ETHOS OF SCIENCE AND THE APPROACH TO PROMOTION IN SCIENCE

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DOI: 10.14611/MINIB.28.06.2018.10

Summary

The quality of research is the most important feature in the world of science. A researcher who achieves an excellence in science has a chance to win recognition and gain authority in her scientific field. In order to succeed in science, a researcher ought to undertake effective personal marketing efforts. The aim of personal marketing is to create and maintain a desirable attitude and/or behavior of others towards a scientist and build a positive scientific image of herself. A scientist who engages in self-promotion may, however, take on herself the odium of the academic community. Hence, the researcher's perception of the importance of personal marketing engagement for success in science determines her activity in this domain. The approach to the issue may vary depending on the system of values and norms recognized as valid in science. The purpose of the study is to examine the differences in perceptions of the importance of personal marketing engagement between researchers who identify themselves with different scientific ethoses.

In order to achieve the objective of the study, I created two research scales and classified surveyed scientists into four groups. Three of these groups professed the ethos of academic, industrial and post-academic science respectively, and the fourth group did not identify with any of the value systems above. Then, I examined how the members of distinguished groups perceive the importance of three potential success factors in science, i.e.: popularization of research results, recognition in the scientific community and recognition outside the scientific community. The analyses were performed on data obtained from 800 scientists who participated in a nationwide CAPI study conducted by National Information Processing Institute at the turn of 2015 and 2016.

According to the surveyed scientists, the most attention should be paid to the popularization of research results, and the least attention should be given to the activities that ensure recognition outside the scientific community. Researchers who identify themselves with the ethos of post-academic science, that is based on values of both academic and industrial sciences, rate the importance of all three aspects of self-promotion relatively high. Scientists who acknowledge the Merton's ethos of academic science are at the opposite

extreme. They rate extremely low the importance of striving for recognition in the non-scientific community. In accordance with intuition, researchers who incorporate the values of Ziman's industrial science appreciate recognition in the scientific community less than other respondents. It is safe to say that the greatest marketing awareness is characteristic for scientists who accept the ethos of post-academic science, and the poorest — for those who identify themselves with the ethos of academic science.

Keywords: ethos of science, personal marketing, personal brand, academic science, industrial science, post-academic science

Introduction

Traditionally, science was identified with the search for truth and knowledge generated within science was regarded as an autotelic value. Scientists didn't use to lay a claim to the effects of their work, but only wanted others to recognize that they are the authors of the work and wanted to gain recognition in the scientific community (Bauer, 2013; Maiväli, 2015; Ziman, 2000). They were expected to remain humble, as according to the words of Bernard of Chartres, a medieval philosopher and theologian, as scientists only "climb on the shoulders of giants" who searched for truth before them. Closed in the world of "pure science", they didn't try to attract the interest of people outside the scientific community. Science, like an ivory tower, was supposed to be independent from the rest of the society (Ziman, 2000).

Social changes and advancing technological progress, which apparently started in the middle of the 20th century, have led to a situation in which science started delivering measurable economic value and knowledge became a product which should be adapted to the needs of the market. Following curiosity and simple search for truth in taking up research has been replaced by the will to deliver useful solutions responding to the current needs of the society and the economy (Bauer, 2013; Mittelstrass, 2012; Nowotny, 2006). Science is regarded as a very competitive venture and scientific work is becoming similar to corporate work. Competition is growing both on the institutional and individual level (Kwiek, 2015a; Kwiek, 2015b). The share of funds offered on the basis of contest-related project financing is growing and scientists are under growing pressure of applying for grants and competing for funds. (Nowotny, 2006; Ziman, 1996a; Ziman, 2000). Individual scientific success is playing an ever greater role. That's why it is not enough to conduct original and credible research projects, but it is also necessary to popularize their results among a broadly understood group of stakeholders and to strive to build a desirable image of yourself as a scientist.

Along with the evolution of the rules of scientific game the set of norms and values forming the ethos of science is being updated. Whether scientists can find a place for themselves in the new system depends on their approach to the ongoing changes. At the same time, the transition

from the expansion and popularization of knowledge, to its capitalization raises many controversies. It is not uncommon among scientists to have a feeling of an internal conflict arising from the perception of the paradigm of entrepreneurship as a threat to traditional "purity of science" (Etzkowitz et al., 2000).

The topicality of the aforementioned phenomena in the Polish sector of science has become a premise for an attempt to identify the ethoses of science followed by scientists in Poland and further, to analyse their approach to the issue of promotion of science. In order to achieve the assumed goals, the author formulated two research questions:

1. Which ethoses of science do Polish scientists associate themselves with?
2. Does following different ethoses of science differentiate the perception of the significance of promotion in science?

Answers to these questions came from the statistical analysis of the material obtained from 800 scientists who took part in the nation-wide survey conducted by the National Information Processing Institute (OPI PIB) at the end of 2015 and the beginning of 2016.

The structure of the article was subordinated to the goals of the research. In the first place the systems of norms, which have been formed and popularized in the scientific community were described: the ethos of academic science, the ethos of industrial science and the ethos of post-academic science. The next subject of discussion is how engagement in promotional activities can affect the authority of a scientist and the main research hypothesis is presented. Separately, the used research method is described. Next, detailed results are presented and the correctness of the formulated hypothesis is verified. Finally, the conclusions from the conducted analysis, as well as limitations of the research and suggestions for further research works are presented.

The ethos of science

The concept of the ethos of science was introduced by Robert Merton in the article titled *A Note on Science and Democracy*. published in 1942.

According to R. Merton (2002) it is an emotionally laden system of values and norms binding for the scientists, which is internalized by them to various degrees. The ethos of science consists of: communism, universalism, disinterestedness and organized scepticism; all of this together in literature on the subject has received the acronym CUDOS.

Communism means that knowledge as the effect of cooperation constitutes common property and the scientist can only strive to make others recognize his precedence in making a certain discovery. What goes against this rule is patenting and not publishing the results of research, which is regarded as immoral.

According to the second element of the ethos — universalism — the decision whether a particular research hypothesis is real should be made on the basis of objective criteria, regardless of the individual characteristics of a scientist such as: nationality, ethnic origin, religion, or gender. This means scientific career is available for every talented individual.

