Heliyon 8 (2022) e10510

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Management factors influencing lecturers' research productivity in Vietnam National University, Hanoi, Vietnam: A structural equation modeling analysis☆,☆☆

Nguyen Anh Tuan [a,b], Truong Thi Hue [c,*], Luong Thuy Lien [d], Luu Huu Van [a], Hoang Thi Tuyet Nhung [a], Luu Quoc Dat [a]

[a] VNU University of Economics and Business, Vietnam National University, 144 Xuan Thuy Road, Hanoi 100000, Viet Nam
[b] VNU International School, Vietnam National University, Hanoi, 144 Xuan Thuy Road, Hanoi 100000, Viet Nam
[c] VNU School of Interdisciplinary Studies, Vietnam National University, 144 Xuan Thuy Road, Hanoi 100000, Viet Nam
[d] VNU University of Social Sciences and Humanities, Vietnam National University, 336 Nguyen Trai Road, Thanh Xuan, Hanoi 100000, Viet Nam

ARTICLE INFO

Keywords:
Management
Research productivity
Resources for scientific research
Structural equation modeling

ABSTRACT

Increasing lecturers' research productivity plays a crucial role in improving teaching quality and university prestige. This research aims to establish and test a model for evaluating management factors that affect the research productivity of Vietnamese university lecturers. Data were collected by surveying 398 lecturers and researchers at universities affiliated with the Vietnam National University, Hanoi (VNU). Structural equation modeling (SEM) methodology was applied for data analysis. The research outcomes indicate that resources and policies to favor research activities are the two most influential factors affecting research productivity in lecturers. The decentralization factor, in contrast, did not show statistical significance, since its p-value was greater than 0.05. Based on the results obtained, several policy recommendations are proposed, namely: (i) ensuring resources for faculty's scientific research activities; (ii) improving policies for lecturers to enhance their scientific research achievements: (iii) developing strategies for scientific research activities; (iv) enhancing awareness of affiliated unit leaders about the importance of scientific research.

1. Introduction

In today's knowledge-based economy, research is recognized as an important cornerstone of higher education systems (Vuong et al., 2018). The quantity and quality of research are heavily weighted in global university rankings. As a result, increasing lecturers' research productivity contributes significantly to improve teaching quality, as well as universities' global status and prestige.

Many studies have investigated a variety of factors influencing university lecturers' research productivity. Nevertheless, these studies have

☆ Firstly, VNU and its affiliates need to prioritize to ensure resources for faculty's scientific research activities. Factors such as equipment, research space, digital libraries, and data-bases for scientific research activities urgently need to be improved or new investment. In order to create national and worldwide scientific and technology products, VNU and its affiliated units need to invest in upgrading and developing a system of key laboratories at the State and VNU. Regarding finance, VNU and its affiliated can attract external financial sources from sponsors, investors, funds, organizations..., or establish funds to support scientific research, invention and commercialization of scientific and technological products. The mechanism for allocating resources for scientific research also needs to be improved at both VNU and affiliated units.

☆☆ Secondly, VNU administrators should pay attention to improving policies for lecturers to enhance their scientific research achievements. The policy on lecturers' working time also needs to be changed more flexibly. Specifically, the Ministry of Education and Training should allow universities to make their own decisions about flexible working hours corresponding to lecturers' own strengths (in terms of research, teaching, and community service). Accordingly, lecturers with a knack for scientific research will have more time for research, thereby improving their research efficiency. Progressive policies such as "tailor-made" incentives, sabbatical leave, which are being applied in many developed countries, should also be applied at VNU to motivate lecturers to do scientific research. In addition, lecturers with scientific research results should receive different financial and non-financial remuneration from others. By the above innovation, VNU and its affiliates can attract leading experts, scientists, national and international talents in the field of science and technology to work.

* Corresponding author.
E-mail address: huetruongthi.vnu@gmail.com (T.T. Hue).

https://doi.org/10.1016/j.heliyon.2022.e10510
Received 8 February 2022; Received in revised form 20 May 2022; Accepted 26 August 2022

mainly focused on examining the influence of institutional and/or individual factors on the lecturers' research productivity, such as the drivers of the work environment, resource-related factors, motivation factors, etc (Abramo et al., 2017; Nafukho et al., 2019; Okendo, 2018; Tafreshi et al., 2013; Yang, 2017). Many studies have mentioned the impact of management factors on the lecturers' research productivity, including research objectives (Bland et al., 2005; Jahan et al., 2018); decentralization (Aydin, 2017; Hwang, 2016); leadership (Jahan et al., 2018; Kiat and Claire, 2017); support for research activities (Abramo et al., 2017; Yumeen et al., 2018); policy regimes to motivate lecturers' research activities (Hoffmann et al., 2017; Salman et al., 2018); and resources (Hosseinifar et al., 2016; Yang, 2017). However, it seems that no empirical studies have examined the overall impact of management factors on lecturers' research productivity, particularly in developing countries. Faced with the rapid changes of today's industrial revolution 4.0, university administrators need to improve governance in order to improve the research quality, innovation and creativity, and to contribute to each country's knowledge-based economy. As a result, in the current context, analysis of the effect of management factors and evaluating the significance of these factors in lecturers' research productivity through quantitative models is critical and urgent for universities, especially in the context of developing countries, which have many limitations in university governance, like Vietnam.

In Vietnam, the research productivity level of lecturers remains low (Pham and Hayden, 2019), and their research ability was inappropriate (Nguyen and Klopper, 2019). To date, there have been few studies on the drivers for research output of lecturers in Vietnam. Notably, Nguyen et al. (2021) investigated the effects of institutional policies (infrastructure policy, management policy, human resource policy, communication policy, financial constraint) on research productivity. Though Nguyen et al. (2021) just focused on Vietnam science and technology universities and have not considered other management factors such as decentralization, leadership, research support... Vuong et al. (2018) and Pham and Hayden (2019) investigated the factors affecting Vietnamese academic's internationally-indexed publishing. However, these studies are all based on secondary data, and did not consider the management factors as perceived by lecturers. Tran et al. (2020) and Trinh et al. (2020) overcame these limitations by applying in-depth interviews, Delphi, and AHP, respectively. However, in these studies, scientific research results were only considered from the perspective of articles in international scientific journals (not considering other types of research results), and the participants are all scientists in all types of institutions rather than university lecturers. Regarding the approach, so far, it seems that only the study by Nguyen et al. (2021) in Vietnam used structural equation modeling (SEM). Meanwhile, according to Shin and Konrad (2016), to analyze cause-and-effect relationship models, SEM is one of the most widely applied methods, and it has also been commonly used in management studies.

Among Vietnamese higher educational institutions, VNU is the leading center of training, scientific and technological research. Currently, this university has 35 units, including 08 affiliated universities, 04 affiliated faculties, 07 research institutes, 02 training and research centers, and 14 support/service units. VNU has the mission of training high-quality human resources, fostering talent, creativity, research and cutting-edge technology, and transferring knowledge: it plays a pivotal and pioneering role in reforming the Vietnamese higher education system. In recent years, VNU has consistently ranked first in Vietnam, among the top 150 universities in Asia, and among the top 1000 universities in the world, according to the rankings. As of the end of 2019, VNU had nearly 500 training programs, with over 40,000 students studying at bachelor's, master's, and doctoral levels in natural sciences, technology, economics, culture, education, foreign languages, psychology, philosophy, and literature.

As a result, the aim of this research was to investigate the effect of management factors on the scientific research productivity of lecturers at VNU, Vietnam. The results of this study are not only meaningful to universities in Vietnam, but also give significant implications for similarly ranked universities (among the top 1000 universities in the world) in developing countries. The rest of this analysis is structured as follows. Section 2 examines the research on management factors influencing lecturers' research productivity. The methodology are presented in section 3. Section 4 reports on the results of an analysis of the factors affecting the scientific research outcomes of lecturers at VNU, Hanoi. Section 5 contains the conclusion, discussion, and policy implications for increasing lecturers' research productivity.

2. An overview of the management factors affecting lecturers' research productivity

Several studies have investigated factors affecting lecturers' scientific research productivity. To date, there have been three approaches to examine the antecedents of research productivity of academic staffs, namely, individual, institutional, and a mix of both. Regarding the institutional approach, some studies investigated the drivers of the resource-related factors, and work environment. For instance, Vuong et al. (2018) showed that the work environment creates impact on the research outputs of social scientists. Nafukho et al. (2019) revealed the number of undergraduate students, the percentage of Ph.D. students, and the funding allocated for research activities affected significantly research results of faculty. However, these studies have not considered the perspective of management factors, so they have not given specific insights into the policies that the universities create to promote research activities. Some studies examined collaboration factors. For example, Ghabban et al. (2019) investigated that job satisfaction and international collaboration positively impact scientific research outputs. Trinh et al. (2020) demonstrated that receiving support from research assistants and supervisors, collaborating with domestic and international peers are the key drivers for scientific research performance off academic staffs. Tran et al. (2020) showed that "networking-related factors" played an important role in the success of publishing articles in international journals. However, these studies have not separately considered whether the collaboration is due to the efforts of the university or individual scientists.

Regarding the individual approach, some authors focused on motivation factors. Chen et al. (2006) investigated the association of research performance and intrinsic and ex-trinsic motivators. Nafukho et al. (2019) indicated that the research performance of academic staffs varied by rank, gender, work experience, discipline, institution, and terminal degree. However, it is difficult to distinguish between intrinsic and ex-trinsic motivators. Besides, Nafukho et al. (2019) and Chen et al. (2010) have not indicated whether drivers originates from the management activities and policies of universities to their enhance research performance.

