DOCTORAL (PHD) THESIS

Anett Krisztina Szabó
GÖDÖLLŐ

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Hungarian University of Agriculture and Life Sciences

DOCTORAL SCHOOL OF ECONOMICS AND REGIONAL SCIENCES

FACTORS INFLUENCING RESEARCH CAREERS

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III

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LIST OF ABBREVIATIONS

ABT:	Agricultural and biological sciences
EGYT:	Other sciences
EIS:	European Innovation Scoreboard
EU:	European Union
FKA:	Academy of Young Researchers
GII:	Global Innovation Index
R & D:	Research and development
RDI:	Research, development and innovation
OECD:	Organisation for Economic Co-operation and Development
SII:	Summary Innovation Index
TÉR:	benchmarking system
WB:	World Bank – World Bank
WEF:	World Economic Forum
WIPO:	World Intellectual Property Organisation

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1 HISTORY, OBJECTIVES

In recent years (Hungarian) society has faced a series of problems that have not been the case in recent decades. Here we can think of the pandemic that broke out in 2019 (COVID-19) or the invasion of Ukraine initiated by Russia on 24 February 2022. In addition, Hungary has suffered from droughts that have not been seen for many years. Global warming and its consequences are no longer just a "scientific" problem for decision-makers or researchers, as it is now being met by all social groups. Today, limited resources are depleted and the supply of raw materials is stalled in several areas. Food and energy prices are rising drastically and our society is facing inflation (again) that threatens the well-being and security of livelihoods of thousands. Both individually, but also through their effects, these problems have a very serious impact on economic, social and ecological processes. Preparing for these challenges is also becoming increasingly prominent in research. (Szendrő, 2022)

Both because of the problems and the constant search for a source of competitiveness that is partly solved, the scientific results are understandable, thus the increased demand and demand for productive human capital (highly skilled workers and researchers). Due to the constant search for the source of competitiveness, which is a partial solution to the problems and the increased need and demand for scientific results and this way for productive human capital (highly qualified employees and researchers) can be understood.

The role and necessity of researchers is becoming increasingly evident not only for the academic sector, but also for decision-makers, the business world, and the individual people who make up the society. Although the majority of researchers have previously been employed in higher education, research institutes and the academic world, the business community has recognised its importance and therefore employs the majority of researchers with doctoral degrees. In fact, many researchers have won either Nobel or Turing awards based on their work and achievements in the business sector. (Bőgel, Mátyás, 2022)

At the same time as the demand for researchers increased, human resource research also became more and more prominent. (Eurostat 2022) It is crucial for the long-term sustainability, prosperity and competitiveness of organisations, communities and society to recruit, maintain and increase the effectiveness of researchers with a high level of knowledge and productivity. (World Economic Forum, 2012) The question arises over and over again as to what challenges and how to respond to specific disciplines and training courses. (Lakner, 2022; Pupos, 2022) In the last 10 years, more and more studies have started to assess the research situation and motivation.

(Friesenhahn, Beaudry, 2014; Miranda-Nieto et al., 2021; Dornbusch et al., (2012); Arzenšek et al., 2014; Shmatko and Volkova, 2017; Woolston, 2020) However, according to Shmatko and Volkova (2017), we do not know enough about the motivations of the researchers. According to the researcher, a repeated (panel- and longitudinal) survey is needed, which is also indicated by the current strong motivational direction, according to which it is increasingly important to examine the dynamics of external and internal motivational factors over time.

Globally, the Global Young Academy and its national organisations, as well as several researcher and research institutes, have begun to explore the researcher careers, factors and motivations that influence it. On the basis of several research findings, it can be assumed that the commitment of younger and older generations and their intentions to leave careers are different, however, in order to ensure the supply of researchers, representatives of the younger generation tend to be the focus of the research. (Katz et al., 2019)

Surveys on the situation and motivation of researchers also started in Hungary, which were carried out on a large sample by the members of the Young Research Academy of the Hungarian Academy of Sciences (FKA) in 2018, and then repeated – in a way that made comparison difficult, significantly different from the structure of the previous one – in 2022.

In an Alpár et al. survey (2019) Hungarian young researchers evaluated an average of 6.47 on a 10-degree Likert scale that they would leave their research career within 5 years. Among respondents, representatives of agro- and earth sciences are the most concerned about leaving the profession in terms of classification in the discipline. According to the research, people under the age of 35 and academic assistants have the highest career exit potential.

According to the results of the Hungarian surveys, leaving the career path is essentially caused by problems of a financial nature, such as low income and lack of research resources. (Alpár et al., 2019; Németh et al., 2022) Following this, career problems emerge and the lack of infrastructure due to low funding was also identified as one of the factors that led to the abandonment of research careers. It is also supported by excessive administrative burdens and problems with the benchmarking system. The limited ability of young researchers to attend conferences and further training is also not supported. To a lesser extent, but also the lack of social esteem and a lack of work-life balance support the intention to leave the profession among researchers. However, the extent of mentoring and impact in the academic sphere and the educational burden play little role in leaving the career. (Alpár et al., 2019)

Research carried out by Global Young Academy and other international research institutes and academic journals is also an opportunity to gain a better understanding of the international situation. (Ayalon et al., 2015; Agashe et al., 2022; Dolgin, 2017; Shmatko and Volkova, 2017; Woolston, 2020)

Woolston (2020) also concluded in his international survey that postdoctoralists may not always receive adequate wages for their work and for their significant additional responsibilities. Only 46 % of respondents said they were satisfied with their salaries and benefits. There is no significant difference in salaries between men and women and between representatives of minority groups. However, there were significant differences between regions, where Australian-Asian respondents and then North and Central American respondents searched the most, significantly leaving behind European and Asian researchers. Based on the answers there is also a significant difference in science disciplines. On average, astronomy and planetary sciences and biomedical researchers earn higher salaries, while the salaries of researchers in the social sciences and ecology and evolution are far below them. Savings opportunities have also been explored. 22 % of respondents are unable to make savings from their postdoctoral income, while 48 % say they can set aside but not as much as they want. (Woolston, 2020) In his research interviews published in Dolgin (2017), he points out that many researchers outside the lab take a second job at the expense of their free time to earn a decent income. The same survey also highlighted problems in accessing childcare allowances, which was a problem for 13 % of respondents.

Although average wages have not been determined among Russian researchers, this is the most significant reason for the temporary or permanent abandonment of the research career. However, in the context of leaving the research career, according to their answers, they do not intend to leave the research career. According to Shmatko and Volkova (2017, 61), "the dissatisfaction with material aspects does not automatically lead to a mass withdrawal from scientific life, as it is the only environment in which a significant part of the specific needs of researchers can be met at all, which is the most important requirement for a researcher." Russian doctoral students do not view material aspects as valuable for themselves, but rather see it as a means of achieving their goals. (Shmatko, Volkova, 2017)

Agashe et al. (2022) explains in detail the problems faced by Indian researchers, where the funding difficulties of research activities are also given particular attention. 44 % of young researchers surveyed received de minimis aid and only 7 % of respondents received significant grants. As a result of the funding difficulties, 43 % of young researchers did not carry out their

research. The lack of transparency in the review system, the reduction of previously approved subsidies, the bureaucratic system, or the lack of a supportive atmosphere further complicates the work of young Indian researchers. Only 32 % of Indian researchers say the promotion takes place on time. Similar to the Hungarian evaluation systems, in India, research results and educational activities dominate performance evaluation and promotions. In addition, the extent to which it is able to obtain resources and the extent to which it provides research service to the institution and to the scientific society is also important. Several respondents indicated that factors such as the nature of the relationship with the leader and the political position will be taken into account in promotion. 35 % of respondents were satisfied, while 28 % were not satisfied with the current promotion criteria. The educational burden is also a major problem for Indian researchers, as nearly half (47.8 %) of respondents replied that the teaching burden does not comply with the law.

Researchers from the Association of Southeast Asian Nations (ASEAN) countries are already challenged to participate in meaningful research, but if they succeed, they face the problem of significant overburden, thus frustrating the lack of time to produce useful results. The problem of time can be understood not only in the long term, but also in the short term, since, like other reports, ASEAN respondents report that there is not enough time for research within a day due to administrative and performance evaluation tasks. The biggest challenge is the lack of funding opportunities and the lack of support to obtain funding opportunities. There is not only a shortage of financial resources, but also a lack of human resources or management support. The lack of mentoring among ASEAN respondents is also high compared to other research findings. In the survey, other research highlights issues such as racism, religious discrimination and sexual harassment. (Geffers et al., 2017)

Israeli researchers also report research funding problems, where it is a serious problem thatpurchasing consumables and equipment is more expensive in their home country than abroad, and the research framework available at their own institution is not too high. (Ayalon et al., 2015)

By preparing the thesis I have undertaken to answer the following question:

What are the factors that most influence different segments of researchers at different stages of their career?

In order to answer the above question, I have developed the following objectives as a result of the research:

C1: Mapping researchers' sustainability stance and looking for a related segmentation aspect.

C2: Mapping of factors influencing the career motivation of researchers and examining their temporal nature.

C3: Research on current motivational factors of researchers.

C4: Mappingof drivers of career abandonment among the responding researchers.

C5: Identifying factors to make a career in research more attractive.

2 MATERIAL AND METHOD

I based the research process and the research model on the guidelines of Sajtos, Mitev (2007). In order to establish the scientific basis of primary research, I carried out a literature review, during which I reviewed several Hungarian and international scientific literature, as well as articles and policy publications published in the world press.

Then I elaborated the question I wanted to answer in the thesis, which is as follows: What are the factors that most influence different segments of researchers at different stages of their careers? In order to answer this question, I defined 5 goals and 8 hypotheses to be examined, which are presented in detail in Table 1.

