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# USING FUZZYAHP METHODS TO ASSESS THE FACTORS AFFECTING LECTURERS' MOTIVATION IN SCIENTIFIC RESEARCH AT THANH HOA UNIVERSITY OF CULTURE, SPORTS AND TOURISM

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*By reviewing domestic and foreign studies related to lecturers' motivation in scientific research, the article sets up a model of the factors affecting lecturers' motivation in scientific research at Thanh Hoa University of Culture, Sports and Tourism (TUCST). The results of the article showed the four factors affecting lecturers' motivation in scientific research as follows (1) Research environment; (2) Lecturers' awareness of scientific research; (3) lecturers' competence on scientific research; (4) Support for scientific research.*

**Key words:** Scientific research, Fuzzy AHP (FAHP), motivation, TUCST lecturers

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## **1. Introduction**

Scientific research is a lecturer's mission in addition to teaching and serving the community. The Ministry of Education and Training has stipulated that lecturers must spend at least one third of their total working time during the school year on scientific research tasks (Circular No. 47/2014/TT-BGDĐT). Thus, scientific research is one of the important tasks in renewing and improving the quality of training. At Thanh Hoa University of Culture, Sports and Tourism (TUCST), the title of lecturer is prescribed 270 hours of teaching obligation and 195 hours of scientific research. And these two criteria are used as the basis for evaluating and ranking lecturers and annual labor ratings.

Scientific research activities contribute to increasing professional knowledge and skills to help lecturers perform their teaching tasks well, thereby affirming and improving TUCST's operational capacity and reputation in the society. Therefore, improving work motivation in general as well as motivation for scientific research in particular to help lecturers develop professional capacity is the premise of improving the reputation of educational institutions. Determining the factors affecting the faculty's motivation for scientific research is the key to motivating lecturers to improve their motivation to participate in scientific research at universities in general at TUCST in particular.

In the paper, the authors will synthesize the theoretical basis of the factors affecting the motivation to participate in scientific research, thereby conducting qualitative research on the factors affecting lecturers' motivation to participate in scientific research at TUCST.

## **2. Theoretical basis**

### ***a, Concepts on science***

Vu Cao Dam (1999) stated that science is also understood as: "A system of knowledge about all the laws of matter and the movement of matter, the laws of nature, society, and thought".

According to the Law on Science and Technology (National Assembly, 2013), science is a system of knowledge about the nature and laws of existence and development of things, natural and social phenomena and thinking.

### ***b, Concepts on research***

Research is the search for knowledge, or systematic inquiry, with an open mind to the discovery, interpretation and development of methods aimed at advancing mankind's knowledge.

According to Babbie (1986): Research is the systematic process of collecting data and analyzing information to enhance understanding of a phenomenon.

According to Kothari (2004): Research is a systematic process of collecting and analyzing data in order to explore related issues.

According to Shuttleworth (2008): Research is all about collecting data, information and facts for the development of knowledge.

According to Kumar (2014): Research is one of the ways to find answers to questions.

Research is the systematic process of collecting and analyzing information to enhance understanding of a phenomenon or problem.

### ***c, Concepts on scientific research***

According to Armstrong and Sperry (1994), scientific research is based on the application of scientific methods to discover new things about the nature of things, about the natural and social world, and to create innovative methods. and higher and more valuable new technical means. This form of research provides information and scientific theories that explain the nature and properties of the world. The results of scientific research create practical applications. Scientific research activities are funded by government agencies, social funding organizations. Scientific research activities are classified according to academic and applied fields. Scientific research is a widely used criterion in assessing the standing of academic institutions.

According to Earl R. Babbie (2011), scientific research is a way by which: (1) People systematically investigate scientific phenomena and (2) It is the process of applying scientific principles. ideas,

According to the Law on Science and Technology (National Assembly, 2013), scientific research is an activity of discovering, discovering and understanding the nature and laws of things, natural and social phenomena and thinking; create solutions to apply in practice.

Scientific research: Scientific research is the activity of discovering, discovering and understanding the nature and laws of things, natural and social phenomena and thinking; create

solutions to apply in practice. Scientific research is the process of forming and proving a scientific thesis about an object or phenomenon to be discovered.

