Svetlana A. Korableva

PhD student,
National Research University "Higher School of Economics",
St. Petersburg, Russia;
e-mail: sbolshakova@hse.ru

Models of Scientific Leadership in Russian *R&D* Institutions: an Empirical Reconstruction

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This article discusses the concept of leadership in science. The main goal of this research is to define the concept of leadership and models of leadership in science by considering an example of *R&D* sector in Russia. To achieve the goal a qualitative study was conducted, which included data collection by conducting in-depth interviews and subsequent analysis of the information received. In total, 16 respondents from different positions, from different fields of science and from different cities participated in the study. It is important to note that all respondents held managing positions in scientific organizations, which is an important element of the study, since the respondents have extensive management experience so their answers were based on practice.

As a result of the research, different models of leadership in science have been identified, which have their own specific features and traits. Also, as a result of the study, a general idea of leadership in science was analyzed: what is the basis of leadership in science, what traits should be inherent in a leader in science and other important aspects. Leadership is not universal, both in relation to all spheres of human life (business, science, etc.), and in relation to science itself, although there are a large number of identical signs. However, scientific leadership has its own distinctive features that greatly distinguish it from other types of leadership.

The results of the study are critically important, as they give an idea of leadership and management in science. At the moment, management system in science is not a widespread topic of research, so this work is unique and relevant and can be used as a basis for subsequent research.

***Keywords*:** scientific leadership, leadership in science, scientific recognition, models of scientific leadership.

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Introduction

There is leadership in any industry — business, politics, sports and other areas of human life. In this study, the main area where leadership is studied is science, or rather the *R&D* sector. Research and Development (R&D) includes creative and systematic work carried out with the aim of increasing the volume of knowledge, including knowledge about humanity, culture and society, and developing new applications of existing knowledge [*OECD*, 2015]. Despite its peculiarities and laws, science and *R&D* also have their own leaders. A scientific leader can be defined in different ways. It can be someone who is in some way superior to another scientist, someone who leads a team, as well as someone who unites a scientific team, motivating it to achieve a common goal. For a long time, it was believed that a supervisor should have certain qualities, competencies, perform a certain role and perform certain tasks. But more and more scientists are talking about the transformation of the scientific sphere — an epochal turning point which blurs the boundaries between science and other spheres. Many boundaries are erased, leadership becomes universal, sometimes formal. Science includes norms from business, a large number of administrative phenomena. Therefore, it is important to understand how scientists themselves construct the image of a scientific leader, because they are the ones who know the field of science and its unspoken rules and norms.

The problem of this study can be formulated as follows: it is unclear whether leadership is a universal phenomenon, or scientific leadership has strong specifics, driven by normative structure of science?

The main goal of this research is to define the concept of leadership and models of leadership in science by considering an example of *R&D* sector in Russia.

In this regard, the following research questions were raised:

4. How do scientists themselves describe a scientific leader, how do their views differ and what do they have in common?
5. Is there a stable profile of personal qualities, professional qualities and competencies of a leader in science? Or does the profile of a scientific leader not have a single set of certain criteria?
6. What categories are used to form leadership in science and how does it relate to leadership in other theoretical concepts?

In connection with the goal of the study and the questions, the following research objectives were set:

— to identify the theoretical concepts of leadership, their features and differences;
— to determine how scientific leadership is interpreted in modern scientific society (the profile of a scientific leader), to define models of scientific leadership;
— to determine to what extent the concept of leadership is universal for all spheres and areas.

Theoretical background

This section is an analysis of literature, which is the basis for this study. The purpose of this review is to define leadership concepts, study their differences, and determine the basis for subsequent hypotheses.

The earliest theory of leadership is the theory of personality traits or leadership qualities. The very first authors [*Tead*, 1935; *Fayol*, 1949; *Baird, Mann*, 1959; *Stogdill*, 1974] who studied this concept believed that leaders have a certain special set of personal qualities that are given to leaders from birth and cannot change over time. Based on this approach, scientists believed that leaders are born, not become. That is, it is impossible to become a leader without having certain qualities. Scientists who adhered to this approach believed that there are qualities that a leader must possess otherwise he will not be able to become one.

Other authors have studied the behavioral approach to leadership [*McGregor*, 1960; *Likert*, 1961; *Blake, Mouton,* 1986; *Lewin*, 2000]. They argued that the head determines his behavior. Or rather, behavior towards subordinates, that is, leadership style. In this approach, the main focus is on management. Leadership style can be defined as a set of behavioral traits that a leader uses in relation to subordinates to encourage them to achieve goals. Despite the general meaning of behavioral concepts, different authors define them differently. The first scientist who described behavioral leadership styles was K. Lewin. The author identifies three types of leadership: authoritarian, democratic, and authoritarian.

The situational approach is considered by such authors as [*Fiedler*, 1967, 1971, 1981; *Vroom, Yetton*, 1973; *House*, *Mitchell,* 1975; *Hersey*, 1985]. This approach provides for the dependence of the effectiveness of management on various situational factors. Situational factors may be the specifics of the task, the needs of subordinates, the external environment, etc.

In general, there are four main situational models. F. Fiedler identified three factors that influence the behavior of a leader: the relationship between subordinates and the head, the structure of the task, the official powers of the head. Relationships can be both good (loyalty, trust, etc.) and bad. The task can be structured and unstructured (its familiarity, wording, etc.). In turn, the official powers of the leader can be strong (a lot of formal power, etc.) and not strong. Thus, the author believes that there are 8 potential types of leadership depending on different situations.

There is also a theory of leadership based on emotional intelligence, which is studied by such authors as [*Goleman et al.*, 2008]. The main idea of the concept is that it is necessary to be able to manage the emotions of other people, to be aware of your own emotions and feelings as well as the emotions and feelings of other people (subordinates).

Prior to this, general concepts of leadership were described, which are not directly related to science, but rather represent a common understanding of leadership as a phenomenon that exists in different fields. At the next step, it is necessary to consider leadership in science and understand its features, similarities and differences from the general concept of leadership.

