Exploring Academic Patenting in Indonesia (1990-2015)

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Abstract. This study reveals the performance of Indonesian universities and institutes in producing academic patent for the period of 1990 until 2015. The study focused on the top 10 Indonesian universities by research performance index in 2015. Bibliometric data of academic patents from the Indonesian Patent Database were gathered and analyzed. Qualitative and quantitative analysis were deployed to portray the recent condition of academic patenting. Several anomalies were identified at the end of this study. Firstly, correlation study shows that no effect of academic quantity and quality research to patent filling. Secondly, the potential of technological-based institutes is not well developed in producing patents. Lastly, invention count on engineering-related inventions are still behind the medical, veterinary and food ones.

1. Introduction

Indonesia ranks 97 of 141 countries in the Global Innovation Index 2015 report [1]. This yearly report is meant to assess the innovation level among the countries. The report shows that innovation output sub-index of Indonesia is lesser than the innovation input sub-index. It suggests Indonesia to have improvement in public policy for spurring the commercialization of university/research institute outcomes. This suggestion is supported by the achievement for patent application and royalty/fee receipts that is nearly zero.

Earlier model of national innovation was proposed by Etzkowitz [2], on his proposal of triple helix innovation model. The model defines the linkage among university, industry and government in knowledge-based economy. Later, quadruple helix of national innovation ecosystem was introduced in facing the open innovation era [3]. Those studies mention that patent (academic patent and corporate patent) may be used as the media to connect all the parties involved in the national innovation ecosystem.

Study on the impact of patent could be traced back to the findings of Jaffe [4]. He finds that the corporate patents are impacted linearly by the progress of university researches. Other studies were carried to understand the impact of academic patenting activities with respect to the national innovation condition. Evidence from several nations suggest that the spillover effect of the academic patent creation to the national innovation level is present [5–8].

History of intellectual property legal system in Indonesia is relatively very young with only 25 years of application [9]. The earliest regulation governing patent system in Indonesia was issued in 1953 under the Ministry of Law Decree No. J.S. 5/41/4. Even though the Paris Convention for the Protection of Industrial Property had been ratified by the Indonesian government in 1979, the modern
era of Intellectual property system in Indonesia was recorded in 1986. Special task force was assigned to set up a proper patent system in Indonesia. Law no. 6 of 1989 was the first patent law in Indonesia. Lately, to comply with the TRIPS (Trade-Related Aspects of Intellectual Property Rights) agreement, Indonesian government issued Law no.14 and no.15 of 2001 as the revision for the earlier patent and trademark law.

Very limited studies on academic patenting have been conducted in Indonesia. A glimpse of typical patenting process in Indonesian university was conducted by Payumo [10]. Bogor Institute of Technology (IPB), one of the prestigious Indonesian university, was selected as the object to be described. The report mentions that the patenting process at IPB is managed by an internal IPR and Research Publication Office, similar to other Indonesian universities. Another study find that ITB as one of the prestigious technological university in Indonesia faces difficulty in exploited its patents [11]. Unlike Indonesia, several numbers of research have been conducting to study the academic patenting at overseas countries [12–22]. A comprehensive study on top universities worldwide in the perspectives of academic patenting was published in 2015 [17]. The study finds that the research publication quantity is positively related to the patent application number. However, no clear consistency in support saying that the quality of academic research is in line with the patent application number. Additionally, the influential researches for patent application are chemistry, electrical engineering, mechanical engineering and instruments.

Generous numbers of academic patenting study have been conducted. Despite all these research findings, there is still gap in academic patenting research for the case of Indonesia. Therefore, this study is meant to reveal the recent condition of Indonesian academic patenting, focusing on the patent filling achievements.

2. Procedures
This descriptive study was started by collecting the academic patents of Indonesian universities/institutes. Academic patents were gathered from the patent database provided by the Directorate General of Intellectual Property Indonesia (http://e-statushki.dgip.go.id/). This office is considered as the patent office for Indonesian jurisdiction. It is controlled by the Ministry of Law and Human Right of The Republic of Indonesia. Data collecting process was started by patent search activity. The official name of each universities was used as the keyword for searching under assignee name. For this study, only top 10 Indonesian Universities 2015 by the research performance index, were taken into the consideration. The list was published by the Ministry of Higher Education, Research and Technology in early 2016. The outcome were limited by the latest filling date of 31 December 2015. As many as 523 patent applications were assigned under those universities/institutes. Qualitative patent analysis was conducted by analyzing the bibliometric information (assignee, patent classifications) of each patents. Correlation analysis was utilized to define the relationship between academic patenting and academic research. Quantity of academic research was collected from the universities publication indexed by Scopus and the quality of those researches were defined as their H-index. Lastly, analysis on the invention types were carried out by collecting the International Patent Classification (IPC) numbers of each filled patents. Any findings would be compared and analyzed to the result of similar studies.
Table 1. Indonesian universities and institutes ranking by research index in 2015 [23]

