Dmytro Domin,
Dimitri Lunin,
Olena Domina,
Anton Komyshan,
Kristina Veski Saparali,
Vitalii Osadchyi

The technology of scientific and practical communications: InGraph case study

Monograph

Edited by
Doctor of Technical Sciences, Professor
Dmytro Domin

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Authors

Dmytro Domin
Doctor of Technical Sciences, Professor (Ukraine), Member of the Management Board InGraph LTD (United Kingdom)
ORCID: https://orcid.org/0000-0002-7946-3651

Dimitri Lunin
CEO InGraph LTD (United Kingdom)
ORCID: https://orcid.org/0000-0001-8500-3240

Olena Domina
Member of the Management Board Scientific Route OÜ (Estonia)
ORCID: https://orcid.org/0000-0002-3093-3085

Anton Komyshan
Senior Software Engineer, Simon Kuznets Kharkiv National University of Economics (Ukraine)
ORCID: https://orcid.org/0000-0002-3958-9698

Kristina Veski Saparali
UX generalist designer (USA)
ORCID: https://orcid.org/0000-0002-9264-1141

Vitalii Osadchyi
CEO Translation.in.ua (Ukraine)
ORCID: https://orcid.org/0000-0003-4242-6328

Abstract

The **InGraph** Platform is presented as an information-technological product's scientific and practical implementation. The logical, structural, informational, and technological implementation of this Platform provides a usable service to all subjects of scientific activity who create scientific works and use them: authors, reviewers, as well as end users engaged in science and practice. The Platform's mechanisms, which enable the interaction of all its users with each other, form the technology of scientific and practical communications on the principle «everyone gets what s/he needs, at a minimal time cost». Such technology, implemented through the Platform, creates the following possibilities for its users: self-realization, altruistic opportunities, social prospects, economic opportunities, and organizational capabilities. This allows us to argue about the multi-vector nature of the Platform, which creates an alternative model for the dissemination of scientific knowledge.

The **InGraph** Platform's concept implements the transition from a one-dimensional model of «scientist for scientist» or «science for science» to a two-dimensional model of «science for improving human well-being», thereby emphasizing the provision of practical needs based on the results of research as a priority for science. Such needs can be considered in the context of improving human well-being. Opportunities for users to find and receive the scientific and practical information they need are realized owing to the developed principle based on three-level access to content.

The developed feedback mechanism implemented on the Platform makes it possible to assess the objectivity of reviewers and offer opportunities for rating scientists, teams, and institutions while creating a comfort zone for users of scientific content. It also prevents events associated with the evaluation of content by incompetent users and minimizes the risks of collusion schemes between subjects of scientific activity.

The proposed procedure for assessing the price of scientific works submitted by authors on the basis of closed access, in the form of a function of their scientific quality and level of scientific novelty, makes it possible to implement the transparency of the formation of the cost of scientific content. The transactional mechanism of the Platform implements such a system of distribution of goods in which the dominant role is given to the authors of scientific works. Authors, at the same time, always have the opportunity to personally choose whether to provide their works in closed or open access, without any payment for publication in the latter case.

Keywords

Information-technological Platform **InGraph**, scientific and practical communications, Actors, scientific content, quality of scientific content, effectiveness of scientific activity, feedback mechanism for quality assessment, capitalization of scientific works.

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Introduction

Everything evolves for a purpose. It is unlikely that this thesis requires any evidence. The evolution of mankind is a continuous process of implementing this thesis; its vector is formed by representatives of science. The desire of scientists to satisfy their curiosity in understanding the world has always been combined with attempts to create something that could make life more convenient. It is noteworthy that the fundamental laws inherited by us, discovered by scientists of the past and stimulating the abrupt growth of human development, are quite simple. Therefore, in the scientific community, there is a known thesis that everything that «lay on the surface» has long been analyzed by researchers of the past. Despite the simplicity, owing to the discovery of these laws, modern science has the opportunity to «extract» new knowledge. The definition of «extraction» is appropriate since obtaining even insignificant new results predetermines the need for continuous improvement of research tools and methods, which is invariably associated with the need to invest in scientific enterprise. However, this does not necessarily guarantee results of any considerable significance.

The growth of scientific fields and areas, stimulated by the introduction of modern information systems and technologies, creates new expectations from the results of scientific activity. It is also natural to accept the desire of researchers to gain recognition for their results since the ambitions of scientists are part of the motivation of scientific activities. But what is the significance of these results and how can it be assessed? With a small amount of knowledge and a vital need for society to use it, this knowledge was transformed by business representatives into specific products for human activity. Thus, the motivation for profit by business representatives stimulated the development of science of the past.

However, at the present stage of development of society, a gap has emerged between the «quantity» of the scientific product produced and the ability to transform it into a specific product ready for human use. This is due both to a significant increase in the results of scientific research in all fields of science and to the form of their presentation to consumers. A scientific product in the modern sense is identified with a scientific publication, which means the need to assess its quality. But once the published research results do not reach the final consumer from the field of practice, there is a need to assess the effectiveness of scientific activity. This, in turn, gives rise to the need to devise criteria for such an assessment; the citation criterion turned out to be the most popular. The validity of this criterion is clear — the more a particular publication is cited, the more popular it is considered, and, therefore, represents a better study. However, this approach takes science away from the end user of its results. Those catego-

ries of society that create material values, as a rule, do not write scientific articles and do not quote them. As a result, the model of dissemination of scientific knowledge is implemented exclusively in the field of science while the scientific product of the scientist is used mainly by other researchers. Therefore, the communication model is one-dimensional and includes a system of connections only between subjects of scientific activity. The emphasis on such a model leads to the fact that the level of trust in science on the part of practice decreases with the model of communications among practitioners also acquiring a one-dimensional form. At the same time, for a practitioner, the possibilities of searching for scientific works that can be useful to him/her are limited due to the huge number of scientific publications and resources where they are published.

Finally, another important aspect of scientific activity should be noted — financial. The realization of the ambitions of a scientist by disseminating the results of his/her research is not always accompanied by financial success. Research grants are an important part for scientific actors, but they are not available to everyone. In this case, it is necessary to conduct research under conditions of limited funding or its absence at all. The motivation for this activity for a scientist is the desire to move up the career ladder in his/her institution, the speed of which largely depends on the indices of his/her citation. However, if the criterion for assessing the quality of scientific works is only citation indicators, then their usefulness for practice may be unjustified.

Thus, the modern model of communications in society, one way or another connected with the product of scientific activity, has a number of drawbacks:

- it is mainly not focused on the consumer of a scientific product that creates material goods;
- the search for funding for the research requires time and organizational resources from the scientist, distracting him/her from the main activity;
- motivation for a scientist associated with the recognition of his/her contribution to science and receiving financial remuneration is implemented in a limited way.

A more preferable model is a scientific communications model that takes into account the interests and implements the possibilities of meeting the needs of all parties involved. For scientists, this is the presentation of their works with the possibility of their capitalization; for practitioners, it is an opportunity to receive exactly those works that are of the greatest practical value for them and the opportunity to assess the quality of these works. For funding organizations, the transparency of assessing the quality of scientific works and the honesty of ratings, allowing for a more balanced selection of research teams for the implementation of projects for which they allocate funds. This model can also take into account the interests of society related to the provision of its services for multilingual communications, both in scientific and practical environments.

To implement the above with minimal time, a universal information resource is needed, which should have the following features:

- communication tools that are understood not in the sense of personal communication, as in social networks, but in the sense of providing opportunities to solve specific practical problems: for the authors of scientific works — to distribute them, for users — to receive these works, for funding organizations — to choose teams with the greatest potential for the implementation of funded projects;
- to be unified, providing an opportunity for authors not to look for scientific journals suitable for publication, and for users — not to choose journals from a large set in order to find the necessary scientific and practical information for themselves;
- to guarantee the transparency of the assessment of the quality of scientific content by reviewers;
- to provide a feedback mechanism for assessing the quality of content and the objectivity of reviewers;
- to give the opportunity for authors to place their works in open or closed access, and, in the latter case, capitalize on them;
- to assign copyright to the creators of scientific works, and not to their distributors;
- to give the opportunity to choose for reviewers the right to review scientific works uploaded on a volunteer basis or for a fee;
- to provide mechanisms that allow one to perform transactions and distribute funds between authors and reviewers;
- to ensure the honesty of the distribution of benefits in the process of creating and distributing scientific works on the basis of the primacy of their authors.

By meeting such requirements, this information resource would make it possible to implement an innovative technology for the dissemination and acquisition of scientific knowledge through an information-technological platform solution. It is based on the principles of transparency in assessing the quality of scientific works, both in scientific and practical terms. Therefore, the use of the concept of «technology of scientific and practical communications» is justified, emphasizing the fact that the communication system is based on the use of platform information-technological solutions. The **InGraph** Platform presented in this monograph is exactly the product that implements the technology of scientific and practical communications based on the use of the most popular mechanisms of interaction between scientists and practitioners, including transactional mechanisms. The presence of these mechanisms provides opportunities for the provision and acceptance of scientific papers and for a two-level assessment of their quality. In this way, the Platform differs both from social networks and information-technological products focused on publishing activities.

Chapter 1
Effectiveness of scientific activity and motivation for its subjects

1.1 Effectiveness of scientific activity of scientists

In paper [1], to assess the importance of scientific research and the significance of the contribution of a scientist, a quantitative indicator called an *h*-index is proposed. In support of the need for such an assessment, the author gives the following arguments. If a scientist has received the Nobel Prize, then his/her contribution to science is obvious and does not require other evidence. However, the number of such scientists is very small. Therefore, it is natural to assess the contribution to science of other participants in the world scientific community. Such an assessment is carried out by the following calculation: the scientist receives an index equal to h if h from all his publications is cited at least h times each. Such simplicity in determining the quantitative indicator was positively perceived by the part of the scientific community that deals with the issues of assessing the effectiveness of the scientist's activities. The possibility of rating on this principle has simplified the task of assessing the effectiveness of the activities of individual scientific teams, and even entire scientific institutions. Moreover, the proposed principle of assessment and comparison based on determining the *h*-index has become in demand precisely from the structures involved in hiring scientists, promoting them on the career ladder, and allocating grants for research.

However, despite its simplicity and expected usefulness as a criterion for an impartial comparison of researchers and their scientific achievements, the objectivity of the *h*-index is very conditional. In addition to the possibility of forming a system of agreements, especially if the scientific community in a given subject area is not so large, the assessment is carried out only within the scientific environment. These two circumstances are significant if we are talking about the importance of scientific research in the applied sense of this concept. Therefore, despite the fact that citation data contain useful information, the *h*-index expresses rather the interests of scientists working in the field of basic science.

The idea of the *h*-index based on the analysis of its advantages and disadvantages was advanced in works [2, 3]. It should be noted that this development was put on a mathematical basis, that is, it was guided by the formalization of the description of the evaluation criterion. Thus, the *g*-index was introduced as an improvement of the Hirsch *h*-index for measuring the global citation of a set of publications, taking into account the factor of their ranking. Once this set is ranked in descending order of the number of cita-

tions they received, the *g*-index will be the unique highest number at which the first *g* articles together received at least g^2 citations. Moreover, the uniqueness of the existence of *g* for any set of papers is proved at $g \geq h$ [2].

In addition, it was noted that the intensity of disputes regarding the methods of citation analysis is significantly reduced due to the appearance of simple and objective, in the opinion of the author of works [2, 3], indicators, such as the *h*-index. At the same time, it is noted that when using such a criterion, the subject area should be taken into account since it becomes necessary to compare the timing of publication and time periods of citation [3]. However, the rationale for using the *h*-index as a way to assess the effectiveness of a scientist's activities precisely according to the criterion of objectivity is the weakest link in the argumentation. This is due to the fact that the human factor cannot but play a role in the formation of appropriate ratings. The obviousness of this statement is based on the very principle of rating in which the results of citation are directly related to the communications of scientists who are in one way or another connected by common interests in their subject area.

The influence of the subject area and the factor of possible coincidence of the names and surnames of scientists on the efficiency of estimation using the *h*-index were investigated in [4]. It was concluded that the *h*-index is more appropriate in areas of science in which the typical number of citations per article is relatively small, for example, in mathematics or astronomy. For other areas, other assessment criteria may be preferable, for example, *h*(2)-index, more appropriate for chemistry and physics. In this case, the scientist's *h*(2)-index is defined as the largest natural number at which each of his/her *h*(2) most cited publication received at least $[h(2)]^2$ citations. It is especially noted that to verify the authorship of the corresponding publications, using the *h*(2)-index requires less work compared to using the *h*-index.

Paper [5] cites loss of information and low resolution as the main shortcomings of the *h*-index. A loss of information is caused by ignoring excessive citations, which can be misleading about the effectiveness of the scientist's activities. As evidence of this, an example is given when the total number of citations of the scientist's publications is much greater than that of many researchers with higher *h*-indices. The low resolution is due to the fact that the identity factor of the *h*-index for a group of scientists is not taken into account. Therefore, for more honest and accurate comparisons, work [5] recommends using an *e*-index in conjunction with the *h*-index. It has a simple geometric interpretation, representing the difference in the area bounded by the $CN=\mathrm{f}(PR)$ curve at the top at the interval from $PR=0$ to $PR=h$, and area h^2:

$$e^2 = \int_{PR=0}^{PR=h} CN(PR)\,\mathrm{d}(PR) - h^2, \tag{1.1}$$

where *CN* is citation numbers, *PR* is publication rank, *h* is the Hirsch index.

Thus, the *e*-index is positioned in the cited paper as a necessary complement to the *h*-index, especially for the evaluation of widely cited scientists or for an accurate comparison of the scientific results of a group of scientists who have an identical *h*-index. It is also noted that other indices of the h-type, for example, *R*- are *h*-dependent, have information redundancy with *h* and, therefore, when used together with it, they mask the real differences in the excessive citation of different researchers. The use of the *e*-index actually indicates a preference for those publications that are cited more often and, therefore, are of higher quality. Therefore, the way it complements the *h*-index, which focuses mainly on the number of citations, raises questions precisely because of the partial conflict between the *e*- and *h*-indices.

Further formalization on a mathematical basis of the evaluation criteria based on the citation of publications was carried out in [6]. Analyzing the existing indices such as the total number of citations, *h*-index, MaxProd-index, *w*-index, *h*(2)-index, a general method for constructing aggregation operators is proposed, based on the model for constructing zero-insensitive functions. Moreover, it is shown that the above indices can be obtained from the method proposed by the authors. The analysis of work [6] indicates that the criteria for assessing the effectiveness of the scientific activity of the scientist stimulated the development of the direction of research into the mathematical construction of factors of bibliographic influence, which are expressed in the form of citation indices or approaches to their construction. In support of this, study [7] is worth mentioning, in which a method for finding scalar estimates of the results of research activities of scientists is proposed, based on the calculation of metric distances between points of multidimensional space, the coordinates of which are composed of scalar estimates. The proposed method, termed the *PR*-*q*-method, is positioned as a modification of the *PR*-method used by the Google search engine.

Underlying the *PR*-*q*-method is a scalar assessment of the results of scientific activity of the *i*-th scientist, calculated as follows:

$$q_i = \sum_{j=1}^{n} \beta_{ij} \xi_j q_j, \; i = \overline{1,n}, \tag{1.2}$$

where q_i is an assessment of the research activities of the *i*-th scientist; β_{ij} is a coefficient determined by the number of citations of publications of the *i*-th scientist in the publications of the *j*-th scientist; ξ_j is the coefficient that ensures the existence of a non-trivial solution to the system of linear algebraic equations (1.2); q_j — evaluation of the research activities of the *j*-th scientist.

Scalar evaluation of the results of the scientific activity of the *i*-th scientist can be used in the vector integral assessment of the scientist's research activities proposed in [7]. At the same time, scalar *PR*-*q*-assessments can be components of the vector of the *w*-dimensional space of assessments of the following type:

$$F_i = \left(f_i^1, f_i^2, ..., f_i^w\right),\ i = \overline{1,n}, \tag{1.3}$$

where f_i^b is a scalar real assessment of the results of the scientific activity of the i-th scientist, which can be estimates of the h-index, g-index, e-index, PRq-score:

$$F_i = \left(h(i), g(i), e(i), PRq(i)\right),\ i = \overline{1,n}. \tag{1.4}$$

The effectiveness or efficiency of the scientific activity of the i-th scientist is assessed by the proximity of points F_i and F_i^* using various metrics: Euclidean (1.5), urban (1.6), Minkovsky for period $v > 2$ (1.7), or any other under a number of conditions:

$$\rho^1\left(F_i, F^*\right) = \sqrt{\sum_{b=1}^{w}\left(f_i^b - f^{b^*}\right)^2},\ i = \overline{1,n}, \tag{1.5}$$

$$\rho^2\left(F_i, F^*\right) = \sum_{b=1}^{w}\left|f_i^b - f^{b^*}\right|,\ i = \overline{1,n}, \tag{1.6}$$

$$\rho^3\left(F_i, F^*\right) = \left(\sum_{b=1}^{w}\left|f_i^b - f^{b^*}\right|^v\right)^{\frac{1}{v}},\ i = \overline{1,n}, \tag{1.7}$$

where F_i^* is a point in the w-dimensional space with coordinates f^{b^*}, which are estimates of the results of the research activities of scientists, the best in terms of achieving maximum efficiency or efficiency for the corresponding index (h-index, g-index, e-index, PRq-score, etc.):

$$f^{b^*} \geq \max_{i=\overline{1,n}}\left(f_i^b\right),\ b = \overline{1,n}. \tag{1.8}$$

In other words, the proposed integral assessment requires the proximity of the actual values of the effectiveness of the scientist's activities to some standard — the larger this proximity, the higher the effectiveness of the scientist. However, the question of what to choose as such a benchmark remains unanswered. If we take for it the highest values of the h-index, g-index, e-index, PRq-score, etc., then one needs to either take as a basis the indicators of the most effective scientist, or set some value chosen in advance. In both cases, the factor of subjectivity will be decisive.