*d, The meaning and the motivation of scientific research*

According to research results at Times Higher Education (2019), there are many university rankings in the world, all of these rankings place heavy emphasis on scientific research and international publication, and the scientific research criteria are weighted. high; accounting for 30% of 5 criteria, including teaching (learning environment); research (volume, income and reputation); citation (research influence); international outlook (staff, students and research), and earnings (knowledge transfer). This shows us that scientific research has a special importance in higher education. At the same time, scientific research is a job that not only contributes to improving the quality of training but also creates new knowledge for the development of mankind.

Some authors also emphasize the role of scientific research in teaching, according to Rowland (1996) who argues that teaching and research should coexist, because there is a clear connection between teaching and research. Research is mutual stimulation and support.

The motivation for scientific research is the willingness of lecturers in the implementation of scientific research articles and works at all levels. In addition, the research motivation is also reflected in the self-discipline of the lecturers in scientific research activities when the lecturers take advantage of their time, and have a continuous research orientation.

**3. Review of studies on factors affecting lecturers' motivation of scientific research**

Activities and quality of scientific research of lecturers are topics of interest to many researchers. Around the world, researchers work on scientific research dynamics in many different ways. In each different research area, scholars have discovered different factors affecting the motivation of lecturers for scientific research:

Nicholls et al. (1989), studied individual differences in research motivation. Those are the differences in perception of scientific research ability, task orientation, self-needs, beliefs and values. Research results show that, awareness of scientific research ability, task orientation has an impact on motivation of scientific research, in which the level of impact of awareness of scientific research ability is the largest.

Author Bailey (1999), has conducted quantitative research, measuring motivation and confidence of scientists. Data were analyzed using STATVIEW II statistical software. Techniques of factor analysis, one-way analysis of variance and other correlation measures. Research results show that: Teaching assistants, bachelor's degree lecturers, scholars have low research productivity and women have higher teaching motivation. Lecturers are lower in both research motivation and self-confidence while associate professors and professors have high scientific research productivity. Men and women have similar research motivation and confidence. Lecturers have higher qualifications and greater research productivity, higher motivation and confidence in scientific research.

Ryan (2014) has conducted quantitative research with a motivational scale through five aspects: (1) Material motivation, (2) self-assessment from outside, (3) Motivation from within,

(4) self-assessment of suitability with capabilities and (5) personal goals coincide with organizational goals. Ryan used EFA factor analysis, CFA factor analysis and SEM. The results of the study show: Internal motivation and extrinsic motivation are the strongest. Differences in study performance by age and sex were also identified.

Cao Thi Thanh and Pham Thi Ngoc Minh (2018) built and tested a model of factors affecting scientific research motivation of lecturers at Hanoi University of Industry. Applying quantitative research method, analyzing data from a sample of 183 lecturers of Hanoi University of Industry, the research results show that the scientific research motivation of lecturers of Hanoi University of Industry is affected by three factors, which are: (1) Interest in scientific research, (2) Self-needs, (3) Good perception of scientific research ability.

Research by Le Thi Thuong (2020) has conducted research on 218 questionnaires at Hanoi University on the factors affecting the motivation of lecturers' scientific research by the method of factor analysis EFA, regression multivariate on SPSS. The analysis results show that the factors proposed in the model have different degrees of influence on the scientific research motivation of Hanoi University's lecturers, including: (1) Professional capacity of lecturers, (2) Faculty's social issues, (3) TUCST's scientific research environment, (4) TUCST's support for scientific research activities and (5) Lecturer's perception of research scientific research. These factors explained 61.81% of the influence on the motivation of lecturers for scientific research.

Le Thi Kim Hoa and Bui Thanh Khoa (2020) also proposed a model and conducted research based on the results of 862 survey questionnaires collected at universities in Ho Chi Minh City and Ho Chi Minh City. Online questionnaire to survey at universities in other provinces in the country. The study used SPSS software version 26 to process the collected data, including: Reliability assessment of the scale, exploratory factor analysis (EFA), correlation analysis, and regression analysis. regulation. The results of the study have shown seven factors that create motivation for lecturers in doing scientific research, including: (1) Income, (2) Reward and recognition policy, (3) Promotion opportunities, (4) Hobbies, (5) Awareness towards carrying out scientific research, (6) Sense of responsibility, and (7) Improving professional qualifications and capacity.