Robert Merton, a sociologist, is considered the founder of social science [*Merton, Storer*, 1973]. It was he who proposed to consider science as a social institution, which has its own norms, laws that regulate the activities of scientists. The scientist formed a number of laws, a set of norms — the "scientific ethos", which he considered the main mechanism of functioning of this social institution — science. Merton believed that the main force that drives science is the desire of every scientist for professional recognition. In other words, all the research, the results of scientists are a desire to get recognition, to be better than others. Despite the fact that Merton does not consider "leadership", it can be suggested that the desire for recognition is the desire for leadership, since the more colleagues recognize a scientist, recognize his work, the more a scientist stands out, has significance, the more trust in him, his influence on the team.

Moreover, Robert Merton defined the phenomenon of the "Matthew Effect" — the phenomenon of uneven distribution of advantages, the meaning of which is that the one who initially has advantages accumulates them without difficulty, while the one who is initially limited by advantages has a smaller step to success [*Merton,* 1988]. This phenomenon is also being investigated in science, when existing achievements help a scientist to get more and more of them, sometimes without even applying efforts. As an example: a scientist has a lot of grants, so he gets another grant only because the previous grants went to him.

As already mentioned, the basis for the selection of a scientist (leadership to one degree or another) is recognition. However, after this theory, many other scientists put forward their theories on how to get recognition, how to measure it and how to determine it.

According to the authors [*Artyukhin et al.,* 2018], scientific leadership is understood precisely through domination, which is manifested in the organization of the activities of scientific structures. According to the authors, in modern Russia, scientific activity and scientific is considered through a bureaucratic approach, which is characterized by documentation, rationality, formalism, a clear distribution of functions, etc. Also, one of the main features of bureaucracy is the appointment of officials. According to the authors, the management of science carries the ideas of bureaucracy when it is based on formal citation indicators, ratings and other similar parameters. From this understanding of science comes the understanding of scientific leadership. With a bureaucratic approach, the leader is appointed depending on scientometric indicators, or the manager / administrator becomes the leader. However, science also has a social structure, thanks to which leadership is not based on formal indicators and administrative hierarchy. It is necessary to summarize that according to M.I. Artyukhin, V.A. Kupriyanov, S.A. Dushina, scientific leadership is not bureaucratic management. Scientific leadership is a combination of factors — cognitive breakthrough, social significance of the leader, academic recognition. That is, scientific achievements, merits in a particular field, versatile involvement in science, recognition of importance in scientific society, which in turn is based on the rationality of scientific contribution, are important for a scientific leader. There are many examples when scientific leaders set research directions, selected scientists, offered solutions and ideas. That is, scientific leadership was based not on a position in the bureaucratic hierarchy and subordination to someone's will, but on the ability to invent and implement new ideas, to attract interested parties [*Ibid.*, 2018].

However, there are other theories that highlight the importance of scientometric indicators as a basis for measuring and evaluating scientists and their contribution to science (scientific recognition). Among the authors, M.A. Akoev, V.A. Markusova, O.V. Moskaleva, V.V. Pislyakov can be distinguished. The authors study the data of science identify many arguments in favor of using, for example, citation as a basis for evaluating scientists — "To cite someone is to recognize the impact of a predecessor on your work, a kind of a way to repay an intellectual debt to the person you are quoting" [*Akoev et al.*, 2014]. The authors identify the reasons for citing publications: recognition of contributions, criticism of previous works, definition/description of methods, confirmation of contributions, respect, and others.

Analyzing leadership in a particular context, it is necessary to note such a phenomenon as managerialism in the academic world. Scientists, including those analyzed above, note the influence of management structures on the world of science and education. The interest of studying it lies in the fact that often the evaluation of employees is more quantitative (the number of published publications, for example). At the same time, goals are set more in a formal context. Many authors disagree with the correctness of these introductions in

scientific and academic environments. It is necessary to start with what managerialism is. David Boje believes that managerialism can be defined as a way of considering organizational theory and behavior of organizations exclusively from the point of view of managers who are key functional agents of a bureaucratic society [*Boje*, 2008]. And when we talk about managerialism in science, we are talking about the application of the rules of organizations in science and the academic environment.

Managerialism is based on several components (features): firstly, the concept of efficiency as the primary value that guides managers in their actions and decisions; secondly, the belief in the universalist nature of management tools and methods; thirdly, managers realize themselves as a separate social group with their own interests; fourth, managers are viewed as moral agents who care about public interests [*Abramov,* 2007, 2011].

But science is not the sphere to which it is necessary to apply all the rules and goals that are applied in other spheres, without adapting and understanding the specifics of science [*Pavlyutkin*, 2004; *Chernobrovkina*, 2019; *Niyazova*, 2021]. First, how should efficiency be measured? To measure it, quantitative indicators are introduced, in the weather for which time is lost on research, development, etc. An example is the mandatory minimum number of publications. Secondly, there is no universal method of management in the scientific environment, since the manager himself in the scientific environment is often an informal leader and does not "manage" in the usual sense of the word, but "chooses the direction and motivates to achieve goals".

Speaking about leadership, we can also consider the theory of Pierre Bourdieu, a French sociologist, about capital and the scientific sphere in principle. The author defines such a concept as a "scientific field" — a system of objective relations between positions achieved (in the previous struggle), a place (i. e. competition, the specific stake in which is a monopoly on scientific authority, defined as technical ability and — at the same time — as social power, or, if you like, a monopoly on scientific competence, understood as the ability to legitimately (i. e., authoritatively and authoritatively) speak and act on behalf of science, socially assigned to a certain individual [*Bourdieu,* 2005]. Scientific authority is a special kind of social capital, which under special conditions can be accumulated, transferred and transformed into other types of capital. The author will also highlight such a concept as Symbolic capital — any kind of capital (cultural, social or economic) that has a special recognition within the social field. Most often, the symbolic capital is prestige, reputation and honor. Scientific authority can also be attributed to symbolic capital. P. Bourdieu suggests that scientists evaluate science as a set of political and scientific strategies. In other words, science has common features with other social fields (mechanisms of dominance, capitalization, competition, etc.); at the same time it has autonomy and specificity, which consists in the search for scientific truth. This means that leadership in science also has both a symbolic support (prestige, recognition, etc.), as well as a political basis [*Ivanova*, 2012].

As a result of the analysis of the literature, the following general theories of leadership were identified:

— theories of personality traits;

— behavioral theories;

— situational theories;

— theories of leadership based on emotional intelligence.