The third good practice is disinterestedness, which shouldn't be mistaken for the lack of individual motivation. A scientist can follow various reasons for taking up scientific activity — from the desire for fame and money to care about the good of humanity. However, the scientist shouldn't have a direct economic, or political stake in the conducted research, as this could lead to a biased approach to the assessment of results. That's why pure disinterestedness is typical of researchers who look for new knowledge for the sake of knowledge itself. The norm supports the rule of objectivity in science and from this point of view may justify the mentality of ivory tower as a necessary condition to maintain disinterestedness.

At the same time organized scepticism requires solidary and consistent verification of scientific work, as well as the popularization of theory, methods and research techniques which are supposed to support scientists in their struggle to find the objective truth.

Even though the context for the works of R.Merton was the rise of the Nazis in Germany and the threat that science could become an instrument of the totalitarian state (Enebakk, 2007; Krimsky, 2006) the set of values they promote has been present in Western-European thought already for two and a half thousand years (Huff, 2007; Kalleberg, 2007). In the past scientists participated in a kind of a (*a gift economy*), a system of exchange

and free provision of the effects of own research works based on the rule of mutuality and responsibility, expecting only the recognition of the scientific community (Mauss, 1990). It was a social and philosophical ideal, which gave every member of the scientific community a feeling of stability. That's why many scientists still regard "pure science" this way (Ziman, 2000).

In the 1970's the ethos of academic science was criticised by the sociology of science, which had emerged by that time. The critics claimed there is no homogenous ethos of science and Merton's norms are too general and abstract to be used for particular research projects. They also argued that the norms were only partially used at the stage of professional academic science (from about the middle of the 19th century to World War I) and in the remaining period they proved insignificant (Radder, 2010).

What contributes to the changes of norms and values forming the ethos of science are the processes of transformation, differentiation and hybridization of the scientific community (Bourliaguet, 2016). The ethos of academic science has an institutional character and describes the method of functioning of science as a whole, rather than the dispositions of an individual scientist (Knuuttila, 2012). In times of privatized science it can be perceived as outdated and unfit for the current reality (Bourliaguet, 2016; Rodriguez, 2007).

As a result of the industrialization of science the capitalization of knowledge started gaining precedence over such values as: scientist's autonomy, objectivity, communism, or disinterestedness (Etzkowitz, 1998; Kalleberg, 2007; Knuuttila, 2012; Krimsky, 2006). Industrial science, which emerged by the 1960's, constitutes almost an antithesis of academic science. This is because its goal is delivering results with direct commercial value. It introduces norms alien to the academic culture, as it is proprietary, local, authoritarian, commissioned and expert. In literature these norms are often put together in the acronym PLACE, which stands for their first letters. They mean respectively that industrial science: generates reserved knowledge, which is not necessarily published; focuses on local problems and needs instead of expanding the understanding of the world; research is conducted under leadership, rather than individually; strives to achieve the ordered, practical results and hires experts for this purpose (Ziman, 2000).

What can serve as evidence of the ongoing changes are such phenomena as: the transformation of universities into entrepreneurial universities,

creating spin-off companies, the fact that scientists work as consultants, or that the industry sponsors research, licensing and the popularization of intellectual property rights. The argument against these changes is that scientists are losing their objectiveness and neutrality as through cooperation with the industry they gain benefits in form of license fees, or dividends from shares. (Rodriguez, 2007). Another source of controversies is the privatisation of research results through patenting, which makes it impossible for other scientists to develop these results in course of their research projects free of charge (Radder, 2010). This situation contradicts Merton's norm of communism and is often called the tragedy of anticommons (Heller and Eisenberg, 1998; Radder, 2010).

According to John Ziman (1996b) currently science is subject to a transformation into a new variation called post-academic culture. A whole series of factors serves as evidence of this process, among them we should mention the following: team character of scientific activity, dynamic growth of scientists' activity, insufficient public financing for science and stronger competition for funds for research, as well as growing industrialisation and growing pressure on creating useful knowledge. The introduction of a new concept suggests that currently science doesn't fit in either the academic, or the industrial model. However, J. Ziman (2000) points out that post-academic science arises from academic science and constitutes its continuation and thus retains many of its features. He claims that in post-academic science, even without disinterestedness, it is possible to maintain objectivity. It is because individual interests lead only to a short-term loss of objectivity and to bias, which is corrected by the community of scientists operating on the basis of the remaining norms: organized scepticism, communism and universalism.

Post-academic scientists are expected to at least partially turn towards applications and to be aware of the potential applications of their work (Ziman, 1996a; Ziman, 2000). Cooperation has replaced the concept of community crucial for academic science. Research teams started operating as small business ventures and their members became consultants, or experts serving consulting functions and preparing ordered reports (Ziman, 2000). Together they work on problems they don't formulate themselves and are rewarded depending on their contribution to the success of the team (Ziman, 1996b).

Promotion in science from the perspective of the scientist

When in course of individual in-depth interviews conducted by the National Information Processing Institute in 2015[1] scientific employees were presented with the profiles of three scientists: researcher, educator and an entrepreneur commercializing the results of his research, and were asked what other professional roles they could play, the respondents mentioned the populariser of science. These responses show that informing about the results of own research works is in a way a part of a scientist's profession. What also confirms the importance of scientific communication is the need to engage the society in research, which has been noticed on the European level and which was expressed in *Rome Declaration on Responsible Research and Innovation in Europe* in 2014. It is because the society plays a double role — sponsoring and consuming the knowledge generated by scientists and the popularization of science is becoming an intermediary linking the two worlds in this relation.

The significance of communication in science is emphasized not just with regard to the society in general, but also in the context of its particular groups. It is expected that a scientist at various stages of a conducted project will convey information about his research to many target groups from both the scientific and non-scientific community. In the first place, according to tradition, the recipients of this information should be other scientists, but also the authorities and administrative units (in particular, the units dealing with the dissemination and promotion of science) of the institute, or university employing the researcher and the sponsors of the project, including the grantor. Further, scientific communication should be established also with the representatives of the media, business, branch organizations, or opinion leaders who deal with the field of science in which a particular researcher is active.

As Peter Weingart points out (1998), popularization of science is not a new phenomenon. What is new is only the form and intensity of this activity, which comes from growing dependence of science on rare resources and thus also on social acceptance. Scientists, if they want to obtain funds for their research, have to seek social support. Conducting communication activities they can draw the attention of public opinion to the researched phenomenon, or problem, highlight a solution for the problem, convey the information to

the groups interested in the results (potential scientific, or business partners). Such activity of scientists is supported by the universities and institutes employing them, as this way they can gain additional publicity and boost the competitiveness of their units (Kohring et al., 2013). Finally, communication activity makes it possible to build your own image and the recognisability of a scientist in the scientific and non-scientific community.