Regarding the mix approach (both individual and institutional factors), a number of articles presented a set of characteristics of highly productive research institutions. Bland et al. (2005) proposed a model of institutional, individual, and leadership characteristics. However, this model has not been studied at the university level, but only at the departmental and individual levels, and combined management factors with several other factors. Heinze et al. (2009) showed that creative accomplishments are associated with facilitating leadership, timely support of external resources, small group size, and stable research sponsorship. However, these are not characteristics of universities alone, but of all productive research institutions.

In short, the above three approaches indicate that there still seems to be lack of literature focusing on management factors that influence lecturers's scientific research productivity. However, a number of governance-related factors have emerged that considered institutional factors, which are typically research objectives, leadership, support for research, policy regimes to motivate lecturers research activities, and resources for research. These factors will be analyzed in more detail in the following sections.

Management factors, according to Koontz et al. (1984), are related to designing and maintaining an environment in which individuals working together in groups can accomplish tasks and goals. Stoner and Wankel (1987) also stated that management is the process of planning, organizing, leading and controlling the activities of the members of the organizations and using all resources of the organizations to achieve the set goals. In this study, management factors are understood from the point of view of Stoner and Wankel (1987) because this concept has been accepted and used quite widely. Accordingly, factors such as research objectives, leadership, decentralization, support for research, policy regimes to motivate lecturers research activities, resources for research are all related to the process of planning, organizing, leading and controlling the activities of the members in universities, and also related to using resources of the universities to achieve the set goals.

2.1. Research objectives and strategies

Developing strategies and defining objectives for the advancement of research in university play an important role in promoting lecturers' research productivity. In order for lecturers to have a strong research record, the research strategy and objectives of the university need to be feasible, clear, and widely shared (Aref et al., 2017; Bland et al., 2005; Hedjazi and Behravan, 2011). The research strategy and objectives of the university and faculty, if formed in multiple dimensions (top down, bottom up, coordination between units and groups), will be feasible and have better implementation results (Kiat and Claire, 2017; Sheridan et al., 2017). The research objectives of the university and faculty need not conflict with individual researchers' research interests and desires (Jung, 2012).

The support structure for research is also stronger at universities that have objectives and development orientations based on a research university model, positively affecting lecturers' research productivity (Jahan et al., 2018). Hwang (2016) pointed out that leaders who are involved in setting objectives and strategies will have a greater orientation to their staff's efforts, thus enhancing both faculty and overall university research productivity. Bland et al. (2005) asserted that these objectives must be not only explicit, but also visible, widely shared, and play a role in directing the responsibilities of organizational members. As objectives are shared seamlessly between various teams and members, the sense of working towards and achieving mutual objectives is increased, resulting in dynamism and excellence throughout the organization (Kiat and Claire, 2017; Sheridan et al., 2017). Okendo (2018) demonstrated that limitations affecting research resources, institutions, and research culture have a detrimental impact on university research productivity. One aspect that most adversely affects lecturers' scientific publications is constraints on feasible preparation for research activities. As a result, to improve the productivity of research, a strategy with objectives that are not only explicit but also realistic, appropriate to the background of schools and lecturers, is needed. In light of this existing knowledge, the following hypothesis was formulated.

H1. Objectives and strategies for research have a positive impact on lecturers' research productivity.

2.2. Decentralization

A number of studies have shown that the level of autonomy and decentralization for lecturers in universities has an impact on the outcome of lecturers' research. According to Bland et al. (2005), successful research organizations are those that use the approach of "assertive-participative governance", in which management decisions are taken with the participation of a wide number of stakeholders, with an emphasis on feedback systems and collaboration. The approach of "shared governance", with the characteristics of equivalent participation of members in governance activities, good communication and connection among members, and valuing academic freedom enhances and facilitates collaboration between universities and their lecturers and administrators, thereby helping to boost research productivity (Jung, 2012). Aydin (2012), Smeby and Try (2005) and Sheridan et al. (2017) all obtained similar results.

According to some studies, decentralized organizational structure is a characteristic of high-productivity research organizations. Kiat and Claire (2017) found that faculties and academic institutions that are decentralized generally tend to publish more efficiently. Bland et al. (2005) and Aydin (2017) both mentioned the aspect of "decentralized organization", which they described as a "flat" organizational structure in which member involvement is both encouraged and expected.

Many studies, such as those by Hwang (2016) and Sheridan et al. (2017), have also shown that autonomy, with an adequate degree of decentralization for lecturers, is linked to research productivity; autonomy in administrative organization is often followed by high decentralization for individual members, and this is one of the characteristics of organizations with a strong record of research. According to Aydin (2012), management style according to Theory Y and Z has a positive impact on the productivity of lecturers, with Theory Z having the most positive impact, characterized by employee participation in decision making; Theory X, on the other hand, has a negative impact. According to Heinze et al. (2009), academic freedom with the establishment of small groups (approximately 6–8 people) is a common characteristic of academic institutions with great creative achievements. As described by Edgar and Geare (2013), autonomy has been considered to be significantly important at the faculty level for research achievement.

Okendo (2018) discovered that flaws in the formation of autonomous research groups and associations constitute one of the most important factors influencing the outcomes of lecturers' research publications. Hwang (2016) demonstrated that the degree of autonomy of the research team is one of the most major factors determining lecturers' academic achievement in Korea. According to Sheridan et al. (2017), the degree to which faculty members engage in faculty decision-making processes, such as fair involvement in problem solving and decision-making, having a say in resource allocation, participating in meetings that allow for the expression of views, and having respect for the dean, has a positive impact on faculty research productivity in the United States.

Based on this information, the following hypothesis was proposed.

H2. Decentralization has a positive impact on faculty research productivity.

2.3. Leadership

Many studies have been conducted to illustrate the importance and effect of leadership on lecturers' research productivity (Bland et al., 2005; Hwang, 2016; Heinze et al., 2009; Kiat and Claire, 2017; Yang, 2017). According to Bland et al. (2005), the following leadership characteristics positively impact the productivity of research: Leaders are highly valued for their ability to research, their ability to provide leadership and direction in research, and a participatory management style that fulfills key roles. According to Heinze et al. (2009), organizational (school) and group leadership are both essential (with many important roles) for creative effectiveness. The group leader links scientific fields, selects research members and fosters new skills, develops and nurtures new ideas in a flexible manner, attracts support, and offers a secure environment for members to conduct research and be creative. The position of the organizational leader is especially important in establishing the vision and mission of the research. According to Hwang (2016), among institutional factors, leadership factors have the greatest positive effect on research productivity. Yang (2017) also demonstrated that leadership support for research would help to improve research productivity by building a research "atmosphere" (Departmental Research Atmosphere). According to Kiat and Claire (2017), leaders must have high credibility, clearly communicate research initiatives and objectives, increase decentralization, and establish autonomy for research lecturers.

Similarly, research conducted by Aydin (2017), Aref et al. (2017), Farzaneh et al. (2017), Hedjazi and Behravan (2011), Jahan et al. (2018), Sheridan et al. (2017) and Whelan and Markless (2012) found that leadership has a positive impact on lecturers' research productivity. As a consequence, the following hypothesis was formulated.

H3. Leadership has a positive impact on lecturers' productivity in research.

2.4. Support for research

Many studies have demonstrated the beneficial function of research support. According to Lertputtarak (2008) and Wichian et al. (2009), a school's policy of directly encouraging research activities will increase lecturers' research productivity. According to Tafreshi et al. (2013), the more often activities that promote research take place, the more a research-oriented culture is developed, thus influencing the consciousness and competitiveness of research. Similarly, Aref et al. (2017) discovered that an organizational environment with sufficient research support personnel, as well as support for lecturers' research activities, has a positive impact on research performance.

Some studies have been more detailed in terms of administrative and financial assistance. Yumeen et al. (2018) demonstrated that the ability of stakeholders to support research is regarded as one of the most important factors influencing lecturers research productivity, especially administrative support of employees and department coordinators. Similarly, studies by Jahan et al. (2018), Kiat and Claire (2017) and Sheridan et al. (2017), indicate that administrative and logistical support is critical to the faculty and school's research productivity. Hosseinifar et al. (2016), Farzaneh et al. (2017) and Okendo (2018), all mentioned that administrative and financial procedures have an effect on lecturers' research productivity.

Previous research has also mentioned a number of other specific supporting factors. According to Aref et al. (2017), universities that have units aimed at successful funding management and attraction of investment to support research activities (for example, research support funds and functional departments that can attract funding) can motivate lecturers to publish. Rubin and Callaghan (2019), and Hosseinifar et al. (2016) demonstrated that good support for the transfer and commercialization of science products (e.g. company establishment, construction facilities, or successful collaboration with businesses) increased the research productivity of schools and lecturers. Abramo et al. (2017), Hwang (2016), Jahan et al. (2018) and Okendo (2018) concluded that promoting the establishment and advancement of research groups or research units, or research support in general, is a factor that positively affects research productivity. Abramo et al. (2017), Hwang (2016) and Olumide et al. (2019) showed the importance of supporting and facilitating lecturers' frequent interaction, collaboration, and information sharing through activities such as organising conferences, scientific workshops, training and retraining, sharing experiences, and disseminating new knowledge. On the basis of this knowledge, the following hypothesis was developed.

H4. Research support has a positive impact on lecturers' research productivity

2.5. Policy regimes to motivate lecturers research activities

Many studies in the higher education environment have shown that the policy regime for lecturers has a positive effect on research productivity. According to Salman et al. (2018), policy regimes such as prioritizing time for research, compensation, salary raises and promotions, career advancement available at universities, and supporting teaching jobs (satisfaction with the subject, timetables, and teaching assistants) have an impact on lecturers' research achievements. According to Hoffmann et al. (2017), the variables that have the greatest effect on research productivity are growth in income and rankings based on research accomplishments, funding, access to research assistantships, and time spent on research. Aydin (2017) also found important factors influencing research productivity, such as research skill education, lecturers' connections, adequate and commensurate income, promotion and reward, research time allocation, proper workload policies, research autonomy, and benefits (such as holidays and travel), recognition for research effort, administrative and teaching work requirements, and organizational research objectives.