It can be seen that the scientific research motivation model of lecturers, according to previous researchers, can be expressed as the following equation:

$$\text{Faculty's scientific research motivation} = i1X1 + i2X2 + \dots + inXn$$

In which:  $Xn$  represents the  $n$ th influencing factor

$in$  are the parameters

#### **4. Research methodology**

In the study, it is different from the methods published by previous researchers. The authors use fuzzy AHP research method (FAHP) to conduct an assessment of the factors affecting the motivation of scientific research of lecturers at Thanh Hoa University of Culture, Sports and Tourism.

##### **Fuzzy AHP (FAHP) analysis**

Despite its widespread use, AHP often has limitations because of its inability to combine uncertainty and inaccuracies inherent in mapping between perceptions, judgments, and judgments of decision makers. converted to the exact numbers used in the AHP method. Therefore, while fuzzyness is a common feature of decision-making problems, the FAHP method was developed to solve this problem. It allows the decision maker to express an approximation or approximation of the inputs using fuzzy numbers. To compute and aggregate weights to rank the alternatives, many methods have been proposed, but among them, fuzzy extent analysis is one of the most widely used methods. most commonly used.

According to Jaded, a fuzzy set A in space U is represented by a function  $\mu_A: U \rightarrow [0,1]$ . The function  $\mu_A$  is called the membership function (or feature function) of the fuzzy set A and  $\mu_A(x)$  is called the degree of belonging of x to the fuzzy set A. Thus, the fuzzy set is a generalization of the clear set by allows the membership function to take any value in the interval [0,1], while the membership function of a clear set can only take two values, 0 or 1. The fuzzy set A is represented in the space U by the set of all pairs. element and its membership level:

$$A = \{(x, \mu_A(x)) | x \in U\}$$

In the FAHP method, the experts' ratings are represented by triangular fuzzy numbers. This is the first step, then the fuzzy matching matrix will have the following form

$$\tilde{A} = (\tilde{a}_{ij})_{n \times n} = \begin{bmatrix} (1, 1, 1) & (l_{12}, m_{12}, u_{12}) & \dots & (l_{1n}, m_{1n}, u_{1n}) \\ (l_{21}, m_{21}, u_{21}) & (1, 1, 1) & \dots & (l_{2n}, m_{2n}, u_{2n}) \\ \vdots & \vdots & \ddots & \vdots \\ (l_{n1}, m_{n1}, u_{n1}) & (l_{n2}, m_{n2}, u_{n2}) & \dots & (1, 1, 1) \end{bmatrix}$$

trong đó  $\tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij})$  và  $\tilde{a}_{ij}^{-1} = (1/u_{ij}, 1/m_{ij}, 1/l_{ij})$  với  $i, j = 1, \dots, n$  ; và  $i \neq j$ .

In order to perform the pairwise comparison between fuzzy parameters, the language variable is defined corresponding to the evaluation levels according to the following table:

**Table 1: Interpretation of language variables**

Code of language variable	Language variable	Corresponding triangular fuzzy numbers	Inverse triangular fuzzy number
1	Equal importance	(1,1,1)	(1/1, 1/1, 1/1)
2	The importance between levels 1 and 3	(1, 2, 3)	(1/3, 1/2, 1/1)
3	Moderate importance	(2,3,4)	(1/4, 1/3,1/2)
4	The importance between levels 3 and 5	(3,4,5)	(1/5, 1/4, 1/3)
5	More important	(4,5,6)	(1/6, 1/5, 1/4)
6	The importance between levels 5 and 7	(5,6,7)	(1/7, 1/6, 1/5)
7	Very important	(6,7,8)	(1/8, 1/7, 1/6)
8	The importance between levels 7 and 9	(7,8,9)	(1/9, 1/8, 1/7)
9	Quite important	(8,9,10)	(1/10, 1/9, 1/8)

