Article

Impact of Governance Factors over Lecturers' Scientific Research Output: An Empirical Evidence

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Abstract: This study aims to determine the governance factors that influence the scientific research output of lecturers through the application of PLS-SEM, in conjunction with ANOVA and *t*-test. Based on a survey of 398 lecturers in twelve higher education institutions (HEIs) in Vietnam, the psychometric properties of the scales measuring the considered dimensions of scientific research outputs were initially examined through the Exploratory Factor Analysis (EFA) procedure, prior to being input into the PLS-SEM model. The SEM model comprised six constructs for the scientific research outputs: scientific research objectives of HEIs, leadership, decentralization, policies for lecturers, support for scientific research activities, and resources for scientific research. The results reveal that resources for scientific research have the most impact on lecturers' scientific research output, followed by policies for lecturers, support for scientific research activities, scientific research objectives of HEIs, and finally, leadership.

Keywords: lecturer; scientific research; governance; management; higher education institutions

1. Introduction

Scientific research achievement is among the key criteria used to evaluate performance and university rankings on a global scale [1]. The future of universities is related to lecturers' achievements and progress in scientific activity [2]. Scientific work is among the most important activities of the faculty of any higher education institution [3]. Lecturers' scientific research output has received increasing attention from many countries, because many governments, including those in developing countries, have found that this is crucial in today's knowledge-based economy [4].

Due to the high importance placed on scientific research activities, several scholars have investigated the factors affecting lecturers' scientific research results [5–11]. Some studies considered this issue in the context of Vietnam [12–16]. However, studies focusing on governance factors that affect scientific research outputs of university lecturers are lacking. To date, the majority of studies in the literature have approached institutional factors [17–19] and individual factors [7,10], or a mix of both [7,9,11,20]. The main research methods applied are regression analysis [1,7,21], analysis of variance (ANOVA) [22,23], structural equation modeling (SEM) [10,19], analytic hierarchy process (AHP) [14,18], interviews [15,16], and Delphi [13]. Therefore, the impact of governance factors (not institutional factors or individual factors) on the scientific research results of lecturers remains under-investigated.

SEM, one of the most commonly applied techniques to analyze cause-and-effect relationship models, has also been widely applied in the context of economics and management studies [10]. There are two popular approaches to estimate linear structural models: Covariance-based (CB-SEM) and Partial least squares (PLS) SEM. In contrast to CB-SEM, PLS-SEM is commonly used to develop theories in exploratory research by focusing on explaining the variance in the dependent variables [24]. Meanwhile, according to [25], there is no theoretical basis to date that can be explicitly used to explain the cause-and-effect relationship, nor is there any common theoretical framework in previous studies on the factors influencing the research output of lecturers. Some studies have applied CB-SEM [10,19], but have not considered PLS-SEM.

This study aims to determine the impact of governance factors on the scientific research output of lecturers. In order to meet the research goals, the PLS-SEM method was used. Furthermore, the ANOVA and *t*-test approaches were also applied to investigate the differences in the scientific research output among lecturer groups stratified by demographics.

2. Literature Review

2.1. Governance Factors

To date, several studies have been conducted on the factors that impact the research output of the faculties within a higher education institution. Some studies focused on collaboration and networking factors. For instance, Ref. [5] showed that organizational factors such as job satisfaction and international collaboration had a positive effect on scientific research productivity among academic staff. The works by [26,27] concluded that the key factors that contribute to the success of publishing research in highly ranked American journals were collaboration with established overseas scholars, English language, and research ideas. The study by [14] demonstrated that the most important factors influencing faculties' research performance were collaboration with domestic and international peers, and receiving support from research assistants and supervisors. The study by [13] revealed that "networking-related factors" were a key determinant in the success of international publishing. However, these studies have not yet distinguished the collaboration factors from governance policies by higher education institutions (HEIs), or lecturers themselves.

Some studies examined the impact of university policies, work environment, and resource-related factors. For instance, Ref. [5] investigated IT funding and university policies; and [13] concluded that policy-related factors have a positive impact on scientific research productivity. The study by [7] examined institutional characteristics, including the number of undergraduate students enrolled, percentage of Ph.D. students enrolled, and funding allocated for research function, and revealed that they are significantly associated with faculty research productivity. The work by [12] revealed that work environment affected the adjusted research productivity of social scientists. However, these studies provide limited understanding on the specific policies (e.g., policies for lecturers) and resources, as well as the specific factors of work environment, that HEIs create to support research activities by lecturers.

Other studies investigated individual factors, particularly motivation factors. For instance, Ref. [7] showed that the research productivity of faculty varied by gender, institution, terminal degree, rank, discipline, and work experience. Notably, Ref. [11] examined the relationship between research productivity and the intrinsic and extrinsic motivators associated with conducting research. According to this study, there was a significant difference in research productivity between faculties associated with doctoral vs. non-doctoral degree granting programs. Receiving or having tenure was the most important reward, while securing a possible administrative position was the least important. There was a significant difference in the importance of these rewards between tenured-untenured and between male-female faculty members. A strong link was found between research productivity and the attainment of a tenure position and of a promotion, but the link between publications and salary increase was not strong. However, Ref. [7,11] have

several prominent limitations. It is difficult to draw a distinction between these two types of motivation. One factor that may be an extrinsic source of motivation for one person, can be considered an intrinsic source of motivation by another. Besides, Ref. [7,11] have not shown whether motivation originates from the governance policies of HEIs to enhance research achievement.

Some authors proposed a set of characteristics for a productive research organization. The work by [9] indicated that creative accomplishments are associated with small group size, organizational contexts with sufficient access to a complementary variety of technical skills, stable research sponsorship, timely access to extramural skills and resources, and facilitating leadership. However, these factors are features for organizations with great creative achievements in general, not necessarily every university where lecturers work. Ref. [20] recommended a synthetic model of individual, institutional, and leadership characteristics predicting individual and department research productivity, based on the combined results from multiple regressions. However, this model was examined at the individual and departmental level (i.e., not the university level), and combined governance factors with several individual or environmental factors.

To date, three approaches were applied to investigate the influential factors on the research performance of lecturers, namely, individual, institutional, and a mix of both. According to [28], institutional factors play an important role in developing a research culture to promote greater interaction and transfer of knowledge to society. Some factors that are related to university governance have been found in prior studies that considered institutional factors. However, it seems that there has been very little discussion about the impact of governance factors in particular (i.e., not institutional factors, in general). Therefore, it is worthwhile to empirically investigate the governance factors that influence the research output of lecturers, as well as the level of impact of those factors.