It should be noted that these theories are generalized, their authors study leadership in the context of all spheres.

The following are the theories of leadership in science:
— recognition-based leadership;
— theories of managerialism;
— theory of symbolic capital as basic of recognition;
— theory of orientation to quantitative performance indicators (scientomentics) as basic of recognition.

After analyzing the literature and different concepts, it can be said that leadership in science can have two foundations — general leadership and special leadership in science. In other words, is scientific leadership different from leadership in other fields? If scientific leadership is based on recognition, what is its measure and how to acquire it?

Methodology

The purpose of this study is to determine the profile of a scientific leader in the modern world.

The problem of this study is the lack of a clear understanding of who a scientific leader is in the modern world.

The problem is that the scientific leader in the modern world can be represented in different ways. It is necessary to understand what qualities a scientific leader should have, what behavioral models he should use, what functions he should perform, what relation he should have to science.

An analysis of the literature has shown that there are a large number of theories and opinions about who a leader is, including in the scientific field. However, during the analysis, no studies were found that would study this problem in practice. That is, it is not clear who the scientific leader is in the modern world. Many young scientists want to become leaders in their field in the future, but they do not know exactly how to achieve this, what qualities and knowledge they need to possess. Therefore, it was decided to study this problem.

The object of this research is the heads of *R&D* institutions, units.

The subject of the study is the opinion of leaders about scientific leadership, its features.

Objectives of this study:
— to determine the formal characteristics of the leader (how he came to the position, how many people are subordinate, etc.);
— to define how the leader defines the concept of a scientific leader;
— to determine which personal characteristics (qualities) are important for a scientific leader;
— to determine which behaviors a scientific leader should use;
— to determine which factors should influence the behavior of a scientific leader;
— to determine the general profile of the scientific leader.

For this study, a method of qualitative analysis of primary information was chosen (content analyses). Primary information is extremely significant, since it is the most relevant to the research: it is collected during the study, so the collected data will relate specifically to the present time; the primary information will be able to most clearly answer the questions and tasks of the study, because it will not contain other topics.

In order to collect the necessary information, the interview method is used. The relevance of this method lies in the fact that with the help of interviews it will be possible to

collect the necessary information from the target group, in other words, to choose exactly those individuals who will definitely help to collect the necessary information.

A research interview is a conversation with a research purpose. There are different types of interviews, but a semi-structured type was chosen for this study. The choice of this type of interview is justified by the fact that in the process of conducting it answers to specific questions will be received, but it will be possible to obtain more relevant information with the help of additional questions and clarifications. With the help of a semi-structured interview, it will be possible to achieve deeper and more detailed answers, understand the true motives of the respondent.

The interview method was chosen for the following reasons.

1. Many issues that are subject to discussion need to be properly explained, as they can be understood in different ways.
2. It is necessary to ask additional questions in order to get the most complete answer (with causal relationships, explanations). And additional questions depend on the respondent's answer, which cannot be predicted in the questionnaire method.
3. In this study, the goal is to understand the very essence of leadership in science, not the statistics of answers and opinions.

One of the important stages is the preparation of an interview guide (questions) that should correspond to the objectives of the study.

1. To determine the formal characteristics of the leader (how he came to the position, how many people are subordinate, etc.

Relevant interview questions:

— What position do you hold?
— What does your unit do? How many people are there in it?
— How long have you been in this position?
— How you came to this position?
— What responsibilities do you have?

2. To define how a respondent defines the concept of a scientific leader.

Relevant interview questions:

— Who is a leader in science?
— In your opinion, how do these concepts compare — a formal leader and an informal leader?
— A leader must be related to science?
— Do you think a formal leader (who hold formal position) should also be an informal leader?
— Do you think a leader in science is different from a leader in other fields?

3. To determine which personal characteristics (qualities) are important for a scientific leader.

Relevant interview question:

— Are personal qualities important for a leader? Which ones exactly?

4. To determine which behaviors a scientific leader should use.

Relevant interview questions:

— Is it important how the leader communicates with his team?
— What kind of relationship do you think a leader should build with his team?

— If we consider exactly the context in which the leader should give instructions to subordinates, then how exactly should this happen? Should the leader make decisions on his own and issue decrees, or consult with the team and solve problems together?

5. To determine which factors should influence the behavior of a scientific leader.
Relevant interview question:
— There are theories that describe situational hikes to leadership. They argue that the leader should change his behavior depending on different situations. For example, from the specifics of the task, from the team that is working on this task, etc. Do you agree with this opinion?

6. To determine the general profile of the scientific leader.
Relevant interview questions:
— Are formal achievements in science important for a leader? Significant publications, citations?
— Is there a difference between the leader of different scientific fields?
— If you describe a scientific leader with 3 adjectives, what adjectives will they be?

Sampling of the study

Since this study is qualitative, non- probability sampling is used — purposive sampling.
The following criteria were taken into account when determining the sample:
1. Respondents should hold senior positions in scientific fields.
2. Respondents must be of different gender and age.
3. Respondents should be in different positions according to the level of management.
4. Respondents should represent different fields of science.
5. Respondents should be from different cities.

Generalizing, it can be said that the basis of the sample is diversity (with certain limitations), since more objective results require the opinion of representatives of different scientific communities.

The sample consists of 16 respondents. 6 women, 10 men.

Table 1. Sample

№	Criteria	Description
1	Age	32–44
2	Quantity	16
3	Gender	Male, female
4	Fields of science	10: (Sociology (3 respodents), History (3 respodents), Psychology (1 respodent), Economics (1 respodent), Philosophy (1 respodent), Physics (1 respodent), Mathematics (1 respodent), Chemistry (2 respodents), Biology (2 respodents), IT (1 respodent)
5	Academic degree	Candidates of Sciences, Doctors of Sciences
6	Posision	Head of the laboratory, head of the department, Vice-rector, Deputy Vice-rector, Director of a research institute, Deputy Director of a research institute, Director of a research center.
7	City	Moscow, Saint Petersburg, Tyumen, Novosibirsk, Tomsk, Vladivostok

Source: Author's own research

Findings

In the first question, where respondents were asked to describe who a scientific leader is, all respondents described him differently, but there are a lot of common features that all respondents highlighted — recognition, achievements in science, ability to work with a team and other features.

