Dynamic Hypothesis of Performance Model for Academic Staff

Hasimah Sapiri, Nor Haslinda Zainal Abidin and Tisya Farida Abdul Halim

Abstract— **This article presents the development of a dynamic hypothesis for academics staff performance in higher education institution. The performance of academic staff focus on the three interrelated key indicators. They are research, publication and supervision. Then, the hypothetical framework portraying the main interacting variables and its relationship in influencing academic staff performance was developed. It highlights the feedback process between structural, process and the performance factors. The conceptual framework was designed as a preliminary step towards the simulation model development. The dynamics hypothesis enables the researcher to gain insight into the complexity of evaluating academics staff performance.**

Keywords— **academic staff performance, performance model, causal loop diagram, dynamic hypothesis**

I. Introduction

Higher education institutions play an important role in a country's development. These institutions provide educational development with the necessary highly qualified manpower. To maintain the success of educational institutions in providing quality education, a certain mechanism is required to monitor, control and coordinate the strategic plan. Furthermore, the success of educational institutions depends on the performance of academic staff in achieving the objectives of being the center of academic excellence. Therefore, the performance of academic staff in higher education institutions should be observed and improved continuously. This is to ensure that qualified manpower and researches are produced efficiently in meeting the university's standard of intellectuals. Furthermore, a periodical performance assessment of academic staff could also ascertain that resources are being used adequately and tasks are being completed effectively at all time.

Measuring job performance in higher education institutions (HEI) received little attention compared to other industries. This is due to their complex nature and difficulty in measuring their outputs [1]. Equally, there are less literature describing the dynamic hypothesis in assessing performance for an academic staff. Hence, this study seeks to examine the factors that influence academic staffs' performance and to develop a dynamic hypothesis which describes the main interacting variables and its relationship.

Hasimah Sapiri, Nor Haslinda Zainal Abidin, Tisya Farida Abdul Halim
School of Quantitative Sciences, College of Arts and Sciences
06010 Sintok, Kedah, Malaysia

. This paper is organized as follows. Section 2 discusses a review of the related literature. This is followed by section 3, where research methodology is described by explaining a general dynamics hypothesis process and sample of data. In section 4, an explanation on the hypothetical framework and the causal loop diagram for academic staff performance is given. The last section provides a summary for this paper.

II. A Brief Review of the Literature

There have been several studies to measure academic staff performances reported in literatures, see for example [1-6]. In one study [1], three types of measurement in assessing performances for academic staff were developed.   The measurements are outcomes, processes and input.   The outcome measures performance in terms of the number of graduates, researches, scholarships and services to community that had been produced. The processes illustrate the periodical assessment process which includes the teaching and learning process, and research administration process.   The third measure relates to the efficiency and utilization of the institution's educational resources such as courses offered, laboratory utilization and the quality of prospective students.

In another study [4], a model of key performance indicators based on balanced scorecard was developed to measure the performance of academic staff in a private university. Their evaluation is based on teaching activities, research and innovation, supervision, writing and publication, consultancy and services to community activities.

Furthermore, another relevant study measured the performance of academic staff chosen from a selected faculty [6]. The authors listed two inputs (department utilization and program offering) and three outputs (quality of graduate, quality of research and quality of staff service) as the most influential indicators in measuring the performance of an academic department.

III. Methodology

A. Dynamic Hypothesis Processes

In this study, a dynamic hypothesis of academic staff performance model is developed using causal loop diagram. A causal loop refers to an influence diagram or mathematically known as directed graph. A causal loop enlightens a dynamic process of a system in which the chain effects of a cause are traced through a set of related variables back to the original cause. A causal loop is formed when a set of variables has been linked together in a connected path. Causal loop shows a

relationship between variables and serves as a basis for quantitative models, when backed by formulae that quantify variables [7]. Dynamic hypothesis is describes as a working theory of how the problem arose and it guides the modeler on a certain structures [8]. A study in [9] highlights five basic rules in developing a dynamic hypothesis, as shown in Figure 1.
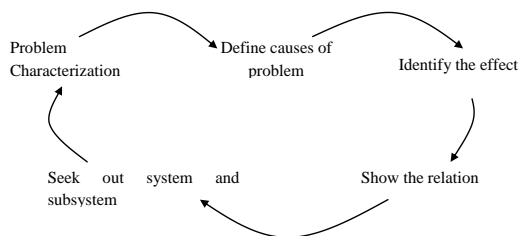

Figure 1: Dynamics hypothesis development process (adapted from Goyol and Dala, (2014))

Dynamics hypothesis development starts with problem characterization. This rule involves the process of characterizing specific problem through investigating the key variables, time horizon and boundary of the problem. Once the problem has been recognized, the factors involved are being identified. Next, causes that become an effect to another factor are recognized. Relations between causes and effects are developed using effect arrows. Lastly, the system and subsystem in the dynamics hypothesis are classified.