In Vietnam, only a few studies have attempted to address the factors associated with the research output of lecturers. The studies of [12–16] have been undertaken to investigate the factors influencing internationally-indexed publishing. Among these studies, Ref. [12] is one of the most notable, indicating that collaboration with international researchers resulted in higher productivity among social scholars in Vietnam. However, these studies were conducted with secondary data, and did not examine the governance factors as perceived by researchers in HEIs. The studies by [13–15] overcame the limitations of [12] by utilizing in-depth interviews, Delphi, and AHP respectively, however they only focused on internationally-indexed publishing by all types of academic organizations and academics staff, and not by HEIs and lecturers in particular.

It should also be noted that according to the literature review, the most commonly employed research methods for this topic were regression analysis, CB-SEM, ANOVA variance analysis, Delphi, interviews, case analyses, descriptive statistics, and AHP, whilst the PLS-SEM method has not been adopted. The methods of some prominent previous studies are listed in Table 1.

Table 1. Research methods on governance factors affecting scientific research output of lecturers.

Author	Methods
[29]	CB-SEM (LISREL)
[10]	CB-SEM
[19]	Delphi, CB-SEM
[11]	Regression
[20]	Regression, *t*-test
[1]	Regression
[22]	Regression, ANOVA
[21]	Regression
[30]	Regression, EFA
[31]	Regression

Table 1. *Cont.*

Author	Methods
[32]	Regression, *t*-test
[7]	Regression, ANOVA
[33]	Regression, Bootstrap
[34]	Regression
[12]	Ordinary least squares, secondary data
[14]	AHP
[18]	AHP, ANOVA, and *t*-test
[23]	ANOVA, semi-structured interviews
[35]	*t*-test
[36]	Mann–Whitney U test
[37]	Mann–Whitney U test
[13]	Delphi
[15]	Semi-formal, in-depth interviews
[16]	In-depth interview
[35]	In-depth interviews
[17]	Descriptive statistics, interviews
[9]	Design and analysis of typical situations
[38]	Document analysis, model recommendations

2.2. Scientific Research Outputs

Regarding the evaluation and measurement of scientific research output, Ref. [39] indicated that research evaluation studies employ various instruments and indicators, depending on the particular aims of the study.

In terms of the quantity-based approach, researchers generally agree that scientific research output is measured by the total number of publications by the institution. According to [4], research output relates to creative ideas that, after being studied, are published in magazines, newspapers, patent applications, or academic journals. In addition, some researchers pointed out other indicators such as the amount of research funding [8], membership in a scientific association [40], and the financial budget allocated to research [4].

In terms of quality and the influence-based approach, Ref. [41] emphasized that scientific output must be presented by internationally-indexed publishing. The authors of [42] utilized H index to measure the research performance of scientists. The works by [7,43] argued that H index is a reliable indicator that is recognized worldwide to evaluate the scientific research performance of scientists.

The work by [38] defined the holistic approach in quantity, quality and influence. Table 2 shows a framework that identifies research output measurements and is recommended by [38].

So far, there has been a controversy on the influence-based approach. The authors of [44] mentioned that not all publications are indexed in research databases for citation, and it is difficult to assess the true value of a publication by H index. There are differences between industries and fields; the number of years of publication (first published is more likely to be cited) and the age of scientists significantly affects the citation index. Therefore, the H index, in some cases, is not accurate and fair when comparing the research productivity of scientists and organizations. According to [25], the approach based on the number of publications has been more widely used than that based on the qualitative measures to evaluate the research productivity of academics at most universities around the world. Hence, in this study, the quantity-based approach was adopted.

Table 2. Indicators of measuring scientific research output.

No.	Indicators
1	Number of articles published in refereed or professional journals
2	The impact factor of the journals
3	Number of published books
4	Number of edited books
5	Number of published chapters in refereed books
6	Number of edited chapters in refereed books
7	Number of citations
8	Citations as a measure of impact
9	Patent registration
10	Received research grant
11	Participated in research projects
12	Number of honors and awards
13	Number of papers presented in meetings or conference
14	Number of invitations to present papers
15	Number of supervised dissertations
16	Supervised one or more honors/master students
17	Supervised one or more Ph.D. students
18	Served as an editor of an academic journal
19	Positions held in a professional association
20	Maintained professional contact with colleagues overseas

2.3. Hypotheses

Among the institutional and individual factors in prior studies there are some typical governance factors to be found, including the scientific research objectives of HEIs, leadership, policies for lecturers, support for scientific research activities, and resources for scientific research. Besides these, some studies also mentioned "decentralization" or related content among the institutional factors.

Regarding the scientific research objectives of HEIs, Ref. [6,38] showed that having a research agenda defined as the combination of strategic problem-solving frameworks to achieve research goals is the best technique to enhance research productivity and easily monitor the measurement of academic progress. Other studies also argued that in order to achieve worthy scientific research achievements a university's scientific research objectives need to be clear, feasible, and widely shared [22]. The university's statement of its core mission has a strong effect on its research output [43]. The findings above were developed and supported by [20], who suggested that universities should set clear, visible, shared goals to enhance their overall research performance. Therefore, the first hypothesis was proposed:

Hypothesis 1 (H1). *There is a positive relationship between the scientific research objectives of HEIs and the scientific research output of lecturers.*

To the best of our knowledge, decentralization has not been considered a scale in any quantitative research model. However, some studies have found a positive correlation between decentralized organizations, the autonomy of HEIs, lecturers, and lecturers' scientific research output. The work by [20] showed that an effective research apparatus feature is the "assertive-participative management" mechanism characterized by management decisions with wide participation by stakeholders. The work by [38] also mentioned that this mechanism, which is characterized by decentralization and empowerment, has a positive impact on scientific research output. In addition, Ref. [20,22,30] showed that the autonomy of the organization and lecturers is among the most contributing factors to scientific research achievements. Therefore, this research generalizes and supplements this new scale in the proposed model. Hence, the second hypothesis was proposed:

Hypothesis 2 (H2). *There is a positive relationship between decentralization and the scientific research output of lecturers.*

