Received: 13 January 2023 | Revised: 2 June 2023 | Accepted: 9 June 2023 | Published online: 16 June 2023

RESEARCH ARTICLE

Artificial Intelligence and Applications
2024, Vol. 2(4) 335–342
DOI: 10.47852/bonviewAIA3202660

BON VIEW PUBLISHING

An Exploratory Study of Factors Affecting Research Productivity in Higher Educational Institutes Using Regression and Deep Learning Techniques

Rasha G. Mohammed Helali[1]

[1]*Computer Science Department, University of Bisha, Saudi Arabia*

Abstract: Higher education is grappling with challenges from globalization. The competition between worldwide universities depends not only on the availability of infrastructure and faculty members' teaching quality but also on their research performance. The research produced by faculty members has a significant impact on a university's standing, ability to acquire funds, and ability to enroll both domestic and international students. The objective of this paper is to identify factors affecting scientific research productivity in selected higher educational institutes. The paper reports the views of academic staff from different educational institutes on such issues as the determinants of research performance. A quantitative analysis approach, including correlation and regression, in addition to deep learning, was utilized to achieve the aim of the paper. The findings of this research demonstrate that the support of academic institutes for enhancing research and providing facilities and funds for such purpose has a great impact on research performance. The allocation of hours of scientific research to the faculty member also had a positive impact on the improvement of scientific research. Linking career promotion and scientific research encourages faculty members to publish more papers. Moreover, the level of qualification for faculty members has a great impact on their rate of publishing papers.

Keywords: higher education, scientific research, research performance, educational institutes, funded researches

1. Introduction

Productivity in general is defined as the quantitative measure between the number of resources used and the output produced [1]. In an educational sector, the quantity and quality of research are heavily considered and weighted in global university rankings [2]. Number of studies considered scientific research from different point of view. Their aim is to find out main factors that may affect or influence scientific research in different institutes. Now, many universities or academic institutes seeking to achieve academic Accreditation from Authorized entities that mainly dependent on quality of learning outcomes and scientific research produced by the institute. The productivity of scientific papers is measured not only by number of research papers published by faculty members but also by the quality of produced research. Many studies addressed this topic from 1960 till now and different point of views found accordingly. Creswell [3] reviewed previous studies the number of research publications and the number of times those articles were cited were discovered to be the two primary indexes for evaluating university professors' research success between the 1960s and the 1980s. They determined that factors that may affect professors' research performance can be divided into individual factors and environmental factors. Future study should use interdisciplinary and diverse methodologies to examine how institutional and research area disparities affect university teachers' research performance, they advised [4]. University academics' research output is broken down by Chang and Chiu into a number of indices in 2008: research project, journal article publishing, book and book chapter publication, conference paper, patent obtained through research results, and academic award. In terms of how to measure university professors' research performance [5]. Wagner et al. [6] shed some insight into the motivating variables that affect how well literature reviews are received by scientists. Their thorough examination of 214 IS literature reviews demonstrates that, in addition to journal-level markers indicating scientific impact, characteristics at the author and article levels (such as expertise and collaboration) are crucial indications of scientific impact.

Toma et al. [7] customized their research for Romanian academic institution. They presented an article identifying the main risks in the Romanian academic institution and cases of occurrence. Their study considered academic, strategic financial, and operational factors.

Chen et al. [8] presented a study to learn more about 320 university professors' perspectives on key aspects of scientific paper production for business schools, and a study was carried out. Based on the study's findings, associate professors are more likely to be motivated by their own psychological thoughts than assistant instructors are by outside advantages like money and promotions. Their study also revealed a lousy correlation between

*Corresponding author: Rasha G. Mohammed Helali, Computer Science Department, University of Bisha, Saudi Arabia. Email: rashahilal@ub.edu.sa

the number of years spent in employment at universities and the creation of research articles.

Alcaine [9] presented a study of various factors that affect academic achievement at top-tier and extremely top-tier research universities in the United States. The doctorate-granting institutions with the highest levels of research activity are highlighted by these high and highly regarded research universities, based on the Carnegie Society for the Advancement of Teaching's 2010 Basic Classifications. The results imply that universities, whether public or private, will continue to seek tactics and regulations that will promote entrepreneurial activity with obvious financial repercussions as well as lure outstanding students in an effort to improve institutional performance.