| Rank | Name of Universities/Institutes                   | Research Performance Index* |
|------|--------------------------------------------------|-----------------------------|
| 1    | Bandung Institute of Technology (ITB)            | 4.0                         |
| 2    | Bogor Institute of Agriculture (IPB)             | 3.1                         |
| 3    | Gajah Mada University (UGM)                      | 3.0                         |
| 4    | Indonesian University (UI)                       | 3.0                         |
| 5    | Hasanuddin University (UNHAS)                    | 2.6                         |
| 6    | Sebelas Maret University (UNS)                   | 2.6                         |
| 7    | Padjadjaran University (UNPAD)                   | 2.5                         |
| 8    | Brawijaya University (UB)                        | 2.5                         |
| 9    | Institute of Technology Sepuluh Nopember (ITS)   | 2.5                         |
| 10   | Diponegoro University (UNDIP)                    | 2.4                         |

*Rated by the Ministry of Higher Education, Research and Technology

3. Results and Discussion

3.1. Analyzing patent filling count

![Figure 1](image1.png)

Figure 1. (A) Total academic patent filling in Indonesia (1990-2015) (B) Breakdown of patent filing for each universities/institutes in Indonesia (1990-2015)

Positive trend on academic patent filling in Indonesia have been detected for the past decades. Total number of academic patent in the past 5 years is 5 times higher than the filling number of its previous decade. The highest filling increment was occurred during the period of 2006-2010 with nearly 400% higher than the previous period. However, the individual achievements were very varied. University of Brawijaya (UB) were able to achieve 92 applications in the period of 2011-2015. Whereas, very unsatisfactory result was shown by Padjadjaran University (UNPAD) with only 1 patent application within the same time frame. The earliest recorded patent application was in 1990 by ITB. Majority of the universities/institutes filled their first patent in the early year 2000. Though ITB is the early adopter, however, for the past 10 years, the performance was overlapped by other universities, namely UB, IPB and UI. Hence, the ranking changes accordingly.
Table 2. Indonesian universities/institutes ranking by number of patent filling (2011-2015) and research performance index (2015).

| Name of Universities/Institutes | Ranking | Research Performance Index | Patent Filling |
|---------------------------------|---------|----------------------------|---------------|
| Bandung Institute of Technology (ITB) | 1       | 7                          |               |
| Bogor Institute of Agriculture (IPB) | 2       | 2                          |               |
| Gajah Mada University (UGM) | 3       | 5                          |               |
| Indonesian University (UI) | 4       | 3                          |               |
| Hasanuddin University (UNHAS) | 5       | 6                          |               |
| Sebelas Maret University (UNS) | 6       | 8                          |               |
| Padjadjaran University (UNPAD) | 7       | 9                          |               |
| Brawijaya University (UB) | 8       | 1                          |               |
| Institute of Technology Sepuluh Nopember (ITS) | 9       | 4                          |               |
| Diponegoro University (UNDIP) | 10      | 10                         |               |

Table 2 exhibits the significant change on the ranking of universities/institutes by research capability after considering the patent filling capability. ITB dropped from the 1<sup>st</sup> position by the research capability index to 7<sup>th</sup> position for the patent filling capability. Further down to the research performance index, there is no clear information on how this index was performed. However, it is believed that the quantity and the quality of the academic research were taken into the consideration.

Table 3. Indonesian Academic Patenting and Academic Research Data (2011-2015)

| Name of Universities/Institutes | Patent filling count | Publication count* | H-index* |
|---------------------------------|----------------------|--------------------|----------|
| Bandung Institute of Technology (ITB) | 17                   | 3486               | 25       |
| Bogor Institute of Agriculture (IPB) | 45                   | 1219               | 22       |
| Gajah Mada University (UGM) | 27                   | 2346               | 28       |
| Indonesian University (UI) | 24                   | 1968               | 26       |
| Hasanuddin University (UNHAS) | 1                    | 572                | 18       |
| Sebelas Maret University (UNS) | 18                   | 535                | 15       |
| Padjadjaran University (UNPAD) | 13                   | 417                | 10       |
| Brawijaya University (UB) | 92                   | 875                | 13       |
| Institute of Technology Sepuluh Nopember (ITS) | 26                   | 1122               | 15       |
| Diponegoro University (UNDIP) | 0                    | 610                | 19       |