In the second question, which concerned the involvement of the leader (the one who manages the team formally) in science and the importance of combining the role of a formal and informal leader in one person, the respondents' opinions differed greatly, but all were reasoned. The majority of respondents noted that it is not necessary for a formal leader to be informal, but others insisted on the opposite. Regarding the attitude to science, opinions also diverged. The majority answered that a formal leader must necessarily be a scientist, but several respondents noted that a formal leader may not have a strong relationship to science, provided that he is engaged in the organization of scientific activities, management, and an informal leader (another leader) is a professional scientist and is engaged in the scientific side.

The third question asked respondents to express an opinion on whether there are differences between a leader in science and a leader in another field (for example, in business). Almost all respondents noted that there is still a difference (despite many similarities). The most important features of a leader in the scientific field are the goal (motivation) — the leader does not work for money, but for an idea, the goals are idealistic, not material; the leader in science communicates with the team in a different way (without an ordered tone, respect for the opinions of the team and the personality of scientists); the leader in science has less developed managerial competencies, he is more immersed in the subject.

The fourth question related to the importance of personal qualities of a leader in science. All respondents answered this question in a similar way, highlighting a standard set of leadership qualities (according to the theories of personal qualities): the ability to organize a team, sociability, responsibility, decision-making ability and other qualities. In a special way, respondents highlighted scientific expertise — professionalism in their field.

The fifth question related to the behavior of the leader. All respondents insist that an authoritarian management style is impossible in science (respondents suggested its possibility, but only in theory), the ties in the team should be horizontal with collective decision-making (except for special situations and questions). Some respondents also stressed the small distance between the leader and the team (so that there is the right to make decisions, etc.).

The sixth question was related to situational approaches to leadership. All respondents answered this question in approximately the same way — there are situations when you need to be flexible, adapt to circumstances (in moderation), and this is very important for effective work.

The seventh question relates to the importance of formal achievements for a scientific leader. All respondents stressed that achievements are very important, as they show the results of activities, are markers of leadership, and are the basis for recognition. However, as it turned out, respondents have very different opinions about which achievements are important.

The eighth question related to the difference in leadership in different scientific fields. Some respondents stressed that there may be differences, for example, if we consider the humanities and natural sciences (way of thinking, specifics of scientific activity and research),

but some do not see any special differences and believe that the differences can only be personal.

The ninth question involved the definition of three main criteria, without which leadership in science is impossible. Someone highlighted the common features of leadership, and someone highlighted scientific recognition, expertise in their field.

It should be noted that no correlations were found not by age, nor by gender, nor by industry, nor by other criteria.

However, it should be noted that the sample was built on diversity according to various criteria, so it is currently impossible to track the correlation.

It should also be noted that this study has *limitations*.

1. In order to track a possible correlation, it is necessary to select more respondents for each criterion;
2. Some questions (for example, 9) do not provide objective information, but only provide additional information for analysis (according to the answers to question 9, it cannot be argued that only these traits are important for a leader and build theories, since respondents may simply forget some quality, or take it for granted anyway).

This table is a systematic report on the first question, when respondents were given the opportunity to determine who is a leader in science.

Table 2. The basis of leadership

№	The basis of leadership	Important characteristics
1	Scientific recognition (must be scientist)	A professional in the field, must also combine administrative duties, might be a head of new scientific directions
2	Scientific recognition (must be scientist)	Expertise, ability to build a team's work, managerial tasks responsibilities
3	Scientific recognition (must be scientist)	Has a degree that confirms the presence of hard skills, very good soft skills (communication, training others, etc.), knows what is happening all over the world in this area
4	1) Scientific recognition (must be scientist) for scientist-leader 2) Great management skills for leader-manager of science	1) World-class research, publications, conferences 2) A manager who understands science
5	A set of traditional leadership qualities in science	The one who can lead the team, responsible, brave
6	Scientific recognition (must be scientist)	Has scientific authority, willingness to work with a team
7	Scientific recognition (must be scientist)	The creator of some new holistic direction, there is a team that develops it. Scientist is not a manager
8	Scientific recognition (must be scientist)	The generation of new ideas, the creator of the team, great publications
9	Scientific recognition (must be scientist)	He is engaged in research, attracts supporters, wants to prome the results to the public

End of the table 1

№	The basis of leadership	Important characteristics
10	1) Scientific recognition (must be scientist) for intellectual (ideological) leader 2) Management skills for administrator-manager	1) Opens up new approaches, ideas, the one that other scientists are following 2) Managerial responsibilities
11	1) Scientific recognition (must be scientist) for scientist — generator of ideas 2) Great management skills and Scientific recognition (must be scientist) for scientist-organizer	1) Can work even alone, communicate through publications, etc. 2) Knows the goals, finds people, receives funding, etc. — effectively organizes the scientific process
12	Scientific recognition (must be scientist)	Soft skills, responsibility, there is a clear goal (semantic content)
13	Scientific recognition (must be scientist)	Actively engaged in science and organizes the scientific process
14	Scientific recognition (must be scientist)	Notable for his scientific results, respected in his society, popularization of science in both broad and narrow circles
15	1) Scientific recognition (must be scientist) for scientific leadership 2) Management skills for administrator-manager	Coordination of work, training, achievements, publications
16	Scientific recognition (must be scientist)	A professional in the field, must also combine administrative duties, might be a head of new scientific directions

Source: Author's own analysis

As can be seen from the table, respondents put many different meanings into the concept of "leader", highlighting different traits, competencies and responsibilities.

The second question discussed the importance for a leader to be a scientist himself (be related to science), as well as to be an informal leader. In the table below grouped information of respondents' responses can be found.