Aydın [10] reviewed the literature on student university selection; the university choice process is explained in terms of the following four models: economic models, sociological models, combined models, and the marketing approach. Then, reference groups, families, institution reputation and qualities, personal variables, location, postgraduate employment possibilities, tuition costs, financial aid/ scholarship, and information sources were the nine primary elements that the study looked into. Numerous studies within the past few years have addressed the rising competition in educational institutions. They have emphasized that the goal of the intensifying competition among universities is to increase the number of students, obtain funding for research, recruit faculty members, and attract students. The significance of research superiority is one of the criteria for evaluating a university's growth.

Quimbo and Sulabo [11] proposed three classifications of factors that influence research performance, namely individual factors, institutional factors, and research self-efficacy. They stated that individual factors include personal characteristics of faculty members such as age, gender, civil status, educational attainment, academic rank, field of specialization, teaching load, number of years in teaching, and research experience [11]. Kristopher and his co-worker published a paper in 2015 considered how can factor such as gender, age, and academic position of the researchers influence scientific performance in terms of publication rate. The study showed that the academic position is more important than age and gender [12].

Recently, Aydin [13] extended his previous work by drawing attention to "research performance" which is a significant part of the competition among the universities. Regarding this goal, the study tries to outline the results of an extensive literature review in the field of higher education research performance. Results revealed that 51 factors correlated to research productivity including availability of research training, work habits, adequate, and fair salaries According to research productivity, a study published in 2015 by Abouchedid and Abdelnour [14], analyses the research output of a sample of higher education institutions (HEIs) in six Arab countries including 310 institutions in Lebanon, Qatar, the United Arab Emirates (UAE), Morocco, Saudi Arabia and Jordan. The study revealed that faculty research output in the Arab world is relatively low and different factors may contribute to this issue.

In 2019, the research published by Younus and NURAZZURA considering the research productivity in Saudi Arabia showed that still the level of research productivity needs to be improved. In contrast, there is no research that showed the level of scientific research productivity in Sudan compared to global productivity [1]. So, the importance of this study is to find out the reasons and factors that may affect the research capacity in academic institute in order to improve it. Another research paper published in 2021 focused on research productivity among women during COVID-19 crisis. They are offered new empirical insights into the experiences and perceptions of women scholars during the early stages of the pandemic by using quantitative approach [15]. In the same year, Nasim and Rahmatullah published a study which investigated the faculty perceptions of their research skills, research productivity, and related hindering factors at a public University in Afghanistan. They use both quantitative and qualitative approaches [16]. Hue et al. [17] presented a study which aimed to determine the priority of the university's governance factors that affect lecturers' scientific research productivity by using Improved Fuzzy Analytic Hierarchy Process Approach. They considered six university governance factors including (i) research objectives and strategies, (ii) decentralization, (iii) leadership, (iv) support for research activities, (v) policy toward lecturers, and (vi) resources for research activities.

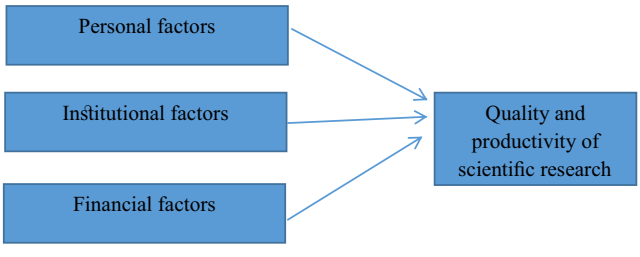
Recently, Tuan et al. [18] presented a study about management factors influencing lecturers' research productivity in Vietnam University. Their work builds on statistical base. Their research outcomes indicate that resources and policies to favor research activities are the two most influential factors affecting research productivity in lecturers. In 2023, Jayasrini et al, presented a new study in the same area. Their research is conducted by perusing the recent and major journals and articles that are published in reliable, high-quality journals on the captioned subject [19].