The use of reward systems is noted in many studies, most notably in those of Aref et al. (2017), Farzaneh et al. (2017), Jahan et al. (2018), Kiat and Claire (2017), and Yucel and Demir (2018). However, Yucel and Demir (2018) discovered that when a compensation regulation scoring system is used, lecturers will focus on quantity, opting for "easy" projects rather than quality.

Some studies, such as those of Aref et al. (2017) and Ramli and Jusoh (2015), refer to the policy of recruitment and contract signing based on the lecturer's research capability. There are also studies on income policy by Negash et al. (2018), Salman et al. (2018), and Okendo et al. (2018). On the policy of increasing rankings (promotion/studying rank), there are studies by Aydin (2017) and Hoffmann et al. (2017). There are studies by Hosseinifar et al. (2016), Jahan et al. (2018) and others on policies to establish favorable conditions for improving research capability at home and abroad. Furthermore, some researchers, such as Aref et al. (2017), Hosseinifar et al. (2016) and Yumeen et al. (2018), include factors such as funding, orientation, and advice to young lecturers.

This aspect of the literature review led to the formulation of the following hypothesis.

H5. The policy regimes relating to lecturers have a positive impact on lecturers' research productivity.

2.6. Resources

Aydin (2017) demonstrated the impact of resource-related factors such as school profits for research, technology and facilities, libraries, and research funding (excluding funding from government). Hoffmann et al. (2017) demonstrated that the factors that have the greatest impact on research productivity are funding, access to research assistants, and time spent on research. According to Nafukho et al. (2019), the element most related to research achievement is the funding that the institution allocates for research.

Yang (2017) highlighted a number of resource-related variables, including research funds (from government, private, and university sources); facilities and equipment (information technology, discussion space, equipment for experiments or research); human resources (students' academic achievement, research assistants' competence, research fellows' competence); and resources from magazines and libraries (print books and journals, digital book and magazine resources, research software, and digital school resources). The data analysis showed that the category of research funding variables is regarded as the most influential, followed by human resources, journal and library resources, facilities, and equipment, in that order. According to Hosseinifar et al. (2016), one of the most important factors influencing research productivity is research resources and databases. In addition, factors such as a shortage of qualified human resources including research assistants, a lack of adequate equipment, grants, and low research budgets were described as significant barriers to lecturers' research publication.

Furthermore, Aref et al. (2017) investigated not only resources but also the efficiency of the resource allocation process, the effectiveness of subject institutional review boards and library resources and facilities (such as full database and analysis applications). Similar results were also reported in the studies conducted by Kiat and Claire (2017) and Sheridan et al. (2017). Negash et al. (2018) demonstrated that shortages of resources and research facilities are critical limiting factors in research productivity. According to Farzaneh et al. (2017), resource-related barriers include the lack of information, facilities and equipment, consultation, time, and funds. The most significant impediment to research is a lack of knowledge and data.

The following hypothesis is therefore proposed.

H6. Research resources have a positive impact on lecturers' research productivity.

2.7. Criteria to measure lecturer research productivity

Productivity and research results are outcomes of research activities that can be presented in the form of papers, books, or reports, or in some other way that can influence the research or information of others (Tauhed et al., 2019). Depending on the purpose, different tools and indicators can be used to measure and evaluate research productivity (Tekneci, 2014).

Many studies indicate that the total number of research items published and released is a quantitative approach to measuring research achievements (Wills et al., 2013). According to Hedjazi and Behravan (2011), research results involve innovative concepts that are studied and then reported in journals, newspapers, patents, or academic documents. Some researchers have also listed other criteria to measure quantity, such as the amount of research funding (Altbach, 2015; Iqbal and Mahmood, 2011), the outcomes of student/research guidance (Altbach, 2015), and membership of the National Academy of Sciences (White et al., 2012).

In terms of quality and impact approach, Costa et al. (2012) stressed that the research results of lecturers must be demonstrated in research works of international stature. Hirsch (2005) developed the H-index citation index to assess research outcomes. The H-index has been highlighted by Abramo et al. (2017), Huang (2012), Nafukho et al. (2019), and others as a credible index that is recognized globally for evaluating lecturers' research productivity.

Furthermore, several researchers, most notably Aydin (2017), have taken a systematic approach in terms of quantity, consistency, impact, and research activities. All of these indicators given by Aydin (2017) and many other authors are summarized in Table 1 as follows:

3. Model specification and research methodology

3.1. Model specification

It is noteworthy that in previous studies, there seems to be no underlying theory mentioned for this research topic (Quy, 2015). To date, only studies on individual factors have used motivational theories such as that of Chen et al. (2006), while other studies do not seem to address the underlying theories when examining the relationship between institutional, environmental or governance factors with research productivity of university lecturers.

Therefore, the hypotheses and models of this study are mainly established based on previous studies. The proposed research model includes 6 factors - 6 latent variables (Figure 1): (i) Organization's research objectives (MT); (ii) Decentralization (PQ); (iii) Leadership (LD); (iv) Support for research (HTNC); (v) Policy regimes to motivate lecturers' research activities (CDCS); (vi) Resources (NL).

Based on the original measurement scales of Aydin (2012), Bland et al. (2005), and Chen et al. (2006), the observed variables for each latent variable in Figure 1 were set up and adjusted through in-depth interviews with five experts. They all are scientists and administrators in VNU, including the head of the scientific research management department, dean, and vice dean working at affiliated universities and faculties under VNU. In March 2020, each expert was interviewed directly at VNU once, within 30 min per one, with the following question: "Are the questions in the questionnaire consistent with the research objective? Is there anything that needs to be added, reduced, or adjusted? If so, how should it be adjusted?" The answers were recorded, synthesized and analyzed to serve as the basis for adjusting the original questionnaire.

Finally, the measurements included: Latent variable "Organization's scientific research objectives" (MT) was measured by 7 observed variables; "Decentralization" (PQ) factor was measured by 6 observed variables; "Leadership" (LD) factor was measured by 7 observed variables; "Support for research" (HTNC) was measured by 7 observed variables (HTNC); the factor "Policy regimes to motivate lecturer research activities" (CDCS) was measured by 7 observed variables; "Resources" (NL) was measured by 5 observed variables; and the "Lecturers' research productivity" scale was measured by 8 observed variables.

3.2. Sampling method and data collection

The questionnaire consisted of 49 items, including 08 items on lecturers' research productivity and 41 statements on management factors. The respondents were asked to rate a 5-point Likert scale, from 1 = totally disagree to 5 = totally agree. To ensure participants' safety, privacy, and confidentiality, at the very beginning of the questionnaire, it was stated that we guarantee any information they provide will be kept strictly confidential, and that such information will only be used for this study.

We collected the data from April to September 2020. Firstly, to ensure that the observed variables are suitable for the research context, we implemented a pilot test including 82 observations before distributing the formal offline survey and online survey (via Microsoft Forms) in April 2020. The sample for this pilot test is randomly taken from lecturers working at some units in VNU including University of Economics and Business, University of Engineering and Technology, University of Education. Then, with the data obtained from the preliminary survey, the

Table 1. Research productivity criteria.

No.	Criteria to measure research productivity
1	Number of publications
2	Journal impact factor (IF)
3	Number of published books
4	Number of edited books
5	Number of book chapters published in monographs
6	Number of book chapters edited in monographs
7	Science citation index (SCI)
8	Number of registered patents
9	Number of commercialized research products/processes
10	Research grants obtained
11	Research projects participated in
12	Number of awards received
13	Number of conference papers delivered
14	Number of times invited to present conference papers
15	Number of doctoral and masterate theses overseen as main supervisor
16	Participation in the editorial board of scientific journal(s)
17	Taking a role in a professional association
18	Number of other publications or research works that have an impact on government/society
19	General academic materials

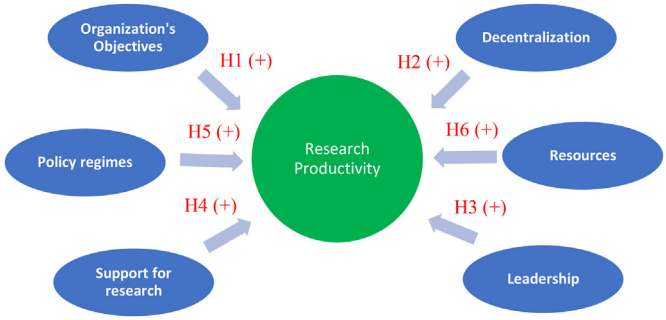

Figure 1. Research model.

internal consistency of the items was evaluated by Cronbach's alpha coefficient. This process led to the elimination of 2 items (items)/ observed variables in the Leadership scale (LD), including *"Unit leaders are reliable and respected"*, and *"Faculty/Department leaders actively* support *and encourage their lecturers' research efforts"*.

Next, for the official survey, we used non-probability sampling method and obtained 413 responses through both online and offline channels. The respondents were full-time lecturers at affiliated universities and faculties under VNU (hereinafter referred to as units), including "the University of Science, University of Social Sciences and Humanities, University of Languages & International Studies, University of Economics and Business, University of Engineering and Technology, University of Education, Vietnam - Japan University, University of Medicine and Pharmacy, International School, School of Law, School of Interdisciplinary Studies, and Hanoi School of Business and Management". The 15 biased observations were excluded from the study. Finally, 398 responses were valid, of which 313 responses (78.6%) were from the online, while 85 responses (21.4%) were from the offline survey. We confirmed that informed consent was obtained from all participants for our research. Table 2 shows the participants' demographics.