**Step 2:** Summarizing the degree of fuzzy influence of the factors

How to conduct: Calculating the sum of each row in the match matrix  $\bar{A}$ , then normalize the sums of the rows just calculated by fuzzy arithmetic:

$$\tilde{S}_i = \sum_{j=1}^n \tilde{a}_{ij} \otimes \left[ \sum_{k=1}^n \sum_{j=1}^n \tilde{a}_{kj} \right]^{-1} = \left( \frac{\sum_{j=1}^n l_{ij}}{\sum_{k=1}^n \sum_{j=1}^n u_{kj}}, \frac{\sum_{j=1}^n m_{ij}}{\sum_{k=1}^n \sum_{j=1}^n m_{kj}}, \frac{\sum_{j=1}^n u_{ij}}{\sum_{k=1}^n \sum_{j=1}^n l_{kj}} \right)$$

với  $i = 1, \dots, n$ .

**Step 3:** Finding the minimum value of each pair of fuzzy numbers

$$V(\tilde{S}_i \geq \tilde{S}_j) = \sup_{y \geq x} [\min(\tilde{S}_j(x), \tilde{S}_i(y))]$$

công thức trên có thể được biểu diễn tương đương như sau:

$$V(\tilde{S}_i \geq \tilde{S}_j) = \begin{cases} 1, & m_i \geq m_j \\ \frac{u_i - l_j}{(u_i - m_i) + (m_j - l_j)}, & l_j \leq u_i, i, j = 1, \dots, n; i \neq j \\ 0, & else \end{cases}$$

trong đó  $\tilde{S}_i = (l_i, m_i, u_i)$  và  $\tilde{S}_j = (l_j, m_j, u_j)$

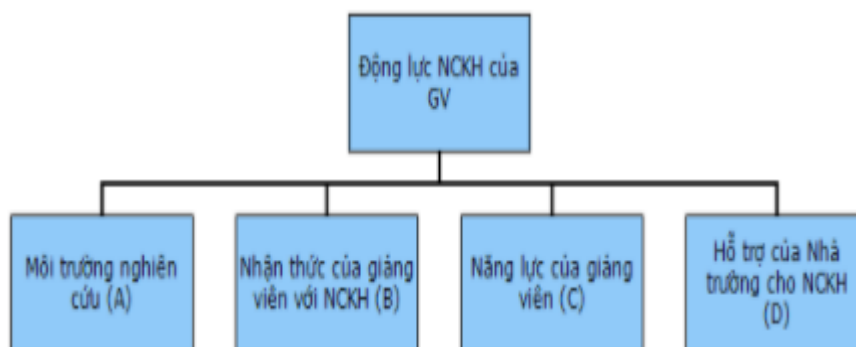
**Step 4:** Calculate the weight vector by normalizing the matrix

$$W_i = \frac{\min V(\tilde{S}_i \geq \tilde{S}_j), j = 1, \dots, n; j \neq i}{\sum_{k=1}^n \min V(\tilde{S}_k \geq \tilde{S}_j), j = 1, \dots, n; j \neq k}, i = 1, \dots, n$$

### 5. Discussion

From the theoretical background and inheritance of research models, the authors propose a research model with factors affecting the motivation of scientific research of lecturers at Thanh Hoa University of Culture, Sports and Tourism, including: : (1) Research environment; (2) Perception of lecturers with scientific research; (3) Competency of lecturers; (4) TUCST's support for scientific research.

**Model 1: The research model is proposed as follows:**



(Nguồn: Nhóm tác giả thiết kế)

Thus, the mathematical model of lecturer's scientific research motivation model has the form:

$$W1 * (A) + W2 * (B) + W3 * (C) + W4 * (D) = LCC$$

In which W1, W2, W3, W4 are the weights of factor (A) Research environment, respectively; (B) Perception of lecturers with scientific research; (C) Competence of the faculty; (D) TUCST's support for scientific research and must ensure  $W1 + W2 + W3 + W4 = 1$

To calculate the set of weights (W1, W2, W3, W4) there will be many approaches to the calculation such as expert methods, statistical methods, but within the scope of the article, the authors only mention Calculation of weight sets by FAHP method.