As listed above in the recent literature, several personal and institutional factors such as the researcher's confidence, collaborations, trainings, preference, teaching load, research skills, institutional support, degree, facilities, fund, and job satisfaction have been confirmed to impact research productivity among the faculty at universities [16]. However, different environmental factors may have different effects. So, more research is still needed in this topic. The main contribution of the current study is to find out the factors affecting research productivity in higher educational institutes and the sample taken from different educational institutes. The rest of the paper is organized as follows: Section 2 shows the model development. Section 3 introduces the used method; then finally results and discussion are presented.

2. Model Development

From a theoretical perspective, to identify the factors affecting scientific research, the educational and research institutions should be treated as an integrated system that includes the researcher, the available equipment, and the institution itself as the central part of this system. To develop a structured model for identifying factors that influence scientific research (Figure 1), we draw on the general classification of factors based on previous studies. The suggested research model focused on the personal, institutional, and financial conceptual variables.

Figure 1
Research model



To implement such a model, each of the listed factors represents a main classification, including another sub-factor.

Personal factors include age, place of work, specialization, financial situation, work experience, and personal attitudes toward publishing papers in indexed journals, etc. Institutional factors include whether institutes offer funds or even encourage participants to enroll in scientific research, some institutes linking scientific research and career, other institutes providing research facilities such as research labs and materials, or even participation in international scientific journals or libraries. On the other hand, the model also considers financial factors that may affect the quantity and quality of scientific research. Such factors include the financial status of researchers and financial aid offered by their institute to encourage research. These factors influence scientific research in educational institutions, but to varying degrees. The aim of this study is to determine which of these factors has the greatest impact on scientific induction, so that its effect can be avoided in the future.

3. Methods

The current study is an attempt to mix quantitative, qualitative, and deep learning methods. For quantitative measures, a study was conducted to determine the variables that influence the performance and quality of scientific research conducted by lecturers in higher educational institutes in Saudi Arabia and Sudan. The study used multi-regression in addition to descriptive analysis techniques to determine the best predictor for the number of published papers and accordingly measure the productivity. To test the model (depicted in Figure 1), a structured survey was conducted and distributed among faculty members in different educational institutes. Finally, random discussions were held with selected faculty members to identify their opinions on the reached results. A deep learning classification model was used to validate the reached results. The following subsections detail the sample collection and instrument design process. Figure 2 below shows the workflow description.

3.1. Sample

Participants of this study were faculty members from different educational institutes who used the nonrandom sampling method. Taking into consideration accessibility and practicality reasons, the study was carried out with 67 faculty members. Of all the participating members, 46% were assistant professors, and 38.5% were lecturers.

3.2. The instruments

A self-developed questionnaire based on the literature review has been constructed. The main objective of the questionnaire is to survey the ideas of instructors and professors at the university level in order to identify factors that may affect research performance from their perspective. The questionnaire can be divided into three main parts (personal, institutional, and financial factors). Table 1 provides a survey that operationalizes our research model (Figure 1).

A three-point rating scale (yes, no, sometimes) was used in most questions. To attain the reliability and validity of the attitude scale, a pilot study was conducted on 190 faculty members. To assess reliability, the item-total correlation was used and the Cronbach alpha reliability coefficient was estimated by ($\alpha = N\rho/[1 + \rho(N-1)]$) [20], which provided information concerning the internal consistency of the scale. Item-total correlation values of the scale ranged between 0.167 and 0.62, indicating that the items represented seemingly similar behaviors. The Cronbach alpha coefficient was found to be 0.874, which indicates internal consistency. After the reliability and validity analyses were completed, the final form of the scale ended up with 20 items (omitting the first 6 items from the questionnaire).

4. Results and Discussion

The sample comprised approximately 50% of respondents aged between 30 and 40 years old and 24.6% aged between 40 and 50. Approximately 87.5% worked in universities, and 31% were divided between educational institutes and research centers. The study sample contained 38% working in the medical field, 30% in the computer science field, and the rest were mixed between human studies and sciences.

