Rewarding Scientific Productivity of University North Employees

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Abstract: Scientific productivity makes for an important indicator to all scientific institutions and professionally recognized scientists. Scientific activity is of particular interest to Republic of Croatia, as it holds a special place in the international (and particularly European) scientific domain. Scientists are known for their reputation, i.e., their productivity is often recognized in magazines that publish their research papers. University North has recently established a special reward system for scientist, in order to ensure proper rewards for scientific accomplishments, i.e., for published research papers, citations of said papers, and an overall improved recognition of the institution that employs them. This system has certain rules and criteria for rewarding scientists. The rewards in and of themselves are contributing to popularization of science at the institution in question; furthermore, rewarding provides for a very good incentive for publishing many research papers with excellent indexing. Publishing research papers is also important to the institution the paper is referencing, as it adds to said institution's visibility and recognition in the European and international domain of research and science.

Keywords: h index; rewarding; scientific activity; Scopus; University North; WoS

1 INTRODUCTION

Scientific activity at University North has been regulated via the Act on Higher Education and Scientific Activity [1], the University Statute from November 7th, 2018 [2], the Regulation on Election into Scientific Professional Vocations [3] and the Regulation on Rewarding Published Research Papers, Scientist Visibility and Granted University North Patents [4]. The right to monetary rewards is reserved exclusively for University North employees [4].

Scientific productivity is mostly measured via quantitative indicators, which include bibliometric parameters of evaluation of scientists and scientific institutions [5]. The scientific productivity evaluation process includes various indicators, but mostly considers the number of published research papers and how many times they were cited. Quantitative evaluation of scientific productivity based on published research papers has become an inevitable factor to evaluation of scientific contribution for the Croatian academic and scientific community [6].

Scientists find it important to choose magazines that publish their research results. Universities prefer scientists who publish in reputable magazines, as it affects the reputation of the University itself [7].

According to the Regulation on Organization and Systematization of University North Workplaces [8], the Department of Science, Art and International Cooperation at North University is in charge of all matters regarding science and scientific activity, which also makes it in charge of the scientist reward system. Furthermore, the Department is in charge of all matters regarding popularization of science and improvement of the University's scientific recognition in the domain of European and international science and research. Scientific work is conducted by scientists with institutions such as universities, scientific institutes, and others. The Department is also in charge of facilitating integration and connections between various domains and fields of scientific and artistic work at University North [9].

The purpose and objective of this paper is to depict the process of rewarding scientists at University North, in accordance with the Regulation on Rewarding Published Research Papers, Scientist Visibility and Granted University North Patents [4].

At University North, the scientist reward system is designed as follows: a scientific research paper is defined as any paper published in magazines indexed within scientific databases Web of Science and Scopus. Web of Science (WoS) is actually one of the products of Thomson Reuters' platform Web of Knowledge (WoK). WoK is a research platform that helps its users find, analyse and exchange information from all areas of science. Some of the products included within Wok are: Biosis Citation Index, CAB Abstracts, Conference Proceedings Citation Index, Current Contents Connect, Food Science Technology Abstracts, Global Health Inspect, Journal Citation Reports, Medline, Web of Science, and Zoological Record [6]. Apart from WoS, Elsevier's multidisciplinary, bibliographic and citation base Scopus has recently been gaining traction with regards to bibliometric and scientometric research. The database's name, Scopus, was inspired by the bird Hammerkop Scopus Umbrette, which is known for its extraordinary navigational abilities. WoS is the key database for all STEM papers (science, technology, engineering, and mathematics), whereas both WoS and Scopus make for key databases for papers related to other scientific fields. Furthermore, patents are also subject to rewards. Patents are inventions that offer new technical solutions with regards to a certain product, procedure, or application. Patents are granted by the State Intellectual Property Office of Republic of Croatia [4].

One must also mention the Hirsch index, which is used to measure and evaluate scientific productivity via the number of published research papers, as well as the effects of said papers (measured by how many times they were cited).

Once a year, University North invites employees to apply for monetary rewards for papers published by the University's scientists. One can usually apply in the following three or four weeks [4].

Monetary rewards are awarded for research papers from the previous year, a scientist's personal influence and visibility, and patents granted by the State Intellectual Property Office in the previous year. The request for a monetary reward cites the authors, research papers and bibliometric data pertaining to said papers. Scientific databases WoS and Scopus have their own special set of rules with regards to determination of quartiles and indicators of citation frequency (via Journal Citation Reports (JCR) and Scientific Journal Rankings (SJR)) [4].