Concerning leadership, Ref. [30] defined that the leadership factor group has the greatest positive impact on scientific research output among several factors. The authors of [9] argued that both organizational (i.e., university) leaders and group leaders are important to the effectiveness of creation. The work by [18] also demonstrated that the support of leaders for scientific research contributes to improving scientific research output by creating a departmental research atmosphere. Notably, Ref. [20] investigated the leadership characteristics of productive research organizations, namely, that they are highly-regarded, have able scholars, are research-oriented, emphasize an assertive-participative style, fill critical roles in areas such as management and fundraising, and keep goals visible. Basing on these findings, the third hypothesis was proposed:

Hypothesis 3 (H3). *There is a positive relationship between leadership and the scientific research output of lecturers.*

Concerning support for scientific research activities, several authors emphasized the role of creating collaborative opportunities and environments for academic staff. The studies by [13,14,28,45] identified that collaboration was a key determinant of international publishing. Therefore, it was recommended that HEIs should establish research groups and collaboration with international and domestic peers to enhance their research productivity. The work by [29] and [35] showed that the university's explicit support of scientific research activities has a positive effect on lecturers' scientific research results. The authors of [19] found that ongoing supportive activities create a culture that values research, thereby influencing the conscientiousness and scientific research results of scientists. Therefore, the fourth hypothesis was proposed:

Hypothesis 4 (H4). *There is a positive relationship between support for scientific research activities and the scientific research output of lecturers.*

In relation to policies for lecturers, Ref. [13,16] argued that time available for research purposes was a key factor for international scientific publishing. The work by [16] showed that university policies and job satisfaction had a positive effect on scientific research productivity among academic staff. The study by [11] revealed a positive relationship between research productivity and having tenure, rewards, promotion, and salary. The study by [35] revealed that the policy of recruiting lecturers and signing contracts based on lecturers' scientific research capacity can enhance their overall research performance. Similarly, income policy was considered by [17] and [23], while promotion policy was considered by [37] and [38]. Notably, Ref. [20] reported several characteristics of productive research organizations. The first is recruitment and selection, whereby significant effort is expended to recruit and hire members who have the training, goals, commitment, and socialization that match the institution. The second characteristic is rewarding, whereby research is rewarded equitably and in accordance with predefined benchmarks of achievement. Hence, the fifth hypothesis was proposed:

Hypothesis 5 (H5). *There is a positive relationship between policies for lecturers and the scientific research output of lecturers.*

With reference to resources for scientific research, Ref. [38] presented resources-related factors, including technology and equipment, libraries, and research funding. The work by [13] revealed that accessibility of international scientific documents, experimental devices or tools, software used for research purposes, and accessibility of research funding sources are the determinants in the performance of international publishing in Vietnam. The study by [18] demonstrated that research funding is considered to be the most important

factor for research results, followed by human resources, journal and library resources, and facilities. Similarly, several other studies concluded that one of the institutional factors for improving scientific research output is financial support [5,7,20]. For this reason, the final hypothesis was proposed:

Hypothesis 6 (H6). *There is a positive relationship between resources for scientific research and the scientific research output of lecturers.*

According to the literature review and hypotheses proposed, a research model was developed with the following factors: scientific research objectives of HEIs, leadership, decentralization, policies for lecturers, support for scientific research activities, and resources for scientific research. Additionally, to determine the difference between population groups in research output, the research model included the following factors (i.e., control variables): gender, age, degree and academic title, experience, position (managers or non-managerial lecturers), place of graduation (abroad or domestically), and scientific area. Figure 1 depicts the proposed research model.
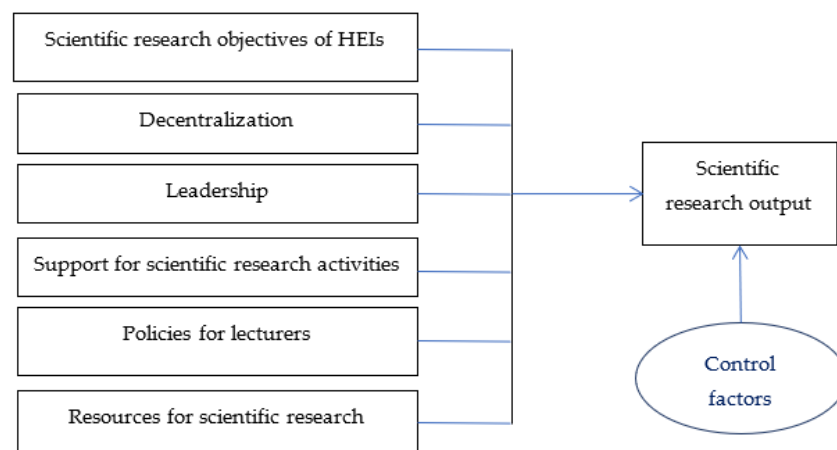
Figure 1. Proposed research model.

3. Methods

3.1. Research Design

A questionnaire was constructed based on the literature review and was adjusted based on the interview results with five experts. The final questionnaire consisted of 49 items, not including the participants' demographics section, which included 41 statements of governance factors and eight items of lecturers' research output. Participants were requested to rate a 5-point Likert scale, whereby 1 = totally disagree, 2 = somewhat disagree, 3 = neither agree nor disagree (neutral), 4 = somewhat agree, and 5 = totally agree.

The data were collected from April to September 2020. Firstly, a pilot study including 82 observations was implemented before distributing the online survey (via Microsoft Forms) and the offline survey. Next, the questionnaire was revised based on the Cronbach's Alpha value from the initial pilot test. In the formal survey stage, a non-probability sampling method was implemented, and a total of 413 responses were collected from 12 HEIs in the North of Vietnam. The 15 bias observations were eliminated. Finally, there were 398 observations valid for further analysis, of which 313 observations (78.6%) were from the online survey via Microsoft Forms (in the period of social distancing due to the COVID-19 epidemic in Hanoi, in April 2020), while 85 observations (21,4%) were from the offline survey (after the period of social distancing; from May to September 2020). Table 3 shows the descriptive statistics of the participants' demographics.

Table 3. Descriptive statistics of participants' demographics.