Table 3. Leader and relation to science

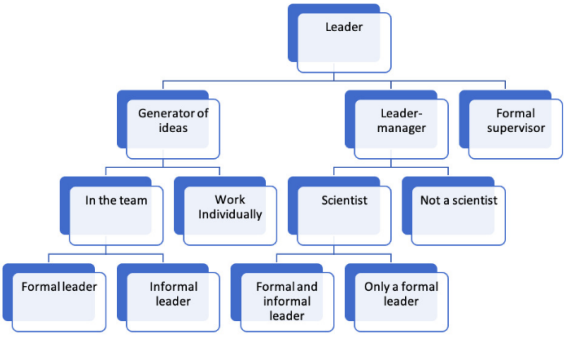
№	Relation to science	Does a formal leader need to be an informal leader?	Causes, consequences, additional notes
1	Must be the scientist himself	Yes (critically) But over time, it may lose due to the administrative part	Must be a scientist himself, understand how it works otherwise the degradation of the collective
2	Must be the scientist himself	No, it is necessary to generally understand the current situation	A formal leader should no longer delve deeply into science
3	Must be the scientist himself	No, often different people	It is important to go all the way in science yourself, be the best in your team

End of the table 2

№	Relation to science	Does a formal leader need to be an informal leader?	Causes, consequences, additional notes
4	Must be the scientist himself	No, often different people	Ideally, formal leader = informal
5	It is necessary to understand science, to be a scientist, but it is not necessary to be a scientist-leader	No, different functions	It is necessary to help scientists-leaders to develop
6	Must be the scientist himself	No	Must have recognition, authority
7	Must understand the specifics, basic features, ideology, etc.	No, informal leaders are scientists	Must effectively manage and create conditions for science
8	Depends on the management level. If there is a laboratory / department, then must be a professional scientist	Depends on the management level. If there is a laboratory/ department, then must also be an informal leader	
9	Must be the scientist himself	No, because managers are often scientists in the past	
10	Must be the scientist himself	No, often different people	
11	Must be the scientist himself	Ideally, yes, but scientists often do not want to take the administrative part	
12	Must be the scientist himself	Yes	Many scientists do not know how to manage
13	Must be the scientist himself	Yes	
14	The leader must be a scientist, the manager-not necessarily, but must understand the field	Not necessary, but desirable. Just a manager can have no influence on the team	The most important thing is that everyone fulfills their functionality
15	Must be the scientist himself (leader), manager-not necessarily	Not necessary	

Source: Author's own analysis

It can be noted that opinions vary. Someone considers it critically important that the scientific process is led by a scientist and is also an informal leader, while someone insists on the help of professional managers.



Source: Author's own analysis

Fig. 1. Models of leadership

After conducting a study, 7 types (models) of leadership in science were discovered. Each type of leadership has its own characteristics, approaches and goals.

Table 4. Types of leadership

№	Type	Main activity	Additional information (activity)	Position (status)	Relation to science
1	Ideological leader	Definition of scientific directions of team development, generation of ideas	A very small amount of administrative work	Formal leader (might be informal as well)	Scientist
2	Ideological leader	Definition of scientific directions of team development, generation of ideas	Work with a team	Informal leader	Scientist
3	Ideological leader	Inventing new scientific directions, generating ideas	Work mostly alone	Informal leader	Scientist
4	Leader-organizer of science	Administrative, organizational and management responsibilities	Search for funding, establishing scientific contacts, defining scientific plans, team building, maintaining of internal and external communications, possibly research activities	Formal leader and informal leader	Scientist
5	Leader-organizer of science	Administrative, organizational and management responsibilities		Formal leader	Scientist
6	Leader-organizer of science	Administrative, organizational and management responsibilities	Search for funding, establishing scientific contacts, defining scientific plans, team building, maintaining of external communications, creating a comfortable environment for scientists, promoting scientific results		Not a scientist, but has basic knowledge and understands all the features
7	Formal supervisor	Administrative activity or absence (formal position only)	Does not contact the team, does not have influence	Formal	No matter

Source: Author's own analysis

The broadest concept of a leader can be divided into 3 groups: 1) a scientific leader — idea generator and a creator of new directions (an ideological leader); 2) a leader — an organizer of science (is a formal leader) and 3) just a formal leader. In any case, the leader-generator of ideas will be a professional scientist, but he can work both individually and in a team. If he works in a team, then he is most likely an informal team leader, since he

brings new ideas to the team, but he can also be a formal team leader. A scientific leader — generator of ideas — can work alone, communicating through publications and other communication channels that do not involve personal and frequent interactions with society.

The head-organizer of science can either be a scientist or not, performing administrative and organizational functions. This type of leadership assumes that the leader organizes scientific processes, attracts funding, solves complex problem situations, etc. In other words, the main part of the work is the management of science. If the head of the organizer is a scientist, then he can be both a formal leader (he is more engaged in administrative and organizational activities, should not delve deeply into science and engage in it), and an informal leader (strong involvement in the team, scientific activity, generation of ideas, etc.), in this case the leader combines both the scientific part and the administrative and organizational part. However, according to respondents, it is very difficult, since there is very little time for science when you are in a formal position. It is also possible that the leader-organizer of science is not a scientist, in this case, he cannot be an informal leader, but in any case he must have certain knowledge in the field where he works, the peculiarity of such leadership is professional management, understanding how to stand processes effectively from the point of view of managerial activity.

In total, there are at least 7 types of leadership in science, each of which is applicable to certain cases. It cannot be said that any one type of leadership is ideal and should be applied to all spheres. On the contrary, according to respondents, each area, environment, and team has its own type of leadership that meets all needs to a greater extent and is considered the most effective. For example, if the team is small, then the leader does not have to take a lot of administrative and organizational responsibility on himself, and therefore he devotes most of his time to science (the ideological leader). If we consider large collectives, where there may be directions within the same sphere, then organizational and managerial responsibilities may come to the fore (leader-organizer).

Table 5. Characteristics of the leader

General characteristics of the leader	Specific characteristics of a leader in science
— ability and desire to work with people; — communication skills; — emotional Intelligence; — responsibility; — working capacity; — ability to lead a team, “charge with an idea”; — ability to make decisions; — ability and desire to manage; — initiative; — purposefulness; — genius (talent); — creativity; — charisma; — ability to plan; — ability to follow trends.	— ability to find different approaches to different people; — professionalism (expertise) in science; — ability to create conditions for scientific activity (attract funding, organize events, establish internal and external communications).