To define the whole set of actions taken by a scientist to create and maintain the desired attitudes and/or behaviours of others towards himself and to create a positive scientific image of himself, we can use the term personal marketing (Armstrong and Kotler, 2012; Shepherd, 2005). The concept can also be related to the practice of controlling and using in a strategic way your image as a tool raising your own professional attractiveness (Issitt, 2016). Adapting themselves to the changes taking place in the scientific community, scientists can use the rich and diversified range of techniques and tools of personal marketing. What proves important in the process of building personal authority, or brand, if we use the terminology from the area of management, are political skills such as: ability to influence people, shrewdness enabling to understand the behaviours and motives of other people, as well as the ability to build networks of diverse relations (Ferris et al., 2000; Ferris et al. 2007). What also proves useful are competences from the area of impression management (Reunes, 2013). What determines the image of a person is, among others, what the person looks like (that is, clothes, posture, or facial expression) and whether the person follows the etiquette. Both verbal and non-verbal behaviours are important, because the perception of a person is under influence of such nuances as: tone of voice, gesticulation, or eye contact.

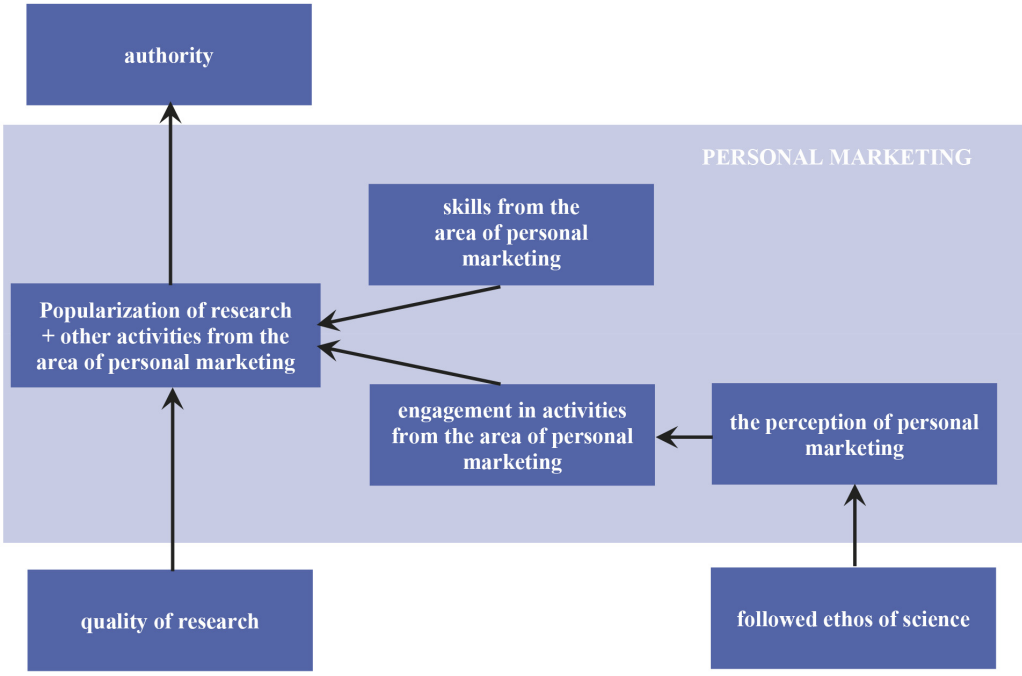
Strategies used offline should be integrated with activities on the Internet, which serve the purpose of building personal brand online. In order to boost his visibility a scientist can create a website devoted to his achievements, write a blog and/or start activity in social media portals, including those dedicated to researchers (e.g. Academia, Mendeley, ResearchGate) and can be present in other topical services, which are coherent with his personal brand and thus strengthen its impact. Thanks to these measures a scientist has a chance to convey his message to recipients outside the world of science: journalists, business partners, non-governmental organizations and sponsors.

Changes taking place in the sector of science, as Matthias Kohring et al. (2013) points out, contribute to the professionalization of communication activities. Public relations agencies focused on the needs of scientific institutions and their employees are being established (e.g. Science PR on the Polish market). They have knowledge and skills necessary to build a desired image and maintain positive relations with the environment, including journalists. Thanks to this scientists can take advantage of support in the area of promotion of themselves and their research.

Paying much attention to activities from the area of self-promotion is important, as they can affect a scientist's professional situation. An academic builds his authority by conducting high-quality research. However, the influence of research projects on the formation of authority is mediated by the way a scientist popularizes information about these research projects. The efficiency of communication activities is determined on the one hand by the engagement of a researcher in this activity and on the other hand, by his competences from the area of personal marketing. At the same time, the level of engagement depends on the perception of activities from the area of personal marketing, which may be influenced by the ethos of science followed by a scientist. A simplified model of the formation of a scientist's authority built for the purposes of this research is presented on picture 1.

The combination of the two dimensions mentioned above, that is, the quality of research and the efficiency of activities from the area of personal marketing makes it possible to create a matrix in which every scientist can be entered, according to the authority right for him. As we can see on picture 2, the matrix of scientific authority consists of four quarters. Moving clock-wise in the first quarter there are scientists who are mature authorities. They can be called "celebrities of science", as they conduct high-quality research and at the same time conduct efficient activities in the area of personal marketing. At the same time, the second quarter groups scientists who may be conducting high-quality research, but neglect self-promotion and/or have no appropriate skills enabling them to reap the benefits of personal marketing. For this reason they find it hard to build their authority in a broader community and gain no more than just local recognition. Starting efficient communication activity would allow them to change their situation for the better, that's why they can be called "scientists with a potential".