Citation networks can be used to cluster publications [8, 9] and find citation relationships, which is of interest in terms of identifying individual groups of documents. The existence and absence of linkages in the citation of publications are used to determine the most important words related to a particular research topic. This, in turn, makes it possible to detect clusters of similar articles and can be practically useful for scientometrics. Approaches to the search for textual similarities in documents are explored

in works [10, 11]. In particular, it is proposed to classify the methods for determining the similarity of texts on the following principle: String-Based, Corpus-Based, Knowledge-Based. Particular attention is paid to the method of analysis of *n*-grams. Among the methods of clustering scientific publications, the greatest attention is paid to the spectral method [12], the method of maximizing modularity [13, 14], the method of factorization of the matrix [15], and the method of compiling a map of random walks [16].

The practical use of the results of such research may involve the search for scientific teams working within some subject, and the formation of working groups of research projects. However, works [8–16] do not reveal the mechanisms of the methods used to solve this problem. A comprehensive method designed for the formation of research project groups is proposed in [17]. It includes a two-stage method of clustering the citation graph of publications of scientists and a method of fuzzy logical inference to coordinate the opinions of experts on the selection of potential partners and include them in the project team.

The two-stage clustering method is based on clustering the citation graph and then combining clusters based on the proximity of publication abstracts. In this case, the distance between publications is calculated using the selected metric and *n*-gram analysis approaches. As a basis for the proposed method, the «text similarity model» is used on the basis of «one to one mapping» [18]. The essence of this method is to measure the semantic similarity of texts using a corpus-based measure of semantic similarity of words and a normalized and modified version of the string-matching algorithm for the longest total subsequence (LCS). The focus is on calculating the similarity between two sentences or two short paragraphs.

After determining the proximity of publication annotations, sufficiently close clusters can be combined based on the function of distances between papers [17]. This is done by finding the center of gravity for each of the clusters and combining those whose distance between the centers of gravity does not exceed a certain threshold value [19]. Further, each cluster is assigned a certain area of scientific research. Identification of the directions of research of scientists is based on the use of information on the publication activity of scientists, taking into account the built set of clusters of scientific areas to which these papers belong. The involvement of experts for this purpose predetermines vagueness of assessments, therefore, in [17] it is proposed to apply the method of three-stage fuzzy logical inference:

- fuzzification through the introduction of the membership function of the scientist to the area of scientific research;
- formation of requirements by experts for candidates for a place in the project team;
- defuzzification using the center of gravity method.

The described methods are recommended by the authors of work [17] for the formation of research groups and the identification of similarities between

fragments of text information. However, it was not determined how the contribution of selected partners to the research project could be assessed.

Comparison of texts using a vector representation can be carried out using latent semantic analysis (LSA), which solves the problem of selecting several relevant documents from a large database of documents that correspond to a given query [20]. The development of this method as a tool for searching and identifying scientific subject areas is proposed in [21], in which a probabilistic thematic model is built, which makes it possible to cluster publications of scientists in scientific areas, taking into account the citation network. This solves the issue associated with the increase in the instability of clustering of the citation graph due to a decrease in the number of clusters. Such a problem arises when combining clusters built on the basis of clustering the citation graph, taking into account the similarity of the annotations of scientific publications.

An overview of the process of clustering scientific disciplines using hybrid methods, identifying, and labeling new topics and analyzing the results using bibliometrics methods is given in [22]. The essence of the proposed hybrid clustering methods is to link bibliographic data, analyze text and «main documents», and use cross-reference links to identify new areas of references. The usefulness is shown of using the weights of the quoted and text components for fine-tuning in accordance with different cultures of citation in various fields of sciences: fundamental, applied, social, humanitarian sciences. This allows important information to be extracted when identifying new research topics at different time periods by using cross-citation detection. Important for the implementation of hybrid methods are publication activity, citation, and international cooperation.

The scheme of clustering of citation graphs on the basis of ensemble training is proposed in [23]. The idea behind ensemble learning is to study a few weak classifiers and use those weak classifiers to form a strong classifier. This makes it possible to get a high-quality result of the classification of areas with high performance. The development of the ideas of clustering can be found in [24] that tackles the grouping of scientists to identify areas in which groups of scientists closely cooperate. As data for this, it is proposed to use the results of scientific activities of these scientists: publication activity, citation of papers, etc. The practical result of such a grouping can be an assessment of the contribution of each scientist to the development of the relevant scientific direction. To this end, the procedure of clustering publications and the subsequent identification of scientists' research based on the results of clustering data on papers is performed. The clustering procedure is carried out in several stages:

- determining the distance between publications, taking into account the citation among them;
- determining the distance between publications based on the degree of proximity in the content of the abstracts of these papers;
- the clustering of scientific publications and analysis of its results.

To determine the distance between papers, taking into account citations, a relationship is established between publications and their citation in the form of a directed graph (P, C), in which papers from the set P are vertices, and citations C are the arcs of the graph (**Fig. 1.1**).

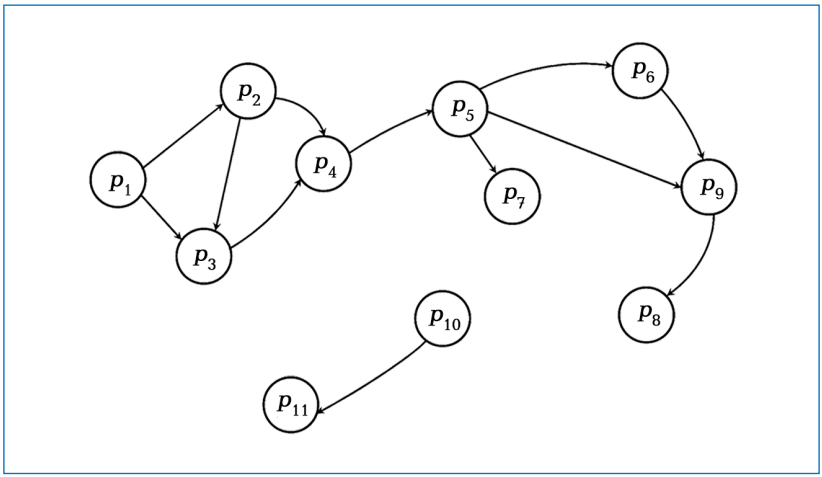


Fig. 1.1 Graph (P, C) that specifies the relationship between publications p_1, p_2,..., p_{11} and citations (arcs of the graph). 11 papers used for example [24]

To set the distance between publications, it is proposed to use the length of the minimum route between the corresponding vertices of the graph (P, C). If there is no route between the vertices, then the distance can be considered as large as one likes.

To determine the distance between papers based on the degree of proximity to the content of the abstracts of these publications, it is proposed to use the results of work [17].

An example of clustering for three clusters y_1, y_2, y_3 is illustrated in **Fig. 1.2**.

In the case of the appearance of a large number of clusters with a small number of elements, an algorithm for combining clusters is proposed, the result of which, for 11 papers (**Fig. 1.1, 1.2**), is illustrated in **Fig. 1.3**.

After carrying out the procedure of clustering the graph (P, C) and combining clusters close to each other, some correspondence is established between a particular cluster and the verbal name of the research area that this cluster represents. That is, each cluster is assigned a certain direction of scientific research. At the same time, information on the publication activity of scientists can be used, taking into account the built set of clusters of scientific areas to which these publications belong (**Fig. 1.4**).

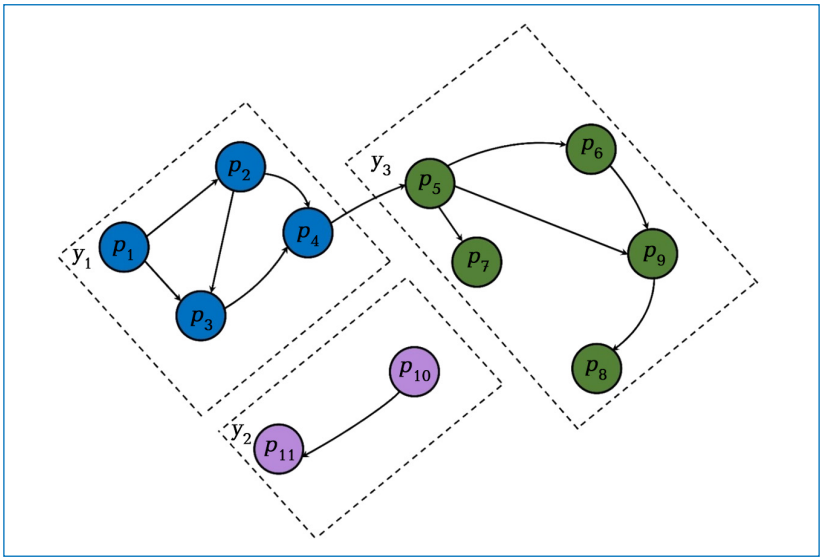


Fig. 1.2 Example of representing the results of clustering a graph (P, C) into 3 clusters y_1, y_2, y_3 for 11 papers (clusters are marked with different colors) [24]

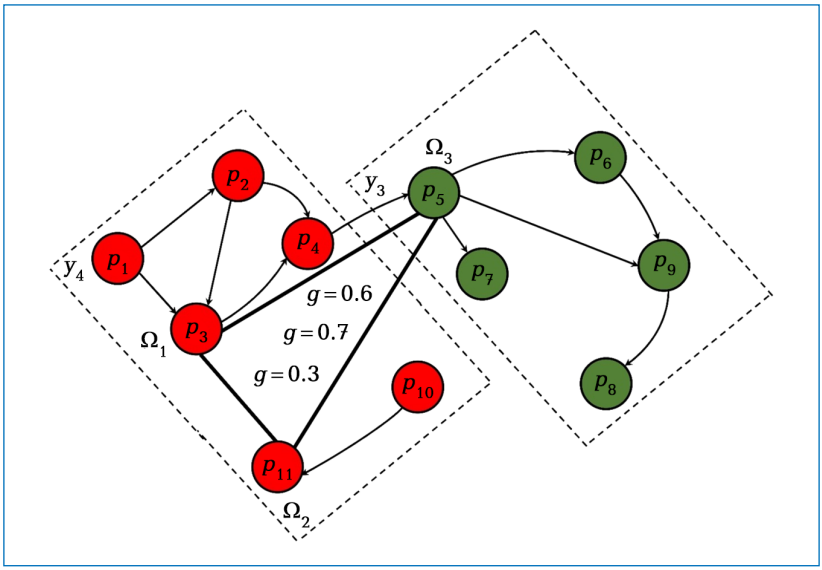


Fig. 1.3 Results of implementation of the algorithm of combining the constructed clusters for the graph (P, C) [24]

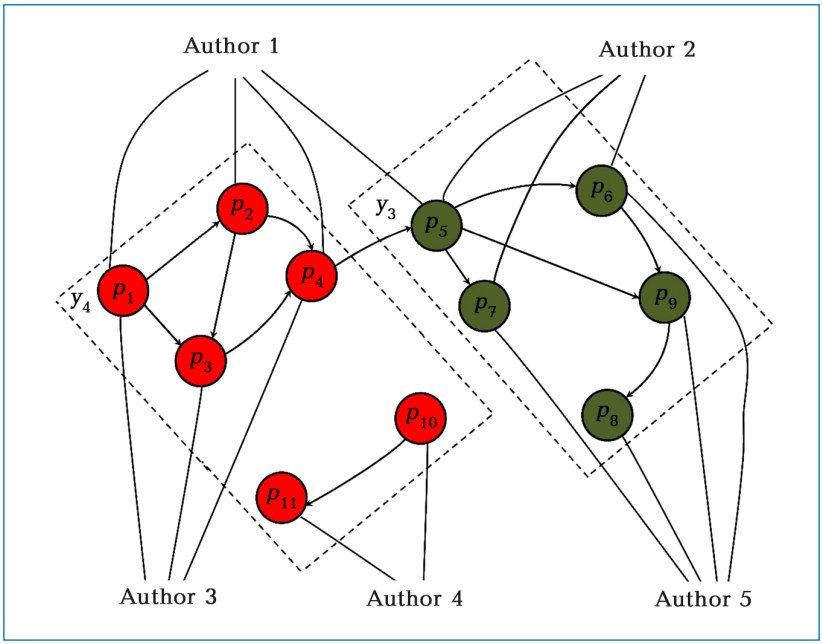


Fig. 1.4 Results of identification of research areas of scientists on the example of a graph (P, C) [24]

Clustering of scientific research as a basis for the formation of scientific areas, including the identification of existing current trends, the assessment of the contribution of individual scientists or the formation of scientific teams, is certainly important. Formalization of the clustering problem based on the use of the mathematical apparatus of graphs is justified but, from the point of view of practical implementation, it is difficult to implement. And this is due not only to the computational complexity related to the multidimensionality of the initial data but also to the lack of understanding of how many resources are required to achieve the goal. Resources here should be understood not only as software and hardware but also as human resources and a set of requirements that they must meet. In addition, it is obvious that the basis for assessing the effectiveness of scientific activities of scientists, through which decisions are made on the choice of scientific teams or ideas about the most relevant scientific directions and successes in each of them, is based on the concept of citation. And this means that such approaches provide only a one-dimensional representation of the effectiveness of the scientific activity of a scientist, which can be called as a «scientist for a scientist». Such a model may be of interest to theorists but does not take into account the interests of practitioners who are potentially ready to use the results of scientific research.

After all, for practitioners, the «income» from the use of the results of scientific research is important, and not how the world scientific community uses a particular paper in the process of its research.

1.2 Effectiveness of scientific activity of institutions

The role of bibliometric indicators in the context of forecasting future scientific achievements is emphasized in [25]. In support of this, the results of an empirical study are given to determine the predictive capacity of the *h*-index in comparison with other indicators of the effectiveness of scientific activity. It is concluded that the *h*-index is preferable for forecasting than the total number of citations, the number of citations per article, and the total number of papers. Work [26] explores the role of scalability in addition to the quantitative indicator *h* to quantify the impact of individual papers, both in time and in the subject area. This makes it possible to highlight the scientific contribution of an individual scientist and can be used as guidelines for theoretical models of a scientist's career growth. Probably, the affiliation of a scientist with a particular institution should have an appropriate impact on the contribution of this institution to the development of science. However, of no small importance in this case is the unambiguous identification of the scientist. To eliminate the ambiguity of the names of authors in very large sets of bibliographic data, study [27] reports an algorithm and a method for checking unambiguousness, based only on the charts of the authors and citations available for the entire period covered by the Web of Science. The algorithm involves performing a two-stage agglomeration clustering, which first connects individual papers, and then combines similar clusters. The algorithm is based on a pairwise metric of publication similarity based on shared co-authors, self-citations, shared references, and citations. The parameterized model proposed in that paper is optimized using the *h*-index-based completeness measure. It should be noted that Web of Science (WoS) metadata and Google Scholar profiles with cross-references were used as input data. That, according to the authors of work [27], contributes to the correct assignment of well-cited publications and the accuracy of the results obtained. Arguments are given regarding the usefulness of the *h*-index in real scenarios of academic ranking. Among these arguments is the demonstration of the coincidence of its forecasts with empirical data obtained from the *h*-index distribution model developed by the authors. It should be noted that today the universal solution that makes it possible to uniquely identify the scientist and helps reduce the likelihood of his/her incorrect affiliation is to assign a digital object identifier (DOI) [28].

Thus, it can be seen that the basis of the contribution of each scientist affiliated with a particular scientific institution to the assessment of the effectiveness of the scientific activities of this institution is the citation of

his/her papers. A quantitative assessment of his/her publication activity, expressed by a specific index or extended indices, is part of the overall quantitative assessment of the effectiveness of the scientific activity of the institution. The extension of such a view in relation to the quality of the scientific activities of the institution may be reduced to the fact that it may have the form of some numerical equivalent, reflecting the aggregate level of satisfaction with the relevant requirements and criteria imposed on the research institution/university by the relevant Ministry of Education/Science of a country. The fulfillment of such requirements should occur within a certain time frame and at the proper quality level [29]. However, it should be emphasized that the institution itself should be considered precisely as a scientometrics subject, emphasizing the fact that the quantitative assessment is based on the indicators of publication activity and citation indicators of scientists affiliated with this institution. Therefore, a set of bibliometric indicators for assessing the effectiveness of the scientific activities of the institution is certainly important.