B. *Sample of Data*

In this study, all 82 academic staffs in the School of Quantitative Sciences (SQS), Universiti Utara Malaysia (UUM) were chosen as sample data. Also, data sources are taken from experts interviews and document reviews. Interview sessions are arranged with the Dean of Awang Had Salleh Graduate School, Universiti Utara Malaysia (UUM), and the Head of Department in the School of Quantitative Sciences (SQS), to gain information regarding the current performance evaluation of academic staff in SQS, UUM. Additionally, document reviews are performed by reviewing relevant historical data obtained from UUM Academic Affairs Department, SQS, and UUM Research and Innovation Management Centre (RIMC) from 2009 to 2012.

IV.   **Analysis of Results**

A. *Identification of Key Influence Factors*

The performance of academic staff depends on various key performance indicators that have been set by the university. This study refers to a study in [4], where the main criterias to evaluate academic staff performance are based on teaching activities, research and innovation, supervision, writing and publication, consultancy and services to community activities.

However, in our study, the performance analysis of academic staffs is based on the most interrelated items; they are (1) Research- the amount of ongoing, in progress and completed research, (2) Publication- the numbers of publications being reviewed and accepted, and (3) Supervision- the amount of ongoing and completed supervision. The performance indicators will also be classified according to the quality of the research (types of grant obtained), publication (indexed/non-indexed publication) and supervision (time-length of completed supervision). Thus, the hypothetical framework portraying the main interacting variables and its relationship in influencing the Universiti Utara Malaysia (UUM) academic staff performance is presented in Figure 2. The identified factors shown in Figure 2 are grouped into three clusters; supervision, research and publication.
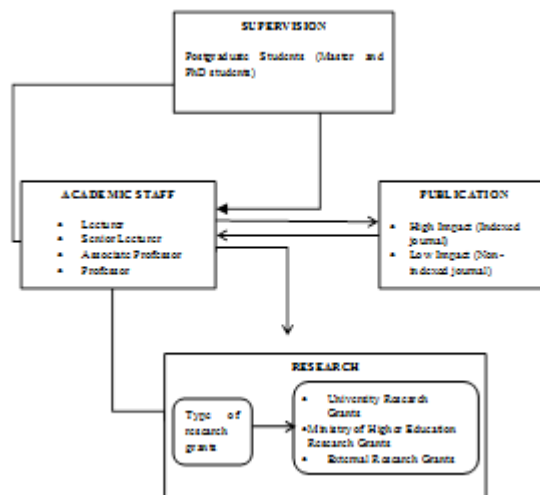

Figure 2: The relationship between staff performance with supervision, publication and research activities

B. *Causal Loop Diagram for Assessing Academic Staff Performance*

The interrelation of academic staff performance with the three main key performance; research, publication and supervision are given in Figure 3. The figure was drawn using causal loop diagram which served as a useful theoretical analysis of the factors involved in developing a model for assessing an academic staff performance. There are two types of causal loop; (1) reinforcing loop and (2) balancing loop. The loop is defined as positive (known as reinforcing loop) when the number of negative relationships is even, otherwise the loop is negative (known as balancing loop). Causal loop is also represented by an arrow headed line with a symbol "+", which means a change in the influencing variable will produce a change of the same direction in the target variable, while the symbol "-" means the effect will be in a opposite direction between the influencing variable and the target variable. The causal loops relation is a helpful tool to predict the impact of desired factors in the system holistically [7].

As shown in Figure 3, the increment of number in research will also increase the number of publication and supervision. Then, research allocation will affect research rate either for internal grants or external grants. Then, changes in publication rate will affect the changes in types of publication either index paper or non-index paper. Any changes in supervision rate, will also cause changes in supervision rate either for PhD student and Master students. Research, publication and supervision rate will then affect academic staff performance and this will lead to staff promotion. Once an academic staff is promoted to a higher level, it will affect rate of research, publication and supervision where they need to increase their research, publication and supervision rate. There are three reinforcing loops in the causal loop diagram, the first reinforcing loop, R1, indicated any changes in research rate will also change the rate of supervision, staff performance, and staff promotion. Then, the second and third reinforcing loop, R2, described the increment of research rate will also increase publication rate, staff performance and staff promotion, while loop R3 represent the increment of research rate as a result from enhancement of staff performance.
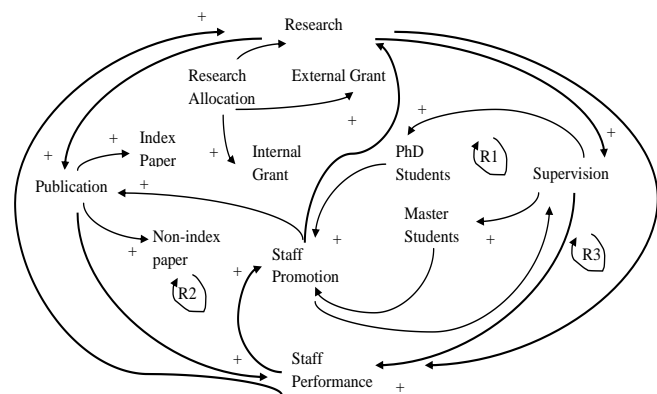