Picture 1. Diagram of formation of a scientist's authority

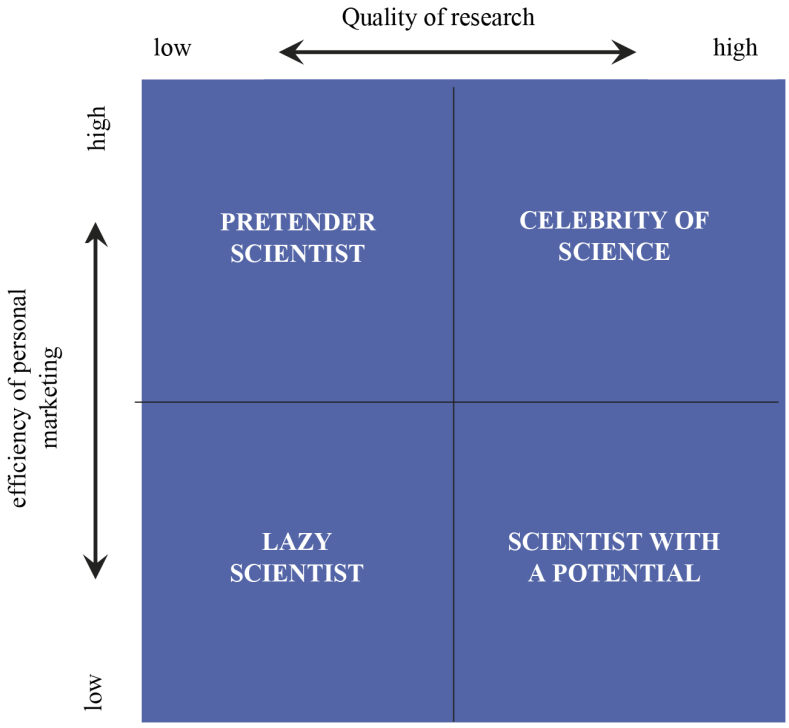


Source: Own materials.

The third quarter of the matrix is populated by "lazy scientists", who also suffer from the lack of authority. However, in their case the reason for this state of affairs is not the lack of efficient activities in the area of personal marketing, but also conducting low-quality research. We can expect that the representatives of this group, if they don't take remediating measures, will lose competition with other scientists for grants and scientific titles, which eventually will force them to leave the sector of science.

Scientists who fit in the fourth quarter of the matrix of scientific authority are in a completely different situation. Even though these people conduct low-quality research, they enjoy respect, especially in non-scientific circles. This is because thanks to their talents in the area of personal marketing and strong engagement in this activity they achieve success in the media. Thus, they can be called pretending scientific authorities.

Picture 2. The matrix of scientific authority



Source: Own materials.

Research hypothesis

In the research conducted by the National Information Processing Institute mentioned at the beginning of the previous subsection, the opinions of the respondents concerning the popularization of science and building your scientific image were mixed. Some of the respondents thought that a scientist should promote the results of his research projects, as the following statements show:

- We are expected to promote our research outside, as this is important from the point of view of image" (habilitated doctor, representative of social sciences and humanities, an employee of an institute of Polish Academy of Sciences);

- "Popularization of scientific knowledge is very important in the work of scientists, sharing knowledge, refuting myths, instead of scientific work for the sake of science" (doctor, representative of exact and technical sciences, employee of a university);
- "You can be an enthusiast separated from the outside world and refuse to get in touch with other people, but this is not good, as you should convey knowledge to others" (doctor, representative of life sciences, an employee of an institute of the Polish Academy of Sciences).

Others expressed negative views of taking up personal marketing activities in science, as the following opinions suggest:

- "Popularization — I don't have time and I don't do this. (…) You either have prestige, or you will gain it. It makes no sense to fight for it, if you work hard, it will come itself. (…) Fame, publicity, can only be harmful" (habilitated doctor, representative of exact and technical sciences, an employee of a research institute);
- "Fame and publicity is something that a scientist shouldn't care about. Currently, in the world of science there are more and more celebrities for whom fame and publicity are important and in a way this is how they define scientific work — by appearing frequently in the media." (doctor, representatives of humanities, social sciences, a university employee).

The examples presented above confirm the observations made by Bruno Bourliaguet (2016), who points out that scientific community has stopped being uniform. Also Alice Lam (2010) points to the fact that scientists differently react to changes taking place in science since the middle of the 20th century. They often have different, or even contradictory opinions on the subject of the social role of scientists and their ethos (Bucchi, 2015). Sanjay Jain, Gerard George and Mark Maltarich (2009) claim that the social role assumed by a researcher can be shown on a scale from a "pure" scientist following Merton's norms and focusing on publishing to a "pure" entrepreneur holding business competences, active in the area of the transfer of knowledge and technology. According to the authors mentioned above the engagement in the latter activity depends on the degree to which commercialization disrupts the academic functions of a scientist and limits the dissemination of the results

of his research in association with the necessity to keep information secret and guarantee patent protection. At the same time traditional scientific values, as the research conducted by Craig Boardman and Branco L. Ponomariov (2009) show, don't have a negative influence on cooperation with the industry.

Scientists more and more often look into the results of their research projects in terms of their technological and economic potential, as they strive to achieve both fundamental progress in the area of knowledge, as well as to discover inventions which can be patented and introduced to the market. This way the development of theory is not perceived in opposition to technological progress and both these elements become the basis of the coherent identity of a researcher (Etzkowitz, 1998). S. Jain, G. George and M. Maltarich (2009) call it hybrid identity to emphasize that it combines two social roles: academic role and entrepreneurial role.

In light of the aforementioned facts, the goal of this research is, first of all, finding out to what extent the ethos of academic science and the ethos of industrial science comply with the ideas and feeling of identity of the Polish scientific community and to what extent scientists in Poland combine the two systems of values. Second thing is that it has been recognized as reasonable to take into consideration the social-psychological perspective in the attempt to answer the question about the significance of promotion in science. Finally, the following research hypothesis has been formulated:

Scientists identifying themselves with different ethoses of science differently regard the significance of promotional activity in science.

The hypothesis has been verified on the basis of the empirical material collected in quantitative research.

Research method

The data presented below come from a nation-wide survey conducted by the National Information Processing Institute from December 2015 to January 2016. The survey was conducted on the basis of questionnaires, using the CAPI technique (Computer Assisted Personal Interview). The surveyed sample was a group of active scientific employees with at least a doctoral degree, employed at research institutes in Poland, units of Polish Academy of Sciences, as well as public and non-public universities. A total of 800 scientists took part in the

survey. They were selected randomly. After the application of analytical balances the surveyed sample was representative for the population, according to such scientist features as: gender, scientific degree/title and type of represented scientific unit. The composition of the sample, according to the basic characteristics of the respondents is presented in table 1.