To determine the generalized indicator of the quality and results of scientific research of a particular institution, work [29] builds a mathematical model for the representation of scientometrics subjects in the web space and, with its help, implements the method of integral assessment of the quality of scientific activity of the institution. This model takes the following form:

$$DB = \left\langle \bigcup_{t=t_0}^{t_1} \left(\bigcup_{i=1}^{n_S} D^S(C_i) \right), \left(\bigcup_{i=1}^{n_J} D^J(C_i) \right), \left(\bigcup_{i=1}^{n_I} D^I(C_i) \right) \right\rangle, \quad (1.9)$$

where $D^S(C_i)$ is the set of data and metadata of scientometrics subjects reflecting the level of the hierarchy «publication» S, n_S is the total number of papers in the system; $D^J(C_i)$ — the set of data and metadata of scientometrics subjects, reflecting the level of the hierarchy «journal» J, n_J — the total number of journals in the system; $D^I(C_i)$ — the set of data and metadata of scientometrics subjects, reflecting the level of the hierarchy «institution» I, n_I — the total number of institutions in the system; t_0 — the time when the first link to the publication was registered in the system; t_1 — current point of time; $t \in [t_0; t_1]$ — the period of time within which the evaluation of the institution for J=const, I=const takes place.

The method of integral assessment of the quality of scientific activity of the institution involves the introduction of a set of criteria $K = \{k_1, k_2, ..., k_i\}$, and the assignment to each of them of its assessment: «qualitatively», satisfactorily», «poor quality» (**Fig. 1.5**).

Evaluations of the criteria are assigned the following interpretation:

- qualitatively: it is considered that the fulfillment of the current criterion fully meets the requirements and capabilities of the institution;
- satisfactory: in general, the value of the indicator is acceptable but for some reason cannot be considered qualitative;

- poor quality: the value of the indicator in no way satisfies the corresponding criterion or requirement for the institution.

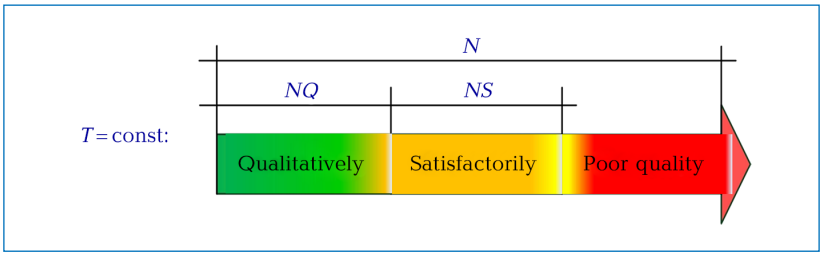


Fig. 1.5 Scale of meeting the criteria for the quality of scientific activity of the institution for the period of time T=const: N is the total number of criteria and requirements that the institution must meet; NQ — the number of criteria meeting which corresponds to the zone of «qualitatively»; NS — the number of criteria meeting which corresponds to the «satisfactory» zone [29]

To quantify the assessments, it is recommended to involve experts whose opinions are taken into account in the calculation of the quality indicator of the scientific activity of the institution (QSA) according to the k-th criterion:

$$QSA_u(k) = \frac{\Delta t}{t_1 - t_0} \sum_{t=t_0}^{t=t_1} \frac{NQ_E(t) + \frac{NS_E(t)}{2}}{N_E}, \tag{1.10}$$

where N_E is the total number of experts evaluating the effectiveness of the institution; NQ_E — the number of experts who assessed the criterion as «qualitative»; NS_E — the number of experts who assessed the criterion as «satisfactory».

The authors of work [30] postulate that the effectiveness of higher education establishments should be based on only one criterion, called the effectiveness of institutional research (IRP). On the basis of this criterion, a model for measuring the research productivity of universities is proposed. The productivity of institutional research is calculated using an indicator consisting of three institutional variables A, B, C, and one parameter F: the number of papers published in peer-reviewed journals (A), the number of published books (B), the number of case studies and/or book chapters (C) published during a given observation time, the number of full-time lecturers (F). The value of the F parameter is taken to be constant during the specified observation period. This view made it possible to develop an institutional ranking structure based on institutional research productivity, taking into account the calculated index of institutional research.

As criteria for evaluating an institution, academic reputation and achievements, infrastructure development, location, professional level of lecturers, availability and level of research base can also be taken into account. Under such conditions, it is important to take into account the inconsistency of some criteria, therefore, as an option for solving this problem, it is proposed to use the TOPSIS method, which is one of the methods of decision-making on several criteria (MCDM) [31]. The issues of rating institutions are also considered in work [32] but, unlike [31], where the validation of the proposed solutions is carried out for engineering colleges, business schools are chosen as objects of research there.

The representation of universities in the format of a set consisting of institutional components, with an emphasis on their correlation, can be found in [33]. University performance indicators are determined using nonparametric data coverage analysis (DEA) with different sets of inputs and outputs and taking into account differentiation by boundaries. In particular, for universities in Europe and the United States, the following boundaries are introduced: global (all universities are united together), regional (Europe and the United States have their own borders), borders of a particular country. Among the factors of external influence on the efficiency of activity, institutional parameters such as the size and composition of the university department, its location, and funding structure are considered. Thus, in work [33], the research activities of universities as a factor in the effectiveness of its activities did not receive a proper assessment.

Formalization of a comprehensive assessment of the results of universities' activities based on the use of the simplex method is proposed in [34]. The assessment is carried out by calculating the volumes of m-simplexes, using selected indicators reflecting the main aspects of the university's activities.

At the same time, assessments of the activities of universities in various categories, obviously expressing efficiency, are represented by the authors of work [34] by the vertices of the simplex in the $(m+1)$-dimensional space of the set of real numbers R:

$$\nu_i \in R^{m+1},\ i=\overline{0,m}. \tag{1.11}$$

That is, the m-simplex introduced in [34] is a set of points $\Delta^m \in R^{m+1}$, the geometry of the location of which in the space of assessments of the activities of universities by categories depends on the number of selected categories:

- Δ^0 (0-simplex) is a point in one-dimensional space (**Fig. 1.6**);
- Δ^1 (1-simplex) is a segment in two-dimensional space (**Fig. 1.7**);
- Δ^2 (2-simplex) is a triangle in three-dimensional space (**Fig. 1.8**),
- Δ^3 (3-simplex) is a tetrahedron in four-dimensional space (**Fig. 1.9**), and so on.

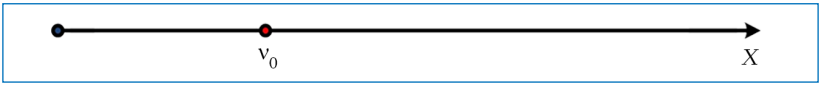


Fig. 1.6 0-simplex (point within R) [34]

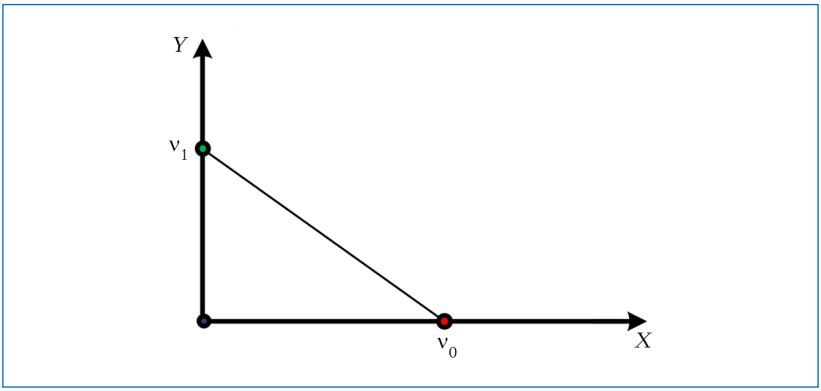


Fig. 1.7 1-simplex (segment within R^2) [34]

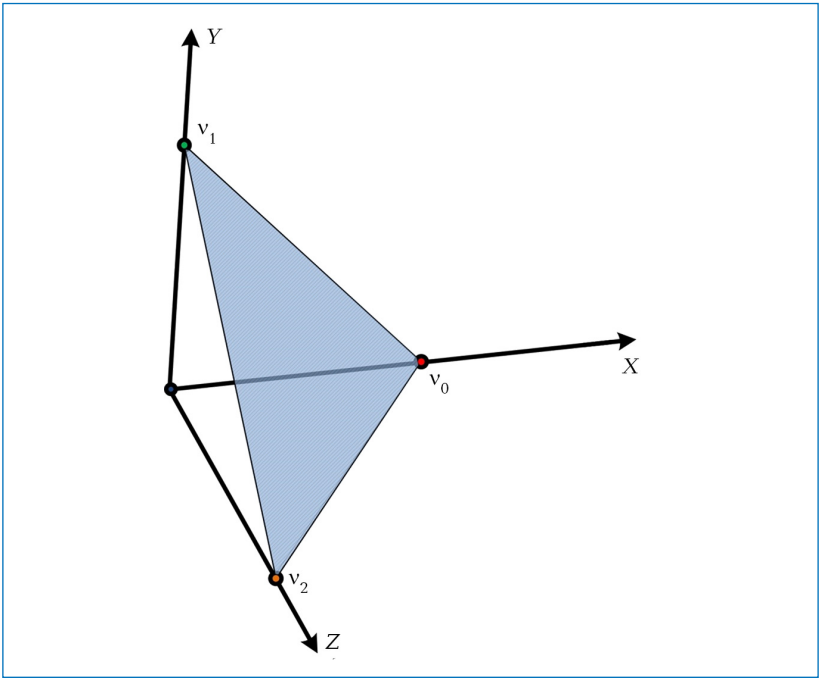


Fig. 1.8 2-simplex (triangle within R^3) [34]

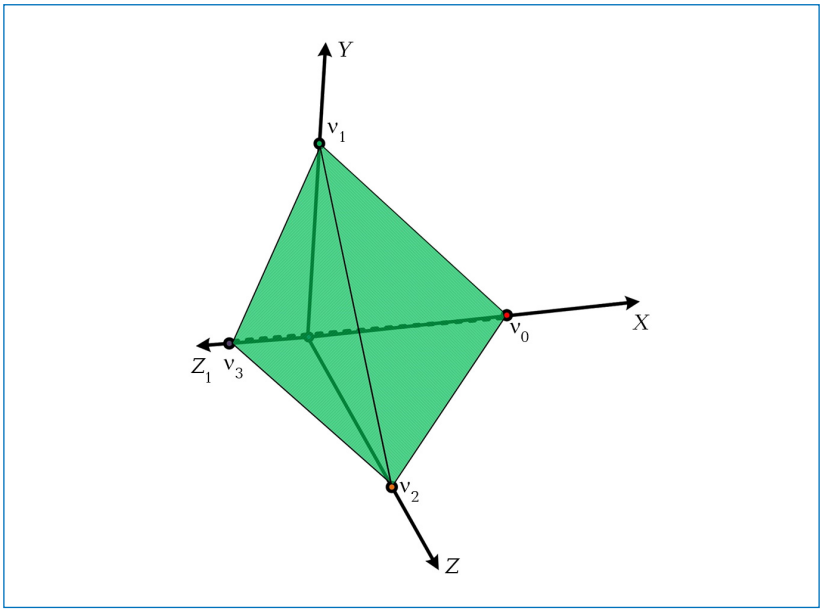


Fig. 1.9 3-simplex (tetrahedron within R^4) [34]

To calculate the generalized volume of the *m*-simplex, the formula by Cayley-Menger can be used [35]. A comprehensive assessment $Q^T(S)$ of the activity of the University S for the time period T can be found from the following formula:

$$Q^T(S) = V\left(\Delta^m\right), \tag{1.12}$$

where $V\left(\Delta^m\right)$ is the generalized volume of the *m*-simplex with vertices at points ν is the essence of the assessments of the effectiveness of the university's activities in the selected categories.

Applied information technology of planning and administration in the project-vector management of educational environments is proposed in [36]. The research component, as a factor in the effectiveness of the activities of institutions — objects operating in such environments, $V\left(\Delta^m\right)$ is included at the level of subjects of scientific and educational activities: scientists, universities and their structural units, for example, institutes, faculties, departments, groups of scientists, united by the implementation of a common project. To formalize the processes of project management, which include projects of educational and research orientation, it is proposed to use Markov chains [37]. The structure of communication between the main subjects of the educational environment (SOE) and the implementation

of the Markov chain for the project environment, as objects of educational and research orientation, can be used to form the vector of administration of the project of a certain SOE. Paper [38] considers the features of the use of Markov chains for the formation of the life cycle of scientific papers, which depends on the publication activity of scientists and the citation of their articles.

The effectiveness of universities through the prism of scientific research conducted by their employees is considered in [39]. The main emphasis is on the importance of publication activity. For a comparative analysis of the effectiveness of university employees, as subjects of the institution, it is proposed to formalize this problem in the class of multi-criteria optimization problems, for the solution of which methods of multi-attributable choice of options are used. The obtained solutions make it possible to choose research teams that provide better efficiency, establishing scientific communications. The latter play an important role in improving the performance of universities, including by expanding the capabilities and geography of publications.

Social networks analysis (SNA) is used in work [40] to study papers, citation networks, including mutual citations, communication structures of subjects of scientific activity. The network of co-authorship of scientists as a prototype of complex evolving networks is considered in [41]. The approaches proposed in the framework of that study make it possible to identify dynamic and structural mechanisms that control the evolution and topology of this complex system.

Paper [42] describes the practical results of the study of the structure of networks of scientific cooperation in the field of scientometrics at the level of individuals, and, in work [43], the concept of related scientists is introduced to study the structure of scientific cooperation networks. Two scientists are considered as such if they wrote a paper article together. Explicit networks of such links have been built using data taken from a number of databases, including MEDLINE (Biomedical Research), Los Alamos e-Print Archive (Physics), and NCSTRL (Informatics).

These networks of collaborations have been shown to form «small worlds» in which randomly selected pairs of scientists are usually separated only by a short path of intermediate acquaintances.

The presence of clustering in networks is shown and a number of differences in the models of cooperation between the studied areas are highlighted.

The need for inter-agency cooperation to achieve certain objectives in the context of efficiency is evident, especially in the context of limited resources and lack of the necessary internal competencies. This circumstance is emphasized in work [44], which analyzes the factors of choosing a partner in bilateral alliance projects depending on the type of partner and the type of innovative project. The use of genetic algorithms for the

selection of partners and the formation of an optimization model for virtual corporations is proposed in [45].

The results of studies [39 – 45] can be used to form information spaces of subjects of scientific activity but do not take into account the factors of dynamics, which is especially important in the modern, rapidly changing world. Changing external conditions and improving the requirements for the quality of functioning of scientific and educational institutions predetermine the need for rapid adaptation to them.

Some solutions in this part can be found in work [46], tackling the development of a method for the formation of information spaces of subjects of scientific activity. The practical purpose of such a development is to create conditions for ensuring the sustainability of the development of higher education. The introduced conceptual apparatus, based on the formation of information spaces of subjects of scientific activity, made it possible to build multiple models of identification and a conceptual scheme for the interaction of individual and collective subjects of scientific activity.

The collective subject of scientific activity is represented in work [46] by a set of identifiers that determine it:

$$\aleph^{C}(a_i,t)=\left\langle \Phi_1(a_i,t),\Phi_2(a_i,t),\Phi_3(a_i,t),\Phi_4(a_i,t),\Phi_5(a_i,t)\right\rangle, \tag{1.13}$$

where $\Phi_1(a_i,t)$ is a standardized assessment of the international activity of a scientific entity a_i at time t, e.g., the number of internships of employees of a collective scientific entity abroad, the number of projects with foreign funding; $\Phi_2(a_i,t)$ – standardized assessment of the cohort of applicants for higher education of a collective subject of scientific activity a_i at time t, if the subject provides educational services, for example, is an institution of higher education; $\Phi_3(a_i,t)$ – a standardized assessment of the scientific or scientific-pedagogical staff of the collective subject of scientific activity a_i at time t, can be an average quantitative assessment of the productivity of employees for a certain period of time; $\Phi_4(a_i,t)$ is a standardized quantitative assessment of the research activities of a collective subject of scientific activity at time t; $\Phi_5(a_i,t)$ is a standardized assessment of the available resource provision at time t, in particular the material and technical support of the collective subject of scientific activity.

The conceptual scheme of interaction between individual and collective subjects of scientific activity in the case of such a representation takes the form shown in **Fig. 1.10**.

Thus, the subject of scientific activity is represented by a set of identifiers, including many publications, quotations, abstracts, performance assessments, and international projects in which this subject participates. However, collecting data to implement the proposed approach presents considerable difficulty, which makes practical use problematic.