For the examination of hypotheses, I determined the primary data demand and the methods to be used. Primary data was collected through standardised questionnaire surveys and standardised interviews.

With the help of the primary standardised questionnaire, I collected the responses of the researchers, which are based on the self-assessment and personal opinions and experiences of the persons interviewed.

Based on several motivational literature and Shmatko and Volkova (2017), I concluded that it is worthwhile to re-examine and consider part of the FKA's 2018 questionnaire, as motivational studies have shifted towards comprehensive internal and external motivational factors and their dynamics over time. (De Brabander, Martens, 2014; Ryan, Deci, 2000; Kanfer, Ackerman, 2000; Leontyev, 1997)

In order to match the results of the research carried out by the primary and the FKA as accurately as possible, I kept the structure and the main elements developed by them, which I shaped in accordance with the results of the Hungarian and international literature (concerning research careers and motivations, as well as the general motivational models) and my own professional motivation.

With the help of the Primary Standardised Questionnaire between 22 November 2022 and 3 January 2023, I collected the answers online, supported by social media platforms and managers/workers of higher education institutions, research institutes and enterprises. However, data collection has become significantly more difficult due to the reference to the GDPR, as most (higher education) institutions are blocked from disseminating through formal channels.

Table 1: The aims, hypotheses and methods of the related study

Researcher's question	Goals	Hypotheses	Material	Method
What are the factors that most influence different segments of researchers at different stages of their careers?	**C1:** Mapping the researchers' sustainability stance and looking for a related segmentation aspect.	H1: Researchers can be grouped into significantly different groups based on their perception of sustainability problems and their relationship with a sustainability approach.	researcher's responses	descriptive statistics, cross-board analysis, ANOVA
	C2: Mapping the factors influencing the career motivation of researchers and examining their temporal nature.	H2: Among the strongest motivational factors for researchers' career choices are the excitement of discovery, flexible working conditions, work-life balance, and the ability to educate students.	researcher's answers, secunder data, managerial responses	descriptive statistics, cobweb diagram
	C3: Research on current motivational factors of researchers.	H3: Researchers can be grouped on the basis of gender, age, discipline and sustainability related research topics based on significant differences in the assessment of current motivational factors.	researcher's responses	descriptive statistics, cobweb diagram, ANOVA
			researcher's responses	descriptive statistics, cobweb diagram, ANOVA
		H4: The strong motivational factors of the researchers and their motivational power change as the time spent on the research career increases.	researcher's responses	descriptive statistics
		H5: Research segments can be defined where ecological, social and economic responsibility has a significantly stronger motivational power.	researcher's responses	ANOVA
	C4: Mapping the drivers of career abandonment among **the**responding researchers.	H6 Financial reasons are the main contributors to career abandonment.	researcher's answers, managerial responses	descriptive statistics
		H7: Motivational factors with significantly different effects on leaving the career can be defined in different research segments.	researcher's responses	ANOVA
			researcher's responses	ANOVA
	C5 Exploring the factors that make your research career more attractive	H8: The research career can be made more attractive by a significant salary increase.	researcher's responses	descriptive statistics, even comparison, cross-board analysis

Source: My own editing

Note: KK: Researcher's questionnaire, VI: Management Questionnaire

During the survey, 124 responses were received, but I removed the responses of respondents who did not perform research tasks, so I analysed 117 responses after data cleansing. Among the elements of the questionnaire there were mandatory and optional questions to be answered, depending on the characteristics of the individual, and consequently I looked at a smaller population. The sample is not representative, but the methods used on the number of elements provide an opportunity to draw conclusions and make suggestions. The processing was done with SPSS and Microsoft Excel.

The respondents were divided into two groups according to the field of science. The first group consists of representatives of agricultural sciences and biological sciences classified according to the Hungarian Academy of Sciences (MTA, 2017). The second group is represented by researchers in philosophy and historical sciences, physical and astronomical sciences, earth sciences, economics and law, chemical sciences, mathematics sciences, engineering sciences, language and literary sciences, and medical sciences.

In addition to grouping in the field of science, the answers of the researchers has been examined, on the basis of gender, the relationship of their subject with sustainability and also their age which I refer to as segmentation aspects in the following.

I analysed the data of the questionnaire replies using statistical methods, regression calculation and variance analysis.

In addition to the survey, I also conducted a qualitative study. I considered it important to examine the factors affecting the research career not only from the researcher's side, but also from the management side. The interviews had two goals, on the one hand, the interviews show what challenges and problems the leaders identified with the topic and what tools they have in place to achieve their goals. On the other hand, by colliding the results of management interviews and research surveys, it is possible to map the differences perceived by different actors.

From the research side, the representatives of the agricultural sciences are overrepresented, their subject is typically related to sustainability, so in the selection of the leaders I found 3-3 leaders from higher education institutions and research institutes in the field of agricultural and life sciences, so that I could explore this field in more detail.

I contacted the leaders of the following institutions: University of Debrecen Faculty of Agriculture, Food Sciences and Environmental Management (1st Institution), University of Szeged Faculty of Agriculture (2nd Institution), Széchenyi University Albert Kázmér Mosonmagyaróvár Faculty (3 rd Institution). Although the Hungarian University of Agricultureand Life

Sciences is one of the most important agricultural-oriented higher education institutions in Hungary, as I do my doctoral studies at this institution, I considered an interview with them not ethical because of my personal involvement. In the case of research institutes, I continued to collect data in the following 3 institutes: Institute of Agricultural Economics Nonprofit Ltd. (4th institution), HUN-REN Centre for Agricultural Research (5th institution) and Research Institute of Organic Agriculture (6th institution). I conducted an in-depth interview with one of the leaders of each institute, except for the Institute of Agricultural Economics Nonprofit Ltd. (Which is a Nonprofit Ltd.), where besides the managing director, also the Human Resources Manager (HR) accepted the request for the interview. A total of 7 interviews were conducted. In view of the GDPR regulation, I refer to the heads of organisations with the serial number of each institution in the chapter results. At the points where I quote the head of HR of AKI Nonprofit Ltd, I indicated their position too.

The interviews took place between 6 June and 25 July 2023 in person or via telephone or online platforms. The length of the interviews varied from 1 to 2 hours.

3 RESULTS AND DISCUSSION

Results of theresearchers' survey

In the thesis I analyse the responses of those who completed the questionnaire and also carry out research activities. 117 responses met these criteria.

Table 2: Distribution of respondents by discipline, age group and gender (persons)

Title of the field of science	Main	45 years old or younger	Over 45 years of age	No		
				man	woman	did not give
Agricultural sciences	**38**	29	9	17	20	1
Biological sciences	**19**	15	4	14	4	1
Philosophy and History	**9**	6	3	5	3	1
Physical and Astronomy Sciences	**2**	2	0	0	2	0
Earth sciences	**5**	3	2	4	1	0
Economics and Legal Sciences	**13**	6	7	8	5	0
Chemistry Sciences	**8**	8	0	3	5	0
Mathematics Sciences	**2**	2	0	2	0	0
Technical Sciences	**8**	4	4	7	1	0
Language and Literary Studies	**2**	1	1	1	1	0
Medical sciences	**11**	8	3	4	7	0
Total:	**117**	84	33	65	49	3

Source: Own production based on primary data collection

The classification of respondents in the discipline was based on the 2017 scientific nomenclature of the Hungarian Academy of Sciences. (MTA 2017) The majority of respondents, 32.47 % (38) work in the field of agricultural research, followed by representatives of biological sciences at 16.24 %, accounting for almost half of the respondents (48.7 %). When processing the results of the survey, they form representatives of the "Agricultural and Biological Science" (ABT) (marked in the table with green) and the representatives of the other disciplines are representatives of the "Other disciplines" (EGYT). See. Table 2.

The majority of 117 respondents (71 %) were representatives of the younger generation, who are 45 years old or younger. 55 % of respondents to the questionnaire were male, 41 % were women, and the remaining 4 % did not wish to indicate their gender. When examining the questions or relationships in which the results are determined by sex, 114 answers are processed.

58 people, i.e. half of the respondents, received a PhD degree. According to the method of employment, 79 % of respondents carry out research activities (including PhD students) in full-time employment and 21 % are in a side job.

I also asked those who completed the questionnaire whether their research topic was related to a sustainability approach. One respondent could mark several approaches (and introduce it on its own), so the number of responses is higher than 117. The topic of 60 % of respondents is linked to at least one sustainability approach, of which 88 % relate to sustainable farming. See Table 3. With the exception of other sciences, all segments have a higher number of people whose topics are related to sustainability.

Table 3: Linking research topics to sustainability perspectives

	none of them	sustainable management	biomass-based economy	circular economy	non-growth	energy efficiency	blue economy	N
Total	47	62	22	25	6	1	17	117
ABT	10	42	12	12	1	0	8	57
EGYT	37		10	13	5	1	9	60
45 years old or younger	34	44	14	19	1	1	11	84
Over 45 years	13	18	8	6	5	0	6	33
Man	26	35	10	12	5	0	11	65
Woman	20	26	11	12	1	1	5	49

Source: Own calculation based on primary data collection

Note: ABT: Agricultural and biological sciences, ONE: Other sciences

Based on the cross-table analysis, there is a significant difference in the relationship of the researcher's subject with a sustainability approach among the representatives of the Agricultural *and Biological Sciences and Other Sciences*. (Pearson Chi-Square p=0,000; Cramer's V p=0,000. There was no significant difference in the sample based on gender or age grouping.