Table 1. The size of the surveyed sample and the structure of the balanced sample

The share of scientists according to	N (surveyed sample)	Structure (balanced sample)
gender	800	100,0%
man	484	57,3%
woman	316	42,7%
scientific degree/title	800	100,0%
doctor	541	68,5%
habilitated doctor	142	18,4%
professor	117	13,2%
type of scientific unit	800	100,0%
public university	502	79,1%
non-public university	89	9,6%
research institute	111	6,5%
unit of Polish Academy of Sciences	98	4,8%

Source: own materials.

In order to measure the acceptance of norms and values typical of academic science and industrial science (CUDOS and PLACE, respectively) the respondents were asked to express their opinions on 16 statements referring to both systems. The respondents assessed the statements on a 11-degree scale, where 0 meant "I definitely don't agree" and 10 meant "I definitely agree". The collected empirical material was subject to factor analysis with the use of the principal component analysis and Varimax rotation with Kaiser normalization. The best result of this procedure, in terms of statistical parameters, at the same time enabling content-related interpretation, was achieved with the assumption of existence of two factors. Measures of adequacy of the choice of variables showed conducting a factor analysis was justified (KMO = 0,669; Bartlett's test of sphericity: $\chi^2 = 654{,}807$, df = 36, $p < 0{,}001$).

The obtained factors explained a total of 41% of variances, including: 20,7% factor I and 20,3% factor II. Factor I contained five positions and out

of them two obtained loads exceeding the values of 0,7 and 0,6, respectively and three others had values above 0,5. At the same time factor II was formed by four positions. Out of them three achieved factor loads close to the level of 0,7 and one position was above 0,5. Taking into consideration the content of positions that formed each of the factors, the following names were proposed for them, respectively: academic science and industrial science. Detailed attribution of positions to scales is presented in table 2. Even though Cronbach's reliability

Table 2. Psychometric properties of particular positions with the distinction of two factors

Position	Norm/Value	Load
Factor I — Academic science		
Research activity should be subordinate only and exclusively to the search for truth	disinterestedness	0,702
Science should expand our understanding of the world regardless of the fact whether its findings can be currently applied in practice	disinterestedness	0,609
Scientific claims should be assessed solely on the basis of their compliance with empirical data and earlier confirmed knowledge, but never based on who and for what reasons announced them	universalism	0,593
A scientist should be wary of all commonly shared views, as it is only thanks to such sceptical approach that the development of science is possible	organized scepticism	0,549
Scientific discoveries are the property of the whole community of scientists, so keeping them secret, or charging money for them is unethical	communism	0,505
Cronbach's alfa	0,557	
Factor II — Industrial science		
Science serves above all the purpose of solving practical problems with a limited coverage — the benefit from general theories is small	local	0,695
Knowledge generated in the scientific process should be the property of those who financed the research, even if this means others will have limited possibilities of using the knowledge	proprietary	0,670
Taking into consideration the current extensiveness of scientific knowledge, only limiting research to a very narrow specialization makes it possible to make new discoveries	ordered /expert	0,660
Scientific work should be subject to strict control and management, like in manufacturing companies	authoritarian	0,531
Cronbach's alfa	0,557	

Source: own materials.

ratio alfa for each of the formed scales achieved a value only close to 0,6 none of the positions was removed, as it would lead to the deterioration of the analysis parameters. The obtained Cronbach's alfa level may suggest the necessity to create separate scales for each of the norms contained in both systems of values. As it was impossible to carry out this proposal in this project, the analyses were continued to carry out a preliminary investigation of the discussed subject.

For every surveyed person results achieved on the scale of academic science and industrial science were calculated. These results were arithmetic averages of answers given to positions forming each of the scales and could range from <0 to 10>. Descriptive statistics concerning both scales calculated for the whole sample were presented in table 3.

Table 3. Descriptive statistics for the created scales

Scale	Median	Average	Standard deviation	Skewness	Curtosis	Minimum	Maximum
Academic science	8,20	7,93	1,48	–0,93	1,17	1,4	10,0
Industrial science	4,25	4,17	2,01	0,05	–0,67	0	9,5

Source: Own materials.

In order to carry out the goal of the research the respondents were divided into groups on the basis of their results obtained on the created scales. The criterion for the division was median, which for the academic scale amounted to 8,2 and in case of the scale of industrial science amounted to 4,2. As a result, each respondent was allocated to one of the groups distinguished according to the followed ethos. The group of scientists identifying themselves with the ethos of academic science was formed by respondents who achieved a result on the scale of academic science equal to, or higher than the median and at the same time achieved a result lower than median on the scale of industrial science. At the same time, scientists in whose case a result equal to, or higher than the median on the scale of industrial science and lower than the median on the scale of academic science were recognized as a group following the ethos of industrial science. At the same time the respondents who achieved results equal to, or higher than the median value

on both scales, formed the group of representatives of the ethos of post-academic science. Additionally, scientists with results below the median value on each of the scales were allocated to the group not following any ethos of science. Detailed criteria of division and the structure of the sample, according to the followed ethos of science were presented in table 4.

Table 4. Criterion of division, the number and structure of scientists, according to the recognized ethos of science

Group number	Recognized ethos of science	Criterion of division (median)	Group size	Structure of the sample
1	Ethos of academic science	academic science ≥8,2 and industrial science <4,25	214	26,8%
2	Ethos of industrial science	academic science <8,2 and industrial science ≥4,25	220	27,5%
3	Ethos of post-academic science	academic science ≥8,2 and industrial science >4,25	188	23,5%
4	Lack of ethos of science	academic science <8,2 and industrial science <4,25	177	22,1%

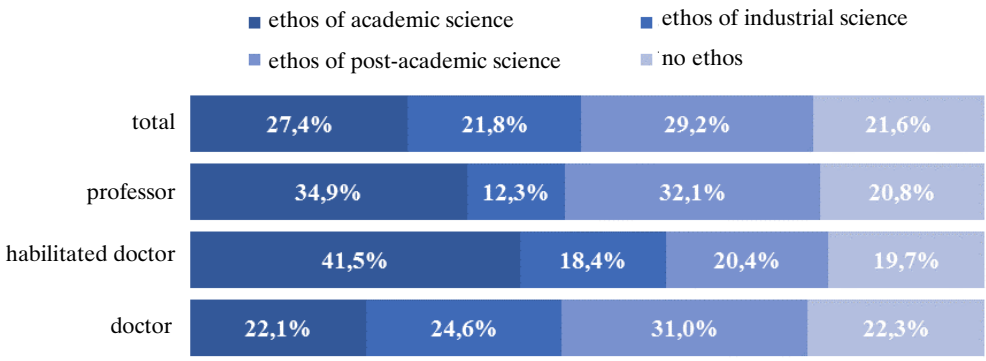
Source: Own materials.