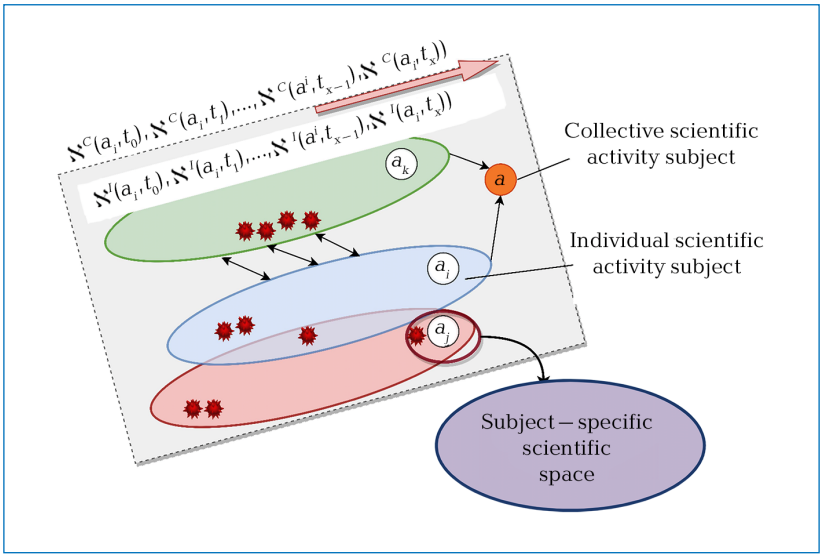


Fig. 1.10 Conceptual scheme of interaction between individual and collective subjects of scientific activity [46]

The development of the idea of the formation of information spaces of subjects of scientific activity is reported in work [47], where the significance of the project structure and the dynamics of scientific productivity in the corresponding subject spaces are established. This makes it possible to choose the subjects of scientific activity and performers in specific subject spaces. The authors conclude that the use of the developed method makes it possible to reduce the subjective influence on the decision on the choice of project implementers, guided only by open sources of information, the productivity of potential performers, their competence, etc. Thus, the assessment of the effectiveness of scientific activities of institutions is considered mainly from the standpoint of the theory of project management where the choice of team [48–50] or partners comes to the fore [51]. It is natural to assume that of particular importance in such a consideration is the set of competencies that each participant must possess in order to achieve the overall goal of the project. The success of such implementation is also a factor determining the effectiveness of the scientific activities of the institution. In this regard, the results of work [52] tackling the development of a competence method for the formation of information spaces of the executors of educational projects in a dynamic environment are of interest. To assess the competencies of the executors of educational projects, it is proposed to calculate three components: assessment of the knowledge of the performer, assessment of the performance of the performer, assessment of the personal

qualities of the performer. Based on the received assessments, generalized assessments of the level of competence of each performer are formed. These assessments for each implementer of a particular educational project are used to determine the level of productivity and potential of this project. The formalization of this task is as follows.

The set $E=\{e^1, e^2, ..., e^m\}$ of m performers of the educational project A is introduced. Each element of this set is assigned three competencies $K(t)$, $P(t)$, $I(t)$, the values of which discretely change in time. The time points t_0, t_1,..., t_{w-1} are introduced in which the values of the selected competencies are recorded. In this case, it becomes possible to record the time series of assessments of the competencies of the performer e_j in the following form:

$$K^j=\left(K_0^j,K_1^j,\ldots,K_{w-1}^j\right)=\left(K^j\left(t_0\right),K^j\left(t_1\right),\ldots,K^j\left(t_{w-1}\right)\right), \tag{1.14}$$

$$P^j=\left(P_0^j,P_1^j,\ldots,P_{w-1}^j\right)=\left(P^j\left(t_0\right),P^j\left(t_1\right),\ldots,P^j\left(t_{w-1}\right)\right), \tag{1.15}$$

$$I^j=\left(I_0^j,I_1^j,\ldots,I_{w-1}^j\right)=\left(I^j\left(t_0\right),I^j\left(t_1\right),\ldots,I^j\left(t_{w-1}\right)\right), \tag{1.16}$$

where K^j is a discrete time series for assessing the knowledge of the performer e_j of educational project A in the educational field according to the tasks of project A that this performer must perform; P^j is a discrete time series for assessing the performance of the performer e_j of the educational project A; I^j is a discrete time series for assessing the personal characteristics of the performer e_j, $j=\overline{1,m}$.

Thus, the executor of the educational project A at the i-th time point $i=\overline{0,w-1}$ is represented by a set of identifiers that determine it:

$$e_i^j=\left(K_i^j,P_i^j,I_i^j\right),\ j=\overline{1,m}. \tag{1.17}$$

After that, the value chain of project A is formed, which is provided by the performer e^j: $\left\{F\left(e^1\right),F\left(e^2\right),\ldots,F\left(e^m\right)\right\}$.

The total value assigned to project A is defined as the sum of the values provided by each performer:

$$F_A=\sum_{j=1}^{m}F\left(e^j\right). \tag{1.18}$$

Having a value system obtained in this way for a certain period of time $i=\overline{0,w-1}$, it becomes possible to standardize competency assessments:

$$\overline{K}_i^j=\frac{K_i^j-\min\limits_{j=1,m}K_i^j}{\max\limits_{j=1,m}K_i^j-\min\limits_{j=1,m}K_i^j}, \tag{1.19}$$

$$\overline{P}_i^j = \frac{P_i^j - \min\limits_{j=\overline{1,m}} P_i^j}{\max\limits_{j=\overline{1,m}} P_i^j - \min\limits_{j=\overline{1,m}} P_i^j}, \tag{1.20}$$

$$\overline{I}_i^j = \frac{I_i^j - \min\limits_{j=\overline{1,m}} I_i^j}{\max\limits_{j=\overline{1,m}} I_i^j - \min\limits_{j=\overline{1,m}} I_i^j}. \tag{1.21}$$

After implementing these procedures, the average values of competence assessments at each point in time can be found $i = \overline{0, w-1}$:

$$\widetilde{K}_i = \frac{1}{m}\sum_{j=1}^{m} \overline{K}_i^j, \tag{1.22}$$

$$\widetilde{P}_i = \frac{1}{m}\sum_{j=1}^{m} \overline{P}_i^j, \tag{1.23}$$

$$\tilde{I}_i = \frac{1}{m}\sum_{j=1}^{m} \overline{I}_i^j. \tag{1.24}$$

Analysis of the proposed approach leads to the conclusion that its practical implementation requires the involvement of experts who must also have a set of specified competencies. It is also important to take into account the fact that modern higher education highlights the possibility of preparing graduates already adapted to the environments in which they will apply the knowledge and skills acquired at the university. And if primary knowledge in specific subject areas or individual disciplines can be obtained from educational literature in Internet sources, then solving specific practical problems in specific companies requires the skills to conduct research work, at least at the initial level. And this implies that the educational process cannot be separated from the research process. This encourages lecturers to conduct independent research, the results of which should be published, and to involve students in it, thereby giving them initial experience in such activities. Therefore, publication activity and the quality of scientific papers are an integral part of the implementation of projects aimed at improving the efficiency of universities. Thus, in the center of everything is a scientific article as a product of the activities of a scientist-teacher of higher education.

1.3 The brand of a scientific journal as a «guarantee» of the quality of scientific publications

Citation indices were well received by publishers and formed the basis for assessing scientometrics indicators of scientific journals. Among

them are the most famous Impact factor (IF) [53], SCImago Journal Ranking (SJR) [54], CiteScore, Source-normalized impact per paper (SNIP) [55].

Impact factor of a journal. IF is a numerical indicator of the importance of a scientific journal showing how many times on average published articles are cited over a three-year period:

$$\mathrm{IF} = \frac{NC_k}{NC_i + NC_j},\ i = k-2,\ j = k-1, \tag{1.25}$$

where NC_k is the number of citations of the k-th year, NC_i is the number of citations $(k-2)$-th year, NC_j is the number of citations $(k-1)$-th year. Thus, the relationship between the time periods in which the number of citations is estimated is expressed formally by the graph shown in **Fig. 1.11**.

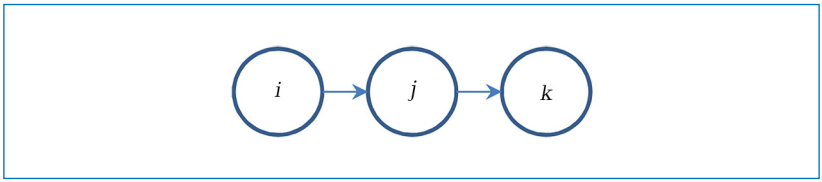


Fig. 1.11 Connection graph of time periods of citation

It should be noted that the impact factors of journals are fundamentally different for different disciplines.

SCImago Journal Ranking. SJR is a ranking score of scientific journals that takes into account not only the total number of citations but also weighted citation rates by year and qualitative indicators, such as the authority of references. The more authoritative a scientific journal, the higher its weight characteristic, so with an equal number of citations, its SJR will be higher. The credibility of the journal implies the number of citations in prestigious scientometrics databases — Scopus and/or Web of Science. Given that the scientometrics indicators are different for different scientific subject areas, the SJR rating actually evaluates the weighted number of citations obtained by a series of publications, taking into account the area of knowledge. In general, SJR is not very different from the impact factor.

The rating of journals by SJR can be tracked directly from [54]. An example of its representation is shown in **Fig. 1.12**.

For each scientific journal, a set of indicators is formed that characterize its influence in dynamics:

$$\mathrm{SI} = f(t), \tag{1.26}$$

where t is a moment in time, SI is a scientometrics indicator: SJR, Total Documents, Total Cites, Self-Cites, External Cites per Doc, Cites per Doc, % International Collaboration, Cited documents, Uncited documents.

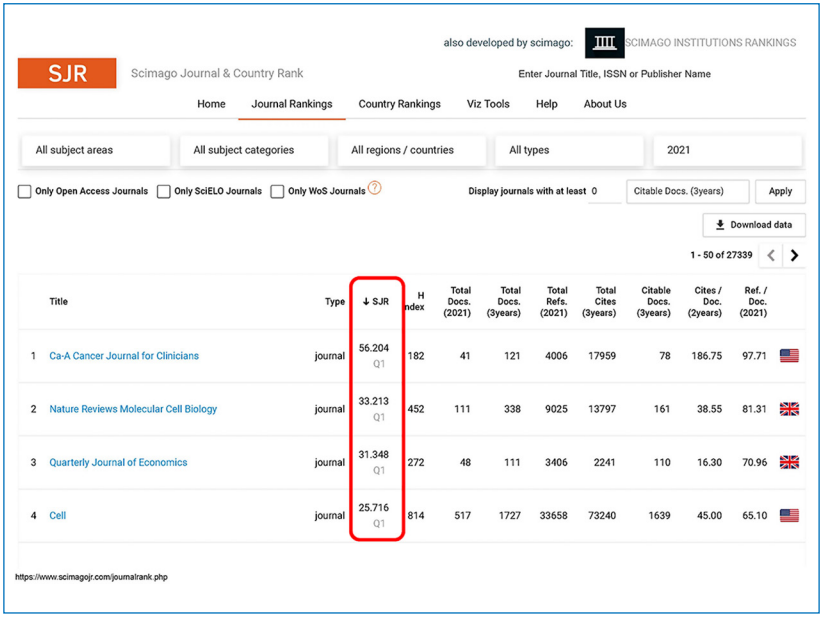


Fig. 1.12 Example of rating journals by SJR [54]

An example of the representation of such indicators is shown in **Fig. 1.13–1.18** for the **Eastern-European Journal of Enterprise Technologies** (ISSN 1729-4061 (online), ISSN 1729-3774 (print)) [56, 57]; Publisher: **PC TECHNOLOGY CENTER** [58].

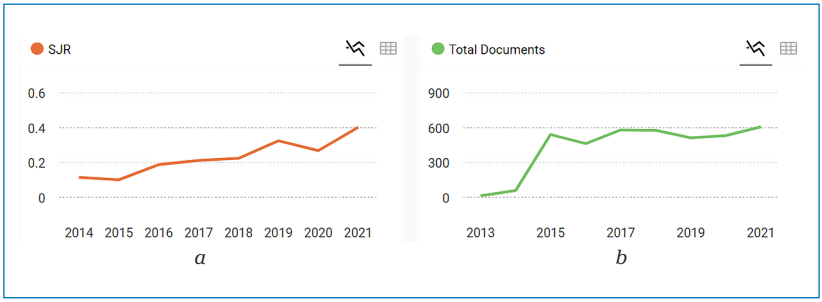


Fig. 1.13 Indicators of the journal in dynamics:
a — SJR, b — Total Documents [54]

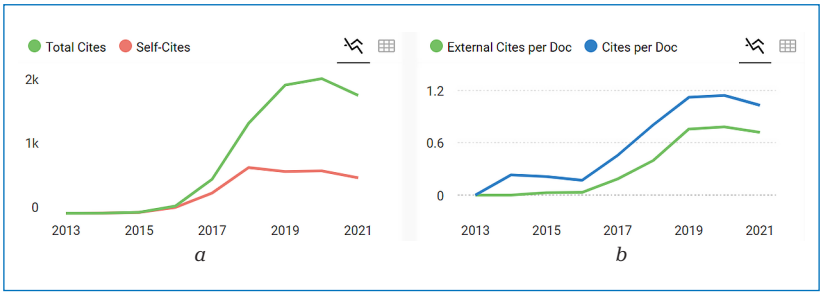


Fig. 1.14 Indicators of the journal in dynamics:
a — Total Cites vs Self-Cites, *b* — Total Cites vs Cites per Doc [54]

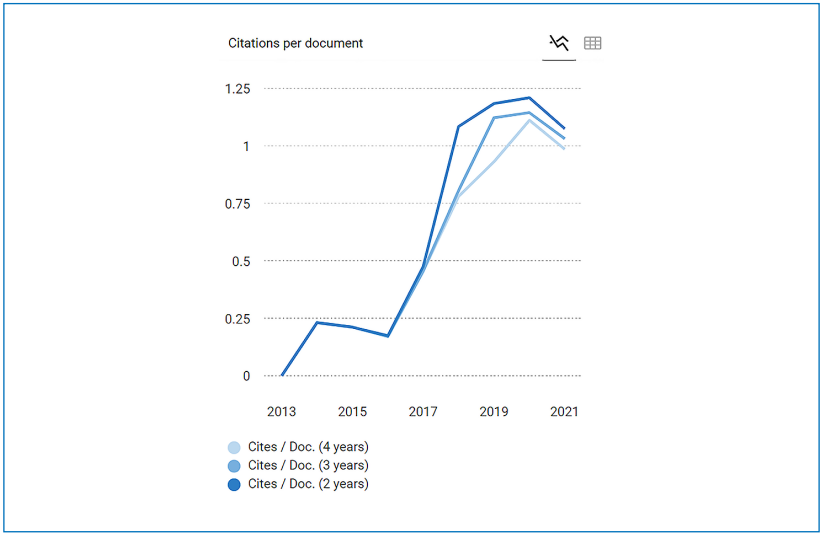


Fig. 1.15 Indicator Citations per document by different time periods [54]

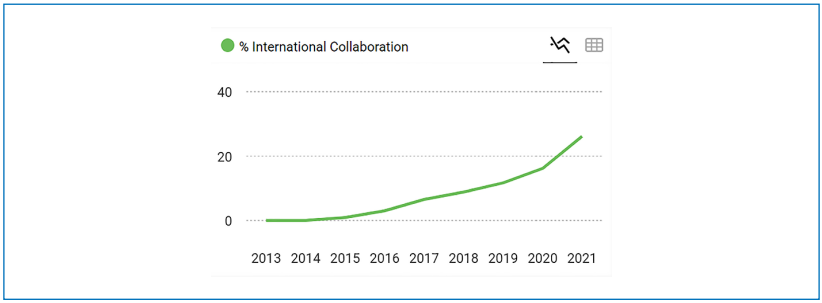


Fig. 1.16 Indicator (%) International Collaboration [54]

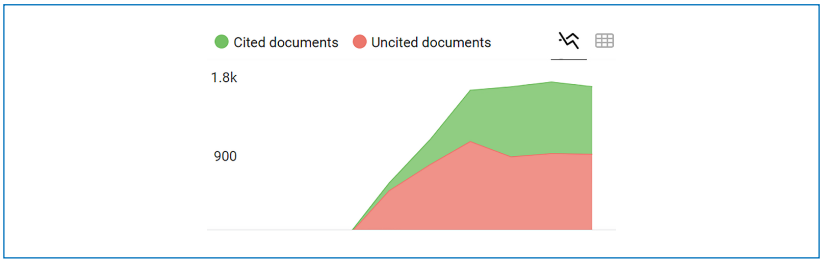


Fig. 1.17 Indicator Cited documents vs Uncited documents [54]

The generalization of all data is presented in the form of a journal SJR (**Fig. 1.18**) and its H-index is calculated (**Fig. 1.12**).

In addition to the above indicators, an internal division into quartiles is introduced, ranking the journals from the highest to the lowest based on the impact index: Q1, Q2, Q3, and Q4. Such data make it possible to extract additional scientometrics information for further analysis of the relevance of the journal in the world scientific community. **Fig. 1.19** shows an example of the relationship between the levels of citing and cited journals according to their quartiles. As an example, the journal **EUREKA**: **Physics and Engineering** (ISSN 2461-4262 (Online), ISSN 2461-4254 (Print)) [59], Publisher: **Scientific Route OÜ** [60], is given.