After the initial phase, Committee for Evaluation of Requests for Monetary Rewards for Published Research Papers, Scientist Visibility and Granted Patents is formed. The Committee examines whether the required criteria is met, analyses the submitted documentation, and decides on the amount of the monetary reward. Once the aforementioned process has been completed, the Committee submits their evaluation and the proposed decision to the Rector, who makes the final decision on the amount of monetary rewards [4].

2 REGULATION OF SCIENTIFIC ACTIVITY AT UNIVERSITY NORTH WITH REGARDS TO REWARDING SCIENTISTS

Based on the University North's Statute [2], the University Senate has adopted Regulations on Rewarding Published Research Papers, Scientist Visibility and Patents Granted to University North's Employees [4].

Monetary rewarding of research paper authors and patent authors/inventors is closely regulated by the Regulation on Rewarding Published Research Papers, Scientist Visibility and Patents Granted to University North's Employees. The right to a monetary reward is reserved for University North employees exclusively [4].

According to the Act on Higher Education and Scientific Activity, scientific activity is based on the following: freedom and autonomy of scientific creativity, open science, scientists' and teachers' ethics, availability of research results to the public, research aimed at developing innovations and technology in the European research space, interconnection with the educational system, international quality measures, incitement and acceptance of specificity of national content, intellectual property protection, and social responsibility of scientists [1].

University North's Department of Science, Art and International Cooperation is charged with conducting all organizational and supporting activities from the domains of artistic, scientific, and innovation-related work at University North. Furthermore, based on previous strategies and analyses, the Department of Science, Art, and International Cooperation suggests, publishes, and supervises the conduction and realization of scientific objectives. The Department is also in charge of all forms of popularization of science, supervision of scientists' success pertaining to scientific and artistic work, and improvement of scientific visibility of University North within the international framework. The Department is in charge of providing necessary help, such as assistance with the process of application, documentation collection and other related activities, to scientists who are applying with their scientific, artistic, and other projects. The Department must inform scientists in a timely manner about all events, conferences, rewards, available scientific subsidies, and other important information pertaining to scientists' possible career advancements [7].

In accordance with Article 2 of the Regulation on Scientific and Artistic Domains, Fields, and Branches [9], scientific and artistic fields are as follows: natural science, technical science, biomedicine and healthcare, biotechnical science, social science, human science, art, interdisciplinary scientific fields, and interdisciplinary artistic fields.

University North's strategy pertaining to scientific research and art for the time period from 2021 to 2027 is focused on the strategic objective of *Ensuring proper quality of scientific activity*. This strategic objective places great importance upon the efficiency and quality of the scientific research process, as it makes for one of the main prerequisites for ensuring high-quality scientific activity at University North [10].

The University cherishes principles of quality in the domain of scientific research and teaching, as well as principles of ethics, creativity, and transparency. Moreover, the University persists in its cooperation with other international and national scientific institutions of higher education and insists on the development and preservations of excellent academic and interpersonal relations.

The University incites critical thinking and creativity via its conception of new ideas and technological solutions, which makes it into one of the key initiators of economic and sustainable development. University North shall strive to be the bearer of society of knowledge, creativity, and strategic development of north-western Croatia.

2.1 Scientific Research Paper

According to the Act on Higher Education and Scientific Activity [1], scientific work pertaining to scientific research papers is conducted by scientists with institutions such as universities, scientific institutes, and others. Scientific work is also conducted by persons elected into associate positions at the aforementioned organizations, as well as other scientists who meet the criteria for performance of scientific activity.

Postgraduate university students and persons elected into professional positions in accordance with the aforementioned Act can also participate in scientific research papers. Furthermore, other students and participants in the scientific and educational process can also take part in the scientific research papers [1].

Prior to choosing the magazine that will publish their paper, it is recommended that authors check the scientific databases said magazine is indexed with in order to make sure that paper will count as credit toward their election into a scientific vocation [11].

2.2 Scientific Research Paper within the Context of Rewarding University North Scientists

In accordance with Article 3, Paragraph 1 of the Regulation on Rewarding Published Research Papers, Scientist Visibility and Patents Granted to University North's Employees [4], the term scientific research paper is defined as any paper published in magazines indexed within scientific data bases Web of Science [12] and Scopus [13].

