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INTERPRETIVE STRUCTURAL MODEL TO ENHANCE RESEARCH PRODUCTIVITY IN INDONESIA BASED ON THE SCIENCE AND TECHNOLOGY INDEX

IDA HAMIDAH*, ASEP BAYU DANI NANDIYANTO, AMIR MACHMUD, DADANG SUNENDAR, NISA AULIA SAPUTRA, IRFAN ALFARIDZI RAMADHAN

Universitas Pendidikan Indonesia, Bandung, Indonesia
*Corresponding author: idahamidah@upi.edu

Abstract

The aim of this study is to enhance lecturers' research productivity and improve the quality and quantity of research outputs, thereby advancing teaching effectiveness, addressing societal challenges, and boosting Universitas Pendidikan Indonesia's higher education performance, particularly in scientific publications. The method used in this research is an interpretive method with a design thinking model and an inductive approach, which starts with data and attempts to obtain a theory about an interesting phenomenon from the observed data. Data was collected based on the performance of the Universitas Pendidikan Indonesia on the Science and Technology Index (SINTA) from March 2023 to May 2024. The data was then processed using the Structural Equation Modelling (SEM) method. The results show that all five exogenous variables have positive t statistical results, and their influence can be seen from the regression coefficient where the variables of publication, intellectual property, number of titles and research funds, institutional support, and human resource support have a positive and significant effect on research productivity at the Universitas Pendidikan Indonesia. Furthermore, based on modelling as a result of SEM analysis, the publication determinant coefficient makes the most significant contribution to research productivity with a value of 0.632, followed by institutional support (0.172), amount and research funding (0.127), intellectual property (0.106), and human resource support (0.036). Thus, institutions must support increasing lecturers' scientific publications, supported by various policies.

Keywords: Design thinking models, Interpretive, Research productivity, Structural models, Structural equation modelling.

1. Introduction

One of the indicators that a university has a good performance in the field of research is its position in the Science and Technology Index (SINTA; https://sinta.kemdikbud.go.id/) owned by the Ministry of Education, Culture, Research, and Technology. SINTA provides benchmarks and analysis, identifies the research strength of each institution to develop collaborative partnerships, and analyses the trends of research and expert directories (see Table 1) [1, 2].

There are several different viewpoints regarding university research productivity. Some authors focus on the quantitative aspect, i.e., research productivity is defined as the number of publications or patents, and others [3]. Others emphasize the importance of research quality, i.e., how research results change industry and society and the quality of the journal in which the publication is published [4]. Some of the driving factors that can allow an increase in research productivity include the following: (i) co-authorship in writing research proposals and publications can strengthen the researcher's desire to continue working [5]; (ii) number of doctoral students due to its higher obligations than bachelor and master students, the number of doctoral students positively correlates with research productivity [6]; (iii) promotions and tenure have increased student research productivity [7]; (iv) institutional support, including supportive policies and programs, has been shown to improve university performance [8]; (v) demographic factors, such as women and male researchers, correlate with research productivity [9]; (vi) mentoring is a type of personal relationship in which a more experienced individual (mentor) will act as a guide, role model, and teacher for less experienced individuals (mentee) and will also provide the necessary support in pursuing the desired profession. Collaboration between mentors and mentees has been proven to increase the number of mentee publications [10]; and (vii) research competencies are demonstrable skills and characteristics that enable researchers to conduct research successfully. These skills involve proficiency in advanced IT analysis and mastery, working in an interdisciplinary environment, building research networks, developing language skills, learning management skills, and strengthening awareness of the relevance of research and its impact on the environment (society, country, institution, etc.) [11]; (viii) research funding observe the strong effects on publication output of receiving research grants. Research funding facilitates publication output and drives dissemination through higher citation and citation metrics, mainly considered a measure of research impact [12, 13]; and (ix) reward system/incentives from research institutions seek to improve by implementing a positively enforced reward system [14].

Table 1. Performance Indicators based on SINTA with metric cluster.

Code	Description	Value	Code	Description	Value
	Publication	583		Intellectual property Rights	160
A1	Scopus article Q1	40	HKI1	Patent	40
A2	Scopus article Q2	35	HKI2	Simple patent	20
A3	Scopus article Q3	35	IPR3	Brand	5
A4	Scopus article Q4	30	HKI4	Geographical Indications	10

Table 1 (continue). Performance Indicators based on SINTA with metric cluster.