Figure 3: Dynamic hypothesis of academic staff performance

v.   **Conclusions**

This paper discusses the development of dynamic hypothesis for an academic staff performance in higher education using causal loop diagram. The dynamic hypothesis enables the researcher to quickly access the inter-relationship between the three key indicators of supervision, teaching and publication on the academic staff performance. This dynamic hypothesis will be used as a basis for developing a quantitative simulation model. The developed dynamic hypothesis will be transformed into stock and flow diagram and several validation tests will be conducted to test the model from its structure and behavioral perspective.

Acknowledgment

References

[1] U, Al-Turki and S. Duffuaa, "Performance measures for academic departments", International Journal of Educational Management, 17(7), pp. 330-338, 2003.

[2] S. Rungratsamee, "A comparative analysis of academic staff's academic performance between autonomous and public universities in Thailand", Journal of International Development and Coorperation, 10(2), pp. 67-81, 2004.

[3] M. L. E. Mapesela, and F. Strydom, "Performance management of academic staff in South African higher education: A developmental research project.", 2005. Proceeding of Trends in the Management of Human Resources in Higher Education Conference.doi:www.oecd.org/dataoecd/35/43/35327193.pdf.

[4] M. I. Mohamad Ishak, M. S. Suhaida, and M. Y. Yuzainee, "Performance measurement indicators for academic staff in Malaysia private higher education institutions: A case study in Uniten", 2009. Proceeding of Performance Measurement Association Conference.doi: www.pma.otago.ac.nz/pma-cd/papers/1115.pdf.

[5] A. O. Adeniyi, A. T. Olugbenga, and J. O. Inegbedion, "Correlation between performance and quality of academic staff in national open university of Nigeria", 2009. Proceeding of 23rd International Council of Open and Distance Education World Conference.doi:www.openpraxis.com/files/Adewale%20et%20al..pdf.

[6] Z. Alwadood, N. M. Noor, and M. F. Kamarudin, "Performance measure of academic departments using data envelopment analysis", 2011. IEEE Symposium on Business, Engineering and Industrial Applications (ISBEIA), 395–399. doi:10.1109/ISBEIA.2011.6088844.

[7] R. M. Chaim, and R. E. Streit, Pension funds governance: combining SD, Agent based modeling and fuzzy logic to address dynamic asset and liability management (ALM) problem, 2008. Paper presented at the 25th International Conference of System Dynamics Society. Retrieved from http://www.systemdynamics.org/conferences/2008/index.htm.

[8] J. D. Sterman, Business Dynamics: Systems Thinking and Modeling for a Complex World. Irwin/McGraw-Hill, 2000.

[9] A. B. Goyol, and B. G. Dala, "Causal Loop Diagram (CLD) as an instrument for strategic Planning Process: American University of Nigeria, Yola", International Journal of Business and Management, 9(1), pp. 77-89, 2014.

About Author (s):

Hasimah Sapiri is currently a senior lecturer at Universiti Utara Malaysia.She has a PhD in Operational Research from Universiti Sains Malaysia, Masters in Mathematics from Universiti Teknologi Malaysia and Bachelors in Mathematics from Universiti Kebangsaan Malaysia.. Her research interest cover simulation and modeling in several functional areas such as educations, economics and healthcare.

NorHaslinda Zainal Abidin is currently a senior lecturer at Universiti Utara Malaysia. She has a PhD in System Dynamics/Operational Research from University of Salford, United Kingdom, Masters in Decision Science from Universiti Utara Malaysia and Bachelors in Statistics from Universiti Putra Malaysia. Her research interest cover computer simulation, system dynamics, operational research, healthcare, obesity and economics.

Tisya Farida Abdul Halim is a PhD student at Universiti Utara Malaysia. She has a Masters in Decision Science from Universiti Utara Malaysia and Bachelors in Mathematics (Hons.) from Universiti Teknologi Mara. Her research interest includes simulation, system dynamics and operations research.