WoS is the key database for all STEM papers, whereas both WoS and Scopus make for key databases for papers related to other scientific fields.

The STEM field consists of study programmes from the biotechnical, technical, biomedical, and natural domains of science, as well as study programmes that result in bachelor's degrees in the field of informatics, business informatics, informational science, informatology, and informational technologies, or a master's degree in informatics, informatology, informational sciences, and informational technology. Furthermore, this area also includes university specialist degrees in business informational systems and STEM teaching study programmes that have been issued a special permission to perform study programmes for future informatics teachers that result in a master's degree in informatics education [14].

WoS is a platform that offers available citation indexes and databases from all fields of science. The platform contains over 33.000 indexed magazines and almost a billion records of cited references. It includes articles, conference anthologies, reports, patents, and others [12].

Scopus is a bibliographic and citation database that indexes sources from all over the world and covers all areas of science [13].

2.3 Patent within the Context of Rewarding University North Scientists

In accordance with Article 3, Paragraph 2 of the Regulation on Rewarding Published Research Papers, Scientist Visibility and Patents Granted to University North's Employees, a patent is defined as an invention that offers a new technical solution pertaining to a certain product, procedure, or application. Patents are granted by the State Intellectual Property Office of Republic of Croatia [4]. According to the State Intellectual Property Office of Republic of Croatia, a patent is an exclusive right granted for an invention that offers a new solution to a technical problem. A patent can be granted for an invention pertaining to a product, procedure, or application [15].

3 THE HIRSCH INDEX

Physicist J. E. Hirsch recognized the need to improve upon the calculation of indicators necessary for scientists' productivity evaluation, the number of published research papers, the influence of said papers measured by the number of times they were cited, the average number of citations per paper, and the number of papers characterized by an above-average number of citations. Hirsch therefore introduced an indicator that can measure the broader influence and recognizable effects of papers written by individual scientists and also magazines [16].

He suggested only one number, called the 'h-index,' as a simpler and more useful way of characterizing scientific activity of researchers [16].

If an author's h-index amounts to 10, that particular author has published 10 or more papers, whereby 10 of the papers were cited at least 10 times, and the remaining papers

were cited less than 10 times. In this case, the total citation number has to amount to at least 100 [17].

The Hirsch index is used to compare scientists from the same field of science and of approximately equal work experience. This also applies to magazines [16].

For the sake of comparison, if two scientists have approximately the same work experience and a relatively equal number of published papers/similar number of citations, but their h-indexes differ, the scientist with a greater h-index is more recognizable than the other one [16].

4 THE PROCESS OF ANNOUNCING THE INVITATION TO APPLY FOR MONETARY REWARDS FOR PAPERS PUBLISHED BY UNIVERSITY NORTH SCIENTISTS

According to Article 7, Paragraph 1 and 2 of the Regulation on Rewarding Published Research Papers, Scientist Visibility and Patents Granted to University North's Employees [4], the invitation to apply for monetary rewards for published work (scientific research papers, patents, and the h-index) shall be extended once a year via the University North's webpage and the Notice Board. The invitation is usually valid for three or four weeks.

The invitation to apply for monetary rewards is officially extended by the University North's Rector, thus inviting all University North employees who meet the criteria defined by the Regulation on Rewarding to apply for monetary rewards for published research papers, scientist visibility, or granted patents. The invitation for monetary rewards pertains to the previous year – for example, if the invitation was extended in 2022, it pertains to all research papers and patents published and visible in scientific databases/registered with the patent office from January 1st to December 31st, 2021. If the invitation was extended in 2022, then the increase in scientist's recognizability (the h-index) must be recorded for the time period from 2020 to 2021 [4].

If a scientific research paper or a patent has more than one author, the monetary reward is equally split between coauthors

Apart from the invitation to apply for monetary rewards, the rector also makes the decision about the gross amount of said reward. Monetary rewards are awarded in accordance with the Regulation on Rewarding as follows.

4.1 Scientific Research Papers Published in the Previous

The rector's decision about the amount of the gross base for monetary rewards serves to define the amount of basis for the final calculation.

The established basis is multiplied by:

- factor 2 if the magazine belongs in the first quartile (Q1)
- factor 1.6 if it belongs in the second quartile (O2)
- factor 1,2 if it belongs in the third quartile (Q3)
- factor 1 if it belongs in the fourth quartile (Q4).

