Development of Competency Standard Model for Researchers to Improve Research Capacity of Indonesia's Polytechnic Lecturer

Carolina Lasambouw[a], Ediana Sutjiredjeki[b], dan Neneng Nuryati[c]

General Service Unit, Politeknik Negeri Bandung, Bandung 40012
E-mail: carolina.magdalena@polban.ac.id
Electrical Engineering Department, Politeknik Negeri Bandung, Bandung 40012
E-mail: e_sutjiredjeki@yahoo.com
General Service Unit, Politeknik Negeri Bandung, Bandung 40012
E-mail: nnuryati@gmail.com

Abstract
This paper describes the development of Competency Standard Model for Researchers and its Assessment model to improve the individual research performance, particularly for polytechnic's lecturer. It is started with literature review and exploratory study to gather initial information on aspects and criteria of quality research. Various information are gathered through interviews and Focus Group Discussion (FGD) involving respondents experienced in conducting quality researches. It resulting nine teen competency units. Assessment model is required to complete research competency model for polytechnic lecturers. The aim of this assessment model development is to measure the gap between the current competencies held by the lecturers for conducting research and the competencies established in Researchers' Competency Standard. Nine main units within a research cycle out of the nine teen competency units, which covering 60 sub-unit competencies were implemented in the assessment process. The finding on the competencies gap is expected to ease the management in an institution on building its lecturers' research capacity and therefore improving the quality of the conducted researches

Keywords: *Researcher Competency Standard, model Assessment, research performance, research capacity, polytechnic lecturer*

1. Preface
Research and development hold important role as two of the backbones for national competitiveness. The role of higher education institution as one of the prominent aspects of research, development, and science application national system is stated in the Law No. 18 Year 2002 Article 6 (verse 4) and Article 7 (verse 1 and 2). Also, in the Law No. 12 Year 2012 it is stated that every higher education institution is required to execute Tree Obligation of Higher Education, which includes conducting education, research, and community services.

As one of three duties of every lecturer in Indonesia, research must be conducted every semester of the ongoing academic year. The research duty holds important position to strengthen other two duties, which includes education and community services. Hence, to improve the quality of higher education in Indonesia, research culture must be cultivated in every higher education institute, with polytechnics as no exception.

In the present, there are 39 polytechnics in Indonesia which are established as public higher education institutes. The aforementioned polytechnics are distributed in 22 provinces in Indonesia across several islands: 13 polytechnics are located in Java Island, 9 in Sumatra Island, 8 in Borneo

Island, 3 in Nusa Tenggara Islands, 4 in Sulawesi Island, 2 in Maluku Islands, and 1 in Papua Island. The province with the highest number of state polytechnics is East Java with 7 polytechnics. Taking the number of polytechnic lecturers in Indonesia into account, polytechnics can contribute to improve national competitiveness due to the vast research potential of the lecturers. Among these polytechnics is *Politeknik Negeri Bandung* (Bandung State Polytechnic).

The state of research conducted by polytechnic lecturers in Indonesia is elaborated in Report of Performance Data of Research and Community Services Year 2010-2012, which details 102 higher education institutes in Indonesia. According to the aforementioned data, only four of the 37 listed polytechnics are categorized as Intermediate's polytechnics, while the rest are Under Supervision's polytechnics. Among those included in the Under Supervision category are major polytechnics such as the state polytechnics located in Bandung, Jakarta, Semarang, Malang, Medan, and Makassar. The assessment of institution research performance is based on the Guide for Performance Assessment of Higher Education Research. There are 14 items of assessment which are divided into four groups, namely:

- Resources for research (30%)
- Research management (30%)
- Research output (35%)
- Revenue generating (15%)

The instrument for institution assessment is later derived into research performance assessments for conducting organization, group of expertise, and individual, as pictured in Figure 1.
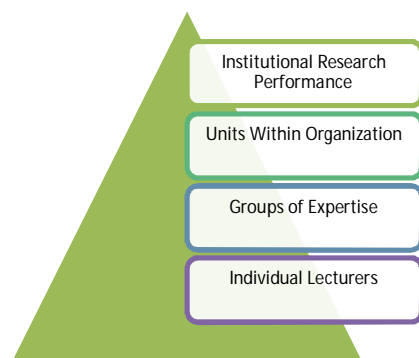

Figure 1. Hierarchy of Research Performance

Based on Figure 1, it becomes clear that the competence of a higher education lecturer as a researcher becomes an important backbone for achieving excellent performance in institutional research. As such, to improve a higher education lecturer's research capacity, evaluation to measure research competency of polytechnic lecturers must be conducted first.

