SCIENTIFIC ETHICS AND HRST -THE HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY

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Abstract

In an anonymous survey diagnostic of environmental conditions at a national research organization, the question "Does scientific ethics influence career development in science?" was answered affirmatively by all respondents in the sample. Therefore, according to commonly accepted understandings of meaning influence, respondents define scientific ethics as a factor of career development. However, the literature review does not show its specific definition among career development factors. This fact motivates us for the present development, aimed at justifying the need to include scientific ethics in the career development factors of Human resources in Science and Technology (HRST).

Keywords: *HRST; Scientific Ethics; career development*

The human resource in science and technology is a specific diaspora of the labor market, subject to the general theory and practice of HR-management, but at the same time possessing a narrow specificity originating from its subject of activity. A significant body of literature on Human resources in Science and Technology (HRST) discusses ethical issues in science and research. Ethical principles are also laid down in the Charter and Code (C&C) of researchers in Europe, bound in the overall structure of the requirements and recommendations of the Community regarding the selection and career development of scientists.[5] In the literature, scientific ethics is considered in its various aspects. Sources discussing the influence of ethical practices in science on career development are important for HRST-management. Such are the issues of publication ethics: authorship, copyright, intellectual property, plagiarism as an essential element of scientific production and the system for evaluating scientific productivity. "Why scientists sabotage their careers with these practices" poses as one of the main questions Newman (2019)[8] in a development based on his experience as a member of the editorial team of a journal.

Questions about ethics in science and research are the subject of international discussions, but they are not foreign to the scientific community in Bulgaria. In 2014 Bohannon[2] points out that over 20% of all publications by Bulgarian authors available in a digital repository of preprint materials analyzed by him are marked as problematic for plagiarism. In 2018 the Union of Scientists in Bulgaria officially issued an opinion on plagiarism, arguing for the need to "limit plagiarism" due to its direct connection with the scientific sphere, and issued a proposal for measures to limit it on a national scale.[11] In the same year, the Commission on academic ethics at the Ministry of Education and Science with a subject of activity mainly related to the control of unethical practices in career development in science was established. [7]

A significant part of the analysts of scientific ethics emphasizes the reasons for provoking unethical behaviour in science and higher education. As such, the following are pointed out: competition for research funding (Edwards & Roy 2017)[4]; acceptance of questionable quantitative performance indicators in science (Vanecek and Pecha, 2020, according to data of Douglas, MacGillavray & Elise, 2021[3]); the "academic performance indicator games" or scientometrics (Biagioli& Lippman, 2020[1] and Douglas, MacGillavray & Elise, 2021[3]; Zagorchev, 2017[13]); reviewing, scientometrics and estimation (Vitanov, 2017[12]; Popetrov, 2017[9]; Lazarova, 2019[6]; Pushkarov, 2018[10]).

Goal and tasks

A significant part of the analysts of science ethics think that scientometrics and indicators of academic results are the main generators of unethical practices, discussing the influence of the pursuit of career development on scientific ethics. Quality science requires a morally "pure" working environment. However, how does scientific ethics affect the quality of the work environment and

does it influence attitudes towards career development in science and research? Clarification of this question is the aim of the present study, structured in two steps: 1. Studying the attitudes about the levels of scientific ethics; 2. Studying the influence of the subjective evaluation of the levels of scientific ethics on the attitudes towards career development.

Material and methods

The present study is based on empirical data from an anonymous survey of the opinion of 102 respondents - researchers employed on a temporary and permanent contract under the Law on the Development of the Academic Staff. To the respondents, a link to prepare the survey was sent. The pre-prepared survey card questionnaire is included at the end of the letter inviting them to participate. The survey card was prepared using Google Docs resources, and by following the attached link, respondents get direct access to the prepared electronic questionnaire.

The questionnaire includes 2 closed-ended items - 1 dichotomous and 1 Likert question on a five-point scale, oriented from the weakest to the strongest assessment regarding scientific ethics; 5 closed-ended questions on a Likert scale oriented from the weakest to the strongest assessment of attitude towards activity and career development in science (Table 2); 7 questions describing demographic characteristics of respondents.