Variables	N	%
Gender		
Male	169	42.5%
Female	229	57.5%
Age		
22–30	50	12.6%
31–40	194	48.7%
41–50	121	30.4%
>50	33	8.3%
Academic title, degree		
Professor	4	1.0%
Associate Professor	59	14.8%
Doctor	210	52.8%
Master	125	31.4%
Abroad graduation or not		
Abroad graduation	190	47.7%
Domestic graduation	208	52.3%
Experience as a lecturer		
<1 year	30	7.5%
1–3 years	42	10.6%
>3–6 years	46	11.6%
>6 years	280	70.4%
Scientific research area		
Natural Sciences	179	45.0%
Social Sciences	219	55.0%
Position		
Manager	146	36.7%
Non-managerial employee	252	63.3%

According to Table 3, the ratio of males to females is 42.5% and 57.5% respectively. In terms of age, the majority of lecturers (48.7%) fall into the 31–40 age group, 30.4% fall into the 41–50 group, 12.6% fall into the 22–30 group, and only 8.3% of the lecturers are over 50 years old. Qualification in the survey sample is high; up to 52.8%, 31.4%, 14.8%, and 1% of lecturers have the academic title of Doctor, Master's degree-holder, Associate Professor, and Professor, respectively. The number of lecturers who have more than six years of working experience accounts for quite a high proportion (70.4%), while 11.6% and 10.6% of lecturers have 3–6 and 1–3 years of working experience respectively. Only 7.5% of the lecturers have less than one year of experience. Regarding scientific research areas, social science takes the highest proportion at 55%, while natural science accounts for 45%. The ratio of abroad to domestic graduation is similar, with 47.7% and 52.3% respectively. The number of lecturers without managerial positions accounts for a higher percentage than those with managerial positions, with 63.3% and 36.7% respectively.

3.2. Data Analysis Techniques

Firstly, the *t*-test and ANOVA approaches were adopted to determine the differences in scientific research output between lecturer groups, according to their demographic characteristics. Next, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to achieve the research objectives. This approach has several advantages. PLS-SEM was recommended in the initial period of theory development to access and verify the exploratory research models [46]. It also has several benefits for cause-and-effect analysis in behavior studies [47]. PLS-SEM has been the best alternative to CB-SEM in cases wherein there is little background theory available [30,48] even though PLS-SEM is not as effective as CB-SEM in model fit evaluation. Furthermore, there have not been any common

theoretical frameworks in previous studies on the factors influencing the research output of lecturers [25]. In addition, a new scale (i.e., decentralization) was added to the research model proposed in this study. For these reasons, it is appropriate to utilize PLS-SEM.

PLS-SEM is based on two main steps, namely, measurement model assessment and structural model assessment [46]. Within this study, the SmartPLS 3.3.3 application of PLS-SEM was used to assess the measurement model, the convergent, discriminant validity, and composite reliability. Finally, the bootstrapping technique analyzed the t-statistics for the path coefficients to assess the importance of the hypothesized connections.

The factors were coded as follows: OBJ = scientific research objectives of HEIs, DEC = decentralization, LEA = leadership, POL = policies for lecturers, SUP = support for scientific research activities, RES = resources for scientific research, and OUT = research outputs (Appendix A).

4. Results

4.1. t-*test and ANOVA*

Table 4 presents a summary of *t*-test and ANOVA results to demonstrate the difference between participants' research output among demographic variables.

Table 4. Summary of and *t*-test and ANOVA results.

Lecturer Group	Sig. of Levene's Test	Sig. of *t*-test/Welch/F Test		N	Mean
Gender	0.477	Sig. of *t*-test	0.000		
Male				169	3.971
Female				229	3.731
Age	0.001	Sig. of Welch Test	0.000		
22–30				50	3.557
31–40				194	3.876
41–50				121	3.935
>50				33	3.625
Academic title, degree	0.087	Sig. of F Test	0.000		
Professor				4	4.437
Associate Professor				59	3.924
Doctor				210	3.868
Master				125	3.712
Abroad graduation or not	0.700	Sig. of *t*-test	0.018		
Abroad graduation				190	3.884
Domestic graduation				208	3.787
Experience as a lecturer	0.000	Sig. of Welch Test	0.003		
<1 year				30	3.500
1–3 years				42	3.732
>3–6 years				46	3.856
>6 years				280	3.880
Scientific research area	0.002	Sig. of *t*-test	0.000		
Natural Sciences				179	3.997
Social Sciences				219	3.699
Position	0.111	Sig. of *t*-test	0.000		
Manager				146	3.684
Non-managerial employee				252	3.919

The difference in the scientific research results of lecturer groups is summarized hereafter. Regarding gender, there is a difference in scientific research output between the sexes, shown by the sig. of the *t*-test being <0.05. More specifically, the mean value shows that male lecturers have higher scientific research output than female lecturers.

Concerning age, there is a difference in scientific research output between age groups, shown by the sig. of the Welch test being <0.05. More specifically, the mean value of age

groups shows that scientific research output decreases in the order of the following age groups: 41–50, 31–40, >50, and 22–30.

In terms of academic title and degree, there is a difference in scientific research output among lecturer groups with different qualifications, shown by the sig. of the F test being <0.05. More specifically, the mean value of the groups shows that scientific research output increases gradually by the level of academic title and type of degree.

In terms of lecturer experience, there is a difference in scientific research output among lecturer groups with different seniorities, shown by the sig. of the Welch test being <0.05. More specifically, the mean value shows that scientific research output increases gradually with seniority.

Regarding the scientific research area, there is a difference in scientific research output among lecturer groups, shown by the sig. of the T-test being <0.05. More specifically, the mean value shows that scientific research output is higher for the field of natural sciences than it is for the social sciences.

Concerning managerial position, there is a difference in scientific research output between lecturer groups, shown by the sig. of the T-test being <0.05. More specifically, the mean value shows that scientific research output is higher for lecturers who do not hold managerial positions compared to those who do. This is likely because lecturers who hold managerial positions have busier schedules and less time allocated for conducting research.

In terms of abroad graduation, there is a difference in scientific research output among lecturer groups, shown by the sig. of the T-test being <0.05. More specifically, the mean value shows that scientific research output is higher for lecturers who graduated abroad.

4.2. Measurement Proposed Research Model Assessment

The psychometric properties of the scales measuring the considered dimensions of scientific research output were first examined through the Exploratory Factor Analysis (EFA) procedure, before being included in the PLS-SEM model. The study procedure was carried out using SmartPLS software version 3.3.3. The SEM model included six constructs, namely, scientific research objectives, decentralization, leadership, support for scientific research activities, policies for lecturers at HEIs, and resources for scientific research. To assess the measurement model, the convergent and discriminant validity and composite reliability were considered.

In Table 5, for this measurement model, all of the quality criteria were met, since all factor loadings, Cronbach's alpha values, composite reliability (CR) values, and average variance extracted (AVE) values were above the recommended thresholds (0.7, 0.7, 0.7, and 0.5, respectively) [24,49–51].