This paper describes Development of Competency Model of Researchers to Improve Research Capacity of Polytechnic Lecturers, which is focused on two major polytechnics, they are *Politeknik Negeri Bandung* (Bandung State Polytechnic) and *Politeknik Negeri Jakarta* (Jakarta State Polytechnic). The research is divided into three stages. The first stage is the development of Researcher's Competency Standard Model, the second stage is the development of Researcher's

Competency Assessment Model based on the results of the first stage, and the third stage is development of Lecturer's Capacity Improvement Model in conducting research. The aim of this research is to establish and identify a capacity development model for lecturers in conducting research based on a fair assessment method to improve the quality of researches in higher education institutes, particularly for polytechnics and more generally for all higher education institutes in Indonesia.

2. Related Works

Assessment of individual research performance is a complex process. Several studies have been conducted for the aforementioned topic in the past [1][2][3][4]. Generally, the assessment of individual research performance is emphasized on productivity, scientific impact, and research quality. Table 1 shows assessment of individual research performance based on productivity by Directorate General of Higher Education in Indonesia (*DIKTI*).

Table 1. Assessment of Individual Research Performance Based on Productivity

No.	Output Type	
1	Scientific publication	International
		National
		Local
2	Paper author in scientific meetings	International
		National
		Local
3	Keynote speaker in scientific meetings	International
		National
		Local
4	Visiting Lecturer	International
5	Intellectual Property Rights	Patent
		Simple patent
		Copyright
		Trademark
		Trade secret
		Industrial Product Design
		Geographic Indication
		Protection of Plant Variety
6	Appropriate Technology for community	
7	Model/Prototype/Design/Art/Social Engineering	
8	Teaching book (ISBN)	
9	Unpublished research report	

Evaluating individual research performance is an important component of research assessment. Systematically, the success indicators of individual research can be divided into four indicators, namely input, process, output, and result [5].

Generally, the assessment on individual research performance does not evaluate the individual's competence directly. In order to produce good-quality research performance, evaluation and measurement process on a researcher's competence is needed based on standard that can be used to measure a researcher's capability objectively, thus producing high-quality research performance.

3. Methodology
The first step of this research is to conduct literary and exploratory study to gather initial information on aspects and criteria of quality research. Various information are gathered through interviews and Focus Group Discussion (FGD) involving respondents experienced in conducting quality researches. Based on the gathered information, the duties of a researcher are thus identified for developing a framework for researcher's competence. Among the duties included in the framework are required variables for polytechnic lecturers to produce quality researches. Based on the aforementioned framework, a questionnaire is created and distributed to 150 polytechnic lecturers in several chosen polytechnics. The data obtained from the questionnaire is later analyzed using statistic to view the correlation among the variables.

The development of the assessment model is conducted in similar manner. Information gathering is conducted through interview with research manager in the polytechnics. Next, a framework for variable assessment is developed as a base for creating a questionnaire. The validity and reliability test is conducted before the questionnaire is distributed randomly towards polytechnic lecturers. Afterwards, the data gathered through questionnaire is analyzed for developing an assessment model draft on researcher's competence for lecturers in *Politeknik Negeri Bandung*.
The result of the analysis conducted on the gathered data is the most recent competency mapping, which includes identification of the gap between researchers' competencies those have existed and researchers' competencies those need to be improved. The gap of the researchers' competencies is used as a feedback to develop Capacity Development Model for Researchers' Competency for Polytechnic Lecturers (Figure 2).
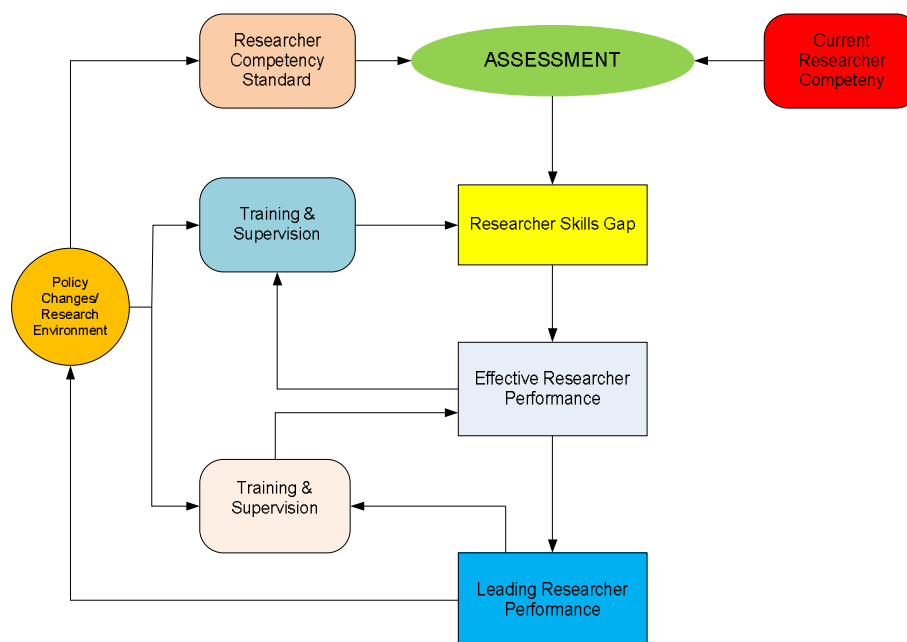