Code	Description	Value	Code	Description	Value
A5	Scopus article Non-Q	20	HKI5	Industrial Design	20
A6	Scopus non-article	20	HKI6	Integrated Circuit Layout Design	20
A7	Scopus Citation	1	HKI7	IPR for Plant Variety Protection	40
A8	Cited Scopus document	1	HKI8	Trade Secrets	0
W1	WoS document core Q1	40	HKI9	Intellectual Property Rights	5
W2	WoS document core Q2	35		Institutional	300
W3	WoS document core Q3	35	APS1	Number of study programs accredited A/Excellent/International	40
W4	WoS document core Q4	30	APS2	Number of study programs accredited B/Very Good	30
W5	WoS document core Non-Q	20	APS3	Number of study programs accredited by C/Good	20
W6	WoS document non-core	20	APS4	Number of study programs Non-accredited	0
W7	Cited WoS document	1	J1	Number of journals accredited S1	60
G1	Garuda document S1	25	J2	Number of journals accredited S2	50
G2	Garuda document S2	25	Q3	Number of journals accredited S3	40
G3	Garuda document S3	20	J4	Number of journals accredited S4	30
G4	Garuda document S4	20	J5	Number of journals accredited S5	20
G5	Garuda document S5	15	J6	Number of journals accredited S6	10
G6	Garuda document S6	15		Research	150.05
G7	Non-cited Garuda document	10	R1	Number of overseas research grants	60
G8	Garuda proceeding	10	R2	Number of external research grants	50
G9	Garuda citation per paper	0.5	R3	Number of internal research grants	40
G10	Garuda citation per lecturer	0.5	R4	Number of research funding (Rp.)	0.05

Table 1 (continue). Performance Indicators based on SINTA with metric cluster.

Code	Description	Value	Code	Description	Value
G11	Cited Garuda document	0.5		Human resources	10
GS1	Google Scholar document	0.5	DOS1	Lecturer Professor	4
GS2	GS citation per paper	0.1	DOS1	Head lector lecturer	3
GS3	GS citation per lecturer	0.1	DOS1	Lecturer Lector	2
GS4	Cited GS document	0.1	DOS1	Expert Assistant Lecturer	1
B1	Teaching book	20	DOS1	Non-Japanese Lecturer	0
B2	Reference book	40		Revenue generating	0.05
B3	Monograph	20	RG1	Revenue generated from IPR	0.05

2. Method

The method used an interpretive method with a model design thinking and an inductive approach, starting with data to derive theories based on UPI performance in SINTA (https://sinta.kemdikbud.go.id/affiliations/profile/414), for 7 months (March-July 2023 and April-May 2024), processed using Structural Equation Modelling (SEM), where complex data was decomposed into several factors and make comparisons and calculations between those factors [15-17] compared to Scopus and Google Scholar, and detailed information for getting this data is explained elsewhere [18-21].

3. Results and Discussion

Figure 1 shows the productivity performance of 20 universities in Indonesia based on SINTA on 31 May 2024, at 11.15 AM Jakarta time. There has been a shift in rankings in several universities. We look at the order of 1-5 on research productivity, overall score, and 3-year score. For the overall SINTA score, the ranking order of 1-5 is UGM, UI, IPB, ITB, and UNAIR, while the ranking order of 1-5 for the SINTA 3yr score is UGM, UNAIR, IPB, UI, and UNPAD. The shift in ranking in the overall SINTA score and 3 years shows that each university is racing to improve its performance.

For the overall SINTA score, UPI is ranked 15th, while for the SINTA 3yr score, UPI is ranked 17th. Compared to the SINTA score obtained by UGM, the UPI score is only 1/4 of UGM. This means that the improvement in UPI's performance in 3 years (2021-2023) is slower than the performance of other universities. More serious efforts need to be made to improve SINTA performance, as the government plans to provide greater incentives to universities that obtain the highest SINTA scores. UPI conducted an analysis of research productivity achieved based on SINTA. Figure 2 shows the increase in UPI research productivity during March, May, June, and July 2023, as well as May 2024. Figure 2 shows that the overall

UPI research productivity has increased from month to month, both for the overall and 3-year scores.

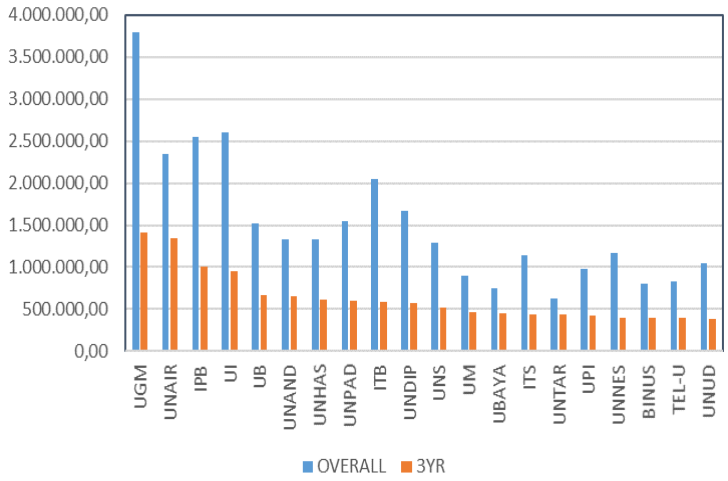

Fig. 1. Research productivity of 20 higher education in Indonesia.