Source: Author’s own analysis

As it can be seen, respondents identify many qualities that should be inherent in a leader in science. However, it can be noted that most of the qualities are non-specific, but relate

to leadership in general, without reference to the industry. To a greater extent, respondents emphasize the importance of the ability to communicate with people, not to be afraid of it, because otherwise it is impossible to be a leader (if you do not consider a scientist who works alone — an ideological leader).

Science and management

As defined above, there are at least 7 types of leadership. Consider those when the leader is a formal leader (has a certain administrative position), while influencing the team. Most of the respondents insist that the leaders should be scientists who have made achievements on the scientific path themselves. Respondents are critical of this issue, believing that a non-scientist cannot lead science, it is wrong, inappropriate. In addition, a leader in an administrative position should not just be a scientist, but be recognized in the scientific community, have outstanding achievements, in other words, have scientific leadership. Such a critical opinion is due to the fact that, according to respondents, those who have not been engaged in science do not know all the features, and since science is a specific field, it is impossible to learn it quickly, and it is impossible to manage what you do not understand.

However, there is another opinion about this. In the course of the study, a special type of leadership was identified — organizational. The peculiarity of this type is that the leader (formal, then who manages and knows how to influence) must be a professional manager (organizer of science) and at the same time may not be a scientist. This does not mean that he should not understand science, on the contrary, he should know its basic features, understand trends, understand the most significant areas for development, etc., but at the same time he does not have to be a leading scientist himself, his leadership can be based on the effective organization of scientific processes (search for funding, networking, search for partners, allocation of financial resources, etc.). This leadership is based on the theory that a leader can effectively manage science, but not be a leading scientist — these positions will be occupied by scientists. One of the proposed options for managing science is management divided between two people — the leader-organizer (professional manager) and the leader-scientist). Respondents see the importance of this approach to science management, as they insist that scientists who do not have managerial education do not possess managerial competencies, as well as managers do not possess deep knowledge in science. There are also respondents who are sure that scientists should lead, but point out the importance of acquiring knowledge and competencies in the field of management when a scientist acquires a leadership position. As can be seen from the analysis, opinions about the management of science can have radically opposite sides.

Science and recognition

The models of leadership in science were considered above.

Despite the fact that several types of leadership have been identified, all of them are based on authority (except for one — completely formal). Respondents have repeatedly stressed that recognition is the most important component of leadership. However, recognition can be achieved in different ways, which can be very different.

After analyzing the respondents' responses, it was decided to identify 3 categories through which one can gain recognition and authority.

The first group is scientometric indicators — indices of the publication activity of authors or organizations, the significance of publications depending on the scientific weight of the journal, etc. (number of publications, number of citations, Hirsch index, journal ratings, rankings, etc.). Some indicators are quantitative (number of citations, publications). The meaning of this group of indicators is to evaluate the effectiveness of a scientist.

Respondents were divided into two groups — those who support this system and those who consider it unacceptable in science. Those respondents who have a positive attitude to this system, argue this as follows:

Table 6. Opinion on scientometrics

For	Against
– This is a way of evaluating effectiveness – It is necessary to be able to apply correctly – To one degree or another, the profile of the scientist is shown – Anyone who understands science will correctly evaluate – In any case, the leader will have good indicators – Publications in some journals mean the world level of research	– It's not the quantity that matters, but the quality – It is necessary to evaluate not where the publications are, but what new they bring to the scientific world – The very essence of science is lost – Often the tool is used incorrectly

Source: Author's own analysis

1. Science must be evaluated, because scientific activity must be effective, and it is necessary to understand who works how;
2. Scientometrics can be applied correctly if you know how to do it. For example, it is impossible to compare quantitatively the indicators of scientists in their different fields, since different fields of science have their own specifics that you need to know, understand, and apply in analysis when using scientometric indicators. For example, there are areas where a priori there cannot be a large number of citations, since the field is very narrow and there are few specialists there. However, if you know all the features, then this tool (scientometrics) can be used correctly to evaluate the effectiveness;
3. Even if you do not know the scientist personally, then according to certain scientometric indicators, you can make a certain profile of the scientist, understand his approximate career path, in other words, make a certain opinion about his scientific activity;
4. People who are immersed in science (fellow scientists) can correctly assess scientometric indicators;
5. These indicators are important, but a real leader will have all the indicators at a high level in any case, and not because he is chasing them, but because he reaches good indicators with his scientific activity;
6. It is impossible to publish in some journals with a high rating without having good research and results (world-class research), so the very fact of publication in them speaks of the achievements of a scientist.

However, there are also those respondents who have a negative attitude towards scientometrics, considering this tool unsuitable for science. They determine their attitude to scientometrics as follows:

1. It is not quantity that matters, but quality. The pursuit of the number of publications (which often affects certain financial components) negatively affects their content, scientists try to divide the full study into many topics in order to make an article out of each topic. Therefore, publications are poor in content. In this case, the negative attitude is precisely to the pursuit of the number of publications.
2. In the modern world, scientists have become proud of where they published, not what they did (discoveries). The discoveries and research themselves have become less important, they are judged more by certain ratings, and not by the scientific component.
3. The very essence of science is lost, as a search for truth, and not a race for formal indicators.
4. Indicators are often evaluated incorrectly, since they do not possess certain knowledge, which negatively affects the objective assessment of the scientist.

Table 7: Opinion on achievements (not-quantitative)

For	Against
– These are markers of scientific leadership – Some awards/prizes are given for very outstanding activities – Some publications and citations are of great importance to the researcher	– Some consider it from quantitative point of view – Awards are different and it is impossible to equate all formal achievements with success in scientific activity

Source: Author's own analysis

This group includes, to a greater extent, those achievements that are of a qualitative nature. This number includes both publications and citations, but they are not considered as something that needs to be measured in numbers (quantitatively). This group also includes awards, awards, certificates of honor, etc.

Those respondents who have a positive attitude to this type of achievement indicate the following reasons:

1. All achievements are social markers of scientific leadership, as they show what a scientist has achieved. In any case, there is an evaluation system in the scientific world, and the scientific society evaluates a scientist by his achievements. Without certain achievements, a scientist cannot be considered a leader. The leader must have experience in scientific publications, presentations at conferences.
2. There are very significant awards that are given only for a very large contribution of a scientist to science, so they are only qualitative in nature.
3. Significant publications and citations recognized by scientists cannot but influence the authority of a scientist, as this shows his contribution to science.