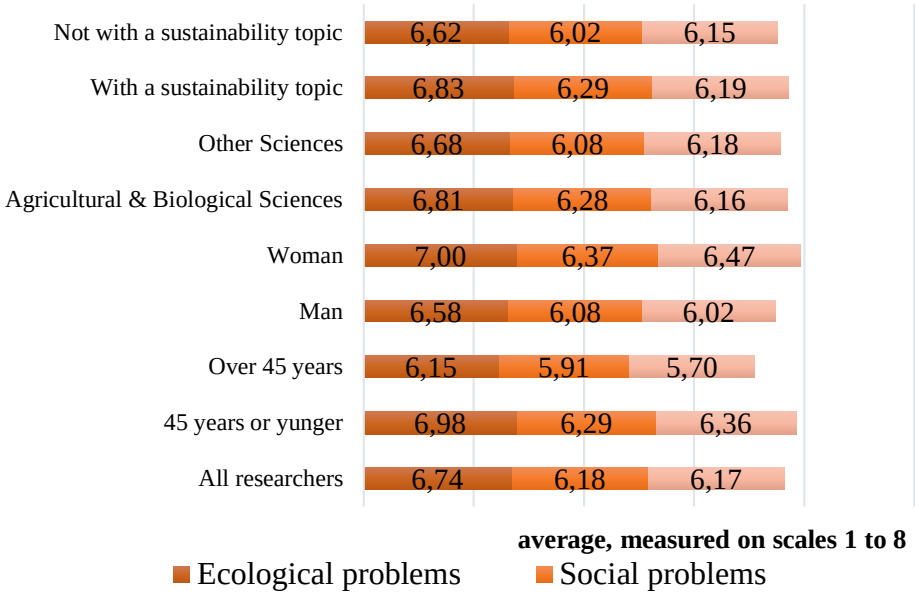

Figure 1: Perception of sustainability issues in different research segments
(based on average score)

Source: Own calculation based on primary data collection

Note: the element numbers are based on the distribution of respondents to the questionnaire

Figure 1 illustrates how different segments perceive sustainability problems. The 8 segments and the links between the responses they gave were explored by a variance analysis. According to different groupings, the researchers have a similar perception of sustainability-related problems. Significant differences can only be observed between groups of researchers "45 years old and younger" and "over 45" in the following areas:

- ecological problems (6.98-6.15; ANOVA F=6,961 p=0.0009; Levene test: P=0.03)
- weather problems (6,32-5,33 ANOVA F=7.565 p=0.007; Levene test: P=0.023,
- economic problems (6.36-5,7 ANOVA F=5.069 p=0.026; Levene test: P=0.028.

Based on these results, I consider it justified to expand the segmentation methods used in Hungarian and international literature (age, gender, field of

science) with the "*connection of the topic with the sustainability perspective - theme*".

Career choices

In order to gain a more comprehensive understanding of the research career and to facilitate the supply of researchers, I also asked about the factors related to career choices. 38 possible motivational factors were assessed among respondents, where an eight-degree Likert scale had to be responded to the extent to which the given factor was motivated by the researcher's career (1= not motivated; 8 is very motivated).

Based on 117 responses, 16 % of motivational factors averaged more than 6, which are the strongest career motivation factors presented within the framework of the thesis. Respondents are mostly guided by "*personal professional interest*" to the research career (average = 6.91). The second place is the "*excitement of discovery*" (average = 6.52), followed by the "continued content of work" (mean = 6.50), "*continuous potential for development*" (average = 6,13) and "*involvement in research activities*". The average of these factors was above 6, which are the driving forces that stem from the nature of the research activity. These factors are also determinative in assessing their current motivation and have a value above 6, with the exception of the "*continuous potential for improvement*" which decreases to 5.98. The "*professional standard*" also has an average of over 6.

Study of (current) motivational factors of researchers

In the following, the motivational power of the factors studied during the primary survey was also examined by presenting the averages and standard deviations in the 4 criteria presented earlier. In this case, the relevant factors should also be assessed by respondents on an eight-degree Likert scale (1= unmotivated; 8 is very motivated). Below are also the strongest factors.

Personal '*professional interest*', '*work content*', '*excitement of discovery*' and '*flexible working conditions*' have been among the most determinants of all groupings and averaged above 6. The average of the personal professional interest factor is the only one that reached 7, and even among researchers with a sustainability topic. I call them basic motivational factors.

In addition to the basic motivational factors, the members of the group of researchers aged 45 years and younger are most motivated by '*involvement in research* activities', '*continuous development potential*' and '*worker relationships'*, similar to career motivations, which can be explained by the age of the survey participants and the stage of their research career. For those aged over 45, these factors are already dominated by "*vocational awareness*"

and "*possibility to shape the future*", although these factors also appear among the strong factors of the young generation. Factors related to responsibility are more important for young people, while "*educational opportunity*" is more importantfor older generations.

When grouping by gender, the average value of '*involvement in research activities', 'continuous development opportunity', 'work relations*', '*vocational awareness*'*and* '*professional quality*' for women exceeds 6, so they are highly motivated. The values of the factors mentioned above, although not much, are lower for men. The average of "*teleworking*" was more than 6 for women alone, from which the family-friendly nature of research work can be inferred. In my opinion, "*teleworking*" can also appear in women as a strong motivational factor, because the majority of respondents are likely to live or plan the future of themselves and their families according to the classical roles and methods of division of labour typical of Hungarian society.

In addition to the basic motivating factors in the field of agricultural and biological sciences, the "*involvement in research activities*", "*collaborative relations"* and the "*impact of professional quality*" are very strong motivational factors. These factors are also decisive for researchers in other sciences, but for them the "*vocational awareness*" and the "*opportunity to cooperate with other/foreign researchers*" are even more important.

Researchers whose themes are linked to a sustainability approach have the most motivational factors with an average of more than 6. Of these three factors are not shown in another group, these are: "*participation in professional decisions"*,"*life/work balance" and* "*ecological responsibility"*". Apart from the basic motivational factors, there is no factor with an average of 6 for researchers whose themes cannot be linked to any sustainability approach. Based on my personal experience and the high number of strong motivational factors that appear here, researchers whose themes are linked to a sustainability topic tend to achieve a balance both in their private and professional life rather than those whose subject is not related and therefore show significant activity, which is reflected in their willingness to participate in decisions.

As the current motivational factors are further compared with variance analysis according to the different segmentation criteria, it is determined which factors have a significant difference between the two groups in the motivational power of the factors contained in Table 4.

Table 4: Significant differences in motivational factors of active researchers according to the 4 segmentation criteria

Factor	age	gender	science	theme
study trip abroad	X			
educational opportunity	X			
employee relations		X		
teleworking		X		
ecological responsibility			X	X
cooperation with other researchers			X	
social responsibility				X
the opportunity to shape the future				X
continuous development opportunity				X
participation in professional decisions				X
involvement in research activities				X
feeling of flow				X
professional level				X
utilisation of knowledge in other sectors				X
contributing to national/regional success				X
possibility of cooperation with industry players				X
work-life balance				X
remuneration				X
working conditions				X
family friendly environment				X

Source: Primary data collection based on own editing

As a result of the examination of the acute motivational factors, it can be concluded that only 2-2 factors can be detected in the grouping of age, gender and science, but the relationship of the topic with the sustainability approach is increasing to 15 according to segmentation. According to the topic grouping, it can be seen that there is a significant difference in the motivational effect of factors that can be linked primarily with professional content and are also future-oriented and development-oriented, such as factors related to responsibility, the possibility of shaping the future, contributing to the success of the nation/region, the possibility of continuous development, the utilisation of knowledge, research and professional quality. On the other hand, there are factors related to the individual's wellbeing and balance, such as the feeling of flow, the balance between private life and work, and the family-friendly environment.

In my opinion, it is important to point out that those with a sustainability-oriented theme in research careers value their motivational power higher in all 15 factors than those who do not have a subject of this kind. See Figure 2.

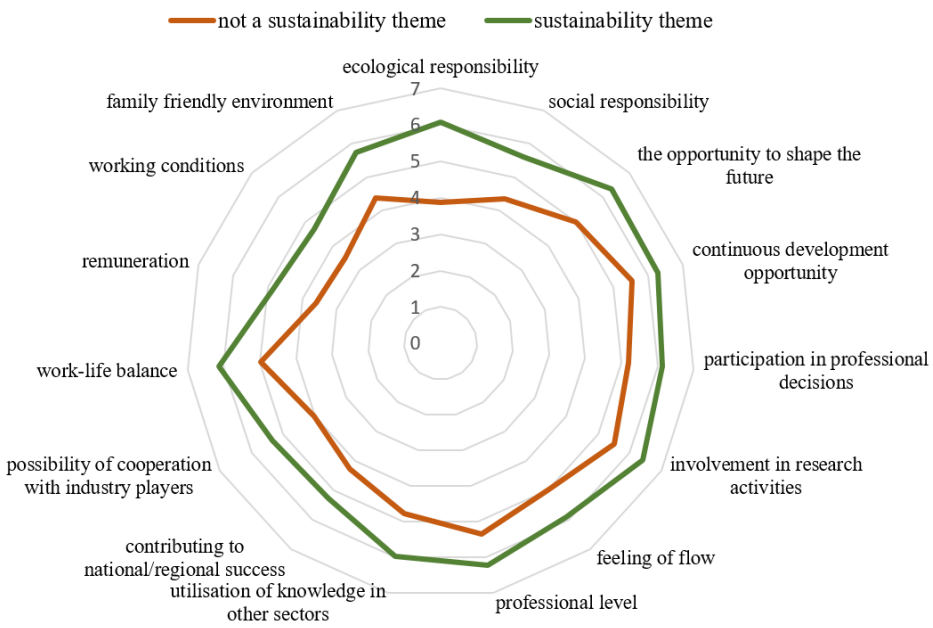

Figure 2: Exploring motivational differences among researchers based on the sustainability of their theme

Source: Primary data collection based on own calculation and editing

Note: $N_{\text{Non-Sustainability Theme}}=47$ $N_{\text{Sustainability Topic}}=70$

Investigation of the factors contributing to researchers leaving their careers

As I indicated earlier, the research carried out in winter 2022 is based on several points on Alpár et al. (2019) for the purpose of ensuring the comparability of the responses received. Issues related to staying on and leaving research path were included in both surveys (with the same scaling) These are the following:

1. All in all, how satisfied are you (currently) with your career and the opportunities you have (in the academic field)?
   on an eight-degree scale (1 = I am not satisfied at all; 8 = I am very satisfied)
2. Have you seriously thought about leaving science for the past 5 years?
   on a ten-degree scale (1 = I didn't think about it, 10 = yes, I was serious about it)

In a survey conducted by the members of the Young Research Academy in 2018, the professional path satisfaction was answered by 1530, while the

question of leaving the career was answered by 1533. On both issues examined, values were lower in 2018 than in the (well) lower primary research at the end of 2022 for any segment or total of respondents.