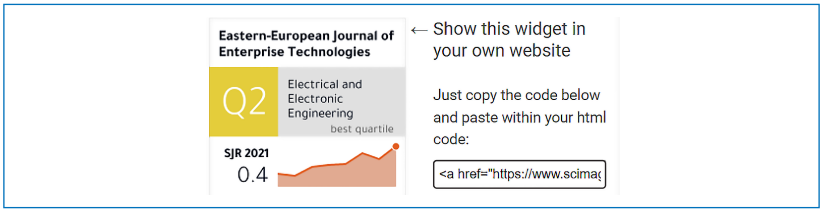


Fig. 1.18 Journal SJR [54]

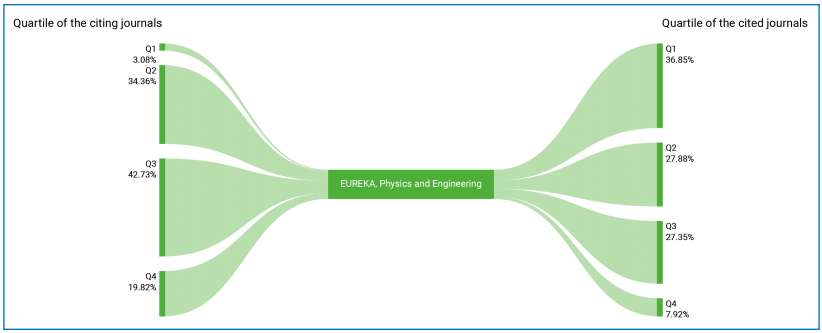


Fig. 1.19 Example of relationships between levels of citing and cited journals [54]

The scientometrics indicators of journals may also include indicators of the relationships between citing and cited journals, represented in the form of a network (**Fig. 1.20**).

The example given is the journal **ScienceRise: Pharmaceutical Science** (ISSN 2519-4852 (Online)), ISSN 2519-4844 (Print)) [61, 62], Publisher: **PC TECHNOLOGY CENTER** [58].

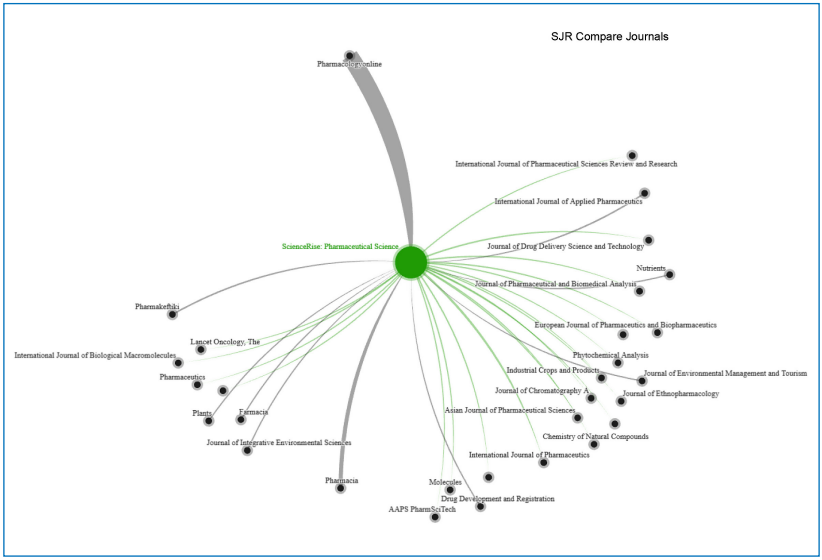


Fig. 1.20 Example of relationships between citing and cited journals [54]

CiteScore. The CiteScore indicator characterizes the average number of citations received by each document published in the periodical:

$$\text{CiteScore} = \frac{NC(T)}{ND(T)}, \tag{1.27}$$

where $NC(T)$ is the number of citations of papers published in the journal for the time period T (T=3 years), $ND(T)$ is the number of documents (published articles) for the time period T.

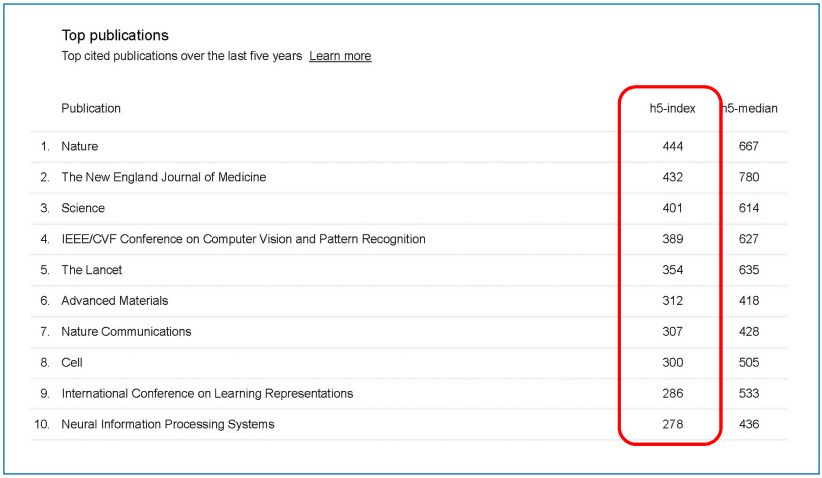
Source-normalized impact per paper. SNIP is a source-standardized level of citation of an article that characterizes the number of citations actually received in relation to the expected amount of knowledge for a given area of a series of publications.

Indicators SJR, CiteScore, SNIP that are relevant as of a given period, provided for by the structure and principles of calculation of each of them,

are displayed in the profile of the corresponding journal in the scientometrics database Scopus (**Fig. 1.21**).

Citation indicators of scientific papers form the rating of scientific journals in Google Scholar [63]. In particular, the *h*5 index is used — the Hirsch index for articles published in the last 5 full years (**Fig. 1.22**). The *h*5 index is equal to *h* if each of *h* papers published over five years is cited at least *h* times.

Fig. 1.21 Example of a journal profile in the scientometrics database Scopus [55]



	Publication	h5-index	h5-median
1.	Nature	444	667
2.	The New England Journal of Medicine	432	780
3.	Science	401	614
4.	IEEE/CVF Conference on Computer Vision and Pattern Recognition	389	627
5.	The Lancet	354	635
6.	Advanced Materials	312	418
7.	Nature Communications	307	428
8.	Cell	300	505
9.	International Conference on Learning Representations	286	533
10.	Neural Information Processing Systems	278	436

Fig. 1.22 Example of ranking journals by *h*5 index in Google Scholar [63]

A review of sources [53 – 55, 63] allows us to state that the citation rates of publications are decisive in assessing the quality of scientific journals.

The status of the resource indexing the journal is important. The scientometrics assessment tools offered by such resources are attractive for solving the problems of quantitative assessment of the quality of scientific activity. Analytics that can be synthesized on the basis of a set of scientometrics indicators makes it possible to rate journals, thereby forming their «branding», tracking current trends in research in different subject areas, and identifying connections between journals, scientists, research teams. The «branding» of the resources that provide such opportunities is attractive to journals as well. The desire of journals to be included in such resources is explained by new opportunities for attracting authors for whom the fact of citation of their publications in the environment of the relevant resources is also important. The formation of the determining quantitative indicators of their publications, mainly the *h*-index, provides them with career advancement, depending on the value of the *h*-index or the impact factor of the journals in which his/her papers are published. The same indicators are important for the ranking of universities since they occupy a share of the evaluation criteria in the Webometrics rating [64].

A weakness in the application of the approach to quantitative assessment of the quality of scientific journals, based on citation indicators, is the one-dimensionality of assessment. As in the case of assessing the effectiveness of a scientist's scientific activity, there is a «scientist for a scientist» model. In this case, and taking into account the fact that it is the scientific journal that represents the work of the scientist, its usefulness for practitioners becomes ambiguous. A «branded» journal indexed by a «branded» resource, which has earned its credibility exclusively on high citation rates, may not be of practical interest because practitioners do not quote papers: they use the results of scientific research. On the other hand, a not-much-cited article, even in non-authoritative journals that are not indexed by «branded» resources, can be extremely important in any sphere of human life precisely because of the practicality of the ideas proposed in it, which do not contain fundamental theoretical research.

Conclusions to Chapter 1

The modern model of assessing the effectiveness of scientific activity of scientists, scientific teams, and institutions, assumes a quantitative measure expressed by citation indices. The basic of them is the *h*-index, modified on the basis of the use of a mathematical apparatus in order to eliminate its formal shortcomings. The values of such indices, mainly the *h*-index, make it possible to rate scientists and are of particular interest to structures dealing with the staffing of scientific institutions. They are also important for assessing the productivity of scientific teams, especially in the case of solving issues related to incentives, and as part of the criteria for assessing the performance of agencies.

The implementation of the mechanism for calculating indices by electronic indexing resources is based on the construction of graphs of interrelations between papers and their citation in the environment of the world scientific community. This allows for scientometrics analysis, identifying important statistical information necessary to predict the development of scientific areas. Affiliation of scientists with specific universities makes it possible to quantify the effectiveness of universities, based on the quantitative assessment of citation indices. Evaluating universities from an educational and research point of view, taking into account the possibility of quantitative assessment based on citation indices, makes it possible to attribute universities to scientometrics subjects of the scientific and educational environment.

Thus, in the hierarchy of «scientist — research team — university», the main scientific «unit» that determines the effectiveness of a scientific institution is the scientist and the product that s/he produces. Such a product is a scientific work, for example, a paper in a scientific journal. The mission of presenting this work among the world scientific community is entrusted to scientific journals, the rating of which is also based on the principle of calculating citations, including the *h*-index. The most cited journals have greater weight and greater prestige, forming a «brand» supported by the «branding» of indexing resources — scientometrics databases, in which such journals are included. The desire of scientists to publish in such journals and provide the possibility of indexing their papers with «branded» resources is justified by the prospect of personal promotion on the career ladder. It is almost the only incentive to write and publish articles. Factors of a financial nature, for example, the capitalization of their intellectual potential, expressed in the direct representation of the results of their scientific research to the world scientific community, are not explicitly expressed. They, in relation to the scientist as an individual, participate in the process of disseminating scientific knowledge only indirectly — namely through career growth in the institution. The factor of ownership of intellectual property, fixed at the level of copyright preservation of the scientist who prepared the scientific work, does not participate in the assessment of the effectiveness of scientific activity. Obviously, these two factors — the capitalization of intellectual work and the consolidation of copyright — are directly related but not advertised in the process of transferring and disseminating scientific knowledge in the form of scientific publications.

The existing criteria for assessing the effectiveness of scientific activity at any part of the named hierarchy have one significant drawback. This is a basic idea of the usefulness and significance of scientific work, based only on the number of its citations. Whatever the mathematical apparatus used to improve citation indices, and whatever forms these indices are dressed in, the essence does not change. The citation index embodies only a one-dimensional model of «scientist for scientist» or «science for science».

Such a model may be of interest only to theoretical scientists. However, even in this case, it cannot be an objective measure of the quality/significance of scientific work. A relatively limited circle of scientists in a narrow scientific field is more likely to obtain large indices than a wide range of scientists in a broad scientific field. Especially such opportunities for such a circle open up if there is access to «branded» scientific journals indexed by «branded» indexing resources. Much also depends on the integrity of the actors involved in the citation processes — the struggle for research grants can potentially give rise to the construction of collusive schemes on mutual citation, either directly or through an intermediate network of colleagues. Artificially created in this case, high citation indices are good markers for structures that allocate grants for research.

Summarizing the conclusions drawn, there are the following shortcomings of the modern model for assessing the effectiveness of scientific activity:

- one-dimensionality, expressed by the formula «scientist for scientist» or «science for science»;
- the priority of the number of publications, rather than their quality, generated by the desire to cite a larger number of works, in particular those whose number of citations is less than the value of the *h*-index;
- subjectivity generated by the evaluation system based on the relationships of scientists, each of whom understands the value of citation to improve personal rating indicators;
- the possibility of constructing collusive schemes on mutual citation, in order to obtain higher indices;
- the lack of transparency, manifested in the absence of uniform criteria for assessing the quality of scientific works, replaced by the «branding» of journals and the «branding» of the resources for indexing publications in which such journals are included;
- the lack of the possibility of capitalizing on one's intellectual work, manifested in the delegation of authority to promote one's scientific work to a journal that assumes the financial risks of the costs associated with such promotion;
- the lack of the possibility of fixing copyright if the publication process does not imply financial costs of the scientist delegating authority to promote his/her scientific work to the journal.

New conceptual and information technology solutions based on them, which would eliminate these shortcomings, are mechanisms that make it possible to return scientific activity to the status of practical significance. The transformation of the one-dimensional model «scientist for scientist» or «science for science» into a two-dimensional model «science for improving human well-being» with the help of such solutions creates new opportunities for the scientist, as a subject of scientific activity, and for science, and for the areas of practical application of scientific knowledge.

A scientist gets the opportunity to expand the representation of his/her papers as a product of his/her scientific activity, declaring himself/herself not only among colleagues but also among potential investors in his/her scientific developments.

Science increases the degree of confidence in itself on the part of the consumer not from science but, generally speaking, from all aspects of human life and activity (hereinafter referred to as the national economy, understanding by this exactly all spheres of life).

Practice gets the opportunity to select for itself the results of those scientific works that have the potential to be implemented in their conditions and for their own purposes and allow them to get «income» in the form that is needed for them. Of particular importance here is the presence of a single large dynamic database of scientific works, in the classifier of which there are precisely those that have a practically oriented orientation in all four fields of science: Physical Sciences and Engineering, Social Sciences and Humanities, Health Sciences, Life Sciences, covering all areas of the national economy without exception.

Such information technology solutions should reduce the materiality of the subjective factor and ensure transparency in the processes for assessing the quality of scientific content. Increasing the degree of objectivity in assessing the effectiveness of scientific activity based on its transparency will ensure the honesty of scientific and practical communications. At the same time, it should be noted that honesty should be understood not only as transparency in assessing the quality of scientific works but also as honesty in the distribution of benefits. The availability of information technology tools that ensure the communication of all actors in the creation, dissemination, and acquisition of scientific knowledge is an opportunity for scientists to capitalize on their intellectual work while retaining copyright.

Chapter 2
The information-technology Platform InGraph: The essence and concept of development

2.1 Purpose of the Platform, its capabilities, and relationships of Actors

To solve the issues related to the one-dimensional model underlying the assessment of the effectiveness of scientific activity, the **InGraph** information technology Platform [65] has been developed, based on a two-dimensional model with a feedback mechanism for assessing the quality of scientific works.

The **InGraph** Platform is an information technology platform whose purpose is to ensure the honesty of the distribution of benefits in the creation and dissemination of scientific works, as well as objectivity in assessing the effectiveness of scientific activities of scientists and universities in the part that concerns the publication of research results.

The honesty of the distribution of goods is understood as the elimination of the intermediary between the creator of a scientific work (the author) and its user (reader). This will enable scientists to capitalize their scientific work outside the salary received at the university, fully utilizing their intellect and professionalism as a researcher with the full preservation of their copyrights, without resorting to the services of intermediaries. Algorithms and tools of the Platform also provide the opportunity for the author to choose an alternative for presenting his/her works in the public domain.

Objectivity in assessing the effectiveness of scientific activity is understood as a transition from a model of rating scientists and universities, based on the calculation of citation indicators of scientific works, to a model in which the quality of scientific works is assessed by end users. In this model, each end user has the opportunity to evaluate the scientific work on the principle of its practical usefulness, after the work has passed the preliminary review procedure by scientists — experts in this subject area. Thus, the model makes it possible to implement a feedback mechanism in assessing the quality of scientific works, making it possible to assess their significance in terms of practical usefulness, as well as the objectivity of reviewers. This ensures the transition from a one-dimensional model that implements the principle of «scientist for scientist» or «science for science» to a two-dimensional model that implements the principle of «science to improve human well-being». The use of such a two-dimensional model makes it possible to judge the objectivity in assessing the effectiveness of the scientific activity

of its subjects since ratings and related prerequisites for financing scientific research are formed directly by users of scientific works from all areas of human activity. Such users are mostly not scientists, do not write scientific papers themselves and do not quote them anywhere. Consequently, the advantage of the proposed model is that it eliminates subjectivity in assessing the effectiveness of scientific activity and the possibility of collusion between scientists on the mutual citation of their scientific works, as a way to increase their own ratings, either directly or with the mediation of colleagues.

It is the provision of objectivity in assessing the effectiveness of scientific activity and the honesty of the distribution of benefits that form the essence of the **InGraph** Platform as a Platform for transparent and honest scientific communications.

From a functional and technological point of view, the **InGraph** Platform is a universal mechanism that allows five Actors (roles) to interact within the framework of professional activities:

Actor 1 — Author (role 1 — author as the creator of a scientific work).

Actor 2 — Reviewer (role 2 — reviewer as an expert in a given field of scientific knowledge/subject area).

Actor 3 — End User-Individual (role 3 — Reader-Individuals).

Actor 4 — End User-Legal Entity (role 3 — Reader-Company).

Actor 5 — Professional End User (role 3 — Professional «Implementer»).

Actor 6 — Grantors (role 4 — Grant-giver).

Actor 7 — Translator (role 5 — Translator).

Hereafter, the following color designations are adopted: blue color — Author, red color — Reviewer, green color — End User.

The possible relationships between Actors are schematically shown in **Fig. 2.1**.

However, all interactions take place through the Platform (**Fig. 2.2**).