*collected and measured by Scopus

Relationship between patenting activities and academic researches is defined. Correlation analysis shows that both quantity (Pearson correlation = 0.17) and quality (Pearson correlation= - 0.156) of the academic research receive insignificant positive impact from the patenting activities. This finding is different from the previous studies. Previously, patenting activities have positive relationship to quantity and quality of academic research[15,16,24]. However, the impact may become negative once the assignee includes corporation [16,24]. By increasing the heterogeneity of the variables academic patenting shows positive effect to the quantity of academic research but not so convincing to the quality [17]. Hence, we identify the 1<sup>st</sup> anomaly of Indonesian academic patenting in this study.
3.2. Analyzing patent filling between universities and technological institutes
Comparing the patent filing achievements of technological institutes to universities shows reversal trend. Institut Teknologi Bandung (ITB) and Institut Teknologi Sepuluh Nopember (ITS) are the technological institute to be analyzed. Figure 2 shows the comparison of the average patent filling between universities and technological institutes. In the first decade of Indonesian patent system, technological institutes (in average) filled more patents. However, in the subsequent periods, universities left the institute by filling more academic patents. In average 21 patents filled by the universities in 2006-2010 and nearly 27 patents in 2011-2015 time frame. This condition is in opposite to our understanding on the competencies of those higher educational institution types.

Patent is about acknowledging inventions by legal protection on any novel process or product [25]. Therefore, the possibility of having invention for patent is higher at the technological institute than the multidisciplinary-university one. Analyzing the prestigious universities in the World, engineering fields lead other body of knowledge in academic patenting activities [17]. However, this condition is proven not applicable in Indonesia, and it becomes our 2nd anomaly.

![Figure 2. Contribution of universities and institutes to the total number of academic patent in Indonesian (1990-2015)](image)

3.3. Analyzing Filled Inventions by Patent Classification System
Knowing that the technological institutes had lesser inventions in the past years, this condition may be supported by knowing the invention classifications of the filled patents. International Patent Classification (IPC) number is meant to classify the invented technologies of filled patent [26]. The system allows more than one invention per patent document. The inventions are clustered into sections and further classified into classes on each sections.
Figure 3. Distribution of inventions by IPC’s section of the Indonesian academic patents (1990-2015).

Inventions that are categorized into human necessities and chemistry, are the major inventions of the Indonesian academic patents. Inventions on agriculture, foodstuff, personal and domestic article, health, life saving and amusement are included into the human necessities section. In total they contribute 47% of the total inventions of the academic patent. Second place belongs to chemistry and metallurgy section with the total of 26% inventions. Engineering-related inventions such as electrical, mechanical and civil engineering are the bottom contributors, with only 3% averagely contribution. Down to the class classification, we find the top 5 classes as shown by below table.

Table 4. Top 5 IPC classes of the Indonesian academic patents (1990-2015).

| No | Class Symbol | Class Title                                                                 |
|----|--------------|-----------------------------------------------------------------------------|
| 1  | A61          | Medical or veterinary science; hygiene                                       |
| 2  | G01          | Measuring; testing                                                          |
| 3  | A01          | Agriculture; forestry; animal husbandry; hunting; trapping; fishing          |
| 4  | C12          | Biochemistry; beer; spirits; wine; vinegar; microbiology; enzymology; mutation or genetic engineering |
| 5  | A23          | Foods or foodstuffs; their treatment, not covered by other classes           |

Referring to the title of each IPC classes, majority of the inventions are related to the medical, natural resources and foods. Having high volume of inventions on those fields may not be a problem to the academic patenting. However, this result indicates that the potential of engineering studies in producing academic patents are not well developed. The leading universities in the world have shown the potential of having engineering expertise in product patents[17]. Extending the engineering-related research to product/process oriented is required to boost the potential of academic patents. Lastly, the 3rd anomaly in the academic patent of Indonesian universities/institute is identified.

4. Conclusions
Study on academic patenting in Indonesia has been conducted. Even though it may be considered as our first action in exploring the condition of Indonesian academic patenting, we have identified 3 major anomalies. It was found that the achievement on patent filling of those universities/institutes has insignificant or negative relationship to both quantity and quality of academic research. The potential of technological-based institute is not exploited yet in producing patent becomes the 2nd identified anomaly. As the generator for new technology, technological institutes are still behind the other
multidisciplinary universities in producing patents. Thirdly, the major inventions to be patented are not in the field of engineering, instead, more inventions are in the field of medical, veterinary and food. Technological advancement in medical and veterinary is the highest number of inventions recorded in the Indonesian patent database.

Comprehensive movements by the regulator are required to boost the productivity of patent filling by the universities/institutes. Extending this study to understand the current patent management practice of each universities/institutes is proposed to be conducted. Additionally, study on perception of the university researchers toward academic patenting may support the conception of the improved patent management policy.

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