The average satisfaction of the younger generation with careers and opportunities ahead increased by 0.53, while the standard deviation of responses decreased by 0.08 to base year 2018. See. Table 5. According to the survey results of the 2022 primary research, careers and opportunities for researchers are the most satisfactory among researchers whose "*theme can be linked to sustainability*", followed by "*non-life sciences*" and "*male*" researchers. However, in terms of the values measured on the 8-degree Likert scale, we can conclude that even the most satisfied groups are only "more" or "bad" satisfied. In terms of career satisfaction, the opinions of younger and older generations of researchers are the same in terms of averages. The least satisfied are women, representatives of life sciences, and researchers "*whose subject is not linked to a sustainability approach*".

Table 5: Satisfaction of researchers with careers and research opportunities

	Alpár D. et al. .	45 years old and	Over 45 years of	A Sustainability	Not reserved for	ABT	EGYT	Men	Women	Total
average	**4,59**	**5,12**	**5,12**	**5,29**	**4,89**	**4,96**	**5,27**	**5,23**	**5,00**	**5,12**
scatter	**1,73**	**1,65**	**1,85**	**1,70**	**1,70**	**1,71**	**1,70**	**1,67**	**1,66**	**1,7**

Source: Alpár et al. (2018) and own production based on primary data collection

The answer to the question "*have you seriously considered leaving the research career in the last 5 years?*" was asked on an eight-degree Likert scale. I briefly refer to this as a career abandonment potential.

The average exit potential of all researchers is 6, from which the groups are symmetrically located in both directions. See Figure 3. The career abandonment potential was minimally improved by 0.1 compared to the 2018 survey among younger generation representatives (average=6.37; s=3.24), although far away from them (and representatives of life sciences, where the average = 6.37 s=3.37) is the highest. Unlike young people, researchers of the older generation think the least about leaving the track (average=5.06 s=3.79).

Female (average=6.27); s=3.33) and sustainability-related topics (average=6.01; s=3.48) researchers.

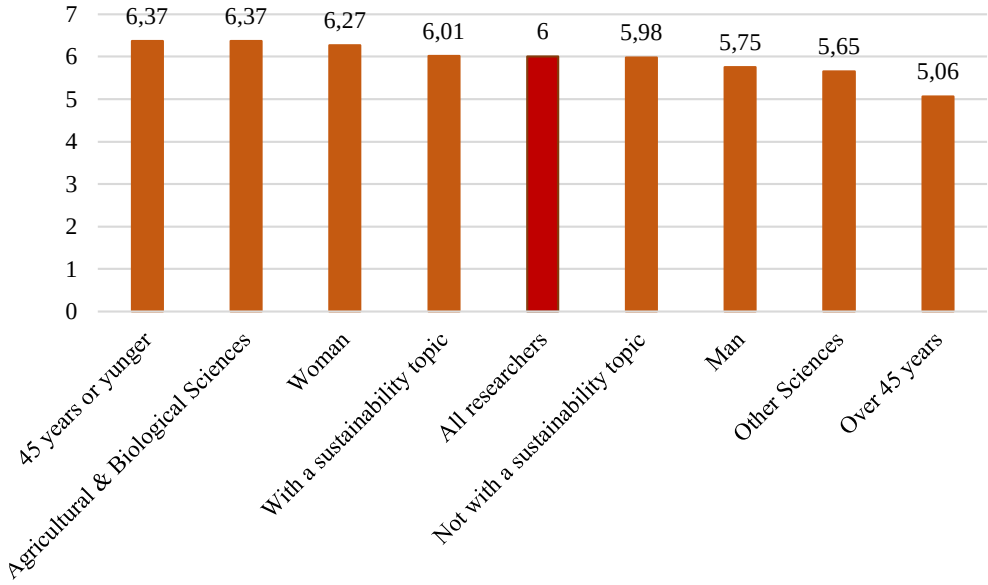

Figure 3: Career Leave Potential of each research group

Source: Based on primary data collection, own calculation

Note:$N_{researchers\ total}$=117 $N_{45\ years\ and\ younger}$=84 $N_{over\ 45\ years}$of age =33
N_{female}=49 N_{male}=65
$N_{Agricultural\ and\ biological\ sciences}$=57 $N_{Other\ sciences}$=60 $N_{with\ sustainability\ theme}$=70
N with$_{non\text{-}sustainability\ theme}$=47

"*What factors dissuade researchers from their scientific careers most"* were required to provide the respondents on an eight-degree Likert scale (1=not at all affected; 8 is very influencing. Alpár et al. (2019) 14 factors in the survey were reassessed and 14 additional factors were assessed in 2022.

Comparing the responses of people under 45 years of age, we find that the first two places in support of leaving the track have not changed: the highest average score was achieved by the "*personal financial difficulties, low income factor*", although it improved by 0.58 in 2022 (average$_{2022}$=6.25). See Figure 4. Second is the lack of research resources (average$_{2022}$=5.94). The value of an unpredictable and predictable professional career has not changed in scale, but this is still the 3 rd most deterrent factor in the primary survey. Fourth is the lack of work-life balance, the average of which increased significantly (up by 0.95) in the 2022 survey compared to the base year 2018. However, it is important to highlight here that the 2018 survey was carried out in the spring

period, while the 2022 survey was carried out at the end of the year in winter. Although it is not statistically justified on the basis of the survey questions, it can be assumed that the end of the year and the congestion of festive tasks had a significant impact on this value. The factors "*pressures and constraints related to the benchmarking system*", *"mentoring, lack of advice from experienced colleagues" and "gender differences"*are also reported with higher average values (i.e. problems felt worse) in 2022 than in the previous survey. There has been a slight improvement in the extent *of the problems posed by "professional progression"* and "*lack of infrastructure*". In terms of scale, the "*lack of support for participation in conferences and further training*" has improved significantly, the administrative burden on researchers has been reduced and their social appreciation has improved.

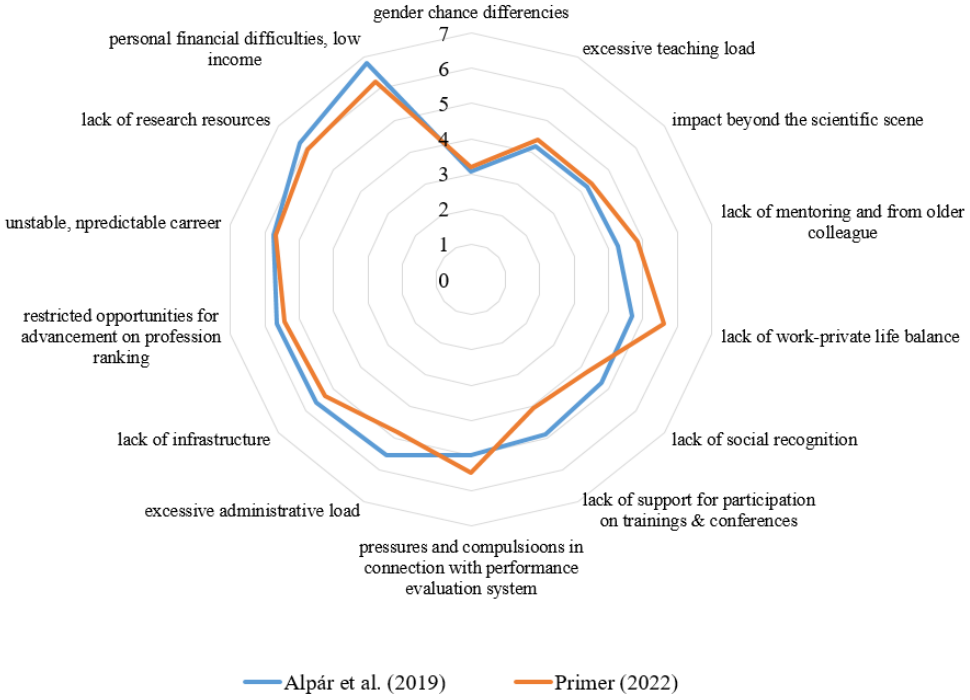

Figure 4: Presentation of the factors supporting young researchers leaving their careers

Source: Alpár et al. (2019) and based on primary research (2022) own editing

Comments on: $N_{Alpár\ et\ al.\ (2019)}$=1535 $N_{Primer\ (2022)}$=84

One of the aims of the thesis is to map the factors to which the members of the 4 criteria are most sensitive, thus determining which factors are the most dissuasive of researchers' careers.

The values of averages and standard deviations for the 8 segments were also established for 28 factors supporting the abandonment of the track. In terms of results, which is one of the most striking, that among researchers over the age of 45 and researchers in *Other sciences*, there were no factors with an average of more than 6, and the value of each factor in career abandonment, apart from a few factors (where similar or minimally higher than that of young people), is less or significantly lower than the average of the younger generation. The results of the study by Colarelli, Bishop (1990), according to which people no longer want new career opportunities after a given age, focus on and stabilise themselves. This is, in my view, justified by the fact that, once the researchers have achieved the position they have set as their goal, together with which they can obtain adequate (material) recognition, they are not interested in acquiring entirely new knowledge, they may turn to new tasks, such as youth education or fulfilling social functions (e.g. membership of the editorial board of professional journals), by which they can pass on their knowledge and gain further professional esteem.