The majority of respondents indicated that they are working in their field of study. More than half of respondents stated that their financial level is average. According to the sample distribution, 61% are working in Saudi universities and 38% are working in Sudanese academic institutes. More than half of the contributors had work experience of more than 10 years, about 43% of them had a PhD degree, and 3% of them were working as assistant professors. The number of published papers also varied; 60% said they had published only two papers or less and 27% had more than two papers. Only 11% of them had more than two papers published in journals indexed in ISI or Scopus. About 56% stated that they had published papers in indexed journals. It is remarkable that the publication ratio by faculty members in human and social studies fields is higher than that of their

Figure 2
Workflow description

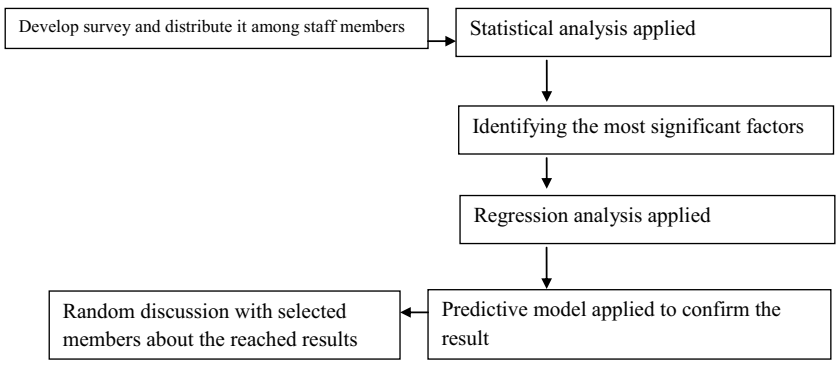


Table 1
Survey about factors that affect scientific research

	Classification	Survey items
Personal factors	Age	• 20-30 • 31-40 • 41-50 • >50
	Institute type	• University • Research center • Academic institutes
	Specialization	• Computer science • Medical sciences • Social science • Engineering • Science
	Qualifications	• BSC • MSC • PhD
	Financial situation	• Poor • Medium • Excellent
	Work experience	• Less than 10 years • More than 10 years • Not available
	Do your current job in your field of specialization	• Yes • No • Sometimes
	Number of published papers	• 0-2 • 3-5 • >5
	Are you eager to publish your papers in accredited journals?	• Yes • No • Sometimes
	How many papers did you publish in ISI or Scopus?	• 0 • 1-2 • >2
Institutional factors	Does your institution provide access to digital libraries?	• Yes • No • Sometimes
	Does the time allocated for scientific research in your institute appropriate?	• Suitable • Not suitable • Not found
	Have you been nominated at the university to enter specialized training courses in your field or in scientific research?	• Yes • No • Sometimes
	Are there any allocated hours for scientific research?	• Yes • No • Sometimes
	Does the university offers research projects in your specialty?	• Yes • No • Sometimes
	Did the admission for funded projects easy?	• Yes • No • Sometimes
	Did you applied for a funded project and was rejected for unknown reasons?	• Yes • No • Sometimes
	Does your organization get benefit from scientific research findings?	• Yes • No • Sometimes

(*Continued*)

Table 1
(*Continued*)

	Classification	Survey items
	Does your institute support research on community issues?	• Yes • No • Sometimes
	Are graduate students encouraged to publish scientific papers from their graduation projects?	• Yes • No • Sometimes
	Is there a plan to guide graduation projects to support the institution's development plans or is it only a requirement?	• Yes • No • Sometimes
	Does the curriculum be updated based on research results?	• Yes • No • Sometimes
Financial factors	Does your institute provide special research labs for scientific research?	• Yes • No • Sometimes
	Does your institution fund research projects?	• Yes • No • Sometimes
	Are employees motivated to publish scientific papers and attend conferences?	• Yes • No • Sometimes
	Is promotion linked to scientific publishing in your organization?	• Yes • No • Sometimes

colleagues in medical or other scientific fields. Only 30.8% indicated that their institutes funded research projects and encouraged faculty members to participate in them (see Figure 4). Less than half (40%) of the faculty members said the specified office hours were not suitable and not enough for scientific research. Only 35.4% of the contributors said that they did not nominate for attending training courses in research methods. About 73% of the respondents said no when asked if there were hours allocated for scientific research (see Figure 3).