Figure 2.   Researcher Skill Gap based on an Assessment

3. Result
3.1. Researchers' Competencies

The ability of an individual to perform certain work is known as work competency. McCleland [6], as the first researcher to describe competency, defines competency as "*the capability of applying or using knowledge, skills, abilities, behaviors, and personal characteristic to successfully perform critical work tasks, specific functions, or operate in a given role or position. Personal characteristic may be mental/intellectual/ cognitive, social/emotional/attitudinal, and physical/ psychomotor attributes necessary to perform the job*". It is also elaborated further that a work usually requires 7 to 9 competencies, which are described as competency model.

In the first stage of this research, the **core competencies** of a researcher have been developed. The core competencies consist nine (9) units those form one research cycle (Figure 3). Based on the aforementioned nine (9) unit competencies, 60 sub-competencies are derived.

Figure 3. A Research cycle

Different from researcher's competency from Vitae [7] which defined one research competency for the entirety of a researcher's duty, the developed researcher's competencies in this research are based on the duties in the research cycle. As such, every duty in the research cycle has more detailed and more specific description taking form of sub-duties or elements followed by performance indicators for each sub-duty.

The nine units of researchers' core competencies developed in this research include:

- Choosing research topic
- Conducting literary study
- Writing a   research proposal
- Establishing the correct research methodology
- Managing research fund
- Conducting research
- Making research report
- Publishing research result
- Adhering to research ethics.

3.2. Researchers' Assessment

Many studies on research assessment model have been conducted and published. However, most of the existing research assessment model from previous researchers emphasize more on the measurement of research impact, while assessment model for measuring researchers' competencies are much scarcer. Basically, assessment is evaluation towards the skills, knowledge, and attitude

possessed by an individual based on established standard with clear criteria,

There are several different aspects on the execution of assessment, ranging from subjective assessment based on an assessor's feeling and opinion to objective assessment based on identified process based on more specific standards and criteria [8].

In the application, most assessments involve combination between human resources and established standards and criteria. The application of competency-based assessment is an effort to push the assessment to be as objective as possible and to reduce the interference of an assessor's opinion and feelings.

Assessment model is required to complete research competency model for polytechnic lecturers which has been introduced in the first year's research. The aim of this assessment model development is to measure the gap between the current competencies held by the lecturers for conducting research and the competencies established in Researchers' Competence Standard. The finding on the competencies gap is expected to ease the management in an institution on building its lecturers' research capacity and therefore improving the quality of the conducted researches. Figure 4 shows the assessment model for researchers' competency resulted from this research and will be used for capacity building for the lecturers in *Politeknik Negeri Bandung*.
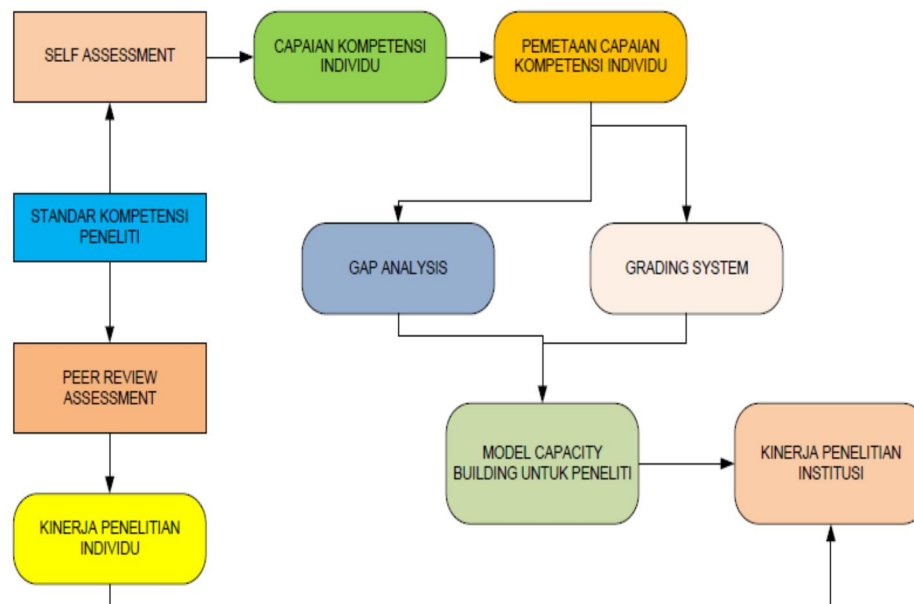