This study will adopt SEM method because it is considered as one of the most widely applied methods to study cause-and-effect relationships, which has also been commonly used in management studies (Shin and Konrad, 2016). According to Hair et al. (1998), this method includes the following steps: Exploratory factor analysis (EFA), Confirmatory factor analysis (CFA), and Multiple regression analysis. To perform this procedure, according to Hair et al. (1998), the minimum sample size requirement is from 100 to 150. On the other hand, there are two ways to choose the sample ratio, 5/1 or 10/1, which means that each latent variable needs to be maximized at least 5 or 10 observed variables (Hair et al., 1998). Accordingly, with the research model including a total of 41 observed variables, the minimum sample size was 205. Thus, the 398 observations used in this study were consistent with the requirements.

Table 2. 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%

3.3. Data analysis method

Data collected from the official survey were analyzed using the statistical software SPSS 26 and IBM Amos 24.0. The analytical procedure of the study, step by step, was as follows.

(i) Test the internal consistency of the measurement scales using Cronbach's alpha - computed with correlations between all pairs of items. The general accepted rule using this coefficient is that an alpha of equal to or greater than 0.6 indicates an acceptable level of reliability. The scale is considered good when this condition is satisfied. In addition, the corrected item total correlation also must be greater than 0.3 (Nunnally and Berstein, 1994).

(ii) Exploratory Factor Analysis (EFA)

In this study, EFA was used to uncover the underlying structure of the scales in the proposed model (MT - Organization's research objectives, PQ - Decentralization, LD - Leadership, HTNC - Support for research, CDCS - Policy regimes to motivate lecturers' research activities and NL - Resources) and identify the underlying relationships between measured variables. Additionally, this method considers the convergence and discrimination of groups of variables and help to remove inappropriate observed variables, thereby improving research outcomes (Hair et al., 2010).

EFA is considered appropriate when the KMO (Kaiser - Meyer - Olkin) coefficient is between 0.5 and 1.0 (Gerbing and Anderson, 1988). The Bartlett test, in addition, is conducted to test the correlation of the observed variables in each scale. If this test is statistically significant (Sig. < 0.05), the observed variables will be correlated with each other (Gerbing and Anderson, 1988). A percentage of variance greater than 50% is used to consider the percentage variation of observed variables (Gerbing and Anderson, 1988). Convergence is evaluated in the Pattern Matrix table. The study used factor loadings, representing the association between latent variables and observed variables, that were greater than 0.5 because this is considered an important level of practical significance (Gerbing and Anderson, 1988). The observed variables with factor loadings less than 0.5 were eliminated. Observed variables that appeared and were measured at the same time in two latent variables where these factor loadings did not differ by at least 0.3 (in absolute value) were also excluded. Finally, observed variables that were isolated only in one latent variable were excluded from the research model.

(iii) Confirmatory Factor Analysis (CFA)

In EFA, data was simply explored and provides information about the numbers of factors required to represent the data. So, in this study, CFA was applied to confirm the fit of the measurement model with the actual data. At the same time, the six hypotheses initially proposed were tested. The model is considered a good fit under the following conditions: The chi-squared/degrees of freedom ratio is greater than 5 (with sample size $N \geq 200$) or less than 3 (when sample size $N \leq 200$) (Kettinger et al., 1995); all of CFI (Comparative Fit Index), TLI (Tucker & Lewis Index), GFI (Goodness of Fit Index), AGFI (Adjusted Goodness of Fit Index), are simultaneously greater than 0.9 (in some cases, CFI and GFI less than 0.9 can also be acceptable, according to Hair et al., 2006); and RMSEA (Root Mean Squared Error of Approximation) is equal to or greater than 0.8.

In addition, an in-depth CFA was conducted to test the convergence, distinction and reliability of the model. According to Hair et al. (2006), the following conditions should be fulfilled: "(1) Reliability: Standardized Loading Estimates $\geq$0.5 (ideally = 0.7), Composite Reliability (CR) $\geq$ 0.7; (2) Convergence: Average Variance Extracted (AVE) $\geq$ 0.5; (3) Distinction: Maximum Shared Variance (MSV) $<$ AVE, Square root of AVE $>$ Inter-Construct Correlations".

(iv) T test and ANOVA

T tests and analysis of variance (ANOVA) were applied to test the differences and similarities in lecturers' research productivity by groups: gender, academic level, age, seniority as a lecturer, scientific field (natural or social sciences), holding managerial positions or not, domestic/international graduate.

(v) Correlation analysis

The study used the Pearson sample correlation coefficient (r) to measure the correlation between the independent variable and the dependent variable and between each pair of independent variables.

(vi) Multiple regression analysis

The study used a multiple regression model to assess the impact of management factors on the research outcomes of lecturers at VNU. The model specification is as follows:

$$KQ = \beta_0 + \beta_1*MT + \beta_2*PQ + \beta_3*LD + \beta_4*HTNC + \beta_5*CDCS + \beta_6*NL + u$$

in which: β_0, …, β_6: Regression coefficients; u: error term; Dependent variable: KQ - Lecturers' research productivity; Explanatory variables: MT - Organization's research objectives; PQ - Decentralization; LD - Leadership; HTNC - Support for research; CDCS - Policy regimes to motivate lecturers' research activities; NL - Resources.

At this step, the model must meet some conditions as follows: (1) The adjusted coefficient of determination ($\overline{R^2}$) ranges from 0.5 to 1; (2) Durbin-Watson d statistic ranges from 1 to 3 to ensure that first order autocorrelation does not occur; (3) T test of model has Sig. < 0.05, indicating the statistical significance of the scales for the model. The standardized regression coefficient (Beta) shows the specific impact of each independent variable on the dependent variable; (4) The Variance Inflation Factor (VIF) is applied to test for multicollinearity, and this index must be less than 2 to ensure that there is no strong correlation among independent variables.

4. Outcomes of analysis of factors affecting lecturers research productivity in VNU

4.1. Testing the internal consistency of measurement scales using Cronbach's alpha

Table 3 shows the results of testing the reliability of the scales, indicating that the corrected item total correlation of the variable MT7 was 0.272 (<0.3), so this variable was excluded from the scale. The test was conducted again with the remaining variables. The final result shows that the Cronbach's Alpha coefficient of all latent variables ranged from 0.8859 (LD) to 0.89 (CDCS). These were greater than 0.6, establishing that the scales had good reliability (Nunnally and Berstein, 1994). The corrected item total correlation of all observed variables ranged from 0.54 (PQ6) to 0.79 (NL2). These were greater than 0.3, indicating that all these observed variables met the requirements and contributed significantly to the general measurement scale (Nunnally and Berstein, 1994).

4.2. Exploratory Factor Analysis

EFA was implemented to evaluate the convergent and discriminant validity of the scales.

a. EFA for independent variables

EFA analysis for the independent variables was carried out over 4 rotations, with the results presented in Table 4.

After 4 rotations, the final EFA outcomes showed a Kaiser-Mayer-Olkin measure of sampling adequacy of 0.879, satisfying the requirement of lying in a range from 0.5 to 1 (Gerbing and Anderson, 1988). The Sig. of Barlett's test was 0.0000, establishing that EFA was useful with the data and that the observed variables had a linear correlated relationship with the latent variables (Gerbing and Anderson, 1988). The average variance extracted was 56.237% (>50%), meaning that 56.337% of the

Table 3. Analytical results of scale reliability.

Scale (Cronbach's Alpha)	Observed variable	The corrected item total correlation	Cronbach's Alpha if item deleted	Scale (Cronbach's Alpha)	Observed variable	The corrected item total correlation	Cronbach's Alpha if item deleted
MT (0.888)	MT1	0.705	0.869	**PQ (0.860)**	PQ1	0.633	0.841
	MT2	0.721	0.866		PQ2	0.655	0.836
	MT3	0.656	0.876		PQ3	0.730	0.822
	MT4	0.711	0.868		PQ4	0.678	0.832
	MT5	0.752	0.861		PQ5	0.673	0.833
	MT6	0.681	0.872		PQ6	0.544	0.855
LD (0.859)	LD1	0.629	0.838	**HTNC (0.881)**	HTNC1	0.671	0.864
	LD2	0.713	0.826		HTNC2	0.670	0.864
	LD3	0.445	0.861		HTNC3	0.670	0.864
	LD4	0.646	0.836		HTNC4	0.677	0.864
	LD5	0.663	0.833		HTNC5	0.664	0.865
	LD6	0.630	0.838		HTNC6	0.666	0.865
	LD7	0.640	0.837		HTNC7	0.662	0.865
CDCS (0.890)	CDCS1	0.707	0.872	**KQ (0.900)**	KQ1	0.706	0.885
	CDCS2	0.736	0.867		KQ2	0.666	0.889
	CDCS3	0.724	0.869		KQ3	0.691	0.887
	CDCS4	0.721	0.869		KQ4	0.682	0.887
	CDCS5	0.493	0.894		KQ5	0.691	0.887
	CDCS6	0.691	0.873		KQ6	0.733	0.883
	CDCS7	0.723	0.869		KQ7	0.664	0.889
NL (0.878)	NL1	0.753	0.841		KQ8	0.652	0.890
	NL2	0.796	0.830				
	NL3	0.723	0.848				
	NL4	0.661	0.864				
	NL5	0.657	0.870				

Table 4. Exploratory factor analysis for independent variables.

EFA Order	Number of observed variables	KMO Measure of Sampling Adequacy	Sig. of Bartlett Test of sphericity	Average Variance Extracted	Number of items deleted
1	38	0.888	0.000	56.369	**02** (PQ6 and LD3, due to the factor loadings being less than 0.5)
2	36	0.885	0.000	56.522	**01** (CDSC5, due to the factor loadings being less than 0.5)
3	35	0.881	0.000	56.824	**01** (NL5, by measured simultaneously in two latent variables)
4	34	0.879	0.000	56.237	**0**

variation in the data is explained by 6 independent variables, exactly as proposed in theoretical model. Table 5 presents the rotated component matrix for independent variables.