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Next, the increase in UPI research productivity for each indicator was displayed. The interpretive structural model of research productivity conducted in 2023 is directed by analyzing SINTA scores in 20 universities in Indonesia from March to July 2023. This data is then processed using the Structural Equation Model (SEM). The research objectives outlined, namely that the interpretive structural model will be built (Fig. 3). Figure 3 shows an interpretive (provisional) structural model based on the results of SINTA score analysis in 20 universities in Indonesia. The description of each x variable is presented in the appendix. Figure 3 shows that five indicators significantly influence productivity: publications, intellectual wealth, institutional support, research amount and funding, and human resource support. When viewed from the determinant coefficient, the number and quality of publications contributed the most to research productivity with a value of 0.632, followed by institutional support (0.172), the number and funding of research (0.127), intellectual property (0.106), and human resource support (0.036).

Associated with the theory that Co-authorship influences research productivity [5], number of doctoral students (HR) [6], *promotion and tenure* [7],

institutional/institutional support [8], individual/demographic factors [9], *mentoring* [10], skills and competencies [11], research funding [12], and incentive system [13], several factors are involved, namely human resource support, institutional support, and research funding. These three factors strongly contribute to increased productivity of increased research. Other factors need to be explored so that the institution can strengthen research performance by optimizing its various supporting factors [22].

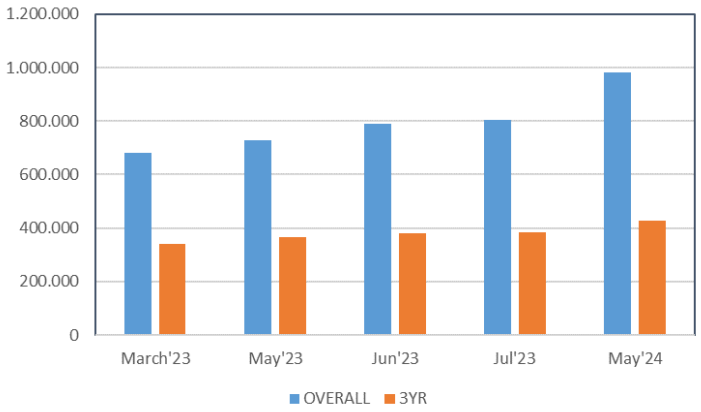

Fig. 2. UPI research productivity based on SINTA.

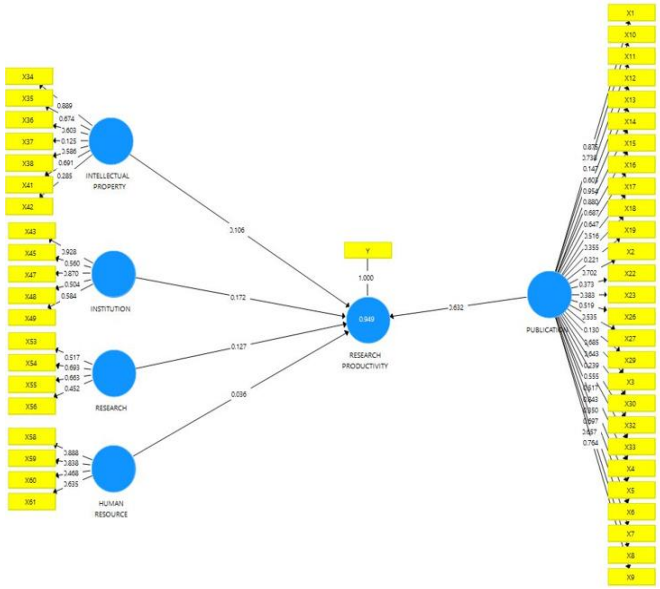

Fig. 3. Structural interpretive model of research productivity.

4. Conclusion

The conclusions of this study based on the results of data analysis are: (i) UPI's research productivity based on SINTA scores is ranked 16th out of all universities

in Indonesia. The increase in UPI research productivity is slower than that of other universities, so UPI's ranking may decrease; and (ii) an interpretive structural model for increasing research productivity has been successfully built based on the performance of SINTA 50 universities in Indonesia. The main indicators are publications, institutional support, research amount and funding, intellectual property, and human resource support.

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