### Contents of scientific research

The research was carried out on 08 experts, including those with a doctorate degree or higher, in addition, 01 Assoc. Mandatory criteria is having experience in participating in scientific research for 10 years or more and having participated at least once in research projects at grassroots and provincial levels, published international articles, published articles. The journal belongs to the category of associate professor...

After conducting in-depth interviews with experts to design indicators for each influencing factor. The authors have proposed Table 2- Factors and indicators.

**Table 2: Factors and indicators**

Factor	Indicator	Encryption
Research environment (A)	Research groups	A1
	Time spending on NCKH	A2
	Resources for scientific research	A3
	Facilities for scientific research	A4
Teachers' perception of scientific research (B)	Scientific Research is a compulsory task	B1
	Scientific Research enhances professional competency	B2
	Scientific Research for career development	B3
	NCKH cải thiện thu nhập	B4
Lecturers' competency (C)	Scientific Research improves earnings	C1
	Professional competency	C2
	Scientific Research	C3
TUCST'S support for Scientific Research (D)	Language ability	C4
	Funding for Scientific Research	D1
	Reward and incentive policy for Scientific Research	D2
	Evaluating scientific research results fairly and accurately	D3
	Acknowledgment of lecturers's contribution of scientific research	D4

(Source: Survey and interview)

After designing the indicator for each factor, the author group conducted the design of a questionnaire to collect data for the assessment by FAHP method, the experts were asked to compare in pairs of 4 groups. factor (A) Research environment; (B) Perception of lecturers with scientific research; (C) Competence of the faculty; (D) TUCST's support for scientific research. Then continue to be asked to compare the elements in each group in pairs.

The assessment sheet is designed with 3 parts: Part I: Information on individual experts; Part II: Reviews; Part II: Thank you

The authors identified a group of experts at Thanh Hoa University of Culture, Sports and Tourism including:

**Table 3: Group of experts (for interviews with FAHP as expected)**

<b>Number</b>	<b>Full name</b>	<b>Department</b>	<b>Experience years of scientific research</b>
1	Assoc. Prof. Dr. Nguyen Thi Thuc	Head of Postgraduate Department	18 years
2	Dr. Ha Dinh Hung	Head of Scientific Research Management Department	15 years
3	Dr. Nguyen Thi Truc Quynh	Vice Head of Scientific Research Management Department	16 years
4	Dr. Nguyen Van Dung	Head of Training Department	15 years
5	Dr. Nguyen Thi Hong Le	Head of International Cooperation Department	14 years
6	Dr. Le Thi Thao	Head of Information-Culture Department	15 years
7	Dr. Nguyen Thi Ha	Head of State Management and Law Department	12 years
8	Dr. Doan Van Truong	Vice Head of Information-Culture Department	10 years

*(Source: by authors)*

The results obtained will be included in the analysis of the steps by the FAHP method mentioned above.

## **6. Conclusion**

Scientific research activities at Thanh Hoa University of Culture, Sports and Tourism are compulsory activities for lecturers. Scientific research activities are of special importance in higher education. At the same time, scientific research is a job that not only contributes to improving the quality of training but also creates new knowledge for the development of mankind. Hence the work. Therefore, it is necessary to research and evaluate the factors



affecting the scientific research motivation of lecturers at Thanh Hoa University of Culture, Sports and Tourism.

The study has proposed a research model with factors affecting lecturers' motivation of scientific research at Thanh Hoa University of Culture, Sports and Tourism, namely: (1) Research environment; (2) Lecturers' perception on with scientific research; (3) Lecturers' competency; (4) TUCST's support for scientific research.

The study using the FAHP method is a new research method, with many advantages: Firstly, it can check whether the survey results are consistent, while the average method cannot check the survey results. this. Second, the calculation results will be more accurate not only in terms of data but also in terms of meaning.

In the next research direction, the authors will conduct directly the research steps of the FAHP method that has been built, accurately determine the influencing factors and the degree of influence of these factors on the motivation of scientific research. from lecturers at Thanh Hoa University of Culture, Sports and Tourism. From there, provide management implications and recommendations for Thanh Hoa University of Culture, Sports and Tourism in order to improve the scientific research motivation for lecturers here accurately and efficiently.

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