The Platform provides all Actors with opportunities for *self-realization*, as well as *altruistic*, *social, economic,* and *organizational opportunities*.

Opportunities for self-realization extend to Actors 1, 2, 7.

Opportunities for self-realization for the Author are manifested in providing him/her with the tools of the **InGraph** Platform for independent submission and dissemination of his/her scientific works with full preservation of copyright.

Opportunities for self-realization for the Reviewer are manifested in providing him/her with a wide selection of scientific works for review in his/her field of sciences. That is, the reviewer sees in his/her account all the available proposals and has the opportunity to choose those works that cause the greatest professional interest. At the same time, based on the results of the review, the reviewer can independently assess his/her competence, seeing the assessments of other reviewers for the same work and assessments of its quality from end users. Thus, the reviewer sees an assessment of his/her objectivity in the environment of the scientific and practical community.

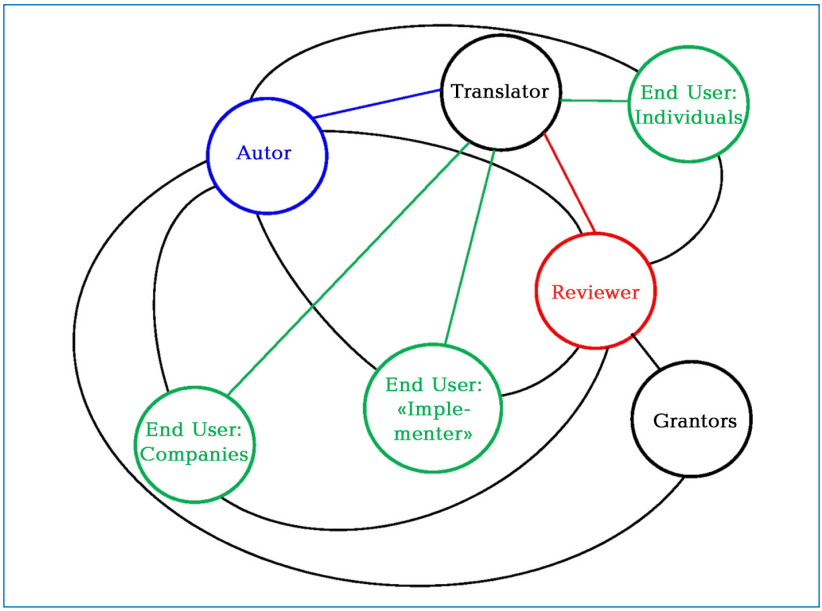


Fig. 2.1 Actors and possible relationships between them

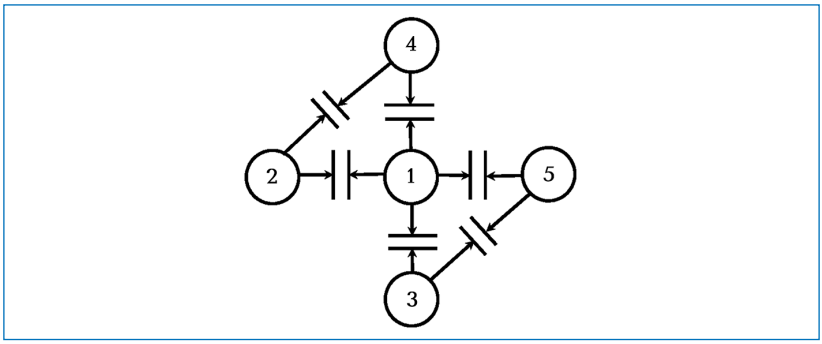


Fig. 2.2 Diagram of interaction between Actors: 1 — Actor 1; 2 — Actor 2; 3 — Actors 3, 4, 5; 4 — Actor 6; 5 — Actor 7; →|← — interaction with the Platform. The relationships between Actors 2 and 7, 6 and 7 are not shown as they are classified as secondary

Opportunities for self-realization for the Translator are manifested in providing him/her with an unlimitedly large audience from among potential customers — authors of scientific papers or end users (readers) — and tools for communication with them to receive and fulfill orders without intermediaries. At the same time, based on the results of the assessment of

the quality of translation from customers, the translator can increase his/her rating, gain additional experience and orders in very narrow areas of science, which is especially important for the scientific community. That is, the principle of «three in one» is implemented — earnings, professional satisfaction, and the acquisition of experience.

Social opportunities extend to Actors 1, 2, 7.

Social opportunities for the Author are an opportunity for scientists who do not have funding for their research or are deprived of the opportunity to participate in grant programs to earn a living and for their research independently, by their intellectual work. This opportunity is realized by placing his/her scientific works in closed access.

Social opportunities for the Reviewer are an opportunity for scientists who are financially constrained (for example, scientists from developing countries) or deprived of the opportunity to participate in grant programs as researchers earn a living and fund their research by reviewing the works of their colleagues.

Social opportunities for the Translator are an additional employment opportunity on the principle of self-employment, using the mechanisms of the Platform.

Thus, the **InGraph** Platform implements a social aspect for scientists, allowing them to survive and conduct their research, as well as evaluate the work of colleagues under conditions of lack or limited funding. This is especially important:

- for scientists from poor or developing countries, but having a high level of professionalism of the researcher and scientific potential;
- scientists who have retired due to their age, but still continue to engage in science, benefiting society while being outside the walls of universities;
- young scientists who are looking for their niche in science but for various reasons do not have the opportunity to join research teams consisting of more experienced and significant colleagues who have monopolized the process of obtaining grants or participating in grant programs (access to sources of research funding);
- scientists from all over the world who have the opportunity to translate their works into the language necessary for the End User, providing the possibility of employment of translators on the principle of self-employment;
- to the end user from all countries of the world who get the opportunity to receive a translation of the scientific works of interest to him/her into their own language, thereby providing the possibility of employment of translators on the principle of self-employment.

Altruistic possibilities extend to Actors 1, 2.

Altruistic opportunities for the Author are an opportunity for a scientist to upload his/her scientific works in open access, if s/he so wishes. Thus, the

principle of «open science» is implemented: the world scientific community gets the opportunity of open access to scientific content, the Author gets a free opportunity to show his/her scientific research to the entire global scientific community with the potential for subsequent communications with interested End Users.

Altruistic opportunities for the Reviewer are an opportunity for scientists to contribute to the promotion of quality scientific content for the benefit of the End User on a volunteer basis.

Economic opportunities apply to all Actors:

- for Authors — an opportunity for scientists to earn for their scientific works without intermediaries;
- for Reviewers — an opportunity for scientists to earn money by reviewing the works of other scientists;
- for Translators — an opportunity for translators to earn money by translating scientific works;
- for Grant-givers — an opportunity for funding organizations to optimize the expenditure of funds allocated within the framework of grant programs for scientific research;
- for End Users — the opportunity to minimize their costs for the acquisition of scientific works for their own purposes.

Organizational capabilities apply to all Actors.

The **InGraph** Platform is a scientist's workplace where all the tools they need for their work are at their fingertips. These tools include:

- personal work (through account solutions);
- communications with colleagues (through integration with the social network of scientists and with the possibility of joining working groups for the joint development of research projects);
- communications with translators;
- communications with grant-givers and «implementers»;
- awareness of the current state of functioning of the Platform and all events taking place on it;
- visualization of personal financial indicators reflecting their activities and success on the Platform;
- visualization of personal rating indicators as a scientist in his/her subject area;
- analysts as a means of feedback to assess the effectiveness and, if necessary, adjust their research activities.

The presence of personal accounts for all Actors allows them to organize their work and communication at their discretion.

The transparency of the **InGraph** Platform is ensured by the principles of functioning fully declared on it, confirmed by the documents attached to the Platform, important for understanding all the work processes on the Platform and the relationships of all Actors. From the point of view of assessing the quality of scientific works, transparency is confirmed by a detailed

description of the principles for selecting scientific papers for review, the process and review criteria in the documents attached on the Platform in the form, free for review or download.

2.2 Principal scheme of the Platform

Putting the Author in the center of attention, as the creator of a scientific work, the Platform makes it possible to satisfy to the maximum extent the needs of the user of this work, not only from science but from any area of the National Economy. Such interests include the need to acquire scientific knowledge to solve specific practical problems, taking into account the needs for a particular type of scientific content: original research, reviews, inventive ideas, reference books, etc. (**Fig. 2.3**).

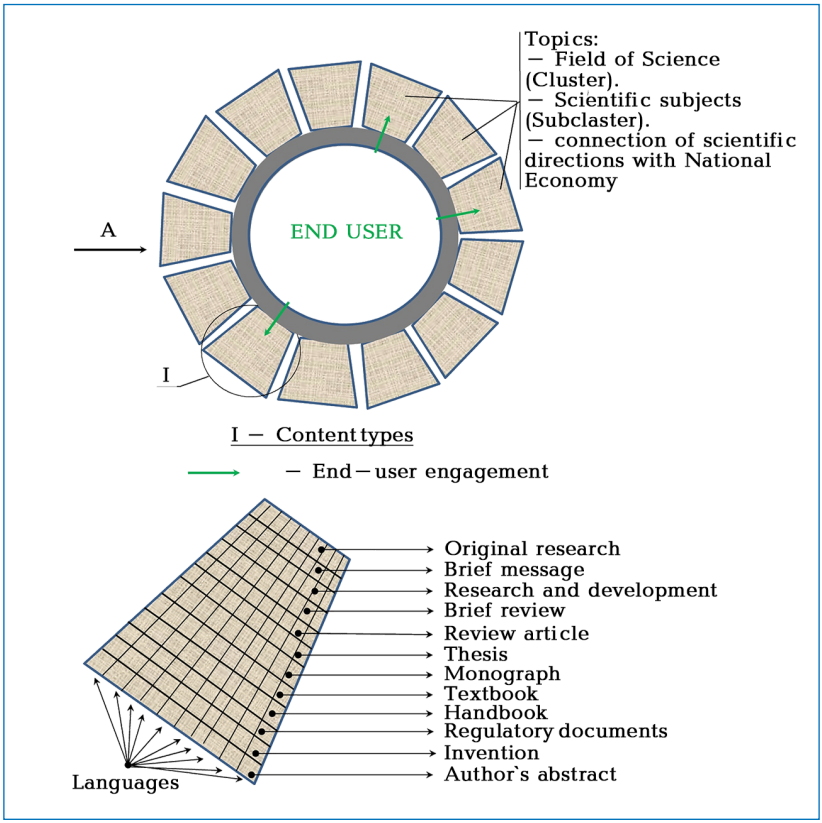


Fig. 2.3 Scheme of opportunities provided by the Platform to Actors 3, 4, 5

Content types include the following:

1. Original research.

The purpose of such papers is to report results from studies conducted by an author (a team of authors) in the chosen field. It is essential that this type of papers should focus on the applied aspects of research results, always emphasizing the importance of the topic for practical application.

Structure of original research:

- Introduction.
- Methods.
- Results and Discussion.
- Conclusion.

The referenced list of used sources may include 20 to 50 titles.

2. Brief message.

It provides a mechanism for the rapid dissemination of new and effective results. It may include reports from initial studies describing unusual or preliminary results using new or adapted research and analysis methods that may promote the method and are likely to stimulate further research in this field. It can take the form of a report on specific use or application.

The format is useful for scientists whose results are time sensitive (for example, in highly competitive or rapidly changing disciplines). Because a given format is a brief message, some experimental details may remain unpublished until the authors write the full manuscript (original research).

Brief messages also include:

- Conference abstracts.
- News: at the forefront of science.
- Methodology or Methods.

Conference abstracts. The main purpose of abstracts is to present a brief affirmative generalization, to reveal the essence, basic ideas and results from more complete content of a paper or a scientific work. The distinctive feature of abstracts is the small volume (2—3 pages) that reflects basic ideas of the full report.

An abstract is a summary of the thought in one sentence. Abstracts differ from a standard text by less reasoning, explanations, additions. Abstracts are a set of statements, each of which was obtained, proven, and verified in the course of research; the process of research itself is not reflected in the text, only the results are reported.

News: at the forefront of science. The purpose of these articles is to report the results of research that is at the forefront of science in your subject area, and in such an interpretation that a reader, a non-specialist in a narrow subject area, can understand and appreciate the essence of a given research, as well as the significance of results.

Methodology or Methods. These papers report a new experimental method, test, or procedure. The method described can be either completely new or may offer a better version of the existing method. A paper should describe the obvious progress in what is currently available.

3. Thesis.

This is a qualification work for awarding an academic degree and qualification. A common requirement is the originality and uniqueness of the thesis work. A thesis is usually presented in the form of a specially prepared manuscript, sometimes in the form of a published monograph. As an exception, when applying for a Doctor of Science degree, a thesis in the form of a scientific report, based on a combination of the earlier published scientific and research-and-development works, is allowed. The structure of a thesis: front page, table of contents, introduction, main part, conclusion, list of references, appendixes.

The content part of the work is contained in the main part. It examines in detail the methodology and research technique. The content of the chapters should be exactly in line with the theme of the work. The structure should be consistent with the study objectives mentioned in the introduction. At the end of each chapter, conclusions are drawn based on the results.

A thesis is an important systemic study containing scientific novelty and practical significance.

4. Author's abstract.

The thesis author's abstract is a summary of the main results of the dissertation work for a doctorate or PhD degree.

The author's abstract is intended to familiarize the scientific community with such issues as:

- the relevance, goals, and objectives of the study;
- the novelty and reliability of the proposed methods and solutions;
- practical and scientific importance of the work;
- testing the work and personal contribution of the applicant;
- the scope and structure of the thesis;
- a reference statement of the content of the work;
- a list of publications on the subject of the work.

The author's abstract is a brief presentation of an important systemic study, which describes the main results of the study and their interpretation, as well as the essence of the evidence base for scientific novelty and practical significance. The features of the author's abstract include information on the practical implementation of results from a systemic study, recommendations for implementation, as well as a list of scientific works by the author, which detail all aspects of the study. It is important to note that this list is the source of a large amount of important scientific and practical information.

5. Monograph.

Monograph is a scientific or non-fiction publication, containing a complete and comprehensive study of a single problem or topic, belonging to one or more authors.

Typically, it contains a detailed description of the research methodology, the presentation of results of the work performed, as well as their interpretation.

This is an important systemic study.

6. Review article.

The purpose of such an article is to provide an overview of a particular area of research, while making a mandatory emphasis on how the results are already being used in practice. Thus, the reader gets the opportunity to independently evaluate the most promising areas of research in a particular sector. Such papers also make it possible other authors to use a given article to prepare their work. The list of sources used should include 100 to 300 titles.

7. Brief review.

The purpose of such papers is to generate new ideas, even if too bold! This means that such articles should not be exhaustive, but must necessarily contain a new author's idea, only formed on the basis of a critical analysis of recent achievements in the chosen research field. The list of used sources should include 50 to 100 titles with archival depth not later than the last 10 years.

8. Textbook.

A textbook is a book containing a systematic presentation of knowledge in a particular area and used both in the education system, at its various levels, and for self-study.

The textbook's educational material consists of empirical, theoretical, and practical components.

9. Handbook.

A handbook is a practical edition, with a summary of the information in a systematic form, in the expectation of selective reading, so that it can be quickly and easily referenced. It is designed for selective reading and intended for quick reading and finding a reference. It has a systematic structure, the titles in them are ordered on a certain principle. It is supplied with auxiliary pointers (alphabetical, subject, name, etc.).

10. Research and development report.

The purpose of such papers is to report the results of experimental or theoretical studies conducted by an author (a team of authors) within the framework of some research programs (commissioned by corporations, foundations, etc.). Articles of this type should be a reliable source of primary research information and do not contain an overview part as a separate section. The manuscripts should contain «bare facts» established as a result of applied research, as well as a brief author's interpretation of the data obtained.

Manuscripts should contain a detailed description of the methods and conditions of the experiments, as well as graphic representation of the results (histograms, diagrams, graphs, tables) in quantities sufficient for a reader to understand the importance of the results.

The list of sources used may include 10 to 20 titles, of which at least 50 % must have an archival depth not later than the last 10 years. The purpose of these sources is to give the reader an opportunity to independently assess the correctness of the research conducted by the author (a team of authors) in terms of the methodology and conditions of the experiments, as well as the initial processing of the results.

We also include a «*Clinical Case*» for medical research to this type of content. *Clinical case* is a detailed account of a particular patient in chronological order. The clinical case description is a detailed account of symptoms, attributes, diagnosis, treatment, and accompaniment of a single patient. Clinical cases include a description of what happens to a person during a disease. The description consists not only of the doctor's observations and the patient's manifestations, but also includes information obtained as a result of diagnostic procedures and developed treatment. Monitoring of personal development should be included in a clinical case.

The purpose of a clinical case is to detect an unforeseen link between the symptom and the disease, to identify an atypical manifestation of the disease in question.

11. Invention.

It is a protective document certifying the exclusive right, authorship, and priority of the invention, useful model, industrial prototype, or breeding achievement.

An invention is a technical solution in any area pertaining to the product, the process of taking action on a material object through material means, its application, including the application of a well-known product or a process for a new purpose.

A useful model is an intangible object of intellectual rights or a technical solution related to the device. Less stringent patentability conditions, shorter deadlines and simplified application procedures have been established for useful models. However, the useful model has a shortened lifespan.