Discriminant validity is the degree to which items distinguish between constructs. Using the Fornell–Larcker criterion, the results indicate that the square root of the average variance extraction is greater than the inter-construct correlations. Regarding the cross-loadings criterion, the factor loadings of each item or indicator must be greater than the rest of its cross-loadings to ensure the discriminant validity of the construct [51]. Seven criteria were used to test discriminant validity, including Fornell–Larcker and cross-loadings. Table 6 illustrates the results of the discriminant validity measurements. In the first column, the square root of the extracted variance that appears in the upper part in parentheses must be greater than the correlations that appear in the following lines of the same column. This criterion was applied for each column. Table 7 shows the fulfillment of this criterion for all the subscales, demonstrating the discriminant validity of the tested instrument.

Table 5. Convergent validity and reliability.

Constructs	Items	Loadings	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Scientific research objectives of HEIs (OBJ)	OBJ2	0.829				
	OBJ3	0.759				
	OBJ4	0.836	0.869	0.879	0.905	0.656
	OBJ5	0.846				
	OBJ6	0.775				
Decentralization (DEC)	DEC1	0.731				
	DEC2	0.747				
	DEC3	0.820				
	DEC4	0.790	0.860	0.866	0.895	0.587
	DEC5	0.777				
	DEC6	0.728				
Leadership (LEA)	LEA2	0.801				
	LEA3	0.791	0.768	0.811	0.845	0.577
	LEA4	0.737				
	LEA5	0.704				
Support for scientific research activities (SUP)	SUP1	0.776				
	SUP2	0.754				
	SUP3	0.766				
	SUP4	0.776	0.882	0.888	0.908	0.585
	SUP5	0.737				
	SUP6	0.780				
	SUP7	0.763				
Policies for lecturers (POL)	POL1	0.812				
	POL2	0.821				
	POL3	0.815	0.894	0.897	0.919	0.654
	POL4	0.818				
	POL6	0.775				
	POL7	0.810				
Resources for scientific research (RES)	RES1	0.837				
	RES2	0.870				
	RES3	0.834	0.881	0.882	0.913	0.679
	RES4	0.785				
	RES5	0.791				
Scientific research outputs (OUT)	OUT1	0.784				
	OUT2	0.751				
	OUT3	0.775				
	OUT4	0.767				
	OUT5	0.771	0.900	0.901	0.920	0.589
	OUT6	0.806				
	OUT7	0.748				
	OUT8	0.734				

Table 6. Discriminant validity.

Scales	OBJ	DEC	LEA	SUP	POL	RES	OUT
OBJ	0.810						
DEC	0.271	0.766					
LEA	0.278	0.390	0.760				
SUP	0.227	0.253	0.192	0.765			
POL	−0.003	0.079	0.265	−0.011	0.809		
RES	0.291	0.268	0.186	0.241	0.049	0.824	
OUT	0.391	0.349	0.412	0.440	0.414	0.629	0.767

Table 7. Hypotheses testing.

Relationship	Hypothesis	Std. Beta	T Statistics (|O/STDEV|)	p Values	Decision
DEC->OUT	H2	0.039	1.236	0.217	Not supported
LEA->OUT	H3	0.121	3.306	0.001	Supported
POL->OUT	H5	0.359	10.872	0.000	Supported
RES->OUT	H6	0.471	16.025	0.000	Supported
OBJ->OUT	H1	0.151	4.768	0.000	Supported
SUP->OUT	H4	0.263	9.587	0.000	Supported

Note: OBJ: scientific research objectives of HEIs; DEC: decentralization; LEA: leadership; SUP: support for scientific research activities; POL: policies for lecturers; RES: resources for scientific research; OUT: scientific research outputs.

As the goal of SEM-PLS is to explain the endogenous latent variance, the key target is to have a higher R square. The greater the value, the better the explanatory power of the model [52]. The authors of [53] argued that a value of R square greater than 0.26 is considered substantial, as a rule of thumb. The results obtained in this present restudy show that the R square value for scientific research output was 0.684, which was acceptable. The corresponding results are presented in Figure 2.
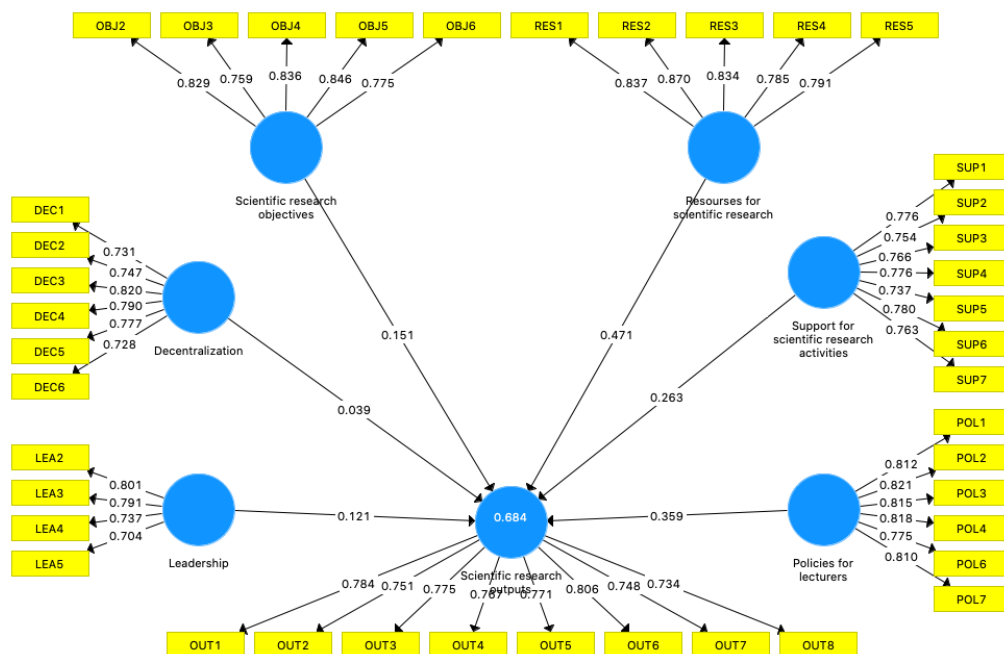
Figure 2. Confirmatory Factor Analysis Result.