Personal financial difficulties are those that, apart from representatives of the age group over 45 and *Other sciences*, are among the most serious factors in all segments, with a value of more than 6.

According to the 4 segmentation criteria, the factors contributing to the abandonment of the track will be examined according to whether there is a significant difference based on the impact on the two groups.

Table 7: Significant differences in the contributing factors of the researchers according to the 4 segmentation criteria

	age	gender	science	theme
an unstable organizational climate	X			
lack of ecological responsibility	X			
restricted opportunities for advancement on professional ranking	X			
Conference Opportunity	X		X	
inflexible working conditions	X			
gender differences		X		X
inadequate occupational safety		X		
excessive administrative burden				X
educational burden				X

Source: Primary data collection based on own editing

According to Table 6, a significant difference between segments can be determined for only 9 track departure factors. According to age, most of the

factors, 5 pcs, which have a different effect on leaving the career, this uncertain organisational climate, the lack of ecological responsibility, the limited possibilities for advancement in the professional ladder, the opportunity to participate in the conference and the inflexible working conditions have come to an end. Only 3, according to gender 2, and only 1 factor according to science differ significantly in the case of themes sereinti grouping.

Making research careers attractive

The "*leading goal"* of the thesis is to formulate proposals to ensure the supply of researchers and to increase the competitiveness of the researchers, for which the development of a prosperous research career is essential. In addition to assessing motivational factors, there has been an assessment of the factors that respondents believe could make the research career more attractive for prospective and current researchers.

I determined the order of the factors using an even comparison method, i.e. all factors were measured against all factors according to which for the given respondent is more important in order to increase the attractiveness of the research career. In the double comparison, the main factor got a point, and based on these I summarised the votes of the 117 respondents.

Importance of the factors that make the research career attractive:

1. expansion of research resources (503 points);
2. significant salary increase (475 points),
3. a more predictable professional career (380 points);
4. development of research infrastructure (335 points);
5. increased support for family researchers (309 points);
6. support for mobility (228 points);
7. professional support system, e.g. mentoring programme (227 points).

In Alpár et al.'s study, the factors were examined independently on an eight-degree Likert scale, with a method which makes the relation of the factors to each other less visible. The factors included in the research report on the situation of young researchers have been complemented by "*extending research resources*" which has by far the highest score in the 2022 survey. See Figure 5.

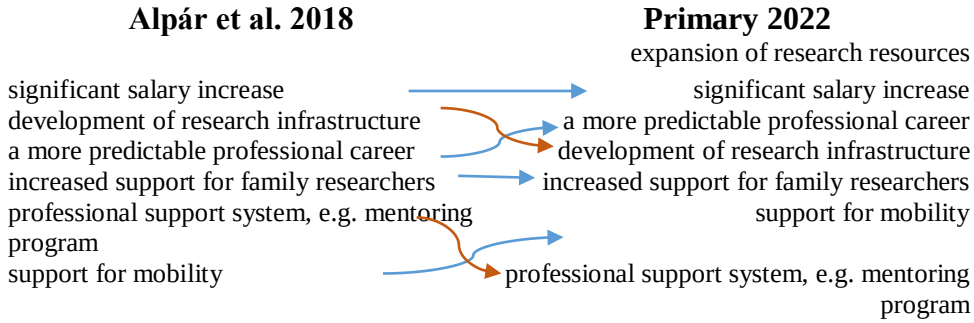

Figure 5: Changes in the prioritisation of factors that make the research career attractive

Source: Alpár et al. (2008) and primary survey based on own editing

Note: $N_{Alpár\ D.\ et\ al.2018}$=1535 $N_{Primer2022}$=117

Results of interviews with executives

The following chapter presents the results of a standardised in-depth interview with a total of 7 executives from 6 institutions, including one HR manager. I asked the leaders to describe themselves as a leader and to describe their organizational culture and their relationship with researchers.

The leaders of five institutions declared themselves to be easy to access and apply the principle of "open doors". 3 leaders respect the hierarchical system, but they also expressed the opportunity for researchers to approach them deeply with their needs and problems and give them real weight.

3 leaders involve workers in the preparation of decision-making, and 1 of them declared themselves "representatives". However, the three leaders agreed that the decision and the responsibility associated with the decision remain with the leader. There was one leader who described himself as creative, intuition-based, and flexible.

Among the higher education institutions represented in the frame of interviews, the majority of people work in the 1st higher education institution (230 people), followed by the 3 rd institution with 110 staff and the 2nd institution with about 60 people. Among the research institutes represented, the 5th institution employs the highest number of 420 people, followed by 112 in the 4th institution and 38 by the 6th institution.

The Road to Supply

To the question of "*when* do you think it's important to move towards the research track?" I received an unanimous answer: young people entering higher education institutions.

The participants in the interview listed a number of factors that lead young people towards a career as a teacher/researcher, but everyone agreed that internal motivation and dedication are critical points.

"They are looking for a challenge in life to realise themselves, it is an inner desire that the existence of researchers offers," said the head of the fifth institution.

"The most important thing is the inner urge. There are very talented students who cannot be guided towards the academic career because they want to work in practice." based on the experience of the leader of the 2nd Institution.

"If there is no internal motivation, it is very difficult to motivate from the outside. The reputation and recognition of the Institute itself can motivate." emphasised the Head of HR of the 4th institution.

The leader of the 6th institution highlighted the freedom of research, which, in his opinion, acts as the strongest motivational factor in choosing a career.

"It is very difficult to find a colleague. One thing is that students choose agriculture and university education, but the number of people entering the research career is further narrowing, taking into account the current PhD scholarships. In my opinion, with the current benefits, you have to be very determined, or you need to be able to create the conditions for a livelihood on the other side so that someone can enter this path. I think that being a researcher is definitely a serious determination, and only a few people have this drive," said the head of the 6th Institute.

The individuality and commitment of teachers to their research topics can also have a strong influence on students in higher education. In this respect, the positive impact of early involvement in scientific work also appeared in the responses of the dean representing higher education, such as participation in the Scientific Students' Conference and early involvement in high-quality (research) work in the framework of research projects.

The leader of the 3 rd institution highlighted the motivating power of the researchers working in the agricultural sector to spend time or tasks outside, as they feel good. In addition to the above, the Head of Institution 1 drew attention to the exploitation of research results. In his opinion, if someone has a home, family or workplace environment where the results of research can be utilised, they are more easily committed to the agro-research career following the choice of agricultural training.

Unfortunately, the initial low profitability opportunities do not support a large number of young people (in higher education) interested in research careers,

as separation from parents and self-care put considerable financial burdens on young people starting their careers.

"Even today, for the majority of young people, everything is determined by the financial situation, respect for the exception. What you need to know is that a young person can't earn as much in the academic field as in the competitive sector, but regardless of that, there is always a dedicated student who is interested in this and comes to a PhD, and if he comes, *he will probably choose the teaching and research careers."*

However, it has been repeatedly experienced that, after gaining some years of experience and financial stability in the competitive sector, several students return to the alma mater to begin their academic careers.

"My experience is mixed, typically from our own students, those who choose the teaching/research career, but there are many who begin to enter the scientific career after trying out the private sector," the head of the 2nd institution reported on his experience.

The head of the 1st institution criticises the implementation of the Bologna system in Hungary, which, according to him, does not facilitate the supply of researchers, since after 3 and a half years, as the talented students obtain their BA/BSc degree, they are immediately absorbed by the private sector and only a fraction of them continue their training.

"Distributed training does not serve researcher's supply because talented students go to work after a BSc degree and come back to MSc after several years if there is something extra knowledge they think about the MSc training." Undivided training is the solution for supply. There are people who are interested, but the number is constantly decreasing. This requires extra motivation, perhaps 5-10 % of students have it." According to the experience of the leader of the 1st institution.

The experience of the 1st institution is supported by the results of Dajnoki, Kun (2016), in which it was found that recent graduates (compared to other sectors) were overrepresented among agricultural workers. In addition, 20 % of the participants who wish to obtain a second degree obtain the same level of education as their existing degree. These results also show that (mostly) talented young people in the field of agriculture tend to be in the private sector, and those who wish to continue their studies also want to develop their knowledge in a horizontal direction.

According to the opinion of the head of the 6th institution, the highly regulated system does not generate interest in the career in young people, but rather discourages them.

"The canonised road is horrifying for the majority of young people. More people are divided among young people, but also among older colleagues, because they feel so bad about the institutional system and set-up," said the head of the 6th institution.

From the answers of the researchers, it can be concluded that in many cases organisational structures and managerial preferences actually work according to the old arrangements (such as hierarchical structures), but the leadership style is more decisive for the organisations consulted.

Factors of keeping on the scientific career track

To the question that, in their opinion, "what are the factors that best keep researchers on track?" I received very diverse responses, with more than 20 (part) factors identified by respondents, after grouping the factors with similar meaning.

Five factors received 3-3 mentions, including advancement opportunities, funding sources, institutional climate, internationalisation and regionality. 2-2 were mentioned about fame and recognition factors and personal perception of research work. The other factors appeared in the answers ones.

Success, as a factor of research career, was highlighted by only 2 leaders (4th institution and 6th institution) as a critical factor for staying on track, but because of its comprehensive nature, it is necessary to highlight it. However, the head of the 4th institution also points to one of the biggest obstacles to success. If there is a discrepancy between the subject and the interests of the researcher, the long-term success of the researcher is often lagging behind and this can pose a challenge to both the researcher and the head of the organisation. According to institutional practice, if a researcher does not seem to be able to complete a particular field, they try to find a new topic, and if necessary, look for a new department for the researcher in order to find the place and theme where he can achieve success.