Table 5. The rotated matrix for independent variables.

Observed variables	Components					
	1	2	3	4	5	6
HTNC5	0.754					
HTNC4	0.726					
HTNC7	0.723					
HTNC2	0.715					
HTNC3	0.710					
HTNC6	0.709					
HTNC1	0.702					
CDCS2		0.790				
CDCS4		0.777				
CDCS3		0.768				
CDCS7		0.762				
CDCS1		0.759				
CDCS6		0.736				
MT5			0.807			
MT1			0.774			
MT2			0.761			
MT4			0.751			
MT6			0.745			
MT3			0.699			
LD2				0.741		
LD7				0.731		
LD5				0.721		
LD6				0.704		
LD4				0.701		
LD1				0.675		
PQ3					0.776	
PQ2					0.767	
PQ5					0.731	
PQ4					0.709	
PQ1					0.701	
NL2						0.896
NL1						0.852
NL3						0.712
NL4						0.691

Extraction Method: Principal Axis Factoring.

Thus, after 4 rounds of EFA analysis for independent variables, the model reduced from 38 to 34 observed variables. In the end, the latent variable "Support *for research" (HTNC)* was measured by 7 observed variables; three others -*"Policy regimes to motivate lecturers research activities" (CDCS)*,*"Organization's research objectives" (MT)* and *"Leadership" (LD)* - were similarly measured by 6 observed variables; *"Decentralization" (PQ)* by 5 and *"Resources" (NL)* by 4. Four items, including PQ6, LD3, CDCS5, and NL5, were excluded due to having factor loadings less than 0.5 or because of double-factor loading problems (Gerbing and Anderson, 1988). The remaining 34 observed variables all had factor loadings greater than 0.5, ranging from 0.675 to 0.807. All observed variables displayed discriminant and convergent properties, measuring 6 latent variables according to the theoretical model. Table 6 presents the rotated matrix for dependent variables. All observed variables had factor loadings greater than 0.5, ranging from 0.692 to 0.778.

4.3. Confirmatory Factor Analysis

CFA was used to assess the fit of the theoretical model with the research data, and to test the convergence, discriminant and reliability of the model.

a. CFA for independent variables

The results of CFA for the independent variables presented in Figure 2 show that the indicators for model fit are all good: CMIN/DF = 1.199 < 5; GFI = 0.917 > 0.9; CFI = 0.984 > 0.9; TLI = 0.982 > 0.9; RMSEA = 0.022 < 0.05 (Kettinger et al., 1995; Hair et al., 2006). It can be concluded that the model is consistent with the research data, and the relationships between the variables in the model are guaranteed to exhibit unidirectionality.

b. CFA for dependent variable

Figure 3 shows that the CFA for dependent variables also produced good results: CMIN/DF = 1.838 < 5; GFI = 0.978 > 0.9; CFI = 0.989 > 0.9; TLI = 0.984 > 0.9; RMSEA = 0.046 < 0.05. The model fits the data well and ensures one-way relationships between variables.

4.4. Results of correlation and regression analysis

Table 7 presents the results of the correlation analysis between the independent and dependent variables in the model. Pearson sample correlation coefficients between each pair of independent variables were all less than 0.4, indicating the absence of multicollinearity.

Table 8 presents the analysis of how management factors impact on lecturers' research productivity. The results show significant and positive impacts of 5 of the 6 factors, including "Resources", "Policy regimes

Table 6. The rotated matrix for dependent variables.

Observed variables	Component
	1
KQ6	0.778
KQ3	0.751
KQ1	0.734
KQ4	0.734
KQ5	0.724
KQ7	0.706
KQ2	0.704
KQ8	0.692

Extraction Method: Principal Axis Factoring.

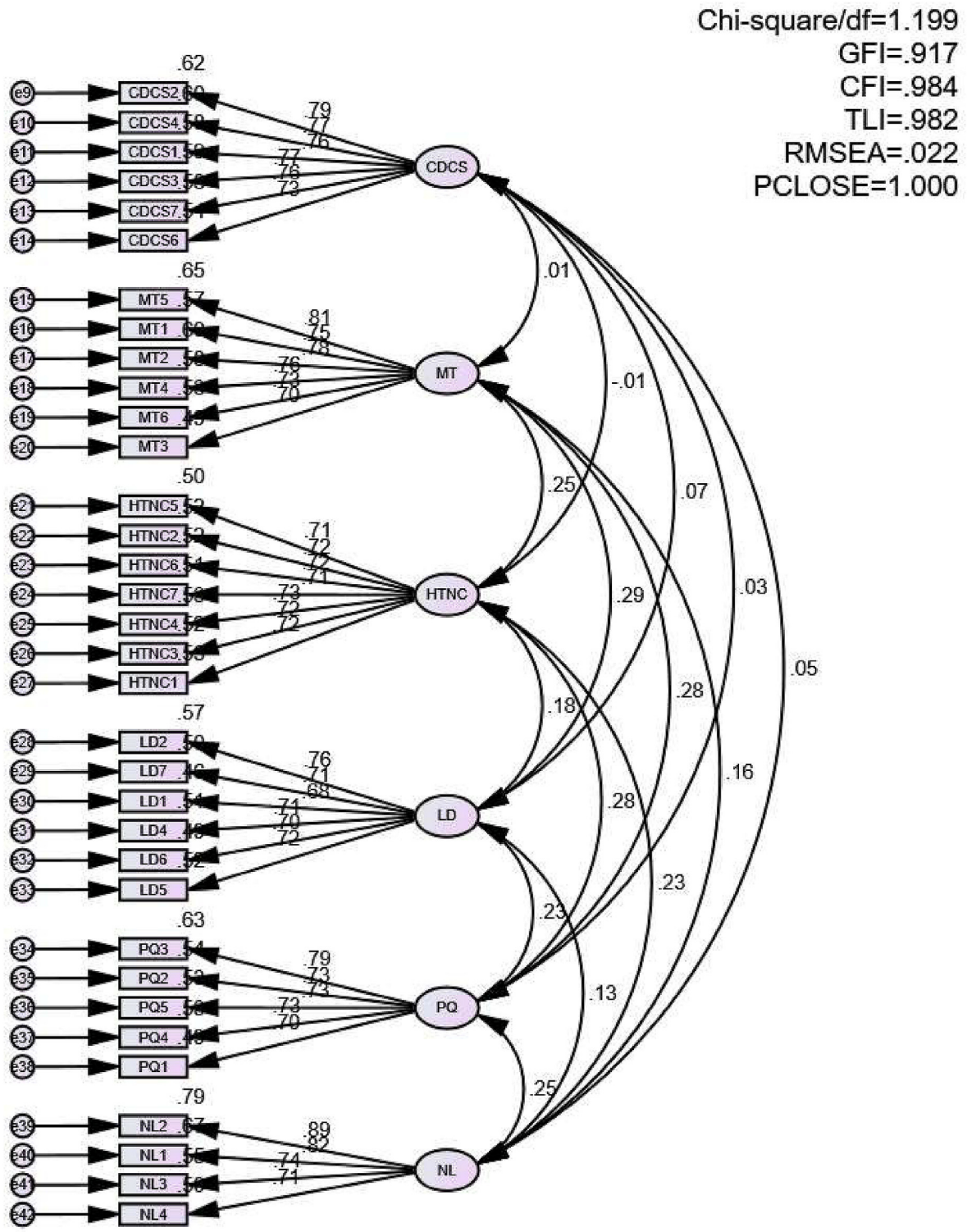

Figure 2. Results of CFA for independent variables.

to motivate lecturers research activities", "Support for research", "Leadership" and "Organization's research objectives". Only the "Decentralization" factor was not statistically significant in this model, since its p-value = 0.07 (>0.05). The adjusted R-squared of the model was 67.1%, indicating a relatively good fit of the model to the research data. All VIF values were less than 2 as expected, and the Durbin-Watson d-statistic = 1.877, lay within the range (1; 3). This means that there was no multicollinearity or first order autocorrelation.

5. Discussion

5.1. Findings and implications

Firstly, there is a close relationship between management factors and the research productivity of university lecturers. This is a positive correlation, meaning that the better the management in universities, the more scientific research productivity of lecturers will be enhanced.

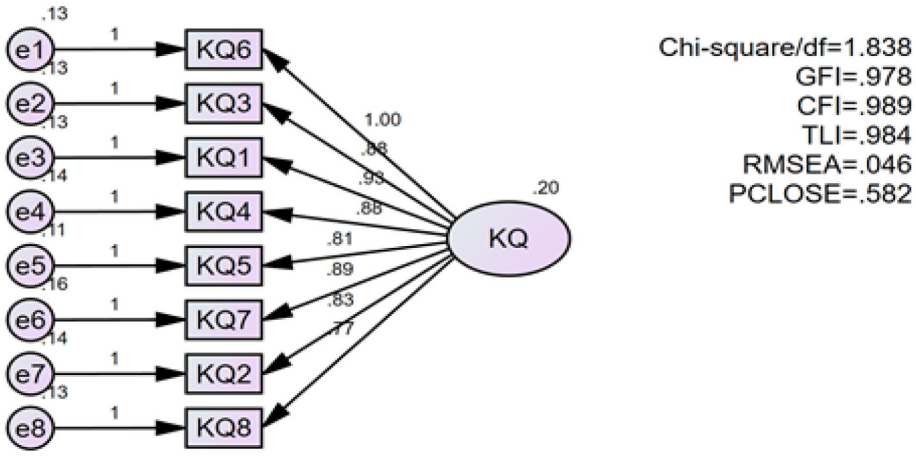

Figure 3. Results of CFA for dependent variables.