The respondents assessed also the significance that the following three factors associated with promotional activity should have for the purpose of achieving success in science: *popularization of research results, recognisability in the scientific community and recognisability outside the scientific community*. They gave answers on a five-degree scale, where 1 means that a particular factor *shouldn't have any significance*, and *5 — should have very high significance*. In order to find out whether between scientists identifying themselves with particular ethoses of science there are differences concerning their opinions on promotion in science, Kruskall-Wallis tests were conducted. Next, in order to find out between which groups of scientists the differences in assessments are statistically significant, the Mann-Whitney U test was carried out. Additionally Friedman's and next Wilcoxon's test were carried out to find out which of the investigated factors is regarded as most important and which one is regarded as least important for achieving success in science in the whole sample of scientists, regardless of the followed ethos. In the survey non-parametrical tests were used, as variables were measured on ordinal scales.

Results of the survey

The traditional ethos of science is most common among habilitated doctors and the least popular among doctors (see picture 3). The latter identify themselves most often with the ethos of post-academic science. At the same time, the approval for the ethos of industrial science decreases along with the development of scientific career. Even though this system of values doesn't dominate in any of the groups of scientists, it is most appreciated among doctors and the least appreciated among professors. Regardless of the held scientific degree/title, on average every fifth scientist doesn't identify himself with any ethos of science.

Picture 3. The percentage of scientists following a particular ethos of science, according to the scientific degree/title



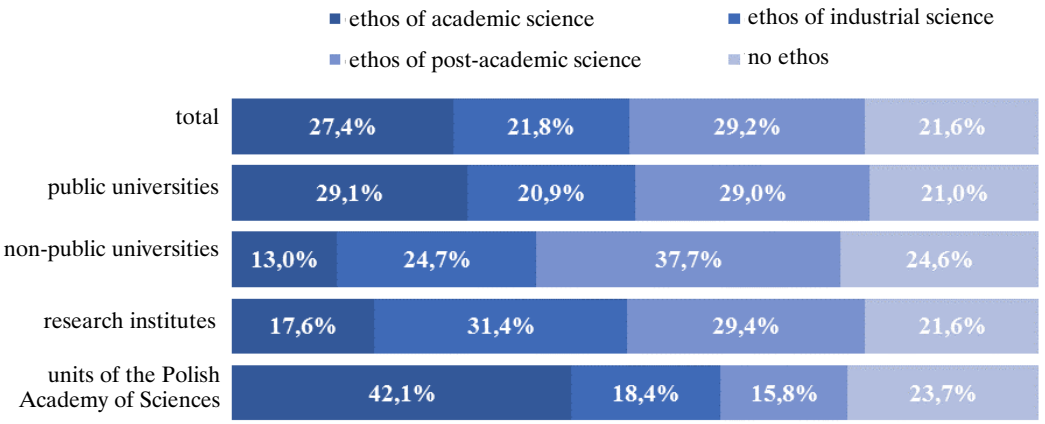
Source: Own materials.

Among the followers of the ethos of academic science most are employed at the units of Polish Academy of Sciences and the fewest work at non-public universities and in research institutes (see picture 4). Among the employees of non-public universities the ethos of post-academic science is dominant. At the same time the highest percentage of scientists identifying themselves with the ethos of industrial science was found in research institutes.

The results of Friedman's test (χ^2 (2) = 392,227, p < 0,001) show that the respondents differently assess the significance of particular factors associated with promotion for the sale of achieving success in science.

The results of Wilcoxon's test, presented in table 5, made it possible to conclude there are statistically significant differences between the following pairs of investigated factors:

Picture 4. The percentage of scientists following a particular ethos of science, according to the type of scientific institution



Source: Own materials.

- recognisability in the scientific community and the popularization of research results;
- recognisability outside the scientific community and the popularization of research results;
- recognisability outside the scientific community and recognisability in the scientific community.

Table 5. The perception of the promotion of science in the whole sample — Wilcoxon's test

Pairs of positions	Wilcoxon's test (on the basis of positive ranks)
recognisability in the scientific community — popularization of research results	Z = –7,505***
recognisability outside the scientific community- popularization of research results	Z = –16,880***
recognisability outside the scientific community — recognisability in the scientific community	Z = –13,209***

*** Correlation is significant at the level of 0,001.
Source: Own materials.

According to the respondents, out of the mentioned factors, popularization of research results (see picture 5) has the strongest influence on success in science. The significance of recognisability in the scientific community has been recognized as slightly less significant. At the same time the respondents think recognisability outside the scientific community is the least important.

The results of Kruskall-Wallis H test presented in table 6 suggest there are statistically important differences between groups distinguished, according to the followed ethos[2] in case of all investigated factors associated with promotion.

Table 6. The perception of the significance of promotion in science and the ethos of science — Kruskal-Wallis H

Position	Kruskal-Wallis H test
popularization of research results	χ^2 (3) = 8,799*
recognisability in the scientific community	χ^2 (3) = 14,555**
recognisability outside the scientific community	χ^2 (3) = 18,932***

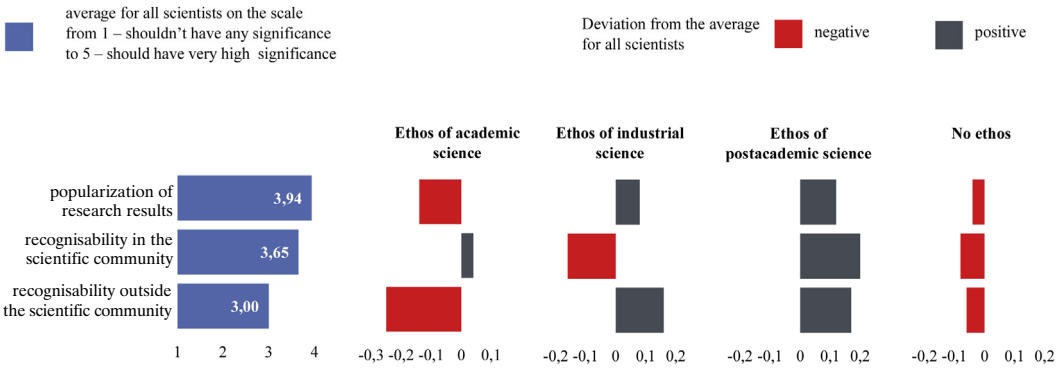
*** Correlation is important at the level of 0,001.
** Correlation is important at the level of 0,01.
* Correlation is important at the level of 0,05.
Source: Own materials.