Size and causes of research fluctuation

Due to the interruption or abandonment of the research career, I also asked the leaders about the organisational fluctuations and reasons. All the leaders said there was a low rate of fluctuation in their institutes. However, the leaders of institutions 4 and 3 reported significant fluctuations in recent years when the institutions were undergoing a radical organisational transformation.

During the interviews, income problems were mentioned 5 times as the reason for leaving the career, followed by 2 mentions of retirement and family reasons. The private sector is not only attractive to researchers leaving the

institute because of its higher income prospects, but also attracts young people and graduates with the opportunity to obtain a practice.

In the case of the 6th institution, where, in addition to research at the table/laboratory, work involving considerable physical exertion is carried out, there were researchers who left the organisation for this reason, but this was described by the leader as a unique case. The leader of the 3 rd institution, on the other hand, previously described the pleasant feeling of free space work as a motivating force, which, in his opinion, replenishes both the researchers and the agricultural workers.

Each organisation primarily struggles with the private sector for researchers, typically due to higher income opportunities. However, according to the leaders of institution No. 4, the EU Specialised Committees and certain policy positions also have an absorption effect.

Staff in the research institute often undertake second-time teaching tasks in higher education institutions, but these do not have an absorption effect due to the generally lower wage offer.

The question is, what leaders think are the dissuasive factors in their research career? Except forthe leaderof institution No. 4, all organisations highlighted primarily as the main reason the low wages and the low appreciation expressed through it.

Of course, the materials. Being attractive is very difficult without the right financial background. International reputation, flexible working hours, creative wages are still not enough. Thre is a risk of brain drain by the corporate sector" emphasised the head of the 3 rd institution.

"Researcher's appreciation, which can be measured in forints. Many people give up a lot of things in order to do this job. I didn't see anything else," said the head of the fifth institution.

"Usually young people change because those who already have significant research backgrounds and results will not change much anymore, they will go to another university for some other reason," he said. Young people are clearly discouraged by the lack of financial appreciation, as they are about to start a family. We understand them," said the head of the third institution.

According to the experience of the head of the 6th institution, the early abandonment of the research career can also be caused by the fact that research work can be a mental and even physical burden that many cannot undertake.

, the leader of the 5th institution encountered a family-related problem in some cases, which deflected a researcher from his or her career. In the opinion of

the geographical (rural) location, in the case of its own institution, on the one hand, it is also an advantage and disadvantage, because it is difficult to attract new staff from Budapest and its surroundings, but they leave the institution less because of the attachment to the place and the low mobility characteristic of Hungarians, which was confirmed by the Head of institution No. 2, that "*Hungarians cling to the land and the house, mobility is not typical of us".*

In addition to the above, according to the head of the 6th institution, there are still institutions where old organizational habits and customs, the lack of authoritarianism, power strife and professional esteem are still problematic, which in some cases can be remedied by a change of organisation, but these factors can cause damage to some people, which may also lead to a departure from the research career. The topic of research fluctuation and career abandonment was explained in detail in the publication of Szabó (2024).

Factors that can make aresearch career attractive

During the interview, the leaders also explained the means and actions they felt could make the scientific career more attractive. Half of the institutes believe that higher wages would improve the attractiveness of research careers. One of them confirmed the view that personal factors have a significant impact on how attractive a research career is to someone. According to the Head of institute 1, the attractiveness of the research career is based on the results of R & D activities, which are used in consultancy and production. In his opinion, their institution and thus the existence of researchers can become attractive by increasing the prestige of both the institute and the researcher's work through corporate success.

"A long time ago, universities were educational institutions that did significant research in addition to educational work, but today this has changed due to a drop in student numbers. ... The basis of strategic development is the promotion of R & D, consultancy and production, if the research community can make a significant contribution to this in the long term, this career can become attractive again."

"We are currently in the process of creating a strategy, one of the main goals of which is to keep researchers on track. We're working hard on that, that's a matter close to my heart. We have limited financial resources, but it is important that employees receive at least the same wages as those working in the private sector," said the head of the 5th institution.

"Materials can also be motivating, but that's not what I would do in the first place. As a non-profit organisation, we cannot compete with the private sector, but of course we try to provide income that is necessary for a normal

livelihood. They certainly don't come to us for wages," said the head of the 6th institution.

The head of the 6th institution expressed that the values of the researchers working in his institute are extremely similar, so for researchers with a sustainability approach and associated values, theinstitute and the work that can be carried out there is also tempting.

On the question of "*How decisive do you see young people'sviews on sustainability in terms of their motivations?*" opinions are divided.

4 out of 6 organisations said that sustainability is a strategic issue for the industry and theinstitute, but that the motivation for young people is already different. The 4 leaders identify sustainability as a key factor, but as internal motivation appears only in the head of an institute. 3 leaders identify it as a call that captures the curiosity of young people.

"It's absolutely important for us, many people come to us because we deal with this topic and that's what motivates them. I think sustainability is a very good call and makes us attractive. In my opinion, many young people are motivated to work on sustainability issues," said the head of the 6th institution.

"Sustainability has become the most important aspect of the past period. This is what our students say and they are interested in their daily lives. Today, we have more than 100 subjects related to the topic and we have research that directly relates to sustainability."

"Sustainability is in everyone's best interest today. If agriculture doesn't care about sustainability, then who? It's a matter of existence for us! We're all close to nature. Both professional and personal motivation are important. In agriculture, we must follow the new trends, we cannot afford to lag behind!" emphasised the head of institution 2.

*"We focus our institutes around circular farming, health and resilience, but young people don't have the system yet, but it's a good call for them. They are usually interested in one topic. During BSc and MSc courses, you will learn the details and be able to interpret, sort and develop the sensitivity of students. After the training, I trust that they will be committed and an integral part of their motivation*the head of institution 1 shared his experience.

The leader of the 4th and 5th institutions put the research objectivity before the subject, according to them there is no special role in career choices, but according to the leader of the 5th institution, this can change in the future.

"We have a dedicated man who may be able to bring together sustainability-related research and attract students and students from whom we can then

make qualified researchers, but I do not yet feel that this is a particularly important aspect for career choices. I do not see this trend yet, but perhaps within a few decades it will change. I still don't see that sustainability issues have crossed the stimulus threshold" according to the opinion of the leader of the 5th institution.

"Sustainability bias is not required in our institute. Objectivity is important for researchers. A researcher should not be an activist, but an expert," said the head of the 4th institution.

It can be seen from the above that the majority of managers believe that sustainability is of strategic importance, but in the words of Herzberg (8, 1987) it does not yet serve as an "own internal generator" for young people.

4 CONCLUSIONS AND PROPOSALS

Within the framework of the thesis, I have undertaken to map out the factors that influence the different segments of the researchers most in the 3 stages of the research career (track, current state and exit). In order to fulfil this task, I have fulfilled five goals and examined the related hypotheses, in the context of which I present my conclusions and suggestions within the framework of this chapter, based on the results.

C1: Mapping the researchers' sustainability stance and looking for a related segmentation aspect.

H1: Researchers can be grouped into significantly different groups based on their perception of sustainability problems and their relationship with a sustainability approach.

In the primary survey, researchers perceive ecological problems as the most serious of seven problems. There are significant differences in the perception of ecological, weather-related and economic problems among researchers aged 45 and under and over 45 years of age. 60 % of respondents have a topic that has a sustainability perspective. There is a significant difference between the representatives of the Agricultural and Biological Sciences and the Other Sciences according to whether their subject is related to a sustainability theme, this could not be detected by age and gender. It can be seen that representatives of agricultural and biological sciences are naturally more involved in sustainability research, but not exclusively. Accordingly, I consider it important to introduce the following as a new segmentation aspect. In this way, it is possible to find out the same and significant differences between the factors that influence the careers of researchers dealing with these topics, which can help to reach out to these researchers more effectively, to engage them and to increase their effectiveness.

Based on the results of the research, Iverified the hypothesis.

Proposal:the fact that most of the research topics are already linked to this approach presupposes the efforts to solve today's emerging and perceptible problems, which on the one hand is a political need, on the other hand academic and thirdly a social demand. However, among the factors influencing the career of the researcher, to my knowledge, the link to sustainability issues has not appeared in such a direct way. In my opinion, it is worth segmenting the researchers according to whether or not their topics are related to a sustainability approach, so that it is possible to find out the same and significant differences between the factors that influence the careers of researchers dealing with these topics, which can contribute significantly to

the more effective reach, engagement and efficiency of these researchers (candidates), which can help to develop the careers of governmental and institutional researchers. The question rightly arises as to why it is not enough to examine researchers in agricultural and biological sciences, since they are naturally linked to sustainability issues. As group, inter- and trans-diciplinary research is brought to the forefront, sustainability-oriented topics are no longer just a field of science, so the theme and not the field of science should be the focus.

C2: Mapping the factors influencing the career motivation of researchers and examining their temporal nature.

H2: Among the strongest motivational factors for researchers' career choices are the excitement of discovery, flexible working conditions, work-life balance, and the ability to educate students.

Both researchers and managers identified professional interest and primary career motivation as first. The strongest factors influencing career choices are presented in Table 7. The researchers considered 36 out of 38 factors – to varying degrees – as motivating at the start of their careers, supporting the leaders' view that starting their careers is a prerequisite for starting a career.

Table 7: Researchers' career motivations according to managers and researchers

Respondent	Leaders	Researchers
Factors	+ professional interest, + over-average motivation, — income	+ professional interest, + excitement of discovery, + content of work, + continuous development potential, + involvement in research activities, + professional level
Question	What are the main factors leading young people towards higher education and then teaching/researcher careers?	To what extent have you been motivated by the given factor when choosing your researcher's career?
Methodology	Primary, standardised in-depth interview, open point	Primary, standardised questionnaire, 1-8 Likert scale

Source: Primary data collection based on own editing

Unlike the researchers, however, there is a strong pessimism among managers on this stage, which is reflected in the predominance of income problems. Although the researchers did not find the income from doctoral studies motivating during the initial period, they do not consider it alarming.