Table 7. Sample correlation coefficients between variables.

		f_KQ	f_HTNC	f_MT	f_PQ	f_NL	f_LD	f_CDCS
f_KQ	Pearson Correlation	1	0.434**	0.389**	0.311**	0.597**	0.285**	0.412**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000
f_HTNC	Pearson Correlation	0.434**	1	0.218**	0.240**	0.213**	0.159**	-0.013
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.001	0.789
f_MT	Pearson Correlation	0.389**	0.218**	1	0.235**	0.158**	0,254**	0,012
	Sig. (2-tailed)	0,000	0,000		0,000	0,002	0.000	0.817
f_PQ	Pearson Correlation	0.311**	0.240**	0.235**	1	0.237**	0.190**	0.032
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.521
f_NL	Pearson Correlation	0.597**	0.213**	0.158**	0.237**	1	0.129**	0.051
	Sig. (2-tailed)	0.000	0.000	0.002	0.000		0.010	0.312
f_LD	Pearson Correlation	0.285**	0.159**	0.254**	0.190**	0.129**	1	0.06
	Sig. (2-tailed)	0.000	0,001	0.000	0.000	0.010		0.229
f_CDCS	Pearson Correlation	0.412**	-0.013	0.012	0.032	0.051	0.060	1
	Sig. (2-tailed)	0.000	0.789	0.817	0.521	0.312	0.229	

** Correlated at statistical significance level of 1%.

Table 8. Results of multiple regression analysis.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0.014	0.160		0.085	0.932		
	f_HTNC	0.197	0.023	**0.265**	8.670	0.000	0.888	1.126
	f_MT	0.153	0.022	**0.216**	7.030	0.000	0.874	1.144
	f_PQ	0.042	0.023	**0.056**	1.820	**0.070**	0.868	1.153
	f_NL	0.234	0.015	**0.461**	15.251	0.000	0.907	1.102
	f_LD	0.077	0.025	**0.094**	3.109	0.002	0.905	1.105
	f_CDCS	0.253	0.019	**0.382**	13.222	0.000	0.993	1.007

a, Dependent Variable: f_KQ

Specifically, these management factors include "policies for lecturers", "research support", "leadership", "resources for research", and "university research goals and strategies". This finding is supported by previous studies on the institutional factors affecting academic staff research performance such as Bland et al. (2005), Hoffmann et al. (2017), Nafukho et al. (2019) and Yang (2017). This result can also be explained by the management concept by Stoner and Wankel (1987), that management is the process of planning, organizing, leading, and controlling the activities in the organizations and using all resources of the organizations to achieve the set goals (scientific goals of the universities). This means that the scientific goals of universities are achieved or not related to management.

Secondly, the level of impact of each management factor on the scientific research productivity of lecturers is different. The level of impact from strongest to weakest is "Resources", "Policy regimes to motivate lecturers research activities", "Support for research", "Leadership" and

"Organization's research objectives" respectively. The factor "decentralization" did not have a statistical impact on research productivity. The impact of each factor can be analyzed as bellows:

The factor "Resources" showed the greatest influence on the research productivity of VNU lecturers. This result is consistent with many previous studies, such as Bland et al. (2005), Hosseinifar et al. (2016), Hoffmann et al. (2017), Nafukho et al. (2019), Okendo (2018) and Yang (2017). In practice, the findings of this study can also be understood because, in the context of Vietnam, the main barriers to scientific publication are funding and time for research (Pho and Tran, 2016). Factors such as experimental devices or tools, software, funding sources, the accessibility of international scientific documents, and research data played an important role in international publishing (Tran et al., 2020). In the context of VNU, it has advantages in terms of human resources, with a high proportion of staff at Professor/Associate Professor level and holding Doctoral degrees, at 19% and 57% respectively, which is higher than many other universities in Vietnam. This is a large group of intellectuals, highly qualified and capable of multi-disciplinary and multi-field activities. The advantages of the association in the use of human resources have been exploited for many years at VNU to build interdisciplinary research groups and carry out key national-scale research tasks. However, the infrastructure and finance conditions for VNU lecturers' research activities are generally still limited. In terms of facilities, VNU has a narrow, scattered and unsynchronized campus. With regard to financial resources, VNU currently does not have enough to meet the requirements for investment in lecturers' capacity improvement, research and training to meet international quality standards. The budget allocation has not really been linked to the planned targets. This is partly because the use and allocation of these resources still need to comply with the general regulations of the State for public non-business education units.

The factor "policy regimes to motivate lecturers' research activities" had a significant influence on the research productivity of lecturers at VNU. This finding is consistent with the previous studies by Aydin (2017), Aref et al. (2017), Bland et al. (2005), Farzaneh et al. (2017), Hoffmann et al. (2017), Kiat and Claire (2017) and Yucel and Demir (2018). This can also be explained by the fact that, the income of lecturers at nonautonomous universities in Vietnam is still quite low, according to the general regulations of the State (Long, 2020), the policies on workload and remuneration for lecturers still have shortcomings (Trinh et al., 2020). "Time for research" influenced significantly the research outputs of social scientists in Vietnam (Vuong et al., 2018; Tran et al., 2020). In the case of VNU, it has implemented several programs in the past few years to help lecturers improve their capacity, revenue, and levels of pay. However, the salary of lecturers in many units in VNU is still not really competitive or highly encouraging. Exceptions occur only in a small number of autonomous units.

The results show that two factors, "Support for research" and "Organization's research objectives", both had a positive influence on the research productivity of the lecturers at VNU. Many earlier studies have also corroborated this, such as Bland et al. (2005), Jahan et al. (2018), Jung (2012), Kiat and Claire (2017), Sheridan et al. (2017), Tafreshi et al. (2013) and Yumeen et al. (2018). In the case of VNU, since the early 2010s, although the State of Vietnam has not yet issued a Decree guiding the stratification of universities, VNU has identified and declared its development goal of being a research university, and gaining a high position in the world's leading prestigious rankings. However, the VNU's affiliated units still do not have a medium- and long-term scientific research strategy; most of the set targets still have high "safety" and lack challenges. The targets of scientific research should be communicated, displayed, monitored and promoted more often in real time.

With regard to support activities for research in general, VNU and its member units have policies and institutions that contribute positively to the scientific research productivity of lecturers. VNU has many research support units, especially the VNU Journal of Science, a Library and Information Center, Centers for Knowledge Transfer and Startup Support, a Science and Technology Development Fund, a system of laboratories and research centers, and hundreds of research groups in all affiliated units, of which nearly 1/3 are strong research groups. In terms of policies, VNU has pioneered policies for higher education institutions such as building and developing key research programs and strong research groups, science and technology awards, and developing Scientists' Clubs. VNU also has a cooperative relationship with ministries, departments within the Ministry, local authorities and many other organizations to attract and support lecturers in carrying out important or interdisciplinary research projects. In addition, VNU and its units aimed to create a culture and environment that valued scientific research, established and developed research groups, and organized many conferences, seminars, and training courses to promote lecturers' research activities. However, VNU's scientific research support still has some shortcomings that need to be overcome, especially in terms of administrative and financial procedures that affect scientific research productivity.

The "Leadership" factor had a positive influence on the scientific research productivity of lecturers at VNU, but the influence level was less than the factors mentioned above. This finding has been confirmed in many studies. Bland et al. (2005) suggested some characteristics of leadership that create a positive impact on lecturers' research productivity, including good scientific research ability; good leadership and direction in research activities; non-authoritarian management styles; and the participation in and fulfillment of key roles by leaders in research. Heinze et al. (2009) indicated the role of leadership in linking scientific fields, selecting and training young talented lecturers, encouraging and developing new scientific ideas, attracting funding, building an environment for research and innovation, and in setting and disseminating targets within the organization. In addition, Hwang (2016) established that "Leadership" is the most significant influencing factor among institutional factors. Kiat and Claire (2017) suggested that leaders need to have high credibility, communicate clearly about their organization's research objectives, and create autonomy for lecturers in research activities, to accelerate scientific research throughout the whole organization.

Finally, different from the results obtained from the studies of Bland et al. (2005) and Hwang (2016), this study shows that the factor "Decentralization" has no impact on research productivity of lecturers at VNU. This is understandable because the decentralization at VNU is mainly in terms of procedures and administration, so it may have little direct and significant impact on lecturers' research productivity. Furthermore, this finding is aligned with some prior studies. Le and Ngo (2015) argued that decentralization should not be as high as possible, and should not be so decentralized that managers do not know what subordinates do. The theory of management Y (Gregor, 2006) demonstrated that there is no absolute autonomy to achieve both individual needs and organizational goals simultaneously. Therefore, decentralization should be at an appropriate level. This also means that, not necessarily, the higher the decentralization, the higher the work efficiency.

From the above discussion, this study makes some recommendations for VNU to improve the scientific research productivity of lecturers, as follows:

Thirdly, VNU and its affiliates should plan long-term and medium-term strategies to enhance scientific research productivity. Scientific research objectives need to be set in a more achievable manner (when accompanied by an investment of resources and research support) rather than just top-down coercion administratively. At the same time, the reform of administrative procedures and digital transformation to better support scientific research also need to be improved. Building a working environment and scientific research culture in which lecturers are always appreciated for their research results, actively participate in research groups, and are facilitated for cooperation with scientists on and off their campus... must also be focused. In addition, to enhance scientific research outputs, it is also possible to develop the form of science and technology enterprises under VNU to apply the outputs of the research process and support activities, such as the registration of patents/inventions, and the

commercialization and deployment of scientific and technological products.