4.3. Testing Research Hypotheses

In the structural model, the relevance and significance of all the direct and indirect effects were assessed, examining the path coefficients, associated t-statistics, and their bias-corrected confidence intervals, which were computed through a bootstrapping procedure. The study conducted the test with a sample size of bootstrapping N = 5000 [46,54]. The proposed hypotheses were considered statistically significant at the 99%, 95%, and 90% reliability levels.

The bootstrapping technique was used to analyze the t-statistics for the path coefficients to assess the importance of the hypothesized connections [55,56]. The *p*-value is a constant measure of evidence, but it is usually dichotomized into highly important, marginally important, and not statistically important at conventional levels, with cut-offs at $p \leq 0.01$, $p \leq 0.05$, and $p > 0.10$, respectively [57].

Table 7 shows that scientific research output ($p < 0.01$) shares a significant relationship with scientific research objectives, leadership, support for scientific research activities, policies for lecturers, and resources for scientific research. This means that five hypotheses in the conceptual model were fully supported (Hypothesis 1, Hypothesis 3, Hypothesis 4, Hypothesis 5, and Hypothesis 6). Decentralization had no direct effect on scientific research output ($p = 0.217 > 0.01$), thus Hypothesis 2 was not supported. Among these variables, resources for scientific research (RES) was the most effective factor ($\beta = 0.471$, t = 16.025, $p = 0.000$). Policies for lecturers (POL) and support for scientific research activities (SUP) had the second strongest influence on scientific research output ($\beta = 0.359$, t = 10.872, $p = 0.000$; $\beta = 0.263$, t = 9.587, $p = 0.000$, respectively). Scientific research objectives of HEIs (OBJ) and leadership (LEA) were also significant factors that affected scientific research output ($\beta = 0.151$, t = 4.768, $p = 0.000$; $\beta = 0.121$, t = 3.306, $p = 0.000$, respectively).

5. Discussion

5.1. Findings and Implications

The results reveal that "resources for scientific research" have the most significant impact on scientific research output by lecturers among the six given governance factors. This reflects the reality of such resources, especially the limited facilities of universities in Vietnam, with narrow university campuses that lack synchronization. Financial resources are also limited in terms of both volume and procedures because most Vietnamese HEIs remain partially dependent on the state's budget; there exist only 23 autonomous universities [58] with better resources.

This finding supports the results of prior studies, from a university governance perspective. By empirical evidence, Ref. [5,7,17,18,37,38] proved that resources for scientific research, including space, equipment, information systems, databases, expenses, funds, and colleagues with good research capacity had a positive influence on lecturers' scientific research output. In Vietnam, Ref. [13] revealed that factors such as the accessibility of international scientific documents, research data, experimental devices or tools, software, and funding sources played an important role in international publishing. The work by [16] demonstrated that the main barriers to publication in Vietnam are funding and time for research.

Therefore, the implication is that HEI managers should pay careful attention to ensuring adequate resources for scientific research. First of all, it is vital to improve research space, equipment, free information systems, databases, and digital libraries for scientific research activities at HEIs. In terms of finance, HEIs should attract more non-state budget revenues and establish funds for internationally-indexed publications, intellectual property applicants, and the commercialization of scientific research outcome. In addition, HEIs should reform the mechanism of budget allocation for scientific research in particular, at both the university and faculty levels.

Secondly, the obtained results demonstrate that "policies for lecturers" had a significant influence on lecturers' scientific research output. This finding provides a comprehensive assessment of how policies for lecturers affect their research outcomes. In fact, the income of lecturers at Vietnamese HEIs that are not yet autonomous is generally low, according to the general regulations of the State [59]. The regulations on workload and rewards for lecturers are all "one-size-fits-all" policies [14]. The finding of this research is consistent with the previous studies. However, provided with a governance perspective, the study has become more relevant for university administrators and management researchers. For instance, the work by [11,20,37,38,60] affirmed that policies related to income, recruitment, remuneration, evaluation, reward, retention, training, and development of teaching staff had a positive impact on the scientific research results of facilities. In Vietnam, Ref. [12,13] pointed out that "time for research purpose" affected the research productivity of Vietnamese social scientists.

Thus, it is recommended that university administrators pay close attention to developing and improving policies for lecturers in order to enhance the overall effectiveness of

scientific research. In Vietnam, the time available for research purposes must be taken into account by HEI managers and policy-makers. Sabbatical leave, which is popular in developed countries as a time to focus on research, should also be considered by Vietnamese HEIs. Furthermore, "tailor-made" incentives for different types of lecturers should be implemented in Vietnamese HEIs. Lecturers with high research output should be rewarded and paid differently compared to others with relatively lower research output.

Thirdly, the results of testing hypotheses show that both "support for scientific research activities" and "scientific research objectives of HEIs" had a positive effect on lecturers' scientific research output. This is also in line with previous research. The authors of [19] and [29] argued that scientific research support had the most significant effect on institutional factors. The work by [20] demonstrated that setting clear common goals in scientific research was one of the factors that had the strongest impact on the results of scientific research by lecturers. The influence of an organization's scientific research objectives on the faculty's scientific research results has also been tested and recommended by [6,19,22,32,61].

Therefore, the implication offered here is that HEIs should actively plan long- and medium-term strategies for scientific research activities, with the positioning of clear scientific research results, along with mechanisms and resources to ensure the validity of the strategies. They should not simply offer annual plans according to the force of administrative procedures. This solution can potentially increase scientific research results in a sustainable and focused manner.

Additionally, HEIs should pay close attention to creating an environment and culture that values and supports scientific research, building and developing research groups, and encouraging collaboration between scientists inside and outside the organization. The managers of Vietnam's HEIs also need to pay attention to administrative reforms, scientific research management mechanisms, and digital transformation to actively support scientific research activities.

Fourthly, the factor "leadership" had a positive influence on lecturers' scientific research output, but it had less of an impact compared to the above-mentioned factors. This finding is consistent with previous studies, but it has more significance when applied to university governance particularly. The authors of [9,20,30] demonstrated that institutions with academic excellence had leaders who could link scientific fields, select and train young faculty members, encourage and develop new scientific ideas, attract funds, build an environment to promote research and creativity, and set and disseminate goals.