Sixty-two percent stated that their institutes do not offer them special labs for scientific research. Only 32.8% of respondents said that it is easy to get the recent scientific research papers in their institutes from their original sites. About half of respondents said their institutes are not encouraging them to participate in scientific conferences (see Figure 3). About 75% of respondents stressed that the promotion linked to the scientific dissemination in their institutions. 71% of respondents said that they applied to funded research projects, but rejected with no known reasons. Only 19% of respondents indicated that results of scientific research were used for developing teaching courses. More than half of respondents said no when asked is there a plan to guide graduation projects to support the Foundation's development plans or is it only a requirement. More than half 51% said that the curriculum is not updated based on the results of the research done in the institute. Figures 1 and 2 above show sample of the collected results.

Correlation results (Table 2) revealed a strong relation between the hours allocated for scientific research by an institute for each faculty member and the number of published papers. Another relation appeared between the number of published papers by faculty members and the availability of funded research opportunities offered by the institute, in addition to its

Figure 3
Are there office hours devoted to scientific research?

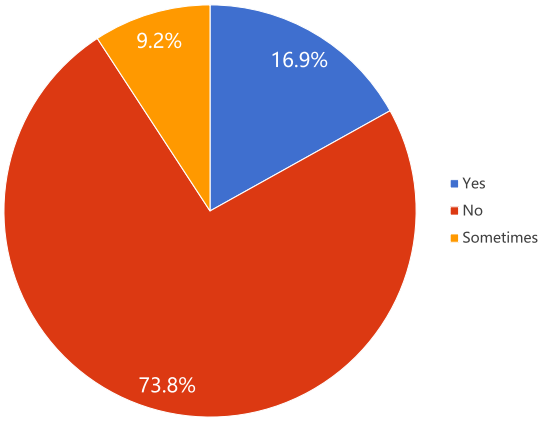
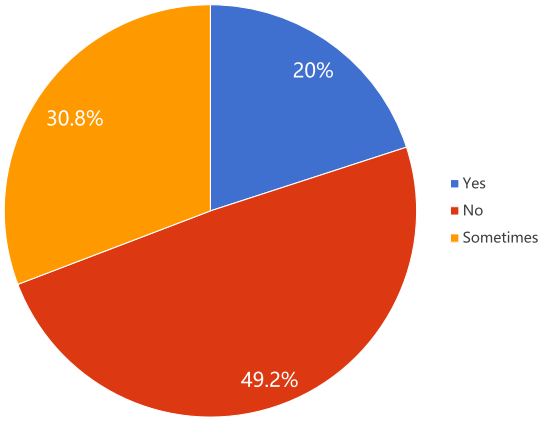


Figure 4
Are employees motivated to publish scientific papers and participate in conferences?



participation in international journals and libraries, which allow their faculty members to access the latest published research easily. The policy of academic institutions in development of the curriculum based on the results of scientific research also has an impact on the number of published papers by its faculty members. An institutional policy that aims to direct graduation projects for developing purposes has a relation to providing research equipment and facilities, such as labs and funds for doing scientific research. One of the main findings is that linking career promotions based on scientific research has a significant impact on the number of published research by institute members and on research quality. Finally, the existence of clear and flexible conditions for arbitration and participation in funded scientific research projects offered by the educational institute, as well as job stability, has a positive impact on the research performance of faculty members. Twenty-two percent stated that their institutes do not offer them special labs for scientific research. Only 32.8% of respondents said that it is easy to get the recent scientific research papers in their institutes from their original sites. About half of respondents said their institutes are not encouraging them to participate in scientific conferences (see Figure 4). About 75% of respondents stressed that the promotion linked to the scientific dissemination in their institutions. 71% of respondents said that they applied to funded research projects, but rejected with no known reasons. Only 19% of respondents indicated that results of scientific research were used for developing teaching courses. More than half of respondents said no when asked is there a plan to guide graduation projects to support the foundation's development plans or is it only a requirement. More than half 51% said that the curriculum is not updated based on the results of the research done in the institute.

The multi-regression technique was applied to a set of selected attributes based on the correlation results in Table 2. Thirteen attributes were selected to build the regression model, including publishing in indexed journals, qualifications, work experience, specialization, office hours devoted to scientific research, financial situation, updating curriculums based on research results, availability of research labs for scientific research, linking between scientific publishing and promotion in the organization, the number of papers published in ISI or Scopus by faculty members, linking between graduation projects and development plans, and availability of research projects funded by the educational institution.