Scientific research papers must reference the North University as the institution where the scientist is employed.

If the magazine belongs to a greater number of scientific categories, the category the magazine belongs to in the lowest quartile is used as a reference point.

4.2 Personal Influence and Scientist Visibility (Paper Production and Citations)

The rector's decision about the amount of the gross base for monetary rewards serves to define the amount of basis for the final calculation:

- the established basis is multiplied by the factor 2 for every unit of increase of the scientist's h-index for the previous year
- newer papers by said scientist must refer to University North / name University North as their employer
- minimal initial value of the scientist's h index must be 1
- the h index is evaluated in accordance with the *WoS* or *Scopus* database [4].

4.3 Patents Granted by the Patent Office in the Previous Year

A patent is granted by an authorized institution, mostly based on examination of the patent application. The patent application describes the invention in a way that is prescribed by Law. The authorized institution can be a national patent office (State Intellectual Property Office in Republic of Croatia) or a regional patent office that examines the patent application for several countries within a region (for example, Republic of Croatia is a member of the European Patent Organization, so the authorized institution is the European Patent Office). A patent is granted in accordance with the principle of territoriality, i.e., it is only valid in the country or region it was granted in [15].

The rector's decision about the amount of the gross base for monetary rewards serves to define the amount of basis for the final calculation. The gross basis is multiplied by the factor 2 [4].

5 REQUEST FOR A MONETARY REWARD

Request for a monetary reward is comprised of:

- 1) Type of application
- a) Scientific research paper
- b) An increase in the h-index
- c) A granted patent.

If the application pertains to a scientific research paper, the author must enter the name of the paper, first and last name of the author, and the CROSBI ID of the paper.

If the application pertains to an increase in the h-index, the author must report the exact amount of said increase. Furthermore, the author must enter their first and last name and proof of the h-index increase.

If the application pertains to a patent, the author must enter the name of the patent and file all relevant accompanying documentation.

In order to provide complete documentation, the author is obliged to deliver the pertinent scientific research papers, as well as the Certificate of the bibliometric data obtained from the National and University Library in Zagreb or the University Library of University North [4].

Application type

a) Application type

a) Application of a scientific paper

b) Report of h-index increase

c) Patent application

Name of the scientific paper and CROSBI ID of the paper/ increase in the scientist's h-index / description and name of the patent

Name and surname of the author, or all authors in the case of multiple authors

Additional attachments/evidence (circle as applicable)

1. Decision on patent recognition from the State Institute for Intellectual Property

2. Qualification papers for awarding

3. Confirmation of the National and University Library in Zagreb (NSK) or the University Library of the University Sjever - bibliometric data (cited works, increase in h-index) according to Art. 5, paragraph 3.

Author's signature:

Figure 1 Request for a monetary reward, University North

(day, month, year).

5.1 Certificate of Bibliometric Data

In Koprivnica/Varaždin.

Bibliometric data are obtained once the paper is published in a magazine. Said data is based on the quantitative indicators that show how often the paper was used, read, and cited, i.e., it is based on the influence and effect said paper has had on the scientific community.

Bibliographic data can be found in scientific databases *WoS* and *Scopus*. Data about the citation frequency can also be found in said databases, which is very important to evaluation of papers published by certain scientists, the institution that employs them and the very publication that published them [4].

5.1.1 Web of Science (WoS)

Eugen Garfield, founder of the Institute for Scientific Information in Philadelphia, is also considered the founder of the citation database *Web of Science*. Back in the 60's, Garfield attempted to create a significant source of new scientific literature on an international level. Said source was supposed to facilitate easier navigation through an increasing number of publications. The multidisciplinary database, the Science Citation Index, encompassed exclusively magazines and later became a source for scientometric research [6].

The WoS database can be used via the webpage http://baze.nsk.hr/baza/web-science/.

The bottom of the webpage provides both the text and the link - Search Database: Web of Science. After a click on the link, the search bar of the database *WoS* pops up [12].

Remote access outside of the institution via the AAI@EduHr identity is enabled by the following link: *Proxy Journal Citation Reports (JCR)* is a citation database available in two editions:

- Science Edition for natural sciences
- Social Sciences Edition for social sciences.