However, there is also an opinion that even awards, diplomas, honorary titles are unimportant for the following reasons:

1. Awards are often considered from a quantitative point of view (the more, the better), the semantic load is lost.

2. It is impossible to collect a "portfolio" and focus only on it, since it can be of a different nature and be a formality, and not real scientific achievements.

Table 8: Opinion on achievements (all formal)

For	Against
– Authority can be determined by other criteria (ideas, thoughts, patents, books, personal qualities, etc.)	– Often does not allow you to achieve certain titles, positions, receiving certain grants

Source: Author's own analysis

There is also an opinion that formal achievements may not be important, since a scientist-leader may have other goals, other indicators of his authority. According to some respondents, a scientist can be very authoritative in a team, but thanks to his new ideas, thoughts, discoveries, books. For example, a scientist can develop something, turn it into a patent, and then into a business, without having a large number of publications, and he cannot be called a leader. This also applies to the management model, which is based on the organization of science. A leader can be authoritative not because of his formal achievements, but because of his ability to organize science, as well as because of his personal and leadership qualities.

However, there are disadvantages to this way of acquiring authority. In an academic environment, it will be almost impossible to achieve success, to hold certain positions. And there is also the possibility of not receiving many financial sources of support, since, for example, some grants cannot be obtained without publications in highly rated journals and citations.

It should be noted that leadership in science, as the study showed, is in any case based on recognition and authority. And recognition is already based on various factors, there are certain markers that are the basis for leadership. These markers are certain achievements. In any case, there should be achievements, but each respondent defines these achievements differently.

All respondents note that publications are critically important for a leader-scientist (and for a scientist in general), since these are the results of his activities, a means of communicating with the scientific world. Someone considers the scientometric approach to be a good tool, provided it is used correctly, while someone assures that the authority of the leader cannot be determined in quantitative ways. Anyway, formal achievements are important for a leader-scientist: publications, citations, grants, awards, awards, ratings, etc., since they are markers of leadership in the scientific environment. However, the assessment of these achievements (how many achievements, which ones) varies and depends on many factors, such as the field of science, goals, as well as the scientist's own opinion and attitude to achievements.

At the beginning of the study, after analyzing the literature, certain hypotheses were put forward.

The first hypothesis was that many heads of scientific structures consider their leadership mainly from the point of view of management, and not scientific leadership, which consists of indicating the direction of research, motivating to comprehend the scientific truth, etc. In other words, science fades into the background, administrative tasks are a priority.

This hypothesis was both confirmed and not confirmed at the same time. On the one hand, indeed, when scientists acquire a managerial position (formal), they begin to engage in administrative duties to a greater extent, losing their informal leadership (if there was one). This is because due to the large number of administrative and organizational responsibilities, there is not enough time to do science. However, are there any such examples when a formal leader continues to engage in scientific activities, leading the team behind him and remaining informal scientific leader at the same time. As the study showed, the responsibilities and role of a formal leader strongly depend on the field of science, direction, personal qualities and competencies and other possible factors.

The second hypothesis was that scientific leaders are always involved in various interactions: with colleagues in the scientific workshop, in communication with students, in interdisciplinary communication, etc.

This hypothesis was fully confirmed.

As the analysis showed, a scientific leader or leader-organizer of science always contacts and interacts with a large number of people (except for a special type of leadership when a scientist works alone). This can be formal communication with your team, personal informal communication with scientists, speaking at conferences, communication with other scientific structures, etc. In any case, a leader cannot be a leader if he cannot communicate with other people and establish contact. Therefore, the ability to build good relationships with the team is very important for a leader (as the analysis above showed, it is important to find an approach to each scientist). To do this, it is necessary to possess certain qualities: sociability, emotional intelligence, ability to work in a team.

The third hypothesis was: "In each field, a leader may have his own specific characteristics, but there are certain features, characteristics that are inherent in all leaders, regardless of the field of science".

This hypothesis was also confirmed. The leader of all fields of science is characterized by a respectful attitude towards the team (scientists) despite the difference in positions (if we consider the leader in a formal position). The leader must have authority, have achievements. Also common qualities are flexibility (the ability to adapt to different circumstances and people), the ability to organize yourself and your company, responsibility, idealistic goals. However, there are certain differences among leaders in different fields. In natural science fields, collective research, in areas where there are great connections with business, a leader may have stronger leadership qualities (persuasion, sociability, initiative, etc.). In areas where the work is more individual, the leader may need leadership qualities to the least extent, think about them, and show them to the least extent.

It is also worth noting that a leader in one field of science cannot be a leader (manage) in another field, since in order to manage in science, you need to be a professional scientist and know all the features (except the leader-organizer of science).

The fourth hypothesis was that Key important qualities for a scientific leader: recognition by the scientific society and influence on it, the ability to "pave the way".

This hypothesis was confirmed partly. All respondents confirmed that there can be no leadership in science without recognition, especially if we consider scientific leadership. To become a scientific leader, a scientist must have a strong authority, the scientific community must see his merits in science, his contribution. However, scientific recognition and reputation are complex concepts that achieve a large number of achievements (the set and number of which may vary from the field of science).

If a scientist does not have a scientific reputation, then no one will follow him, he will not be able to keep the team, etc.

However, if the manager is not a scientist and does not know how to gain scientific recognition, he can also manage science, but only from an organizational point of view.

It is interesting that a scientist can be recognized only in one or several scientific fields, where he is a professional and has scientific expertise. And of course, the ability to pave a scientific path (to determine the horizons of development, to establish a scientific process) is an important competence for a scientific leader, but not necessary for leader-manager who has only management responsibilities.

Conclusion

On the one hand, leadership is an understandable phenomenon that is perceived on an intuitive level, on the other hand, it can be interpreted differently by different people, and have its own specifics. In this paper, a scientific type of leadership is considered — a specific type that has its own characteristics, common features and differences in comparison with a general type of leadership. Many theories indicate that scientific leadership cannot be equated with leadership, for example, in business, since science itself is very different from other areas of human life.

The main goal of this research is to define the concept of leadership and models of leadership in science in the modern world.

