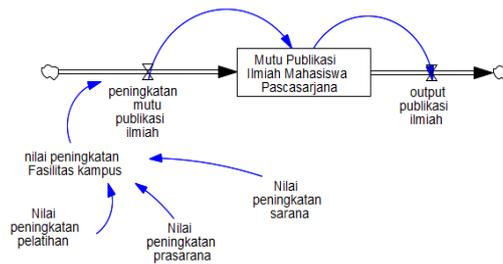Here is a Stock Flow Diagram model that can be formed and simulated.

Figure 3. Stock Flow diagrams

SFD is a continuation or implementation of CLD that has been formed in a case. SFD was also treated using PLE vensim software in this study. In the implementation of this model, setting the *time series* for twenty years after the beginning of the data collected, namely until 2035.

The formula included in the SFD Model simulation is obtained by calculating the average rate of each variable.

Table1: Table of formulas

Variabel	Satuan	Rumus/nilai
Peningkatan mutu publikasi ilmiah	dmnl	Nilai peningkatan pelatihan+Nilai peningkatan prasarana+Nilai peningkatan sarana Nilai : 3.52
Mutu publikasi ilmiah	dmnl	((Mutu Publikasi Ilmiah* nilai peningkatan fasilitas kampus)+Peningkatan jml publikasi)/ Output pub
Output Publikasi Ilmiah	dmnl	Nilai : 1
nilai peningkatan fasilitas kampus	dmnl	Nilai : 3.52
Nilai Sarana	dmnl	Nilai : 0.33
Nilai Prasarana	dmnl	Nilai : 0.33
Nilai Pelatihan	dmnl	Nilai : 2.86

SFD model of the influence of campus facilities on the quality of scientific publications of graduate students shows an increased positive value, which means that increasing campus facilities has a significant effect on the quality of publications. This is shown in the graph below.

Figure 4. Scenario Graph of increasing the quality of scientific publications towards improving facilities.

With an increase value of 3.52, the training value itself is 2.86 which indicates the dominant value in the variable. In the data shown in figure 1, in the period 2015-2021, the increase in scientific publications began in 2018, starting with training. Since the pandemic period in 2020-2021, online training on writing scientific papers has been rife, so the number of scientific publications has reached the optimal point according to the number of graduates.

Model validation is carried out with the AME (*Absolute Mean Error) formula* which has a tolerance value below 10%, because the smaller the absolute value of error the more valid it will be. With a value of 3.52%, the model is declared valid.

Table 2. Model Simulation Validation

Tahun	Variabel	Data Aktual	Data Model	Nilai AME (%)
2015		98	101,45	
2016		104	107,661	
2017	Mutu Publikasi	97	100,414	
2018	Ilmiah Mahasiswa	254	262,941	3,52%
2019	Pascasarjana	447	462,734	
2020		551	570,395	
2021		507	524,846	

Based on the discussion above, there are several things obtained by analyzing the profile and field situation of the research as well as CLD and SFD analysis.

1. The condition of the quality of scientific publications of graduate students of XYZ University appears in the described distribution profile.
2. The quality of new student scientific publications can be identified since 2015 and the quality can only be classified in 2017
3. Dynamic system modeling can classify factors and variables needed to assess the quality of scientific publications. Photographing a large system becomes easier to read causal cause and effect of a condition.
4. Causal loop diagram formed from the quality system of graduate students' scientific publications shows the variables and factors that affect the quality of graduate students' scientific publications. Then the Stock Flow Diagram provides an assessment of variables so that variables that are very dominant for quality improvement needed in campus managerial strategies can be identified.

CLOSING

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