Journal Citation Reports (JCR) enables evaluation of scientific magazines through the impact factor. It can also use quantitative indicators for measurement, evaluation, categorization, and comparation of several magazines to check whether a certain magazine is well represented in the WoS database [12].

JCR categorizes magazines into categories ranging from highest to lowest quartiles (Q1, Q2, Q3 and Q4) based on the data on citation frequency pertaining to magazines represented within the WoS database.

If a certain magazine belongs in the highest quartile (Q1), it means it belongs with the 25% of magazines with the highest influence factor in the pertinent field of science.

If a magazine belongs in the second quartile (Q2), it means its influence factor belongs between the first 25% and 50% of magazines in the pertinent area of science [12].

JCR usually publishes its annual data around June of the following year, as a certain time period needs to pass in order to record the frequency of citation of papers published in a certain magazine [12].

5.1.2 SCOPUS

The *Scopus* database can be accessed via the following webpage:

https://www.scopus.com/search/form.uri?display=basic#bas ic [13].

The scientific database *Scopus* also evaluates representation and division into quartiles (Q1, Q2, Q3, Q4). *SCIImago Journal Rank* (*SJR*) is a *Scopus* citation base that enables various searches of magazines represented within it. The magazines can be searched by their respective scientific field, country, region, publication type etc. [13].

The depiction below shows how easy it is to check the frequency of citation of a certain publication via the *SJR* webpage. For example, 'Podravina', a magazine that often publishes papers written by University North professors, has been entered into the search bar. One must only enter the name of the magazine (in this case, 'Podravina') into the search bar in order to obtain the requested results [13].

A webpage will then pop up, providing a display sorted by year, showing what quartile the magazine belongs in [13].

COMMITTEE FOR EVALUATION OF REQUESTS FOR MONETARY REWARDS FOR PUBLISHED RESEARCH PAPERS, SCIENTIST VISIBILITY AND GRANTED PATENTS

The University North's Rector names the members of the Committee for Evaluation of Requests for Monetary Rewards for Published Research Papers, Scientist Visibility and Granted Patents via a special Decision [4].

Some of the tasks of the Committee are collection of applications based on the extended invitation, examination of the criteria the applicants meet and examination of the pertinent documentation in accordance with the Regulation on Rewards, as well as creation of a record of conducted selection of candidates [4].

Once the Committee has finished its tasks, the rector makes a final decision on the amount of monetary rewards for published scientific papers, scientist visibility and granted patents for that year. Tab. 1 shows details about the annually conducted Monetary Rewards contests, with an exact number of published scientific papers, h-index increases and granted patents [4].

Table 1 Monetary rewards from 2018 to 2021, University North

Year	Scientific Paper	h-Index	Patent
	Applications	Applications	Applications
2018	52	7	0
2019	127	17	0
2020	100	17	0
2021	183	34	0

The table shows that in the year 2018, applicants applied with 52 scientific papers and 7 h-index increases. In the year 2019, there were 127 scientific papers (75 more than the previous year) entered by University North employees, as well as 17 h-index increases (10 more than the previous year). In the year 2020, 100 papers were entered by the University North employees, as well as 17 h-index increases. In 2021, a record number of employees applied with their papers — 183. There was another increase in the h-index reports — 34, which is 100% more than the previous year.

7 CONCLUSION

Scientific productivity is an important indicator to any scientific institution or a recognized scientist. Scientific activity refers to all scientists active in a certain scientific field that are subject to certain rules and norms of operation.

Scientists are recognized by their scientific reputation, i.e., their productivity is recognized by the indexing of magazines that publish their scientific research papers. In order to reward the scientists for their accomplishments, published papers and the citations of said papers, as well as improved scientific recognition of the institution that employs them, University North has established a high-quality scientist reward system.

The reward system has certain rules and criteria for rewarding scientists. The rewards in and of themselves are contributing to popularization of science at the institution in question; furthermore, rewarding provides for a very good incentive for publishing many research papers with excellent indexing. Publishing research papers is also important to the institution the paper is referencing, as it adds to said institution's visibility and recognition in the European and international domain of research and science.

Networking and incitement of scientific activity, as well as rewarding papers published in magazines and books characterized by significant international visibility directly contributes to an increased scientific productivity.

An increase in scientist and researcher visibility, as well as monetary rewards awarded to University North's employees, will contribute toward an increased recognition of University North in significant circles, scientific networks, and reputable research spaces.

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