Figure 4. Assessment model for researchers' competency [9]

In the aforementioned model, competency evaluation is conducted through both self-assessment and peer review, thus a more objective assessment result is to be expected.

Based on the conducted literary study, there are multiple assessment methods which can be divided into two categories: (1) assessment towards knowledge and (2) assessment towards practical skills [8]. Assessment towards behavior falls between the two categories. While skills, knowledge, and behavior are three separate abilities, it is possible to assess all three at once in one assessment activity. For example, in assessment on researcher's competency, it is possible to assess the knowledge to identify research topic, perform literary study, planning research proposal, or planning

research funding. On the other hand, to show certain skills such as making research proposal and conducting the research, a demonstration on the knowledge and behavior established by the competency standard can be clearly proved. When all of the related activities are combined in one assessment, the entirety of the competency units can be assessed at once, meaning the assessment is conducted holistically.

The availability of two types of assessment and the method of integrating behavior on the aforementioned types provide clear direction to the used primary assessment methods. Each method is made possible through the usage of varying and unique assessment instruments or sharing with others as long as the assessment adheres to the rules established by the competencies; namely, the skills, knowledge, and behavior required to perform duties in the workplace.

3.3. Assessment Tool

According to the researcher competency standard, there are two (2) types of assessment instruments which have been developed, viz.:

1. The assessment instrument to measure the individual competency that conducted by individual researchers themselves. It is called Self-Assessment Instrument (SA). The instrument consists of seven sections, namely 1) information lecturers, 2) research experience, 3) competency mapping researchers, 4) the publication of scientific papers, 5) research outcomes 6) participation in scientific meetings, and 7) awards ever received.

2. The assessment instrument to measure the individual competency which conducted by the Peer-Review or Peer Review Assessment (PRA). The tool is developed to be used for observing the ability of any lecturer conducting a research. The format of the tool is adopted from a format that has been developed by the American Education Department in 2014.

Before the SA instrument can be used, the validity and the reliability of the instrument have to be tested. To do the test, the proposed hypothesis are:

Ho: Points score positively correlated with factor scores

H1: Points score are not positively correlated with factor scores

Consideration to accept / reject the hypothesis is done by comparing the value of Corrected Item - Total Correlation, which are expressed as r -count and r - table. The basis of decision-making as follows:

- If the r-count (the value of Corrected Item - Total Correlation) is positive and greater than the r-table (r-count> r-table), then the item or the variable is valid.
- If the r-count (the value of Corrected Item - Total Correlation) is negative and or (r-count < r-table), then the item or the variable is not valid.

With the value of df = number of cases – 2. In this case df = 60-2 = 58. With a significance level of 5 %, hence the figure of **r-table is obtained = 0.254** from the table.

The test results on the Corrected Item-Total Correlation output show that in the 60 sub-competencies none of them is negative or they are   all positive,   and the correlation value is greater than 0.254 . Therefore assessment questions are valid. The reliability of the instrument is tested by comparing the value of Cronbach 's Alpha with the value of   *r-table*. If the value of Cronbach 's Alpha is positive and greater than the value of   *r-table*, then the instrument is reliable. The results indicates that the value of Cronbach 's Alpha was 0.985 , which means it is   positive and greater than the *r-table* (0.254). Accordingly, the assessment instruments are valid and reliable .