The empirical data obtained are subjected to frequency analysis to examine the sampling distribution. To detect dependencies between the subjective opinion about the level of scientific ethics and attitudes towards career development, the methods of variance analysis ANOVA and Student-Fisher T-test were used to detect statistically significant differences in the answers of groups of respondents. Statistical data processing was performed in IBM*SPSS*Statistics, Version 26. Figures and tables were created for visualization using Microsoft Office*2016.

Results and discussion

Out of 102 distributed survey cards, 78 completed were received, which constitutes 76.47% of the general population and meets the requirements for representativeness according to the respondent method. According to their demographic characteristics, the survey respondents are distributed as follows:

Depending on age:

- under 30 years old – 2 people, which makes up 2.7% of the sample.
- 31-40 years - 25 people, which makes up 33.78% of the sample.
- 41 - 50 years - 26 people, which makes up 35.13% of the sample.
- 51 - 60 years - 18 people, which makes up 24.32% of the sample.
- over 60 – 3 people, which makes up 4.05% of the sample.

Depending on gender:

- men – 51, or 68.91% of the sample.
- women – 23, or 31.08% of the sample.

Depending on the length of service in a research institution:

- with 1 - 3 years – 4 people, or 5.41% of the sample
- with 4 - 10 years – 18 people, or 24.32% of the sample
- with 11 – 20 years – 30 people, or 40.54% of the sample
- with 21 - 30 years – 14 people, or 18.92% of the sample
- over 30 years 5 people, or 6.76% of the sample

Depending on work experience before the research institution:

- with work experience before a career in science – 42 people, or 56.76% of the sample
- no work experience before a career in science – 32, or 43.24% of the sample

Depending on educational and qualification characteristics:

- with a "Doctor of Science" degree - 13 people, or 17.57% of the sample
- with a "Doctor" degree – 42 people, or 56.76% of the sample
- without a scientific degree – 19 people, or 25.68% of the sample

• with additional specialities acquired after higher education – 16 people, or 21.62% of the sample
• without additional specialities acquired after higher education – 58 people, or 78.38% of the sample

The frequency analysis shows the following distribution of responses to the item "What do you think is the level of academic ethics in your current job?" (Figure 1): the majority of respondents (28.38%) find it difficult to give a definition; 27.3% define the level of academic ethics at their workplace as "good", followed by 25.68% defining it with the opposite opinion - "low"; 16.22% chose the answer "extremely low" and only 2.70% chose the rating "extremely high". Weak subjective evaluations clearly predominate, making up 41.90% of the responses, and the positive ones approach in quantity to the neutral ones with their share of 30.00%.

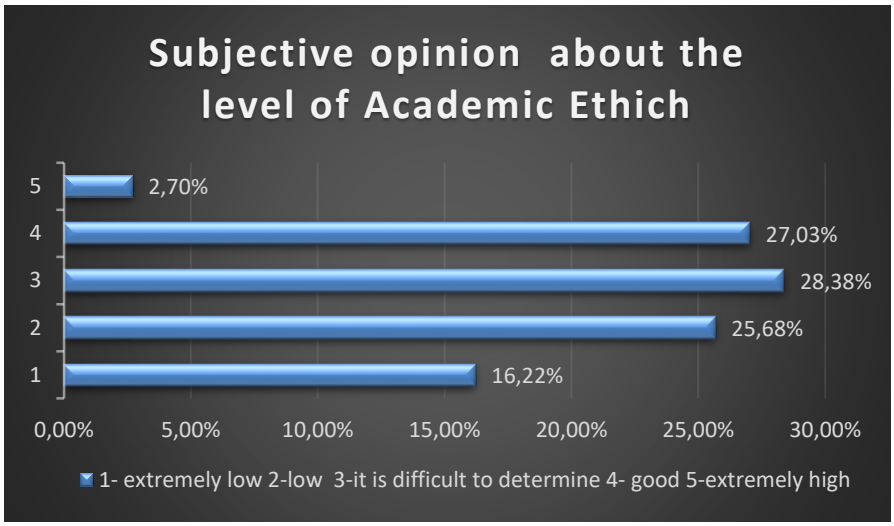

Figure 1. Attitudes about levels of academic ethics in the workplace.