The results of Mann-Whitney's U test (see table 7) show the existence of statistically important differences between the first and the second group and between the first and the third group in the area of assessment of the importance of popularization of research results and recognisability outside the scientific community. Both the representatives of the ethos of industrial science and people identifying themselves with the ethos of post-academic science appreciated the significance of these two factors for achieving success in science more than the scientists following the ethos of academic science (see picture 5).

Moreover, statistically important differences were found between two pairs of groups in the area of the assessment of importance of recognisability in the scientific community. Scientists who find the ethos of post-academic science attractive think this factor is more important for achieving success in science than people identifying themselves with the ethos of industrial science and the respondents not following any ethos (see picture 5).

On the basis of the obtained results we can conclude that the research hypothesis saying that scientists identifying themselves with different ethoses of science differently perceive the significance of promotional activity in science, has been confirmed.

Picture 5. Scientists' assessment of the significance of factors associated with promotion for success in science



Source: Own materials.

Table 7. Perception of the significance of promotion in science and the ethos of science -Mann-Whitney's U test

Position	Average ranks	Mann-Whitney's U test
popularization of research results	Group 1: 194,26 Group 2: 219,06	Group 1–2: Z = –2,273*
	Group 1: 175,35 Group 3: 202,36	Group 1–3: Z = –2,566**
	Group 1: 176,65 Group 4: 184,96	Group 1–4: Z = –0,801
	Group 2: 199,59 Group 3: 206,02	Group 2–3: Z = –0,601
	Group 2: 200,61 Group 4: 186,41	Group 2–4: Z = –1,339
	Group 3: 183,73 Group 4: 166,48	Group 3–4: Z = –1,702
recognisability in the scientific community	Group 1: 219,59 Group 2: 200,51	Group 1–2: Z = –1,684
	Group 1: 179,96 Group 3: 200,87	Group 1–3: Z = –1,943
	Group 1: 184,21 Group 4: 180,48	Group 1–4: Z = –0,351
	Group 2: 182,50 Group 3: 225,68	Group 2–3: Z = –3,914***
	Group 2: 188,56 Group 4: 202,36	Group 2–4: Z = –1,259
	Group 3: 186,28 Group 4: 162,70	Group 3–4: Z = –2,298*

cont. table 7

Position	Average ranks	Mann-Whitney's U test
recognisability outside the scientific community	Group 1: 185,71 Group 2: 229,65 Group 1: 168,16 Group 3: 209,72 Group 1: 173,69 Group 4: 191,75 Group 2: 198,33 Group 3: 203,18 Group 2: 201,69 Group 4: 184,99 Group 3: 181,73 Group 4: 164,68	Group 1–2: Z = –3,829*** Group 1–3: Z = –3,822*** Group 1–4: Z = –1,674 Group 2–3: Z = –0,434 Group 2–4: Z = –1,496 Group 3–4: Z = –1,634

Group 1: scientists following the ethos of academic science.
Group 2: scientists following the ethos of industrial science.
Group 3: scientists following the ethos of post-academic science.
Group 4: scientists not following any ethos.
*** Correlation is significant at the level of 0,001.
** Correlation is significant at the level of 0,01
* Correlation is significant at the level of 0,05.

Source: Own materials.

Conclusions and discussion

The fact that a scientist identifies himself with a particular ethos of science may have a significant impact on his perception of elements of personal marketing such as: popularization of research results and recognisability in the scientific community and outside this community. A synthetic presentation of the differences occurring in this area is contained in table 8.

The representatives of the ethos of academic science attach less importance to the popularization of research results and recognisability outside the scientific community than scientists identifying themselves with the ethos of industrial science and the ethos of post-academic science. This corresponds with Merton's system of values, according to which scientists shouldn't have direct contact with the society, so that they don't use knowledge for personal gain. Contesting the significance of communication activities complies with the norm of disinterestedness, which assumes the goal of seeking knowledge is knowledge itself. What additionally supports such an approach to promotion is the current system of evaluation of science, according to which the quality of research is most important and presenting scientific achievements doesn't directly affect the professional position of a scientist.

Table 8. Perception of elements of personal marketing by scientists identifying themselves with various ethoses of science

	Ethos of academic science	Ethos of industrial science	Ethos of post-academic sciencej	No ethos
popularization of research results	less importantthan for the followers of the ethos of industrial science and the ethos of post-academic science	more importantthan for the followers of the ethos of academic science	more important than for the followers of the ethos of academic science	
recognisability in the scientific community		less important than for the followers of the ethos of post-academic science	more important than for the followers of the ethos of industrial science and not following any ethos of science	less important than for the followers of the ethos of post-academic science
recognisability outside the scientific community	less importantthan for the followers of the ethos of industrial science and of the ethos of post-academic science	more important than for the followers of the ethos of academic science	more important than for the followers of the ethos of academic science	

Source: Own materials.

Attachment to the values of the ethos of academic science may lead to prejudice against scientists present in the media writing popular books about science, or who appear frequently on the radio and/or television. Negative perception of such people is associated with the fear that they could use their success outside the scientific community to improve their position in the world of science (Ziman, 2000).

The development of media in Poland has caused a growth of demand for experts commenting on the current social, political, economic and scientific events. Scientists are regarded as natural candidates for the role of an expert, as they are seen as independent and objective researchers of reality. Some of them engage in cooperation with journalists so much that they are ready to talk about any subject regardless of how far it is from their specialization. The odium of the scientific community is justified in case

when such scientists express private opinions not reflecting the state of knowledge in a particular area. With such actions such scientists fit in the fourth quarter of the matrix of scientific authority, in which we can find pretending scientists (see picture 2).