Based on the researchers' answers, the hypothesis was notverified.

In my view, managers are faced with income problems to such extent because although initial scholarships and incomes would still be sufficient when

researchers enter their careers, scholarships/earning salaries will not increase as much as they would be necessary for young people to meet their most basic needs in the following years. Another problem is that the degree of the doctoral scholarship is fixed (in the case of applications after 2016 a net amount of HUF 140 000 HUF in the first 4 semesters, then HUF 180 000 HUF for 4 semesters), whichdoes not follow inflation. Although scholarships alone are not enough to create a home at the current real estate market prices, scholarships supplemented by a second job or grant source would be sufficient for the young researcher to apply for a loan if the state scholarship could be counted as a salary.

Another internal tension for the young researcher is that the level of scholarships is lower than both the minimum wage and the minimum skilled wage and is significantly lower than the income that can be achieved on the basis of qualifications in the private sector. Given these possibilities, it is understandable that the private sector can easily override the opportunities of higher education or research institutes, so the leaders of these institutes can easily face the absorption of talent from the business sector at an early stage of the training of young researchers. As wages at research institutes and in many cases the additional state PhD scholarships offer a much more favourable opportunity for young people, so this problem seems to be somewhat mitigated there.

Proposal: To ensure the supply of researchers, it is essential that managers focus on positive factors related to research life when recruiting and not projecting negative experiences from previous experiences to candidates. On the other hand, drivers should be encouraged to develop alternative tools to help young researchers at the beginning of their careers, such as the provision of anapartment, the provision of discounted student apartments, the support of car usage, the establishment of institutional scholarships, and participation in applications.

On the one hand, at legislative level, it is proposed, first, to adjust the amount of the scholarship available during doctoral training to the amount of the guaranteed minimum wage. On the other hand, it should be ensured that scholarships received during doctoral training are counted as wages for borrowing and pension calculation.

C3: Research on current motivational factors of researchers.

In Table 8 I summarised the motivational factors most important for managers and researchers. In addition to the 3 factors supporting the start of the research career, the flexible working conditions on the part of the researchers are the most motivating, which is due to the high proportion of young people and

young people present in the sample. On the other hand, managers have focused more on career, income and research embedded development among the motivational factors, which becomes increasingly important for researchers after graduation.

Table 8: Motivational Factors of Active Researchers

Respondent	Leaders	Researchers
Factors	• possibility of progress, • funding for proposals, • institutional atmosphere, • internationalisation, • regionality, • reputation, • recognition, • personal perception of research work, • success	• professional interest • content of work • excitement of discovery • flexible working conditions
Question	What are the factors that keep researchers the most on track?	To what extent are you motivated by the next factor in choosing your research career and are currently motivating you to stay in the research career...?
Methodology	Primary, standardised in-depth interview, open point	Primary, standardised questionnaire, 1-8 Likert scale

Source: Primary data collection based on own editing

H3: Researchers can be grouped on the basis of gender, age, discipline and sustainability related research topics based on significant differences in the assessment of current motivational factors.

From the study of the hypothesis, the responses of the researchers were examined on the basis of four segmentation criteria, during which the 20 factors, which varying degrees of motivating respondents on the research career, are justified to examine the current motivations of the researchers according to several aspects. See Table 4

Based on the researchers' answers, I verified the hypothesis.

As a result of the examination of the acute motivational factors, it can be concluded that only two- two factors can be detected in the grouping of age, gender and science, but the relationship of the topic with the sustainability approach is increasing to 15 according to segmentation. According to the grouping of the topic, it can be seen that there is a significant difference in the motivational effect of factors that can be linked primarily with professional content and are also future-oriented and development-oriented, such as factors related to responsibility, the possibility of shaping the future, contributing to the success of the nation/region, the possibility of continuous development,

the utilisation of knowledge, research and professional quality. On the other hand, there are factors related to the individual's feeling of wellbeing and balance, such as the feeling of flow, the balance between private life and work, and the family-friendly environment. In my opinion, it is important to emphasise that those with a sustainability-oriented topic in research careers appreciate their motivational power higher for all 15 factors.

Proposal: On the basis of the results of the segmentation study, it is appropriate to pay special attention to the approach of a researcher or research group on the theme of a researcher's career model, leadership style, institutional communication and institutional culture in order to achieve the goals of sustainability problems at both national and institutional level.

H4: The strong motivational factors of the researchers and their motivating power change as the time spent on the research career increases.

The researchers in the survey indicated the motivational force of each factor and its effect on them referring to two different timeslots. In Figure 6, factors appeared that have an average of more than 6 when entering the research career, i.e. they have a strong motivational power. For all strong factors, motivational power has decreased compared to career entry, and the average of two factors has decreased to below 6, but the motivational power of the flexible working conditions factor has significantly increased.

In my view, the increase in the motivational power of flexible working conditions lies in the fact that, as time goes on, young researchers are increasingly faced with tasks related to childcare and elderly care, which, while allowing them to work, require flexibility on the part of researchers and their employers. If the employer supports the performance of these tasks by providing flexibility, the employee is relieved of significant inconveniences, which can make them more efficient, satisfied and motivated.

Based on the test results, I verified the hypothesis.

Factors with a strong motivational effect when entering the research career decreased in a low amount, but one factor, the motivational power of flexible working conditions increased significantly and became a strong factor based on its average. The strengthening of the motivational power of flexible working conditions can be explained by the tasks related to childcare and elderly care, as well as the obligations arising from part-time work (watching hours, consulting tasks, tender evaluations, etc.). See Figure 6.

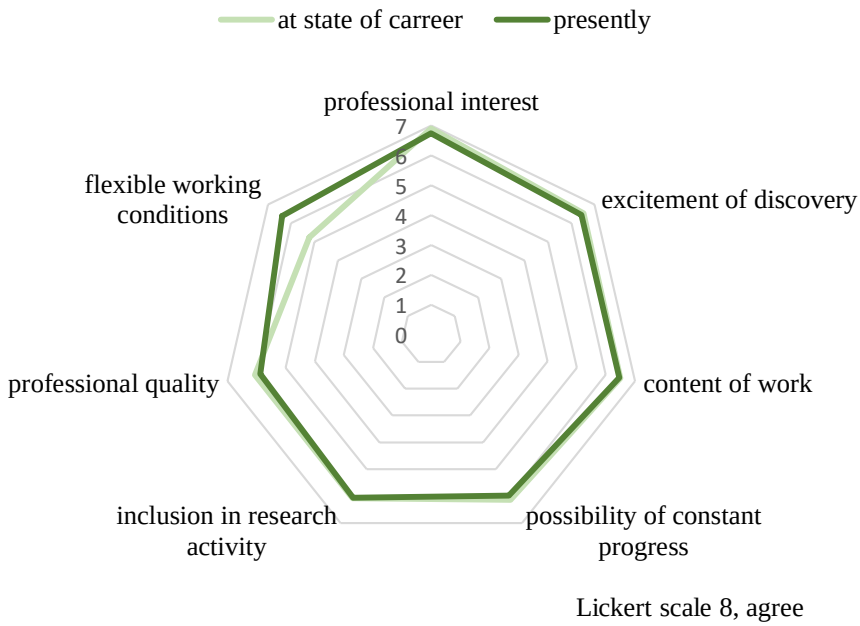

Figure 6: Research motivations when starting the career and presently (N=117)

Source: Based on primary research and calculation

Proposal: Research work has traditionally been characterised as a flexible job, some of which (professional publication, processing and evaluation of research results, (international) professional consultations) can be carried out from anywhere and often without time constraints, with minimal infrastructure.

According to my findings, at the beginning of the research career, it is recommended to shift even higher attendance work for the first-time careers towards more flexible working conditions. However, to create these flexible working conditions, it is necessary to develop a single, transparent organisational concept and culture that will enable employees within the organisation to work together effectively (e.g. by setting fixed working days, time slots, appointments for regular meetings). Furthermore, in order to ensure these flexible working conditions, it is essential to develop the right infrastructure and provide corporate laptops, online meeting platforms and shared storage facilities.

H5: Representatives of the younger generation, agro- and biological sciences, and researchers whose subjects are linked to sustainability are significantly

more motivated by ecological, economic and social responsibility factors than representatives of the older generation, other sciences, and those whose subject is not related to a sustainability theme.

In the case of the researchers involved in the study, I proved that the possibility of ecological, economic and social responsibility motivates those researchers significantly more whose themes are related to sustainability than those whose subjects are not related, but the researchers of agricultural- and biological sciences are only significantly more motivated by ecological issues than those of other disciplines. Based on age group, there is no significant difference in the motivational power of sustainability factors.

Based on the researchers' answers, the hypothesis was partially verified.

Proposal: In the case of organisations/organisational units where research is carried out in the field of agro- and biological sciences, and the sustainability approach appears prominently in research topics, it is worth extending, implementing and communicating this approach to all areas. I see the possibility of highlighting or setting new goals in the periodic review of organisational objectives. These approaches can be integrated into organizational culture, values and day-to-day operations. As the question of enlargement and recruitment is also marked in relation to the career of researchers, it is necessary to include the publication of posts, which is also proposed to present these tasks, opportunities and values, which can make the institution more attractive to researchers with similar interests and values.

C4: Mapping the drivers of career abandonment among the responding researchers.

H6: Personal financial difficulties and lack of research resources are the main contributors to career abandonment and there is no significant difference between the different segments.