Therefore, the implication for university governance is to further improve the awareness of HEIs' leaders of the importance of scientific research in the current context. They need to have a sense of regular and clear communication about the organization's scientific research goals, always recognize and appreciate the results of scientific research, and be fair in resource allocation. The selection and appointment of managers in departments, laboratories, faculties, or universities should have specific criteria that are suitable for the particular job (i.e., high creativity and different from ordinary administrative management). In addition, in the current integration context, HEIs also need to pay attention to fostering and improving management skills towards international standards for university managers.

Fifthly, "decentralization" is a new factor that was added in the research model, and was the only factor that did not have an impact on lecturers' scientific research output. Due to the relevant findings in previous studies, this factor was tested and included in the research model. For example, Ref. [20] demonstrated that participative governance was a characteristic of organizations with high scientific research achievements. The authors of [30] clarified that autonomy in building a research team and staff evaluation policy each had a good influence on the results of scientific research. This result can be explained and supported by several prior studies. The theory of management Y [62] noted that it is impossible to have complete autonomy to achieve both organizational goals and individual needs. Therefore, there is a need to decentralize at an appropriate level. The authors of [63]

argued that decentralization does not mean sharing power to the extent that senior leaders in the organization do not know the important rights of subordinates.

Interestingly, to the best of our knowledge, this may be the first study to quantify "decentralization" in relation to university lecturers' research results. It has experimentally proven whether decentralization affects the research performance of lecturers. Although the results of testing the model and hypothesis H2 show that this factor does not affect the scientific research output of lecturers with a significance level <=0.05, this finding still forms a theoretical and practical contribution as a basis for formulating appropriate university governance policies.

Overall, this study has built a model and verified the influence of governance factors on the scientific research output of lecturers. The results obtained can act as a guideline to aid university managers in improving governance by prioritization of resources for scientific research, policies for lecturers, support for scientific research activities, setting scientific research objectives, and leadership.

Sixthly, the *t*-test and ANOVA results indicate that there is a difference in the scientific research output between groups of lecturers. More specifically, the scientific research output by males is more than that by females. The output of natural sciences is more than that of social sciences. The output by lecturers who do not hold managerial positions is more than that by those who hold such positions. The output by graduates from universities abroad is more than that by graduates from domestic universities. The output by those with advanced degrees is more than that by those with relatively low ones. The output by higher seniority is more than that by lower seniority. Finally, the output by the middle-aged group is more than that by the elderly and younger lecturer groups. The difference between these groups is also mentioned in prior studies [7,11].

Thus, it is recommended that HEI managers formulate suitable policies for different groups of lecturers. For example, the *t*-test and ANOVA results show that lecturers in the natural sciences have higher scientific research output compared to those in the social sciences. Hence, HEIs should have appropriate resource investment policies for each field, and during each period. To rapidly increase scientific research results in the short term, HEIs should focus on attracting and prioritizing more investment for groups of lecturers with higher scientific research output, such as groups with doctoral degrees or higher (especially associate professors and professors); those who graduated abroad; those in the 31–40 and 41–50 age groups; those with at least three years of seniority; and those in the natural sciences. However, to ensure sustainable and balanced development in the long term, HEIs need to pay attention to the scientific research activities of the remaining groups. In addition, the *t*-test results show that the group that does not hold a management position had higher scientific research output than the other. Therefore, the implication is that HEIs should change their mindset about appointing managers: excellent scientists should manage research groups, laboratories, and centers of excellence, without the necessity of holding other administrative positions that limit time and scientific research performance.

Finally, this study has a novel contribution in terms of research methodology on this topic. As the literature showed, it is difficult to find a study that adopted PLS-SEM, even though this approach was considered to be the best alternative to CB-SEM in cases where there is little theoretical background available [30,48]. Moreover, in this study, PLS-SEM was employed in conjunction with the bootstrap technique, *t*-test, and ANOVA to provide detailed insights on this increasingly important topic. In Vietnam, to the best of our knowledge, this is the first study that utilized the SEM approach with such a large population and primary data for this particular scientific issue.

Furthermore, compared with other works in the literature, this work can be considered a rare empirical study that has focused on testing the influence of governance factors (i.e., not institutional factors in general) on the scientific research output of university lecturers. Although the impact of management activities on employee performance is no longer a new research topic, the number of studies focusing exclusively on governance factors

affecting the scientific research productivity of lecturers is lacking. To date, most of the studies only consider the institutional, environmental, and personal factors that affect the results of scientific research.

In summary, this study not only offers theoretical contributions, but practical contributions as well, helping policymakers, managers, and lecturers to take appropriate solutions for groups of lecturers in order to enhance scientific research performance.

5.2. Limitations and Suggestions for Further Studies

All studies have their limitations, and this study is no exception. Firstly, this study uses a non-probability sampling method, so PLS-SEM has not been analyzed by different groups of lecturers (according to demographic characteristics) to understand the influence of governance factors on scientific research output by the groups. Meanwhile, non-parametric measures (Kruskal–Wallis Test, Mann–Whitney U Test, etc.) that are considered more suitable for non-probability sampling have not been utilized.

Second, this study explores the influence of governance factors based solely on lecturers' perceptions of their scientific research output. In other words, this is a cross-sectional study, so it is impossible to compare the change of scientific research output in reality, according to specific time and space milestones.

Third, this study assumes that governance factors have a direct influence on scientific research output. However, in reality there are other mediating factors, such as the behavior, motivation, and attitude of lecturers. Therefore, it is recommended that intermediary factors (both as independent and dependent variables) be added to the research model. Additionally, the review of the literature and practice also showed that there are many other governance and personal factors that affect scientific research output which have not been tested in this study.

Finally, the scope of this research has not focused on research-oriented universities in Vietnam in particular. Therefore, caution should be taken when generalizing the results of this study to all types of HEIs.

In the future, it is more reliable and worthwhile if researchers deploy the probability sampling method, thereby applying PLS-SEM for different sample groups and employing ANOVA more deeply for each sample group. It is possible to use time string data or array data (not cross-sectional data) to conduct empirical research to clarify the relationship between governance factors and scientific research results, which can be expressed after a long time. In addition, it is necessary to explore the relationship between governance factors and the attitude, motivation, and behavior of lecturers with respect to scientific research and scientific research output. It is also possible to combine different approaches (i.e., other individual factors and governance factors) to explain why, in the same environment and with the same governance, lecturers have differing scientific research output. Finally, it is necessary to expand the scope of the research according to groups of HEIs, which can be divided by their research or practice orientation, autonomy, whether they are multidisciplinary or focus on a single field, and whether they are public or private universities.