4. Researcher's Competency Mapping: Case Study *Politeknik Negeri Bandung*
4.1. Responden Profiles

To test the validity and the reliability of the developed model, a trial has been conducted at *Politeknik Negeri Bandung* (*Polban*). This polytechnic is selected because it is one the biggest polytechnic in Indonesia. Currently, Polban runs 40 course programs which are covered by 11 departments, and 493 lecturers to deliver programs. The trial is conducted through a questioner that has been designed specifically according to **Researcher's Competency standard.** The questioner is distributed amongst them. In this trial only 56 lecturers have responded. Lecturers who have returned the questioner are men (31) and women lecturers are 25 (Table 1). This data indicates that men lecturers have more enthusiasm to conduct a research than women lecturers. In addition, the data also reveals that most of Polban's lecturers have less interest doing a research.

Table 1. Respondent gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Men	31	55,4	55,4	55,4
	Women	25	44,6	44,6	100,0
	Total	56	100,0	100,0	

Table 2 indicates the distribution of functional occupation ranks of the respondents. The highest rank is Head *Lektor* (48,2 %), followed by *Lektor* (32,1 % , and finally is Expertise *Assistant* (6%). Actually a lecturer with a higher rank usually more active doing a research than a lecturer with a lower rank. This condition occurs because a lecturer with a higher rank will require more cumulative credit points to fulfill the obligation.

Tabel 2. Functional Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asisten Ahli	6	10,7	11,8	11,8
	Lektor	18	32,1	35,3	47,1
	Lektor Kepala	27	48,2	52,9	100,0
	Total	51	91,1	100,0	
Missing	System	5	8,9		
Total		56	100,0		

Table 3 depicts the respondent final qualifications. Most of them have postgraduate degrees or Strata 2 (80,4%), doctor degrees or Strata 3 (17,9%), and only 1,8% are bachelor (Strata 1). The number of bachelor (Strata 1) is small compared to the other two qualifications. In fact this is a real condition, mostly all lecturers at *Politeknik Negeri Bandung* hold postgraduate degrees at present.

Tabel 3. Respondent Final Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	S1	1	1,8	1,8	1,8
	S2	45	80,4	80,4	82,1
	S3	10	17,9	17,9	100,0
	Total	56	100,0	100,0	

4. 2. Researcher's Competency Map at Politeknik Negeri Bandung
Based on the participant's response during the trial, a grade of researcher's competency at Politeknik Negeri   Bandung can be depicted in Table 4.

Table 4.   Grade's of Researcher Competency at Politeknik Negeri Bandung

No.	Competency Unit	Leading	Established	Recognized	No Ideas	N/A
1.	Select a research topic	15%	58%	10%	15%	2%
2.	Conduct Literature Review	11%	52%	34%	3%	
3.	Proposal Writing	16%	57%	25%	2%	
4.	Define appropriate research methodology	10%	53%	32%	5%	
5.	Manage Research Funding	27%	40%	22%	11%	
6.	Research Implementation	40%	37%	19%	4%	
7.	Research Report Writing	25%	50%	22%	3%	
8.	Academic Publication	36%	41%	13%	10%	
9.	Adhering to research ethics	41%	30%	19%	6%	4%

From the Table, in fact not all of the respondents are qualified as a researcher. Some of them have not acquired enough research skills to conduct a quality research. Even the percentage of respondents who has no ideas about the researcher competency in three   unit competency, viz. *Select a Research   Topic* and *Manage Research Funding*,   are >10 %. Moreover, from the proposed researcher competency model, it is also possible to classify researchers into four categories, namely:
- Leading researcher
- Experienced researcher
- Recognized researcher
- Novice researcher.

In order to decide the researcher category, the researcher competency model should be provided with research performance which covers dimensions of : […]
- Knowledge and intellectual abilities
- Personal effectiveness
- Research governance and organization
- Engagement, influence and impact.

5. Closing Remarks
The research is still going on. The next step is to test developed models in other polytechnics. It is expected that the trial is not only conducted in state polytechnics, but it will be more valuable if the developed model can be also adopted by other higher education institutions, both privates or states.

For instance *Politeknik Negeri Makassar (Makassar State Polytecnic), Politeknik Negeri Ambon (Ambon State Polytechnic)*, *Politeknik Negeri Medan (Medan State Polytechnic)* and Pos Indonesia Private Polytechnic.

To complete the model of Researcher's Competency Standard, and the model of Assessment, this research will come up with the model of research capacity building. Meanwhile the conceptual model of research capacity building has been introduced [9].

In order to improve the individual research performance, the Researcher's Competency Standard can't be stand alone. It has also to be accompanied by a change policy in research management, and creating a research environment; for instance provides an incentives for lecturers who has already reach a high quality research standard. Although there is already another researcher competency, such as Vitae [8], but Researcher's Competency Standard resulted in this research is more applicable for self-assessment leads to researcher capacity building.

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