Regression results emphasize that the most significant factors affecting the number of published papers are the level of qualification of faculty members, the allocation of special hours for research, and the availability of research projects funded by the educational institution (Table 3 below shows the regression results).

The R2 of the regression model indicates that about 57.8% of published papers by faculty members can be predicted by these attributes. This result is consistent with previous studies, such as Bandara and Amarasinghe [19] as well as Henry et al. [21].

Table 2
Part of correlation results

Factors	*P* value
Hours allocated for scientific research	0.01627
Level of qualification	0.02238
Availability of funded research opportunities	0.052129
The development of the curriculum based on the results of scientific research	0.020197
The availability of research equipments and facilities	0.0509
Linking between career promotions based on scientific research	0.0563

Table 3
Regression results

Regression statistics	
Multiple *R*	0.24050189
R^2	0.057841159
Adjusted R^2	−0.037971604
Standard error	0.879911674
Observations	66

To test the validity of the results reached, a simple predictive model using a classification technique was built and evaluated. The classification model is one of the most popular predictive analytics models. These models perform categorical analysis on historical data [22]. The following diagram (Figure 5) shows the simple steps followed.

Neural networks are used as classifiers to confirm the results obtained from regression. ANNs are mathematical models that emulate the behavior of the human brain. Their appeal comes from their capacity for extracting patterns from the observed data without assumptions about the underlying relationships [23]. The sample is divided into training (60%) and testing sets (40%). The training data are labeled primarily based on the number of published papers to either a high or low publication rate. The model accuracy is calculated by using a confusion matrix. Figure 6 below shows the classification results using a neural network.

The following diagram (Figure 7) shows how factors participate in each class.

The results reached confirmed the validity of the proposed model and also results drawn from regression techniques. Furthermore, random discussion between selected faculties revealed that different rules in different institutes may affect research performance, such as the encouragement of some universities for their members to publish in high impact only journals, and also the availability of financial rewards for publication, which is another facility to improve research production. Specifying the consideration of research papers to only high-impact journals may delay the production of new papers due to the long period required for publishing a research paper.

A simple comparison is done between the findings from the current study and the recent research models in the same field. Firstly, Tuan et al. [18] reached results showing that two factors, "Support for Research" and "Organization's Research Objectives," both had a positive influence on the research productivity of the lecturers at their university. Many earlier studies have also corroborated this, such as Bland et al. [24], Jahan et al. [25], and Bandara and Amarasinghe [19]. This confirmed our finding that some institutional and financial factors may affect productivity, including financial rewards and providing resources and equipment for research. Secondly, Hue et al. [17] found that "Resources for Research Activities" constitute the most important factor affecting the research productivity of lecturers at VNU, followed by research objectives and strategies and leadership. This also confirms the findings stated in Table 2 that there is a correlation available between productivity and the allocation of specific time and resources to research, as well as support through the availability of job promotion and funded research.