Respondents' subjective assessment of scientific ethics differed statistically significantly (ANOVA: F=4.72; p= 0.01 and T-test: $t_{2,1}$=2.71, p= 0.01; $t_{2,3}$=1, 97, p= 0.05 - Table 1) depending on the scientific degree of the respondents, as the most positive attitude towards the level of academic ethics, respondents with an acquired scientific educational scientific degree "Doctor" ($\bar{x}_2$= 3,07), and respondents without a scientific degree have the most negative attitude ($\bar{x}_1$= 2,26). (Table 1)

Independent Variable	***Dependent Variable***	***Levels of the independent variable***	***$\bar{x}$ (Mean) of the Dependent Variable***	***ANOVA (F, p)***	***T- criterion (t, p)***
Science degree	Subjective assessment of the level of scientific ethics	without a scientific degree with a "Doctor" degree with a "Doctor of Science" degree	$\bar{x}_1$= 2,26 $\bar{x}_2$= 3,07 $\bar{x}_3$= 2,38	**F=4,72 p= 0,01**	**$t_{2,1}$=2,71, p= 0,01 $t_{2,3}$=1,97, p= 0,05**

Table 1. Influence of the obtained scientific degree on the respondents' attitudes towards career development.

The acquisition of a scientific degree appears to be a turning point in the formation of a subjective opinion about the level of scientific ethics. The differences in the opinions of the respondents after acquiring the first and second scientific degrees ($t_{2.3}$=1.97, p= 0.05 - Table 1) in the direction of reducing the grades points us to the possibility of a part of the respondents falling into the defined "grey zones" [9] of science and the accumulation of more observations on vicious practices.

Respondents without a scientific degree also gave a statistically significantly lower assessment of scientific ethics ($t_{2.1}$=2.71, p= 0.01 - Table 1), which on average is lower than the assessment of respondents with a scientific degree "Doctor of Science". It is possible that the reasons are due to a lack of professional experience or a delay in career development, but such a negative attitude is worrying for a human resource at the first stage of the career.

With regard to career development attitudes in the system of science and research, the frequency analysis of the distribution of responses shows that nearly 2/3 of the respondents (63.5%) consider that there are prospects for career development in their current job, with only 4.1% think they have no prospects. The number of respondents who do not formulate a definite answer to the question is significant - 32.4% (Table 2).

Regarding the clarity of career development opportunities, only 16.2% categorically state a lack of clarity, with the opinions almost equally divided between "yes, completely" - 39.2% and "to a certain extent or to a small extent" - 44.6%, which show hesitancy regarding the clarity of existing career development opportunities. Of those who hesitated, 29.7% declared a higher degree of clarity (yes, to some extent), and 14.9% respectively - a lower one (yes, to a small extent) (Table 2).

The higher scores on the science career prospect scores compared to the distribution of views on the clarity of career development opportunities in the employment institution at the time of the survey indicate a likely need for more clarity on career development opportunities at the organizational level.

The researched opinion of the respondents about career professional development as a personal matter of the individual shows that about a third - 27% of the respondents give an affirmative answer, and only 5.4% do not consider their career development a personal matter. The largest is the group of those who answered "somewhat" - 67.6% of the sample, who practically assess career development both as a private and as an institutional matter (Table 2).

The possibility of scientific work is a strong motive for choosing a professional appearance for 43.2% of respondents who chose the option "true for me"; "37.8% chose “rather true for me”. There are significantly fewer respondents for whom this motive is weak (12.2% - "rather not true for me" and 6.8% - "not true for me") (Table 2).

In the variant that career development acts as a personal motive for exercising the "scientist" profession, the answers are almost equally distributed around the statements "true for me" and "rather true for me" (respectively 33.8% and 32.4%), and the other one third indicated the negative answers "rather not true for me" and "not true for me" (respectively 25.7% and 8.1%) (Table 2).

As expected, research respondents rated the motive for choosing a career path "opportunity for scientific work" more strongly than the motive "opportunity for career development", which is a logical result and does not come as a surprise.

A variable examining career development attitudes	***Levels of the Variable***	***Number of responses n***	***Valid percent %***
1. Is there a prospect of your career development in your current job?	1- no 2- I am not sure 3- yes	n1= 3 n2=24 n3=47	4,1 32,4 63,5
2. Do you have complete clarity about your career development opportunities in your current job?	1- no 2- yae, to small extent 3- yes, to some extent 4- yes, completely	n1=12 n2=11 n3=22 n4=29	16,2 14,9 29,7 39,2
3. Do you think career development is a personal matter?	1- no 2- somewhat 3-yes	n1=4 n2=50 n3=20	5,4 67,6 27,0

4. I work in my current job because I have the opportunity to do scientific work.	1- not true for me 2- rather false for me 3- rather true for me 4- true for me	n1=5 n2=9 n3=28 n4=32	6,8 12,2 37,8 43,2
5. I work in my current job because I have the opportunity for career development.	1- not true for me 2- rather false for me 3- rather true for me 4- true for me	n1=6 n2=19 n3=24 n4=25	8,1 25,7 32,4 33,8

Table 2: Distribution of responses by indicators of career development attitudes.

