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Scientific productivity and the collaboration intensity of Indonesian universities and public R&D institutions: Are there dependencies on collaborative R&D with foreign institutions?

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ABSTRACT

Scientific productivity of universities and public R&D institutions in Indonesia is considerably low, but a notable rate of increase has been observed since 2008. This may be associated with the implementation of new regulation to allocate at least 20 percent of national budget for education. Despite favorable government policy and financial incentives to encourage R&D collaboration among Indonesian universities and R&D institutions, there are still some constraints in managing and maintaining the collaboration. A low degree of collaboration among Indonesian researchers from different research organizations, as indicated by the number of co-authored papers, has been observed. On the other hand, Indonesian universities and public R&D institutions showed strong preference for collaboration with foreign institutions. Most articles published in peer-reviewed international journals were results of collaborative research, predominantly with foreign partners. Indonesian researchers at public R&D institutions indicated a higher degree of dependency with their foreign partners than academicians at universities.

1. Introduction

There are two major concerns related to universities and public research and development (R&D) institutions in Indonesia. These are low scientific productivity and constraints in establishing productive R&D collaboration. The concern with establishing productive R&D collaboration extends beyond universities and publicly funded R&D institutions to include triple helix collaboration with business enterprises. be it among these two science and technology developer groups or to form triple helix collaboration with business enterprise and government agency.

Recently, scientific productivity at the individual level (researcher or academician) and at the institutional level (university and public R&D institution) has been alarmingly low with only slight annual increases. The primary reason for this is a very low national budget allocation for the science and technology sector. However, there was a major change in budget allocation since the Fourth Amendment of the Indonesian Constitution was approved in 2002 which obligates government to allocate at least 20 percent of the total national budget for education. Even though this obligation is not directly for supporting R&D activities, it is expected to have a positive influence on university performance in R&D. After ten years, it is an appropriate time to evaluate this government regulation.

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R&D collaboration has also been encouraged at least for last two decades. Some government policies related to this issue have been deployed, including financial incentive for R&D collaborations. Many different forms and sizes of R&D collaboration were established in response to these public policies. However, scientific productivity of public R&D and higher education institutions has not increased as expected.

This paper will focus on two issues: scientific productivity and R&D collaboration. One available indicator for evaluating these two issues is scientific publications as a proxy for productivity. This indicator can be further used as raw data to scrutinize co-authorship between Indonesian researchers with partners from domestic or foreign institutions. Co-authorship is used as proxy for R&D collaboration. Problems associated with these proxies [6,17,20] are recognized.

2. Scientific productivity

Scientific productivity is measured based on outputs of scientific activity. In the broader perspective, the outputs include published scientific articles and other texts, prototypes and other physical artifacts, theories and content, and a better quality of human resources and institutions. Measuring all of these outputs requires extraordinary efforts and not all of the outputs are quantifiable. In many cases they are not available or the information is not accessible. Therefore, in many studies with the scientometrics approach, the number of articles published in peer-reviewed journal is used as proxy to scientific productivity.

Many factors could affect scientific productivity for individual researchers or research organizations. Defazio et al. [8] found the impact of funding on productivity was generally positive. However, the effect might take several years before it was detectable as shown in case of funding for European Union research collaboration program. Daraio and Moed [7] studied the effect of declining research funding during period 1980–2009 in Italy and found that despite the fact that the level of funding has been dramatically low during the past three decades, Italian science has been able to maintain its performance up to 2007. However, a recent reduction in the level of scientific production, the lagging behind in international scientific collaboration and the great heterogeneity of researchers' productivity may mark the start of a decline of Italian science.

Works of Daraio and Moed [7] and Defazio et al. [8] clearly indicated that the effect of increasing or decreasing funding for R&D activities was not instantly revealed. This delay is due to the fact that some researches require several years before publishable findings can be achieved.

Scientific productivity could also be affected by non-financial factors. Pezzoni et al. [23] related individual R&D career progress with scientific productivity and indicated that they were associated with affiliation to important public research organizations, social ties with senior members, and commitment to work with senior colleagues. Jacob and Lefgren [16] also found that recipients of US National Institute of Health (NIH) postdoctoral fellowship produced about one additional publication over the next five years, which reflects a 20% increase in research productivity.

The phenomenon of entrepreneurial universities over the last decades has received [28] attention. They stated that an entrepreneurial orientation by academia might put regions and nations in an advantageous position in emerging knowledge-intensive fields of economic activity. At the same time, such entrepreneurial orientation required reconciliation with the scientific missions of academia. They also revealed that scientific productivity is positively associated with entrepreneurial effectiveness.

At the macro level, Horta and Veloso [15] conducted a comprehensive comparative analysis of the evolution of the EU15 and US scientific output and impact throughout the 1990s, looking at publications and impact trends by scientific field. Their results showed that changes in scientific production for the two blocks were driven by particular scientific fields which grew or declined at a fast rate during the decade. Throughout this period, the EU15 had eight fields of science, corresponding to 13% of the total papers published, growing at a rate faster than 10% in relation to the world average, while the US had only four fast growing fields, representing 6% of its total output. The situation was exactly reversed for the decline, with the US having more than doubled the number of scientific fields when compared to the EU15 declining at a rate faster than 10%. Despite this recent trend, the US maintains leadership in impact across all scientific fields.

Based on results of all studies cited earlier, there is evidence to support arguments that: (1) scientific productivity is directly influenced by the magnitude of funding available for research and scientific activities, however, there is a time lag for several years after increase or decrease of research funding initiated; (2) individual scientific productivity is also influenced by non-financial factors such as institutional and social (patronage) factors; (3) it is possible to manage a balance between scientific productivity and entrepreneurial effectiveness or in other words, between efforts to achieve academic excellence and to increase direct contribution for economic development; and (4) a scientifically productive institution or country may not necessarily have dominant impact across all or of any specific scientific field, since impact is associated more with quality and relevancy rather than the quantity of scientific outputs produced.

3. Diverse definition of collaboration and use of co-authorship as its proxy

R&D collaboration has been encouraged at all levels, i.e. individual, laboratory or expert group, institution, and country. They are also encouraged between R&D institutions, industries, and government agencies. This three-party collaboration is known as the Triple Helix [9]. At an individual level, Melin [20] indicated that the main benefits generated from R&D collaboration were increased knowledge, higher scientific quality, contacts and connections for future work, and the generation of new ideas.

Collaboration involving R&D institutions have many different formats and sizes, bi-lateral or multi-lateral,