An industrial prototype is an object of intellectual rights related to the appearance, design, and ergonomic properties of the product. Novelty and originality are the main conditions under which the patent ability of an industrial prototype is determined.

A breeding achievement, which recognizes the exclusive right of an individual and a legal entity, relates to the creation of biologically new objects with certain properties.

12. Regulatory documents.

These include codes of rules, standards, technical conditions, regulations. In other words, it is a type of documents whose characteristic is the description of rules, guidelines, characteristics of activities, their results, etc.

Fig. 2.4 shows the Platform modules that provide Actors 3, 4, 5 with the ability to communicate with Actors 1, 2. This diagram is a side view of the diagram shown in **Fig. 2.3** (view A).

The expectations of practitioners from the use of the Platform, differentiated by areas of activity, are realized at the level of establishing links between the fields of science and the areas of the National Economy in several sections: «Fields of science/Cluster — Scope of application», «Fields of science/Subcluster — Structural unit of the Company». One of the examples of such relationships is shown on **Fig. 2.5**.

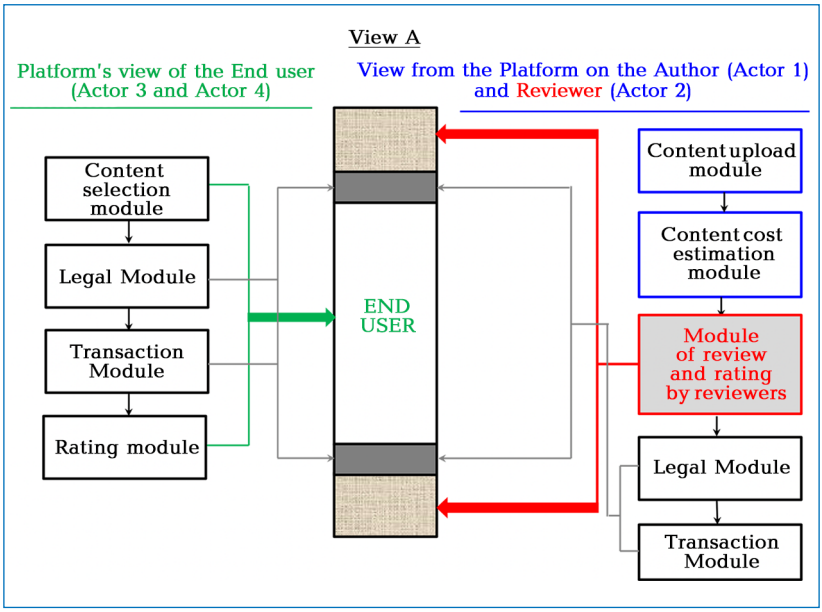


Fig. 2.4 Platform modules that meet end-user expectations

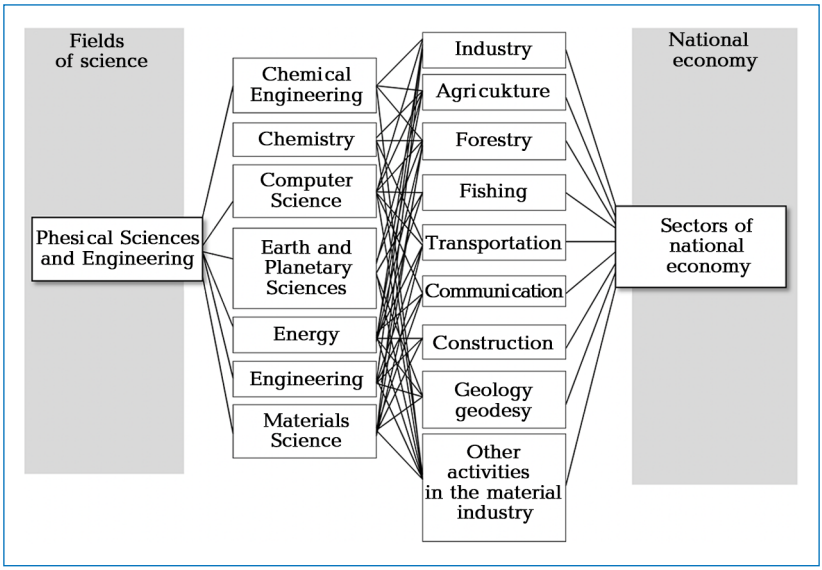


Fig. 2.5 An example of establishing links between the fields of science in the context of «Fields of science — Sectors of national economy»

The fields of science form 4 areas (**Fig. 2.6**), each of which contains several clusters. An example of clustering for the field of **Physical Sciences and Engineering** is shown in **Fig. 2.7**.

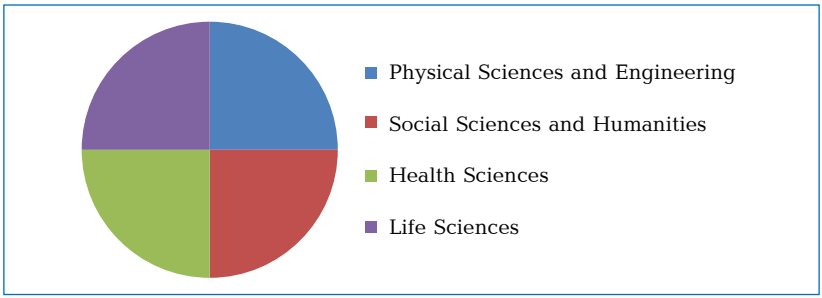


Fig. 2.6 Fields of science

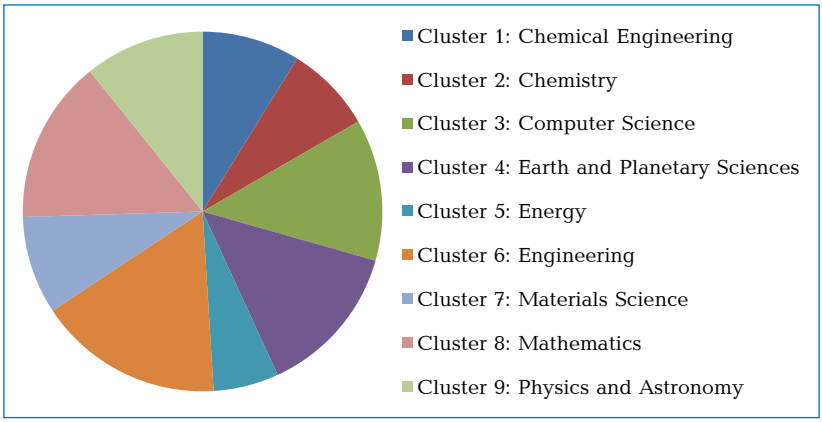


Fig. 2.7 Example of clustering for the field of **Physical Sciences and Engineering**

The formation of the hierarchical structure «Field of Sciences — Cluster — Subcluster» on the example of the field of **Physical Sciences and Engineering** cluster **Chemical Engineering** is shown in **Fig. 2.8**.

Fig. 2.9–2.11 demonstrate the opportunities that Actors 1–5 receive from interacting with the Platform. Thus, each of the Actors receives a set of tools for working on the Platform:

- Author: availability of tools for uploading scientific works, personal account with the display of relevant information, rating indicators, and status of scientific works.
- Reviewer: availability of tools for reviewing scientific papers, personal account with the display of relevant information, rating indicators, and available review suggestions.

- End user: the availability of tools for selecting scientific content for his/her needs, a personal account with the display of relevant information, a tool for assessing the quality of downloaded (acquired) scientific content.

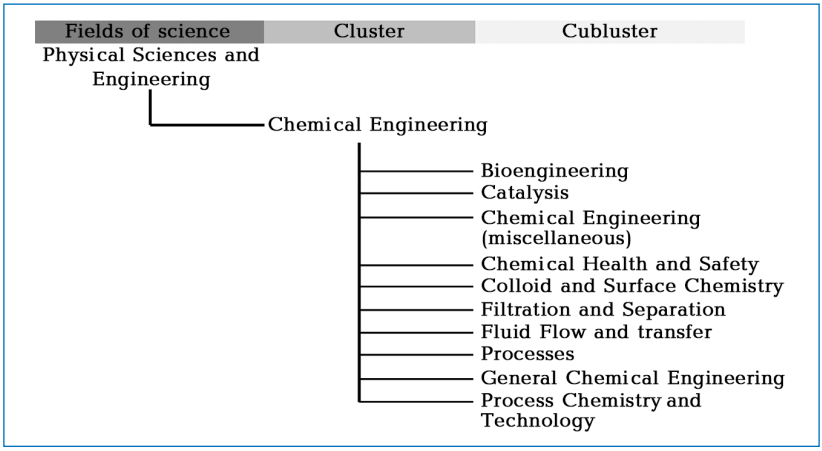


Fig. 2.8 Formation of the hierarchical structure «Field of Sciences — Cluster — Subcluster» on the example of the field of **Physical Sciences and Engineering** cluster **Chemical Engineering**

The main feature of the Platform, from the point of view of the implementation of the mechanism of honest distribution of benefits, is that the dominant role is given to the Author of the scientific work. S/he is provided with the opportunity to create a scientific product, having at hand all the necessary communication tools, with the possibility of receiving income from the implementation of his/her scientific works. At the same time, full communication is ensured between the creators of scientific content, its users, translators, funding organizations (grant-givers) without intermediaries with maximum satisfaction of the needs of all parties:

- for *creators* of scientific content (authors of scientific works) — the possibility of placing their scientific works (articles, monographs, etc.) on the Platform in open or closed access without intermediaries, and when placed in closed access — the possibility of capitalizing their intellectual work outside the salary received at the university;
- for *users* of scientific content (universities, libraries, companies, institutions, government bodies, funds, etc.) — the opportunity to obtain scientific and practical information to meet the needs of their functioning, development, obtaining competitive advantages based on the use of new scientific knowledge without overpayments for subscription and any content as «additional load»;

- for *translators* — the possibility of receiving regular orders for the translation of scientific literature, meeting professional needs, and expanding experience;
- for *funding organizations* — the ability to track the productivity and quality level of work of scientists, research teams, universities when choosing the most competitive research team as an object of funding for scientific research.

The diagram that exhibits the logic of the Platform is shown in **Fig. 2.12**.

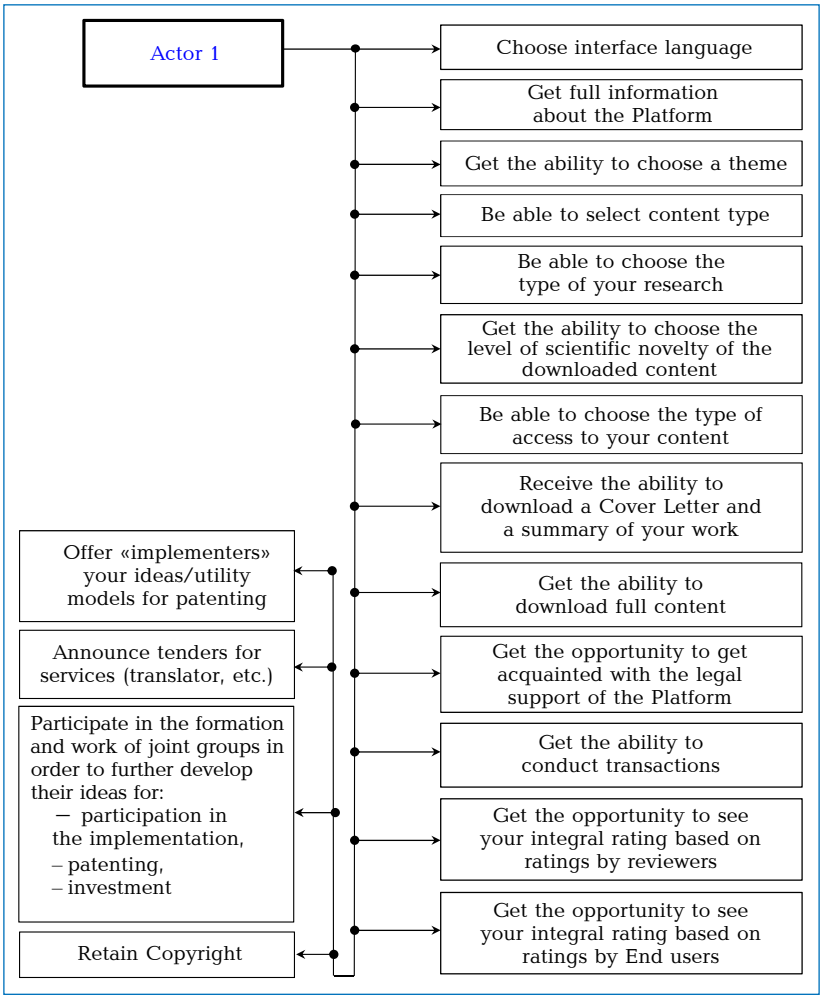


Fig. 2.9 Opportunities received by Actor 1 from interaction with the Platform

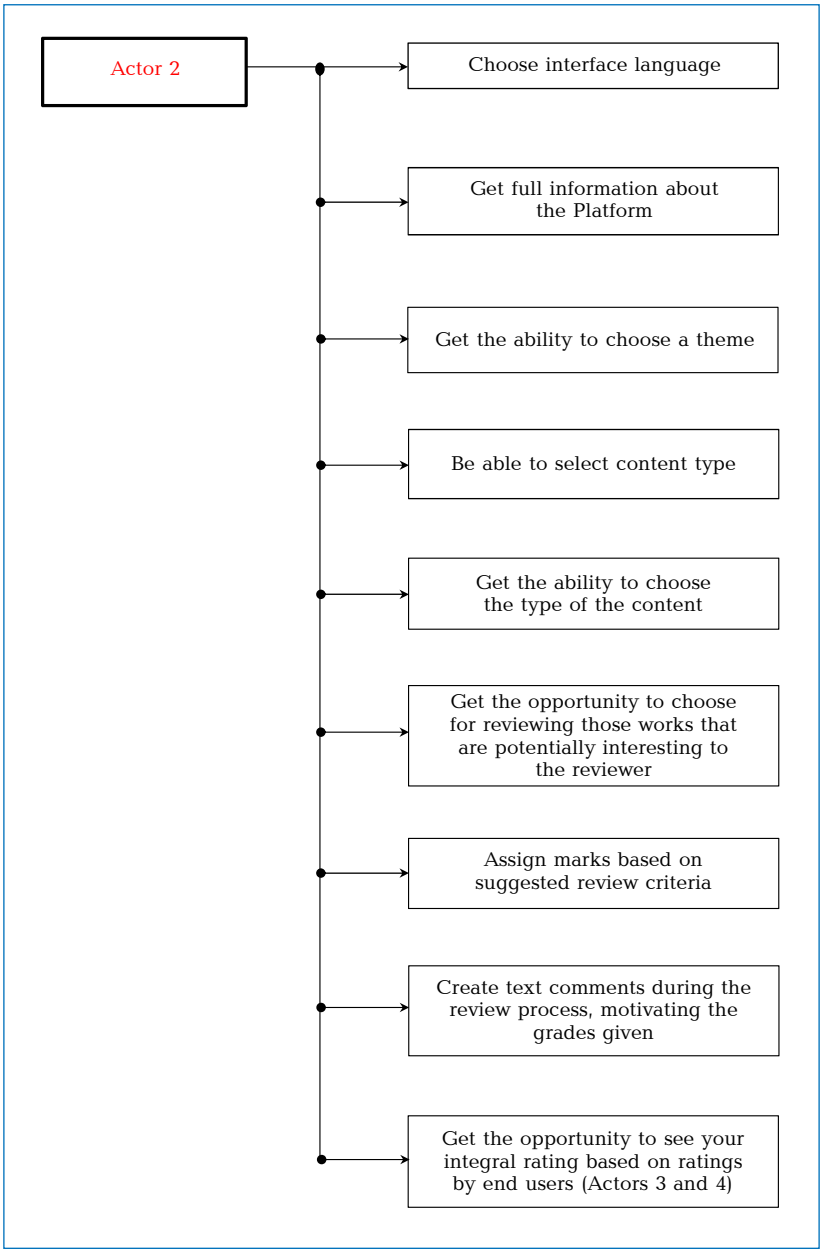


Fig. 2.10 Opportunities received by Actor 2 from interacting with the Platform

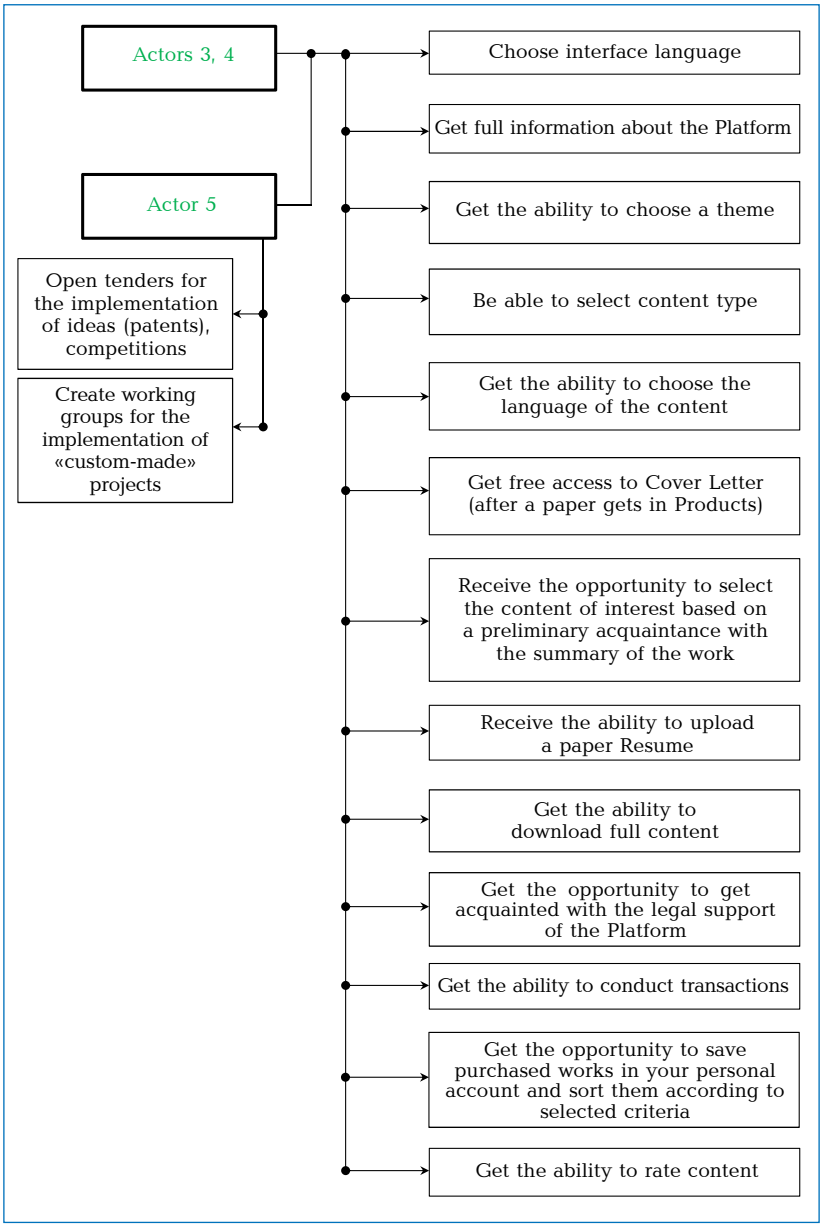


Fig. 2.11 Opportunities received by Actors 3, 4, 5 from interacting with the Platform