The following research questions were raised:

1. How do scientists themselves describe a scientific leader, how do their views differ and what do they have in common?
2. Is there a stable profile of personal qualities, professional qualities and competencies of a leader in science? Or does the profile of a scientific leader not have a single set of certain criteria?
3. What categories are used to form leadership in science and how does it relate to leadership in other industries and theoretical concepts?

The research had several objectives:

— to identify the theoretical concepts of leadership, their features and differences;
— to determine how scientific leadership is interpreted in modern scientific society (the profile of a scientific leader), to define models of scientific leadership;
— to determine to what extent the concept of leadership is universal for all spheres and areas.

It should be noted that in the course of the study, all tasks were completed, all answers to research questions were received. In order to achieve this goal, it was decided to use the content analysis method (analysis of primary information), a qualitative research method was used to collect data — in-depth interview. The sample consisted of 16 respondents, leading scientists, of different genders, ages, fields of science, and positions. Each respondent was interviewed according to a pre-prepared program, which was based on theoretical concepts and hypotheses. After the interview, all the answers were deciphered and analyzed. It was this research methodology that helped to solve all the tasks.

It should be noted that as a result of the study, it turned out that there is no consensus on leadership in science. Many respondents noted certain important traits (sociability, responsibility, ability to create a team, etc., traits that are not specific to science, and therefore

relate to the theoretical concept of personality traits of a leader. In other words, the importance of certain traits is universal. However, several respondents noted that leadership qualities and managerial competencies are less pronounced in the scientific environment than in business.

A distinctive feature of scientific leadership was revealed — a model of behavior and leadership. In science, according to all respondents, horizontal ties are accepted in the team, between the leader and the team, there is no strict hierarchy, decisions are made mainly collectively, the opinion of the team is taken into account, but there may be exceptions. An interesting feature is that the leader needs to find different approaches to different team members, since they are almost always irreplaceable, and therefore it is necessary to respect them, their opinion, their personal qualities. It is also necessary to show flexibility in relation to other factors — the specifics of the task, deadlines, different groups, etc., which corresponds to the theoretical concept of situational leadership and is a universal quality of leadership.

The results of the study identified 7 models of leadership in the scientific field, each of which has its own characteristics. In some models, the basis of leadership is the scientific component, in other words, the leader should be a scientist who, regardless of the formal position, should primarily be engaged in science, conduct research, etc. In this case, the leader must necessarily be a recognized scientist, a professional in his field. In other models, attention is paid more to the organizational functions of the leader (the ability to build and organize scientific activities). In this case, the leader can be like a professional scientist, since he does not have to be one, but only have a general idea of science, know the specifics. In one organization, there may be one leader who performs the role of both a formal leader and an informal one, or there may be two leaders whose duties and functions differ. For example, if an organization has a leader-organizer of science who is not a recognized scientist (or a scientist in general), then the organization must have a leader-scientist (he may be an informal leader) who must have deep knowledge in the scientific field.

Anyway, the leadership model in an organization depends on many factors — on the field, on the personal characteristics of a person, the specifics of the scientific research process, etc. In other words, there is no one type of leadership that would be applicable to all areas of science.

Also, a distinctive feature of scientific leadership is its basis — recognition. If we consider a leader-scientist, then it should be a person with scientific authority, he should be a professional in his field. If the leader is the organizer of science, then recognition may be unscientific.

All respondents claimed that recognition is formed because of achievements and they are critically important for a leader in science. However, respondents gave different answers to the importance of certain achievements, in other words, they assessed the path to recognition differently. Someone has a categorically negative attitude to scientometric indicators, believing that it often does not show real achievements in science, while someone considers it a certain indicator of a scientist's activity and insists on the advantages of using this tool to evaluate a scientist (provided that this tool is used correctly). Someone highlights discoveries, the creation of new directions, the receipt of prizes, awards, etc. To a greater extent, we can say that all respondents agree on one thing — achievements are important, since they are markers of leadership (publications, citations, grants, awards, books, etc.), but everyone evaluates them differently. Therefore, I must say that for different leadership models, their specific achievements are important.

In conclusion, it should be noted that, as the study showed, leadership in science has special characteristics (scientific recognition, behavior model, motives, expertise), so it is not universal (both in relation to other spheres and in relation to different fields of science). Leadership in science is a special phenomenon that can be studied from different sides.

For further work, it can be recommended to conduct an analysis within one scientific field and analyze whether there is a certain accepted (universal) model of leadership in one branch of science, whether there are certain problems with leadership and management in this area, etc.

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Модели научного лидерства в организациях сектора исследований и разработок в России: реконструкция на основе эмпирических данных

Светлана Андреевна Кораблева

Национальный исследовательский университет «Высшая школа экономики»,
Санкт-Петербург, Россия;
e-mail: sbolshakova@hse.ru

В статье рассматривается понятие лидерства в науке. Основной целью исследования является определение понятия лидерства и моделей лидерства в науке на примере сектора НИОКР в России. Для достижения цели было проведено качественное исследование, которое включало сбор данных путем проведения глубинных интервью и последующий анализ полученной информации. Всего в исследовании приняли участие 16 респондентов разных должностей, из разных областей науки и из разных городов. Важно отметить, что все респонденты занимали руководящие должности в научных организациях, что является важным элементом исследования, так как респонденты имеют большой опыт управления, поэтому их ответы основывались на практике.

В результате исследования были выявлены различные модели лидерства в науке, которые имеют свои специфические черты и особенности. Также в результате исследования было проанализировано общее представление о лидерстве в науке: что является основой лидерства в науке, какие черты должны быть присущи лидеру в науке и другие важные аспекты. Лидерство не является универсальным как по отношению ко всем сферам человеческой жиз-

ни (бизнес, наука и т. д.), так и по отношению к самой науке, хотя и существует большое количество схожих признаков. Однако научное лидерство имеет свои отличительные черты, которые во многом отличают его от других видов лидерства.
Результаты исследования критически важны, так как дают представление о лидерстве и управлении в науке. На данный момент система управления в науке не является широко распространенной темой для исследования, поэтому предлагаемая работа отличается актуальностью и научной новизной и может быть использована в качестве основы для последующих исследований.

***Ключевые слова*:** научное лидерство, лидерство в науке, научное признание, модели научного лидерства.