On the basis of Table 9, it can be concluded that both researchers and managers identified personal financial difficulties as the primary reason for leaving the research career. The second most significant factor identified by the researchers was the lack of research resources, which was not highlighted by the managers. From both the leadership and the research side, the unjust system appeared as one of the reasons for leaving the career. Based on management experience, radical organisational change and the prospect of transformation have a significant impact on fluctuation. Based on management reports, family reasons and reaching the retirement age have appeared several times in the background of the change of organisation or leaving the profession. Although it was not typical, one of the leaders pointed

out that significant intellectual and physical pressure associated with research work could also be the cause of the career abandonment.

Table 9: Promoting factors for researchers leaving their careers

Factors	Leaders	Researchers
dissuasive	• low income, • organizational nervatures (habits, authoritarian environment, power strife) retirement, • family reasons, • radical organizational changes, mental and physical exertion	• personal financial difficulties, • lack of research resources, • an unjust system,
Question	What are the main factors that dissuade researchers from their research careers?	What are the factors that dissuade me from the scientific career?
Methodology	Primary, standardised in-depth interview, open point	Primary, standardised questionnaire, 1-8 Likert scale

Source: Primary data collection based on own editing

Based on the managerial and research responses, the hypothesis was partially verified.

Proposal: Income issues pose significant challenges for decision-makers not only at domestic level, but also at international level, as researcher supply and researchers who are already in research status could be supported by a significant wage increase, which keeps pace with inflation (with which the current situation will be preserved) in order to ensure the livelihood of researchers. Forward-looking wage development was an increase in wages corresponding to the given qualifications or slightly above those available in the business sector, which represents an average wage improvement of between 50 and 100 % during the writing of the thesis.

In my practical experience, this salary development is currently available in 2 ways: one is by taking a leading role in international tenders and on the other hand by meeting the business needs of a high standard, in which wages are also determined according to business considerations. However, in order to achieve these goals, I find it impossible to complete infrastructure developments and knowledge of international trends and knowledge (supporting participation in international conferences, by undertaking missions exceeding 3 months) which will enable researchers to make such high-value and knowledge-intensive commitments.

The majority of scientific institutions (research institutes, higher education institutions) have undergone several transformations over the past decade, which has caused considerable uncertainty among the employees of the organisation, including PhD students, teachers and researchers. Accordingly,

I also consider the long-term stability of research networks and institutional structures to be critical.

Although, in my opinion, supported by the experience of personal interviews, they are becoming less and less typical, but the negative organisational instigations have not been eliminated altogether. In my view, a leadership initiative is also needed to remedy and eliminate these problems. The TÉR application is already in operation or under development in most institutions, but these assessments are typically completed in employee reviews. I recommend that the evaluations be two-way, where managers can also receive valuable feedback. Building mutual values and trust is essential for this two-way communication.

H7: Motivational factors with significantly different effects on leaving the careertrack can be defined in different research segments.

As a result of variance analyses, a significant difference between segments can be determined in the case of 9 track leaving factors. According to age, most factors have been identified that have different effects on leaving the career, this is the *uncertain organizational climate*, the *lack of ecological responsibility*, the *limited opportunities to advance in the professional hierarchy*, the *opportunity to participate in the conference* and the *inflexible working conditions*. In groupings by subject, only 3, by gender 2, by discipline only 1 factor are significantly different. See Table 6.

Based on the researchers' answers, I verified the hypothesis.

Related to the unstable organizational climate, organizational transformation as a factor causing fluctuations was also confirmed by the interviewed leaders. Members of the younger generation are significantly more sensitive (strong factor) to this factor than those of the older generation, due to uncertain professional prospects, lack of management support and possible lay-offs. When perceiving a problem, the researchers could see that according to age groups, ecological problems are significantly stronger, which does not provide motivation for them when choosing a career or already being on the research track, but helps them to leave if they do not. Based on age groups, the recruitment of researchers of different age groups also differs significantly in terms of the limited opportunities for advancement in the professional ladder, which may be due to the fact that the most critical period of career development can be attributed to the young age. Inflexible working conditions also support the termination of the younger generation of researchers from work, which, in my view, arises primarily because of the challenges of starting a family and taking a second job. The only factor is the opportunity to participate at a conference, which is more conducive to the intention of older

researchers to leave. In gender distribution, the impact of factors on leaving the career is significantly higher in the case of inadequate occupational safety and gender differences. In both cases, it is natural to experience that women pay more attention to the risks to their health and, accordingly, have a stronger impact on them when the necessary and adequate occupational safety trainings and tools are not provided. The problem of the gender gap in women's career development is well characterised by the generally known glass ceiling phenomenon.

In connection with scientific fields, representatives of the Other sciences are better strengthened by the possibility of attending conferences in the intention to leave the profession, which is probably due to the fact that only a few professionally significant conferences are organised in Hungary, while participation in a high prestige confence entails a significant cost.

Proposal: From the government and academic side, it is necessary to support the development and long-term operation of a sustainable institutional network and structure that provides a stable background for researchers working in it. At the same time, stability needs to be ensured from the personal side, as with the frequent shift of managers, consultants and informal leaders, the long-term plans and goals are under continuous redesign and requires considerable flexibility not only from the professional but also from the personal side.

By providing the opportunity for ecological responsibility, positive results can be achieved, which reduces the willingness of young people to leave their careers and feeds the current research motivations of representatives of the agricultural and biological Sciences. It is recommended to integrate ecological responsibility into the daily life of the organisation and to make use of the opportunities in which the researcher can participate in such tasks.

Predictability andplannability in career development should also be an essential requirement, both for the academic community and for an organisation that can be ensured by clearly defining the conditions and reviewing their individual fulfilment at regular intervals.

Gender differences can also be facilitated by a clear and precise definition of the applicable and necessary rules, criteria and expectations, in which subjective elements are filtered out that may hinder fair competition between men and women.

In order to ensure adequate occupational safety, it is necessary to keep under constant review the conditions that enable to work safely and in accordance with the rules, either through the recruitment of a professional or by an external service provider. There is often a financial impediment to this. To

elevate this issue I propose that these costs, which are necessary for carrying out a specific research task, be eligible for tenders and state aids/mandatory orders and, on the other hand, a mandatory annex to the documents certifying the purchase of certificates/assets certifying compliance with health and safety standards.

C5: Study on the possibilities of making a research career attractive.

H8: Making research careers more attractive by raising salaries

Both managers and researchers have highlighted the development of financial factors, which will increase the attractiveness of the research career, but it is also important for researchers to have a predictable professional career, adequate infrastructure and increased support for families. The leaders see a long-term solution in increasing the prestige that can be achieved through the commercial exploitation of RDI results.

Based on the researchers' answers, the hypothesis was partially verified.

5 NEW SCIENTIFIC RESULTS

T1: I proved that the career choices of the researchers involved in *the study are mainly motivated by the professional interest, the excitement of discovery, the content of the work, the possibility of continuous development, the involvement in the research* activity and the *professional quality* factors, among which the impact of development opportunity and professional quality decreases with the advancement of the research career, and the *flexible working conditions* factor takes its place as a new factor.

T2: In relation to the sample examined, I proved that there is a significant difference between the current motivational factors of the responding researchers – with ANOVA method, with a 5 % significance level – based on age grouping, study trip abroad and on the basis of educational opportunities and gender segmentation, and in the case of organisation based on the teleworking and sciences, ecological responsibility and the possibility of cooperation with researchers are based on factors.

T3: I defined – with ANOVA method, at a level of 5 % significance – the 15 factors – including *the possibility of shaping the future, ecological and social responsibility, and professional standards* – that made the researchers involved in the study more motivated, whose subjects are linked to a sustainability approach.

T4: I confirmed that the strong career motivations of the researchers participating in the study decrease with the time spent on the research track and only a new strong motivational factor emerges: *flexible working conditions.*

T5: Among respondents, the departure of research careers is primarily facilitated by personal financial difficulties, lack of research resources and unjust system (internal institutional system).

T6: I have proved by several approaches that researchers under 45 years of age are significantly more sensitive to ecological problems, while the lack of ecological responsibility affects their intention to leave careers significantly more than older researchers. At 5 % significance, according to ANOVA test.

Table 10: Verification of research hypotheses

Hypotheses	Hypotheses with research results
H1: Researchers can be grouped into significantly different groups based on their perception of sustainability problems and their relationship with a sustainability approach.	**PARTIALLY VERIFIED**
H2: Among the strongest motivational factors for researchers' career choices are the excitement of discovery, flexible working conditions, work-life balance, and the ability to educate students.	**I HAVE NOT VERIFIED**
H3: Researchers can be grouped on the basis of gender, age, discipline and sustainability related research topics based on significant differences in the assessment of current motivational factors.	**VERIFIED**
H4: The strong motivational factors of the researchers and their motivational power change as the time spent on the research career increases.	**PARTIALLY VERIFIED**
H5: Research segments can be defined where ecological, social and economic responsibility has a significantly stronger motivational power.	**PARTIALLY VERIFIED**
H6 Financial reasons are the main contributors to career abandonment.	**PARTIALLY VERIFIED**
H7: Motivational factors with significantly different effects on leaving the career can be defined in different research segments.	**VERIFIED**
H8: The research career can be made more attractive by a significant salary increase.	**PARTIALLY VERIFIED**

Source: Primary research based on own editing

ATTACHMENTS

M1 THE AUTHOR'S PUBLICATIONS RELATED TO THE TOPIC OF THE THESIS

Publications in Hungarian (journal/book detail):

1. Szabó A. K. (2017) Labour market trends and challenges – focus on agricultural research, multidisciplinary challenges, diverse responses, On-line study volume, Budapest University of Economics, Faculty of Commerce, Hospitality and Tourism Department Department of Economics, Department of Economics No. 6, Issue 2 p. 30-49 ISBN: 978-615-5607-29-5
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