Lastly, it is necessary for VNU to take measures to further enhance awareness among leaders of the extremely important role of scientific research in the sustainable development of the university. Unit leaders need to clearly communicate about research objectives and strategies, be fair in allocating resources, recognize research achievements. In addition, the criteria for appointing managers at universities, faculties, departments, and laboratories need to be different from those for other administrative positions. The selection criteria for such highly specialized positions should focus on professional capacity, creativity, connectivity and orientation,... Besides, in the current context of increasing internationalization of education, it is necessary to equip managers with management skills and knowledge towards international standards.

5.2. Limitations

Despite the significant findings, this study still has some limitations. Firstly, the research data has been formed on the basis of lecturers' perceptions through survey questionnaires. Therefore, this study has not been able to track the changes in the scientific research results of lecturers in practice. Secondly, other mediating factors (e.g., behavior, motivation, and attitude) that may influence scientific research productivity have not been examined. Thirdly, non-probability sampling method has some limitations, so multi-group analysis technique has not been implemented. As a result, this study has not shown the difference in the association between management and scientific research productivity of the sample groups. Finally, caution should be exercised in applying the results of this study to other contexts, as it was conducted within VNU and its member units. In the future, it is possible to expand the scope of study to groups of public or private, autonomous or non-autonomous, single or multidisciplinary, research or practice-oriented universities.

6. Conclusion

This study has established and examined model for evaluating management factors that affect the research productivity of Vietnamese university lecturers, by SEM methodology. The results show that there is a close relationship between management factors and research productivity of lecturers. The influential level of management factors, in order from the most significant to the weakest, is: resources, policy regimes to motivate lecturers research activities, support for research, research objectives and strategies, and leadership. “Decentralization” was a new factor introduced by the authors into the research model, but was not statistically associated to lecturers' research productivity.

This study has significant contributions and implications for higher education management. This study has focused on investigating the impact of management factors on the research productivity of lecturers in a developing country - where there is a great need for significant reforms in educational management. Although the influence of management policies on employee performance is no longer a new research topic, the literature focusing on the impact of management factors on research performance is still limited. To date, most literature only approach the individual and institutional factors that influence the results of scientific research in universities. Overall, this study has both practical and theoretical contributions. It may help lecturers, managers, and policy makers to take possible solutions to enhance scientific research performance, thereby contributing to the sustainable development of universities.

Declarations

Author contribution statement

Nguyen Anh Tuan analyzed and interpreted the data; wrote the paper.
Truong Thi Hue: wrote the paper; analyzed and interpreted the data.
Luong Thuy Lien wrote the paper.
Luu Huu Van wrote the paper.
Hoang Thi Tuyet Nhung wrote the paper.
Luu Quoc Dat wrote the paper; analyzed and interpreted the data.

Funding statement

This work was supported by Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 503.01-2019.03.

Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendices A. Description of scales

Scale (Cronbach’s Alpha)	Observed variable	References
MT (0,888)	MT1 - Promoting scientific research has always been an important strategy of the university	Bland et al. (2005), Hedjazi and Behravan (2011), Jung (2012), Okendo (2018)
	MT2 - Faculties and departments have coordination in the process of setting scientific research goals	
	MT3 - The scientific research objectives are disseminated on the university’s media channels	
	MT4 - The university has clear and specific research objectives	
	MT5 - The university’s scientific research objectives are realistic	
	MT6 - Lecturers are satisfied with the university’s scientific research objectives	
	MT7 - The university has high requirements for the scientific research results	

(continued on next page)

(*continued*)

Scale (Cronbach's Alpha)	Observed variable	References
LD (0.859)	LD1 - The university's leaders clearly understand the objectives and orientation of scientific research activities	Bland et al. (2005), Heinze et al. (2009), Whelan and Markless (2012), Sheridan et al. (2017), Farzaneh et al. (2017), Salman et al. (2018)
	LD2 - The university's leaders always recognize the scientific research achievements of lecturers	
	LD3 - The university's leaders have fairness in allocating research projects	
	LD4 - The direct leaders have a high academic reputation	
	LD5 - The direct leaders have good management capacity	
	LD6 - The direct leaders always support the lecturer's research activities	
	LD7 - The direct leaders always treat lecturers fairly	
CDCS (0.890)	CDCS1 - Scientific research capacity is an important criterion in the university's recruitment policy	Bland et al. (2005), Hosseinifar et al. (2016), Hoffmann et al. (2017), Okendo (2018), Salman et al. (2018), Yumeen et al. (2018)
	CDCS2 - The university's policy and reward system encourage and create motivation for lecturers	
	CDCS3 - Current income policy encourages and motivates lecturers	
	CDCS4 - Lecturers are always supported by the university to achieve the title of associate professor, professor	
	CDCS5 - Lecturers are given favourable conditions to participate in research exchanges at domestic and foreign research institutions	
	CDCS6 - Lecturers are given priority to time conducting scientific research works	
	CDCS7 - Young lecturers in the school are periodically trained to improve their capacity on scientific research	
NL (0.878)	NL1 - Lecturers are allocated research space at the university	Whelan and Markless (2012), Yang (2017), Okendo (2018), Salman et al. (2018)
	NL2 - The university invests in necessary equipment to serve the scientific research activities of lecturers	
	NL3 - Lecturers are granted accounts to access the necessary scientific documents for free at the university.	
	NL4 - Lecturers are supported financially to research (for example, international scientific publication, intellectual property registration, ...)	
	NL5 - There are many lecturers with good scientific research ability in the university.	
PQ (0.860)	PQ1 - Lecturers are encouraged to participate in the process of developing policies on scientific research.	Bland et al. (2005), Heinze et al. (2009), Aydin (2012), Hwang (2016), Sheridan et al. (2017), Aydin (2017), Okendo (2018)
	PQ2 - Departments and faculties and are authorised to decide most academic-related issues.	
	PQ3 - Lecturers are encouraged to pursue research directions as their strengths	
	PQ4 - Lecturers are given the freedom to conduct their own research projects	
	PQ5 - The management of scientific research results is based on the autonomy of lecturers.	
	PQ6 - The university always listens to lecturers' feedback through many channels	
HTNC (0.881)	HTNC1 - The university strives to build a culture that values scientific research achievements.	Hosseinifar et al. (2016), Farzaneh et al. (2017), Yang (2017), Okendo (2018), Salman et al. (2018), Ghabban et al. (2019), Rubin and Callaghan (2019)
	HTNC2 - The university simplified administrative procedures for scientific research.	
	HTNC3 - The school has obtained many funding sources for faculty to do scientific research.	
	HTNC4 - Lecturers are supported by the university to transfer and commercialize their research results	
	HTNC5 - The university has policies to support and encourage the establishment of research groups	
	HTNC6 - The university's administrative departments usually support lecturers in conducting scientific research works	
	HTNC7 - The university periodically organizes scientific research activities such as conferences, seminars, workshops, etc	
KQ (0.900)	KQ1 - The number of my works published in prestigious international scientific journals (ISI/Scopus) tends to increase in recent years	Bland et al. (2005), Hedjazi and Behravan (2011), Hoffmann et al. (2017), Nafukho et al. (2019), Hue et al. (2021)
	KQ2 - The number of my works published in other international scientific journals tends to increase in recent years	
	KQ3 - The number of my works published in domestic journals tends to increase in recent years	
	KQ4 - The number of my works published in scientific conference proceedings tends to increase in recent years	
	KQ5 - The number of my books tends to increase in recent years	
	KQ6 - The number of my patents, inventions, and intellectual property registration tends to increase in recent years	
	KQ7 - The number of scientific research projects that I lead tends to increase in recent years	
	KQ8 - The number of scientific research awards that I and my students get tends to increase in recent years	

References

Abramo, G., D'Angelo, C.A., Murgia, G., 2017. The relationship among research productivity, research collaboration, and their determinants. J. Inf. 11 (4), 1016–1030.

Altbach, P.G., 2015. What counts for academic productivity in research universities? Int. High. Educ. 79, 6–7.

Aref, F., Washington, A., Johnson, J., Davis, D., Cross, K., 2017. Factors affecting rehabilitation research productivity in minority serving institutions. In: LU-RRTC State of the Science Conference Atlanta, Georgia September 28-29.

Aydin, O.T., 2012. The impact of theory X, theory Y and theory Z on research performance: an empirical study from A Turkish university. Int. J. Adv. Manag. Econ. 1 (5), 24–30.

Aydin, O.T., 2017. Research performance of higher education institutions: a review on the measurements and affecting factors of research performance. J. High. Educ. Sci. 7 (2), 310–320.

Bland, C.J., Center, B.A., Finstad, D.A., Risbey, K.R., 2005. A theoretical, practical, predictive model of faculty and department research productivity. Acad. Med. 80, 225–237.

Chen, Y., Gupta, S., Hoshower, L., 2006. Factors that motivate business faculty to conduct research: an expectancy theory analysis. J. Educ. Bus. 81, 179–189.

Costa, B., Carlos, A., Oliveira, Monica D., 2012. A multicriteria decision analysis model for faculty evaluation. Omega 40 (4), 424–436.

Edgar, F., Geare, A., 2013. Factors influencing university research performance. Stud. High Educ. 38 (5), 774–792.

Farzaneh, E., Amani, F., Taleghani, Y.M., Fathi, A., Aghdam, F.G., Ardalan, G.F., 2017. Research barriers from the viewpoint of faculty members and students of Ardabil University of Medical Sciences, Iran 2014. Int. J. Res. Med. Sci. 4 (6), 1926–1932.

Gerbing, D.W., Anderson, J.C., 1988. An updated paradigm for scale development incorporating unidimensionality and its assessment. J. Market. Res. 186–192.