On the other hand, as Wiktor Niedzicki (2017, p. 179), a renowned propagator of science in Poland, points out, "without promotion scientific achievements are quickly forgotten". The mission of the media is presenting scientific achievements to the public in an intelligible form. It is the scientists who should monitor whether the message conveyed by the media is appropriate. However, according to some of them, in particular, those following Merton's values, dissemination of knowledge through the media leads to its distortion (Bucchi, 2015). Nevertheless, it is worth cooperating with journalists, as thanks to presence in the media information about a scientific achievement may gain greater coverage. This way it builds the opinion-making image of a scientist and the institution he works for (Osica, 2017).

P. Weingart (1998) distinguished two types of influence of the media on the authority of a scientist. According to the first one of them, which is more common, the establishment of a scientist's authority in the scientific community is preceded by growing interest in him in the media. Journalists treat reputation as proof of competences and credibility of a scientist. However, these properties are not sufficient to guarantee the presence of a scientist in the media. Goodell (1977) in his pioneering work concerning the "visible scientist" highlights the characteristics that a scientists needs to have to attract the media. He names the following features: distinctive personality, high level of communicativeness, good appearance and dealing with subjects concerning social problems and fears in scientific work. The second model of influence of the media is opposed to the first one and leads to the growth of recognition of a scientist in the scientific community *post hoc* — as a result of his presence in mass media.

In comparison to the representatives of the ethos of academic science, greater openness to the society and activities from the area of personal marketing, which make it possible for a scientist to become visible not so much in the scientific community, but in the world of business, is displayed by people identifying themselves with the ethos of industrial science. This is associated with the fact that this group strives to produce useful

knowledge, which can be applied in practice. Such an approach to science is impossible without cooperation between the researchers and the users of the effects of their work (Dabic, González-Loureiro, Daim, 2015). The inefficiency of information-promotional activities is regarded as a serious obstacle for the development of research-development cooperation between science and business (Instytut Zachodni, 2012; Kaymaz and Eryigit, 2011; OPI PIB and Millward Brown, 2014; Poznańska et al., 2012). When scientists separate themselves from the environment, negative stereotypes in the company sector only get stronger. Scientists are perceived as people detached from life, focused mainly on theoretical activity, less competent than company employees and not interested in solving business problems.

Scientists following the ethos of industrial science seem aware of the fact that it is them who should initiate contact with a potential business partner. They are aware of the fact that without conducting efficient activities in the area of marketing, the commercialization of the results of their research may be a problem. What's more, based on the assumption that they are responsible for acquiring funds for research, they regard the private sector as a potential source of financing for scientific activity.

Similar awareness in this respect is displayed by scientists identifying themselves with the ethos of post-academic science, who also appreciate the significance of popularizing research results and recognisability outside the scientific community than the representatives of the ethos of academic science. Additionally, they attach greater importance to recognisability in the scientific community, in comparison to scientists who like the ethos of industrial science and scientists not identifying themselves with any ethos of science.

The need to build recognisability in the scientific community recognized by scientists following the ethos of post-academic science results from the growth of significance of the number of citations and bibliometric indicators (mainly Hirsch index) in the system of promoting scientific employees and awarding grants for research. Apart from the number of scientific papers prepared by a particular scientist, as well as the prestige and availability of magazines in which these papers are published, also the recognisability of the author of these publications influences the aforementioned measures. Scientists enjoying high renown are in this respect in a privileged situation, as they can count on greater interest for

the results of their research, compared to people who haven't established their position in the scientific community yet.

The above-mentioned phenomenon constitutes an element of the so-called Matthew effect, which in the context of science was described by R. Merton (1974) and means that scientists who currently enjoy prestige in the community, in the future will receive greater recognition than less known scientists for work of the same quality. Due to this effect, when a scientist achieves a certain position, losing it is hard and renowned members of the scientific community often remain scientific authorities long after their scientific potential decreased (Ziman, 2000).

However, using solutions from the area of personal marketing will be beneficial also for scientists who haven't achieved an established position in the scientific community yet. This is because self-promotion activities will raise their visibility, which assuming high quality of scientific work, should in the longer perspective lead to the growth of scientific authority.

In times of limited resources and growing competition for funds for research the authority of a scientist is becoming more and more important. Thanks to the trust he enjoys, a renowned scientist can easier obtain scientific grants and achieve further scientific degrees (Maiväli, 2015). Recognition in the community also opens the door to better paid positions, can accelerate promotion and contribute to achieving higher social influence (Ziman, 2000). As a result it often leads to the financial and sometimes even political success of a scientist.

Compared to other scientists, the representatives of the ethos of post-academic science are distinguished by the highest marketing awareness and thus have the greatest chances to fit in the first quarter of the matrix of scientific authority and to become celebrities of science. (see picture 2). At the same time, the remaining persons, assuming that they conduct high-quality research, without higher engagement in promotional activity can only become local authorities and join the group of scientists with a potential.

Ending

In association with the fact that in the recent decades the concept of competitiveness in science wasn't present in Poland, many Polish scientists don't notice the need to promote their scientific achievements. Scientists need to find out that taking up promotional activities is not harmful for their scientific image, but to the contrary, thanks to achieving a synergy between high quality of research and efficient personal marketing they can strengthen their authority. The basis of this transition is the change of ethoses of science they follow — and this is a slow process, which needs time.

The conducted research gave only a preliminary insight into the discussed subject. In the presented model of the formation of a scientist's authority only the first level was investigated. The first level is formed by the influence of the followed ethos of science on the perception of personal marketing. The influence of approaches to personal marketing on taking up actions in this area should be subject to further empirical analysis. It would also be worth replicating this research, building a questionnaire that will enable measuring the ethoses of science followed by the respondents on a higher level of reliability. Continuation of the started studies should enable the particularization and expansion of the proposed general outline of the formation of authority in science.

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[1] The target group covered by the research consisted of people with a doctoral degree, or higher, employed in Polish scientific units i.e. research institutes, institutes of the Polish Academy of Sciences and universities, who have been conducting scientific research for at least five years. In order to secure a representative sample covering all areas of science and the presence of at least two representatives with the same characteristics in the area of two out of three criteria of selection (that is, area of science, kind of institution employing the scientist, the stage of scientific career), 18 in-depth interviews were conducted: nine with non-habilitated doctors below the age of 40 and nine with people older than 40 with the degree of at least the habilitated doctor.

[2] The differences between scientists identifying themselves with the ethos of academic science (group 1), the ethos of industrial science (group 2), ethos of post-academic science (group 3) and scientists not identifying themselves with any ethos (group 4) were investigated.

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