The analysis of variance (ANOVA) shows the presence of a statistically significant influence of the subjective assessment of the level of academic ethics on two of the variables of career development attitudes: respondents' attitudes towards career development prospects (F=6.51, p=0.00) and clarity about career development opportunities available at their workplace (F= 8.03, p=0.00) (Table 3). Those who are positive about the levels of scientific ethics also have positive attitudes about their prospects for career development in science, and there is a non-coincidental parallel increase in ratings between the two variables (Table 3). There is a statistically significant difference in the opinions of the respondents with a "good" opinion about the levels of scientific ethics compared to those who chose negative answers or difficulty in the assessment (T-Test: $t_{4,1}$=4,63, p= 0,00; $t_{4,2}$=5.05, p= 0.00 and $t_{4,3}$=3.42, p= 0.00- Table. 3). Analogous results are also observed regarding the subjective evaluations of the clarity of the existing opportunities for career development in their current workplace - the more positive the attitudes towards scientific ethics, the more positive the attitudes become towards the clarity of the existing career opportunities (T-Test: $t_{4,1}$=6.39, p= 0.00; $t_{4,2}$=3.15, p= 0.00 and $t_{4,3}$=2.46, p= 0.00- Table. 3).

Independent Variable	***Dependent Variable***	***Levels of the independent variable***	***$\bar{x}$ (Mean) of the dependent variable***	***ANOVA (F, p)***	***T-criterion (t, p)***
Subjective assessment of the level of scientific ethics	Career development perspective	Extremely low Low It's hard to define Good Extremely high	$\bar{x}_1$= 2,33 $\bar{x}_2$= 2,26 $\bar{x}_3$= 2,62 $\bar{x}_4$= 3,00 $\bar{x}_5$= 3,00	**F=6,51** **p= 0,00**	**$t_{4,1}$=4,63, p= 0,00** **$t_{4,2}$=5,05, p= 0,00** **$t_{4,3}$=3,42, p= 0,00**
	Clarity of career development opportunities	Extremely low Low It's hard to define Good Extremely high	$\bar{x}_1$= 1,83 $\bar{x}_2$= 2,74 $\bar{x}_3$= 3,10 $\bar{x}_4$= 3,65 $\bar{x}_5$= 3,00	**F=8,03** **p= 0,00**	**$t_{4,1}$=6,39, p= 0,00** **$t_{4,2}$=3,15, p= 0,00** **$t_{4,3}$=2,46, p= 0,02**

Table 3. Influence of the subjective evaluation of the levels of academic ethics on the respondents' attitudes towards career development.

Visibly formed subjective opinions about the levels of scientific ethics have an impact on leading variables for career development: the attitudes about prospects for professional realization and the personal perception about the clarity of the existing opportunities for building a career in science at the respective workplace. As far as the concept of "perspective" is associated with the general outlook and vision for the future, the established statistically significant influence of personal perception on the level of scientific ethics acquires special importance. Respondents with negative attitudes towards scientific ethics state that they have the least clarity about career development opportunities. The reason for the obtained results can be the encounter with negative phenomena from the point of view of ethics.

Conclusions

The results of the present study show that increasing researchers' positive attitudes toward scientific ethics have a positive effect on the attractiveness of a scientific career as a prospective field of professional expression. Contemporary problems of ethics in scientific research and their wide discussion in the public space require in-depth analyzes of the causes of unethical practices in science, but also of their consequences.

They found a statistically significant influence of the perception of the level of scientific ethics on a leading factor for career development, namely the personal judgment of a career prospect in the field shows the need for a deeper study and fragmentation of the concept of "prospect".

Defining scientific ethics as a career development factor would generate analyzes from more and a wider range of specialists from various scientific fields and would contribute to the reasoned management of the "scientific ethics" factor in the desired direction.

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