6. Conclusions

This study has proposed and empirically tested a research model on governance factors affecting the scientific research output of university lecturers. It has adjusted the measurement criteria (observed variables) of the governance factor scales and scientific research output according to the context of Vietnam. The results show that the level of influence of governance factors on lecturers' scientific research output, in order from strongest to weakest, is as follows: resources for scientific research, policies for lecturers, support for scientific research activities, scientific research objectives of HEIs, and leadership. A new scale of "decentralization" has been added to the analytical framework, but it was not statistically significant regarding its impact on lecturers' research output.

In addition, the study examined the difference in the scientific research output of lecturer groups according to their demographics, including gender, age, degree and aca-

demic title, experience, position (manager or not), place of graduation (abroad or domestic), and scientific area. The obtained results reveal that there are differences in the research output between lecturer groups. Hence, they provide empirical evidence for implications in management decision-making and policy-making.

Overall, the obtained results can guide HEIs in evaluating the current status of scientific research activities and the governance factors that influence lecturers' scientific research output, thereby helping these HEIs take appropriate measures to enhance their scientific research achievements in today's knowledge-based economy.

Appendix A Description of Scales

	Code	Observed Variables	Sources
		Scientific research objectives of HEIs	
1.	OBJ1	My university always attaches great importance to scientific research objectives.	[4,6,32]
2.	OBJ2	The scientific research objectives have been set with coordination among the faculties and departments.	[1,20,22]
3.	OBJ3	The scientific research objectives are disseminated via many different channels (website, email, software, etc.).	[20,22]
4.	OBJ4	The scientific research objectives are clear and measurable.	[17]
5.	OBJ5	The scientific research objectives are feasible.	[20,22]
6.	OBJ6	The scientific research objectives are in line with the interests and desires of lecturers.	[1,22]
7.	OBJ7	My university has high requirements for the scientific research output of lecturers.	[20]
		Decentralization	
8.	DEC1	My university encourages the participation of lecturers in the process of management decision-making related to scientific research.	Suggested by the authors
9.	DEC2	Faculties and departments are empowered to decide many professional and academic-related issues.	Suggested by the authors
10.	DEC3	Lecturers are facilitated to pursue their research directions in compliance with their professional capacity.	Suggested by the authors
11.	DEC4	Lecturers actively participate in bidding and implementing research projects.	Suggested by the authors
12.	DEC5	The management of the scientific research output of lecturers is based on autonomy.	Suggested by the authors
13.	DEC6	My university has channels for listening to lecturers' feedback.	Suggested by the authors
		Leadership	
14.	LEA1	The university's leaders tend to communicate clearly about the objectives and orientation of scientific research activities.	[22,30]
15.	LEA2	The university's leaders have a high reputation and are respected.	[30]
16.	LEA3	The university's leaders always show recognition and appreciation for the scientific research output of lecturers.	[20,21]
17.	LEA4	The university's leaders are fair in allocating and approving research projects.	[60]
18.	LEA5	The direct leaders (at the Faculty/Department level) have a high reputation for scientific research.	[30]

	Code	Observed Variables	Sources
19.	LEA6	The direct leaders (at the Faculty/Department level) have good management capacity.	[20]
20.	LEA7	The direct leaders (at the Faculty/Department level) always have effective guidance and orientation in scientific research activities.	[20]
21.	LEA8	The direct leaders (Faculty/Department level) actively support and encourage the faculty's scientific research efforts.	[9,61]
22.	LEA9	The direct leaders (at the Faculty/Department level) provide fair and competitive development opportunities for lecturers.	[9,61]
		Support for scientific research activities	
23.	SUP1	My university puts effort to create an environment and culture that values scientific research activities.	[17,18,20,36]
24.	SUP2	My university puts effort to simplify administrative procedures (within its ability) to support scientific research activities.	[17,36,60]
25.	SUP3	My university has attracted many funding sources for research and development activities.	[5]
26.	SUP4	My university supports lecturers effectively in the transfer and commercialization of research output.	[33,36]
27.	SUP5	My university encourages the establishment and development of research groups and collaborations.	[13,14,27,30,45]
28.	SUP6	My university's departments and faculties always support lecturers' scientific research effectively.	[18,32]
29.	SUP7	My university organizes several scientific activities such as conferences, seminars, workshops, and training courses.	[17,60]
		Policies for lecturers	
30.	POL1	Policy on lecturer recruitment focuses on scientific research capacity.	[1,35]
31.	POL2	The reward regime is encouraging and motivating for lecturers.	[11,32]
32.	POL3	The income regime is encouraging and motivating for lecturers.	[11,17,31]
33.	POL 4	Lecturers are facilitated to become main lecturers, senior lecturers, associate professors, and professors.	[11,35,37]
34.	POL 5	Lecturers are facilitated to improve their capacity at home and abroad.	[17,32]
35.	POL 6	Lecturers are facilitated to arrange the time for scientific research.	[13,15,17]
36.	POL 7	Young lecturers are trained, consulted, and oriented on scientific research.	[34,36]
		Resources for scientific research	
37.	RES1	Lecturers are provided with research space (e.g., private room/desk).	[17,18,61]
38.	RES2	Lecturers are provided with the necessary equipment for scientific research (computers, internet, printers, laboratory equipment, etc.).	[7,13,18,30]
39.	RES3	Lecturers can easily access free information systems, databases, and necessary documents for scientific research at the university, faculty library.	[13,18,32,61]
40.	RES4	Lecturers are supported with funding for internationally-indexed publications/intellectual property applicants/commercialization of scientific research products, or funding support to carry out scientific research works.	[5,13,18]
41.	RES5	My university has many lecturers with good scientific research abilities.	[17,18,30]

	Code	Observed Variables	Sources
		Scientific research output	
1.	OUT1	The number of my international scientific articles in ISI/Scopus-indexed journals tends to increase every year.	
2.	OUT2	The number of my other international scientific publications tends to increase every year.	
3.	OUT3	The number of my scientific papers in domestic journals tends to increase every year.	
4.	OUT4	The number of my research papers published in scientific conference proceedings tends to increase every year.	[4,7,20,37]
5.	OUT5	The number of my books/textbook chapters/monographs tends to increase every year.	
6.	OUT6	The number of my patents, inventions, and registration of intellectual property tends to increase every year.	
7.	OUT7	The number of scientific research projects that I lead every year tends to increase.	
8.	OUT8	The number of scientific research awards that I and my learners get tends to increase every year.	

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