Figure 5
Simple classification model to confirm regression results

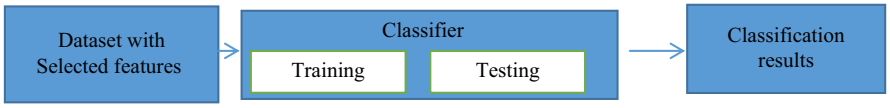


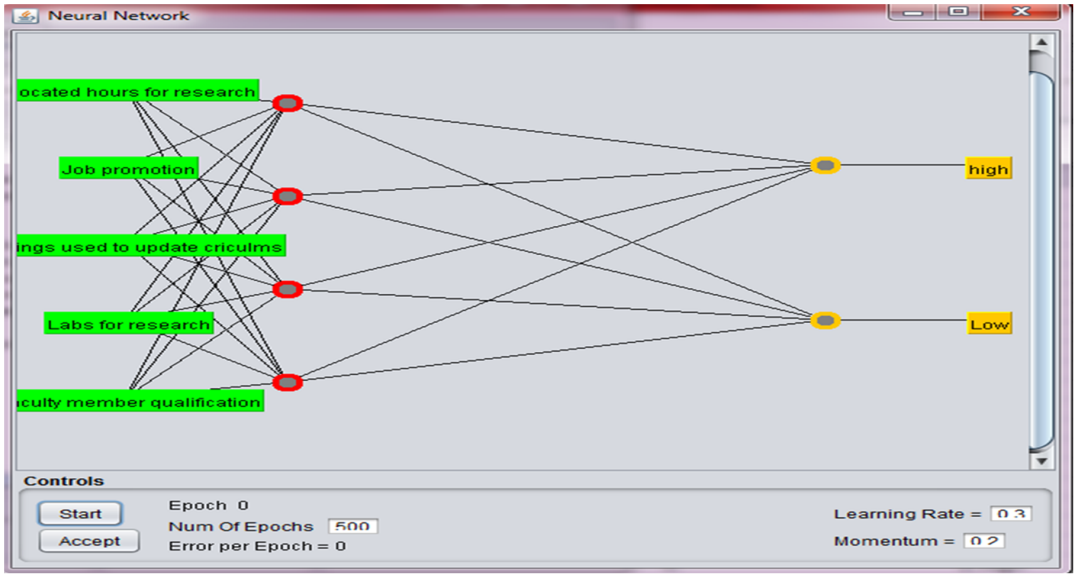
Figure 6
The confusion matrix

```
=== Detailed Accuracy By Class ===

                 TP Rate   FP Rate   Precision   Recall  F-Measure   MCC      ROC Area  PRC Area  Class
                 0.760     0.190     0.704     0.760     0.731     0.562     0.840     0.660     high
                 0.810     0.240     0.850     0.810     0.829     0.562     0.816     0.886     Low
Weighted Avg.    0.791     0.222     0.795     0.791     0.793     0.562     0.825     0.802

=== Confusion Matrix ===
```

Figure 7
Neural network layers



5. Conclusion

The main contribution of the study was to use new techniques such as regression and neural networks, in addition to a statistical approach, and to identify factors affecting scientific research in academic institutes. Results showed that many factors may contribute to and affect academic research, and the role of academic institutes here is to improve the work environment and support staff and students to engage in research groups in order to increase the publication rate.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by the author.

Conflicts of Interest

The author declares that she has no conflicts of interest to this work.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Author Contribution Statement

Rasha G. Mohammed Helali: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration.

References

[1] Golnaraghi, S., Zangenehmadar, Z., Moselhi, O., & Alkass, S. (2019). Application of artificial neural network(s) in predicting formwork labour productivity. *Advances in Civil Engineering*, *2019*(1), 5972620. https://doi.org/10.1155/2019/5972620

[2] Ahmed, Y. A. M., & Diah, N. M. (2019). An analysis of research productivity in Saudi Arabia and Iran. *Journal for the Study of Postsecondary and Tertiary Education*, *4*, 197–208. https://doi.org/10.28945/4404

[3] Creswell, J. W. (1985). *Faculty research performance: Lessons from the sciences and the social sciences. ASHE-ERIC Higher Education Report No. 4, 1985* (ED267677). ERIC. https://files.eric.ed.gov/fulltext/ED267677.pdf

[4] Yang, J. C. C. (2017). A study of factors affecting university professors' research output: Perspectives of Taiwanese professors. *Journal of College Teaching & Learning*, *14*(1), 11–20.

[5] Chang, C. Y., & Chiu, C. Y. (2008). A study on index weights for assessing university professors' research performance. *Journal of National Taipei University of Technology*, *41*(1), 89–106.

[6] Wagner, G., Prester, J., Roche, M., Benlian, A., & Schryen, G. (2016). Factors affecting the scientific impact of literature reviews: A scientometric study. In *Thirty Seventh International Conference on Information Systems*, 1–24.

[7] Toma, S. V., Alexa, I. V., & Şarpe, D. A. (2014). Identifying the risk in higher education institutions. *Procedia Economics and Finance*, *15*, 342–349. https://doi.org/10.1016/S2212-5671(14)00520-6

[8] Chen, Y., Gupta, A., & Hoshower, L. (2006). Factors that motivate business faculty to conduct research: An expectancy theory analysis. *Journal of Education for Business*, *81*(4), 179–189. https://doi.org/10.3200/JOEB.81.4.179-189

[9] Alcaine, J. G. (2016). *Factors affecting institutional performance at high and very high research universities: Policy implications*. PhD Thesis, Virginia Commonwealth University.