Ghabban, F., Selamat, A., Ibrahim, R., Krejcar, O., Maresova, P., Herrera-Viedma, E., 2019. The influence of personal and organizational factors on researchers' attitudes towards sustainable research productivity in Saudi universities. Sustainability 11, 4804.
Gregor, D., 2006. The Human Side of Enterprise. McGraw-Hill, New York, NY, USA.
Hedjazi, Y., Behravan, J., 2011. Study of factors influencing research productivity of agriculture faculty members in Iran. High Educ. 62 (5), 635–647.
Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1998. Multivariate Data Analysis with Readings. Prentice-Hall, Englewood Cliffs, NJ.
Hair, J., Black, W., Babin, B., Anderson, R.E., 2006. Multivariate Data Analysis, sixth ed. Prentice-Hall, U:er Saddle River, NJ.
Hair, J., Black, W., Babin, B., Anderson, R.E., 2010. Multivariate data analysis: a global perspective. In: Multivariate Data Analysis: A Global Perspective, vol. 7. Pearson Education, Upper Saddle River, NJ, USA; London, UK.
Heinze, T., Shapira, P., Rogers, J.D., Senker, J.M., 2009. Organizational and institutional influences on creativity in scientific research. Res. Pol. 38, 610–623.
Hirsch, J.E., 2005. An index to quantify an individual's scientific research output. Proc. Natl. Acad, Sci. U. S. A. Retrieved from https://www.pnas.org/content/pnas/102/46/16569.full.pdf.
Hue, T.T., Hung, L.M., Duc, D.A., Duc, L.A., Huyen, N.T., Thanh, N.K., 2021. Impact of governance factors over lecturers' scientific research output: an empirical evidence. Educ. Sci. 11, 553.
Hoffmann, D., Berg, S., Koufogiannakis, D., 2017. Understanding factors that encourage research productivity for academic librarians. Evid. Base Libr. Inf. Pract. 12 (4), 102–128.
Hosseinifar, T., Isfandyari-Moghaddam, A., Zare, A., 2016. Factors affecting and inhibiting scientific productivity from the viewpoint of faculty members of Kermanshah University of Medical Sciences. Educ. Res. Med. Sci. 5 (1), 29–36.
Huang, M.H., 2012. Exploring the h-index at the institutional level: a practical application in world university rankings. Online Inf. Rev. 36 (4), 534–547.
Hwang, K., 2016. The factors affecting basic research performance funded by government: 'creative research program case in South Korea. Sci. Technol. Soc. 21 (3), 349–365.
Iqbal, M.Z., Mahmood, A., 2011. Factors related to low research productivity at higher education level. Asian Soc. Sci. 7 (2), 188–198.
Jahan, F., Siddiqui, M., Khabouri, Z., Riyami, R., Ahuja, A., 2018. Factors influencing quality of academic research: perception of faculty researchers at Oman Medical College. Med. Clin. Arch. 2 (1), 1–5.
Jung, S., 2012. Faculty research productivity in Hong Kong across academic discipline. High Educ. Stud. 2 (4), 1–13.
Kettinger, W.J., Lee, C.C., Lee, S., 1995. Global measures of information services quality: a cross-national study. Decis. Sci. J. 26 (5), 569–588.
Kiat, K.S., Claire, M., 2017. Underpinning excellence in higher education and investigation into the leadership, governance and management behaviours of high-performing academic departments. Stud. High Educ. 42 (2), 210–231.
Koontz, H., O'Donnell, C., Weihrich, H., 1984. Principles of Management: an Analysis of Managerial Functions, 8th. McGraw-Hill, New York.
Le, V.T., Ngo, K.T., 2015. Textbook of Corporate Governance. National Economics University Publishing House, Hanoi, Vietnam, 2015.
Lertputtarak, S., 2008. An Investigation of Factors Related to Research Productivity in a Public University in Thailand: A Case Study. Victoria University, Melbourne, Australia. Doctoral Dissertation.
Long, P., 2020. For Successful University Autonomy: The Income of Lecturers Must Be at 50 Million/Month. Available online: https://giaoduc.net.vn/giao-duc-24h/de-tu-chu-dai-hoc-thanh-cong-thu-nhap-giang-vien-phai-o-muc-50-trieu-thang-post215605.gd. (Accessed 16 April 2021). accessed on.
Nafukho, F.M., Wekullo, C.S., Muyia, M.H., 2019. Examining research productivity of faculty in selected leading public universities in Kenya. Int. J. Educ. Dev. 66, 44–51.
Negash, M., Lemma, T.T., Samkin, G., 2018. Factors impacting accounting research output in developing countries: an exploratory study. Br. Account. Rev. 51 (2), 170–192.
Nguyen, D.N., Tue, D.N., Kien, T.D., 2021. Effects of institutional policies and characteristics on research productivity at Vietnam science and technology universities. Heliyon 7, e06024.
Nguyen, Q., Klopper, C., 2019. A comparative analysis of Vietnamese and Australian research capacity, policies, and programmes. In: Nguyen, N.T., Tran, L.T. (Eds.), Reforming Vietnamese Higher Education: Global Forces and Local Demands, Education in the Asia-Pacific Region: Issues, Concerns and Prospects. Springer, Singapore, pp. 173–196.
Nunnally, James, Bernstein, C., 1994. Psychometric theory. In: McGraw-Hill Series in Psychology. McGraw-Hill, New York.
Okendo, O., 2018. Constraints of research productivity in universities in Tanzania: a case of Mwenge Catholic University, Tanzania. Int. J. Educ. Res. 6 (3), 201–210.
Pham, L.T., Hayden, M., 2019. Research in Vietnam: the experience of the humanities and social sciences. J. Int. Comp. Educ. 8, 27–40.
Pho, P.D., Tran, T.M.P., 2016. Obstacles to scholarly publishing in the social sciences and humanities: a case study of Vietnamese scholars. Publications 4, 19.
Quy, N.H., 2015. Factors Influencing the Research Productivity of Academics at the Research-Oriented University in Vietnam. Griffith University, Queensland, Australia. Thesis of Education.
Ramli, M.S.B., Jusoh, A.B., 2015. Expectancy theory analysis to conduct research at Malaysian research university. Int. J. Econ. Financ. Issues 5, 366–372.
Rubin, A., Callaghan, C.W., 2019. Entrepreneurial orientation, technological propensity and academic research productivity. Heliyon 5, e02328, 1-11.
Salman, S., Kausar, T., Furqan, M., 2018. Factors affecting research productivity in private universities of lahore: a discriminant analysis. Pakistan Bus. Rev. 1046–1064.
Sheridan, J., Savoy, J.N., Kaatz, A., Lee, Y.G., Filut, A., Carnet, M., 2017. Write more articles, get more grants: the impact of department climate on faculty research productivity. J. Wom. Health 26 (5), 587–596.
Shin, D., Konrad, A., 2016. Causality between high-performance work systems and organizational performance. J. Manag. 43, 973–997.
Smeby, J.C., Try, S., 2005. Departmental contexts and faculty research activity in Norway. Res. High. Educ. 466, 593–619.
Stoner, J.A.F., Wankel, C., 1987. Management - 3rd. Prentice Hall International.
Tafreshi, G.H., Imani, M.H., Ghashlag, P.M., 2013. Designing a model for research productivity evaluation of faculty of district 2 of Islamic Azad university of Iran. World Appl. Sci. J. 21 (12), 1708–1720.
Tauhed, S.Z., Rasdi, R.M., Ibarahim, R., Samah, B.A., 2019. The influence of networking, individual effort, and time management on research performance of academics at Malaysian research universities. Rev. Publicando 6 (19), 325–338.
Tekneci, P.D., 2014. Evaluating Research Performance of Turkish Universities. Middle East Technical University, Ankara. Doctoral Dissertation.
Tran, T., Trinh, T.P., Le, C.M., Hoang, L.K., Pham, H.H., 2020. Research as a base for sustainable development of universities: using the Delphi method to explore factors affecting international publishing among Vietnamese academic staff. Sustainability 12, 3449.
Trinh, T., Tran, T., Le, H., Nguyen, T., Pham, H., 2020. Factors Impacting International-Indexed Publishing Among Vietnamese Educational Researchers, 33. Learned Publishing, pp. 419–429.
Vuong, T.T., Nguyen, T.H.K., Ho, T.M., Ho, T.M., Vuong, Q.H., 2018. The (in) significance of socio-demographic factors as possible determinants of Vietnamese social scientists' contribution-adjusted productivity: preliminary results from 2008-2017 scopus data. Societies 8, 3.
Whelan, K., Markless, S., 2012. Factors that influence research involvement among registered dietitians working as university faculty: a qualitative interview study. J. Acad. Nutr. Diet. 112 (7), 1021–1028.
White, C.S., James, K., Burke, L.A., Allen, R.S., 2012. What makes a ''research star''? Factors influencing the research productivity of business faculty. Int. J. Prod. Perform. Manag. 61 (6), 584–602.
Wichian, S.N., Wongwanich, S., Bowarnkitiwong, S., 2009. Factors affecting research productivity of faculty members in government universities: lisrel and neural network analyses. Kasetsart J. - Soc. Sci. 30, 67–78.
Wills, D., Ridley, G., Mitev, H., 2013. Research productivity of accounting academics in changing and challenging times. J. Account. Organ. Change 9 (1), 4–25.
Yang, J.C., 2017. A study of factors affecting university professors' research output: perspectives of Taiwanese professors. J. Coll. Teach. Learn. 14 (1), 11–20.
Yucel, A.G., Demir, S.B., 2018. Academic incentive allowance: scientific productivity, threats, expectations. Int. Online J. Educ. Sci. 10 (1), 39–55.
Yumeen, S., Ho, S.M., Reg, O., Wong, W., Borschel, G.H., 2018. What factors influence resident research publication in the division of plastic surgery? J. Surg. Educ. 75 (2), 409–416.