[10] Aydın, O. T. (2015). University choice process: A literature review on models and factors affecting the process. *Journal of Higher Education, 5*(2).

[11] Quimbo, M. A. T., & Sulabo, E. C. (2014). Research productivity and its policy implications in higher education institutions. *Studies in Higher Education, 39*(10), 1955–1971. https://doi.org/10.1080/03075079.2013.818639

[12] Rørstad, K., & Aksnes, D. W. (2015). Publication rate expressed by age, gender and academic position–A large-scale analysis of Norwegian academic staff. *Journal of Informetrics*, *9*(2), 317–333.

[13] Aydin, O. T. (2017). Research performance of higher education institutions: A review on the measurements and affecting factors of research performance. *Journal of Higher Education and Science*, (2), 312–320.

[14] Abouchedid, K., & Abdelnour, G. (2015). Faculty research productivity in six Arab countries. *International Review of Education*, *61*, 673–690. https://doi.org/10.1007/s11159-015-9518-5

[15] Lambrechts, A. A., Larasatie, P., Boutelier, S., Guta, H. A., Leonowicz-Bukała, I., Martinez-Suarez, A., & Prashad, S. (2021). Why research productivity among women in academia suffered during the early stages of COVID-19 crisis: A qualitative analysis. *EdArXiv Preprints*.

[16] Tahsildar, N., & Hasani, R. (2021). Faculty-perceived research skills and research productivity: A case study at a public University in Afghanistan. *Indian Journal of Science and Technology*, *14*(3), 229–238. https://doi.org/10.17485/IJST/v14i3.2065

[17] Hue, T. T., Tuan, N. A., Van, L. H., Lien, L. T., Huong, D. D., Anh, L. T., . . . , & Dat, L. Q. (2022). Prioritization of factors impacting lecturer research productivity using an improved fuzzy analytic hierarchy process approach. *Sustainability*, *14*(10), 6134. https://doi.org/10.3390/su14106134

[18] Tuan, N. A., Hue, T. T., Lien, L. T., Van, L. H., Nhung, H. T. T., & Dat, L. Q. (2022). Management factors influencing lecturers' research productivity in Vietnam National University, Hanoi, Vietnam: A structural equation modeling analysis. *Heliyon*, *8*(9), e10510.

[19] Bandara, J. B. K., & Amarasinghe, N. T. (2023). Factors affecting the research performance of science research institutions in Sri Lanka. *EPRA International Journal of Research and Development*, *8*(1), 8–15.

[20] Palmer, P. B., & O'Connell, D. G. (2009). Regression analysis for prediction: Understanding the process. *Cardiopulmonary Physical Therapy Journal*, *20*(3), 23–26.

[21] Henry, C., Ghani, N. A. M., Hamid, U. M. A., & Bakar, A. N. (2020). Factors contributing towards research productivity in higher education. *International Journal of Evaluation and Research in Education*, *9*(1), 203–211.

[22] ProjectPro. (2024). Predictive modeling techniques – A comprehensive guide [2024]. https://www.projectpro.io/article/predictive-modelling-techniques/598.

[23] Delgado, F. J. (2005). Measuring efficiency with neural networks, an application to the public sector. *Economics Bulletin*, *3*(15), 1–10.

[24] Bland, C. J., Center, B. A., Finstad, D. A., Risbey, K. R., & Staples, J. G. (2005). A theoretical, practical, predictive model of faculty and department research productivity. *Academic Medicine*, *80*(3), 225–237.

[25] 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. *Medical and Clinical Archives*, *2*(1), 1–5.

How to Cite: Helali, R. G. M. (2024). An Exploratory Study of Factors Affecting Research Productivity in Higher Educational Institutes Using Regression and Deep Learning Techniques. *Artificial Intelligence and Applications*, *2*(4), 335–342. https://doi.org/10.47852/bonviewAIA3202660