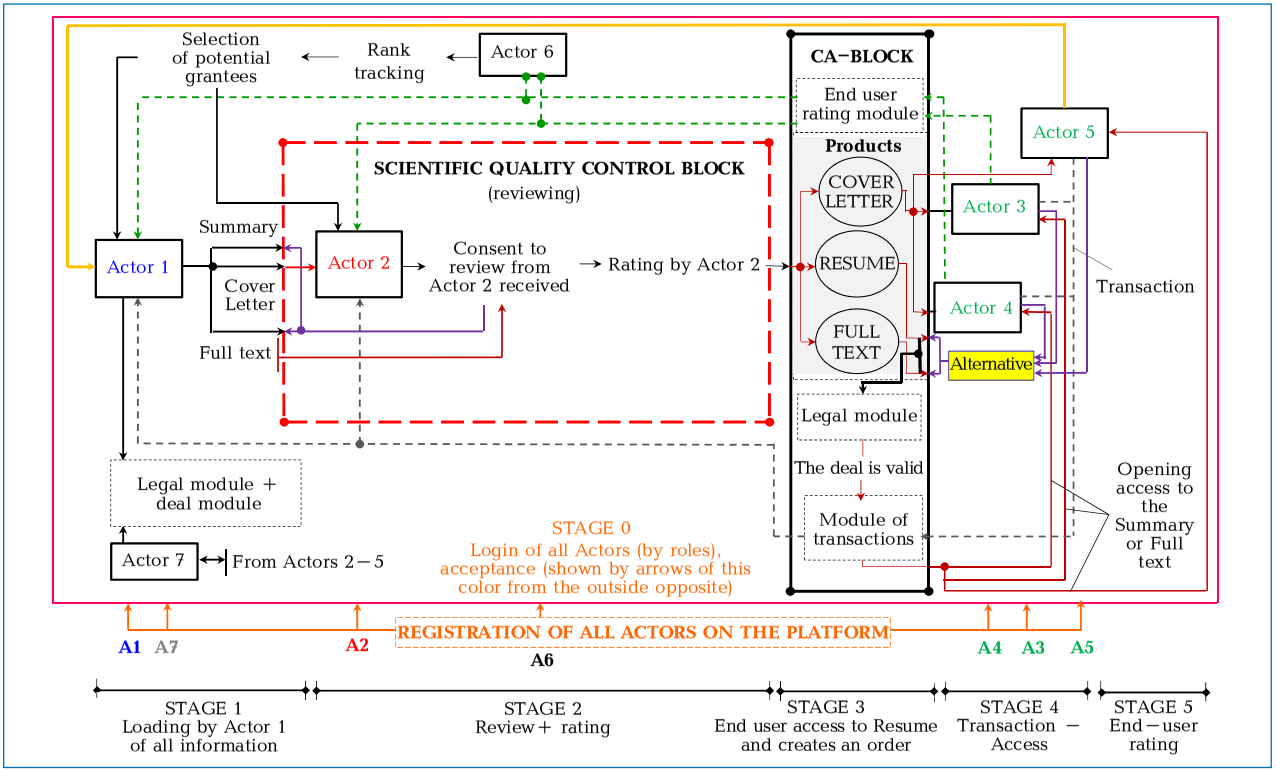


Fig. 2.12 Diagram showing the logic of the **InGraph** Platform:
A1 — Actor 1, A2 — Actor 2, A3 — Actor 3, A4 — Actor 4, A5 — Actor 5, A6 — Actor 6, A7 — Actor 7

Fig. 2.12 adopts the following text, graphic, and color designations:
Actor 1 — Author (role 1 — Author).
Actor 2 — Reviewer (role 2 — Reviewer).
Actor 3 — End User: Individuals (role 3 — End User).
Actor 4 — End User: Companies (role 3 — End User).
Actor 5 — End User: «Implementer» (role 3 — End User).
Actor 6 — Grantors (role 4 — Grantors).
Actor 7 — Translator (role 5 — Translator).
— Scientific quality control block.
— Communication and analytical block (CA-BLOCK).
— Request.
— Execution of a request.
— Flow of funds.
— Rating formation.
— Platform.
— Deal request (access to summary or full content).
— Fulfillment of a request from the «implementer» for ideas/utility models.

Alternative — possibility to choose EITHER **Resume** OR **Full text** of works of interest based on Cover Letter.

Cover Letter is a brief description of the work, which makes it possible to get acquainted with its purpose, scientific results, and the field of practical application. The title of this document does not reflect the formal side in the form of an appeal to the editors, as is usually accepted, but a substantive side that gives an understanding to the End User whether this work is of any potential interest.

2.3 Logic and principles of operation of the Platform

The structure and participants of the α version of the **InGraph** Platform are shown in **Fig. 2.13**; the representation of the principles of the Platform's functioning in the form of a sequential interaction procedure «Actor — Platform» for Actors 1—5 is illustrated in **Fig. 2.14—2.24**.

Each Actor has a personal account from which s/he interacts with the Platform. All scientific works that form the content of the Platform are placed in **Products**, where they are accepted only after receiving a rating for quality, averaged by the results of the review by three independent reviewers — experts in the scientific field to which the reviewed work belongs. The calculation of ratings is carried out in the Platform's analytical unit. Payment system provides transactions and payments to authors and reviewers. Feedback in assessing the quality of scientific works and the objectivity of reviewers is implemented by calculations in the Platform's analytical unit.

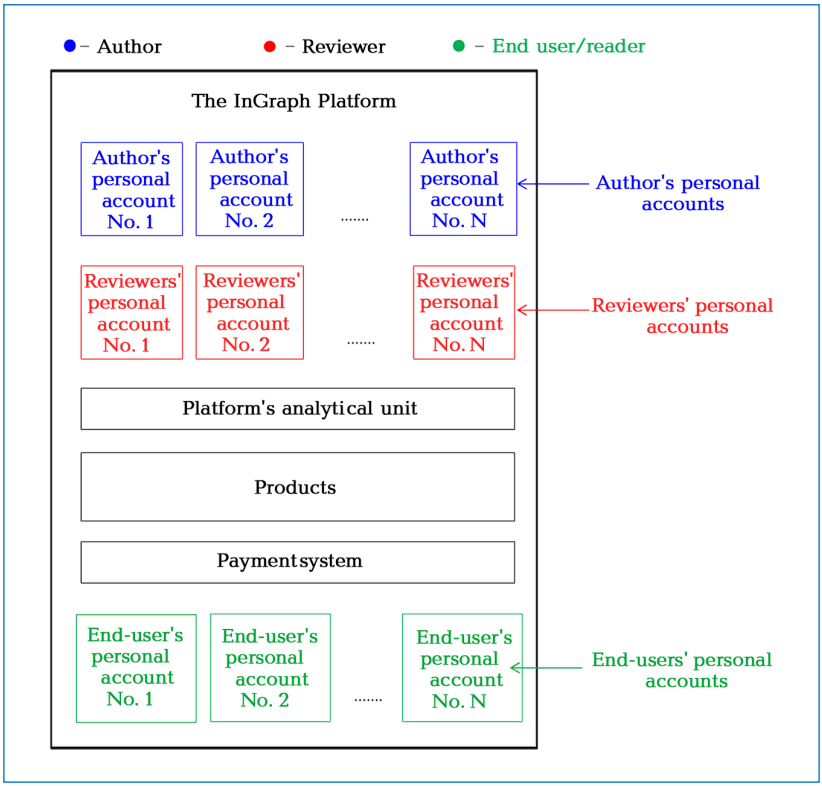


Fig. 2.13 The structure and participants of the Platform's α-version

In step 1, authors and reviewers are registered (**Fig. 2.14**).

After registration, authors and reviewers enter their personal accounts. Authors upload to the Platform their scientific works that have the form of content of any type (**Fig. 2.3**) — step 2 (**Fig. 2.15**).

All works uploaded to the Platform are displayed in the reviewer's account if a number of criteria coincide to ensure accurate positioning of works relative to the subject area of the reviewer.

From the entire available list displayed in his/her account, the reviewer selects those of the works that s/he considers the most interesting, operating on the characteristics of the work available to him/her. Once a work is picked up by three reviewers (**Fig. 2.16**), it becomes unavailable to the rest of the reviewers.

The reviewer, having selected the work for review, requests from the Platform access to the full text of the work, receiving as a response the full Resume and Full text (**Fig. 2.17**).

Having received the Full text of the work, each of the three reviewers begins the review process (**Fig. 2.18**), operating with the form of the reviewer that is provided to him/her by the Platform, depending on the level of scientific novelty declared by the author in the process of uploading the work to the Platform.

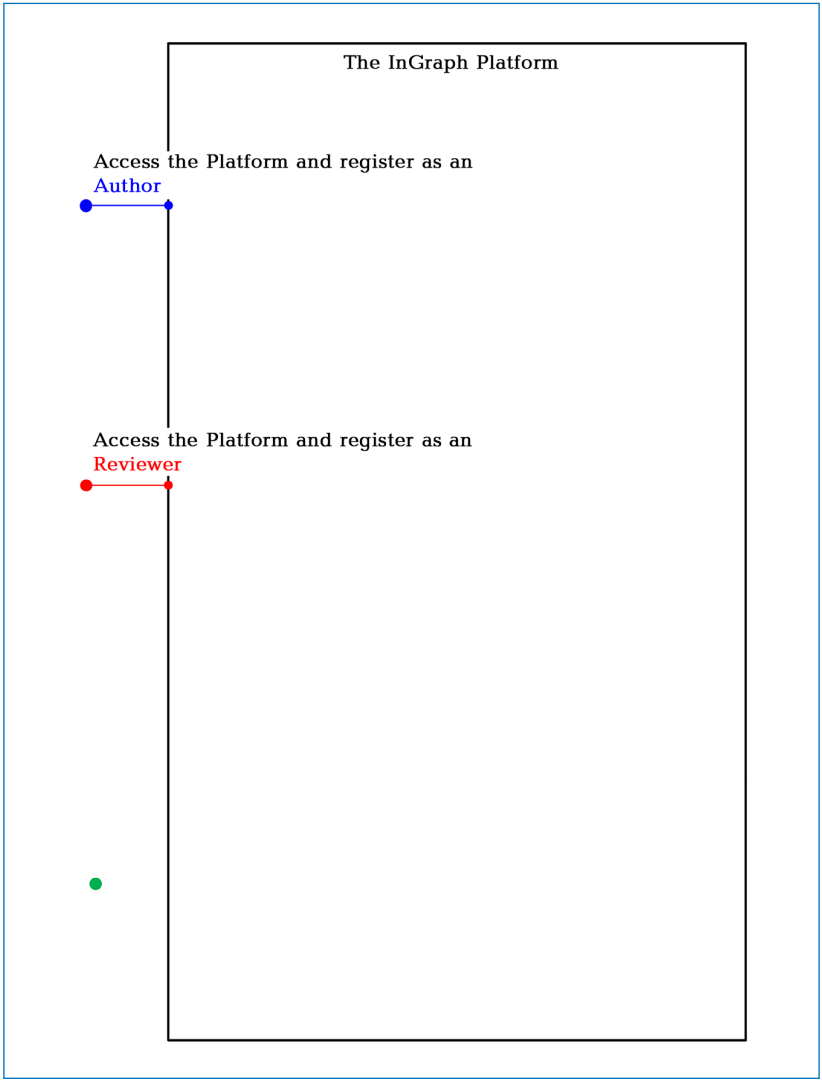


Fig. 2.14 Step 1: Access the Platform and register

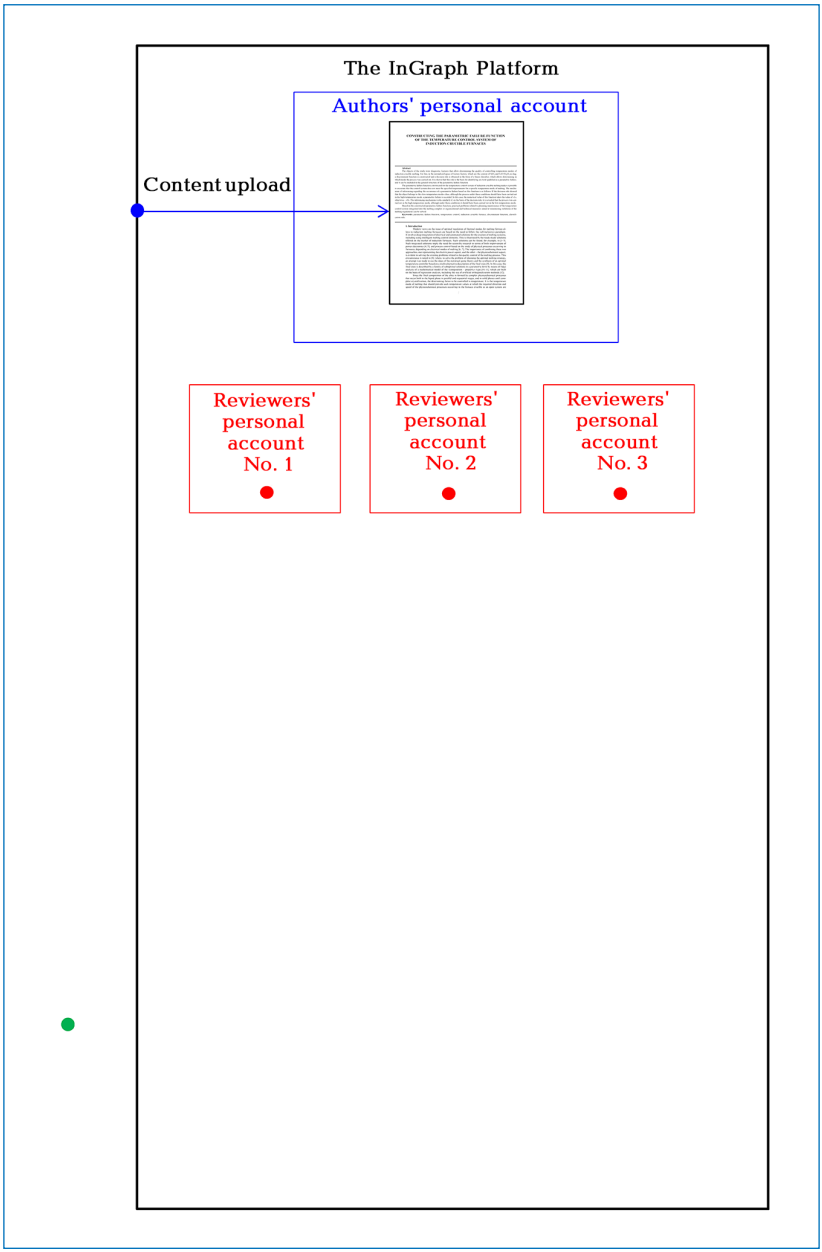


Fig. 2.15 Step 2: Content upload

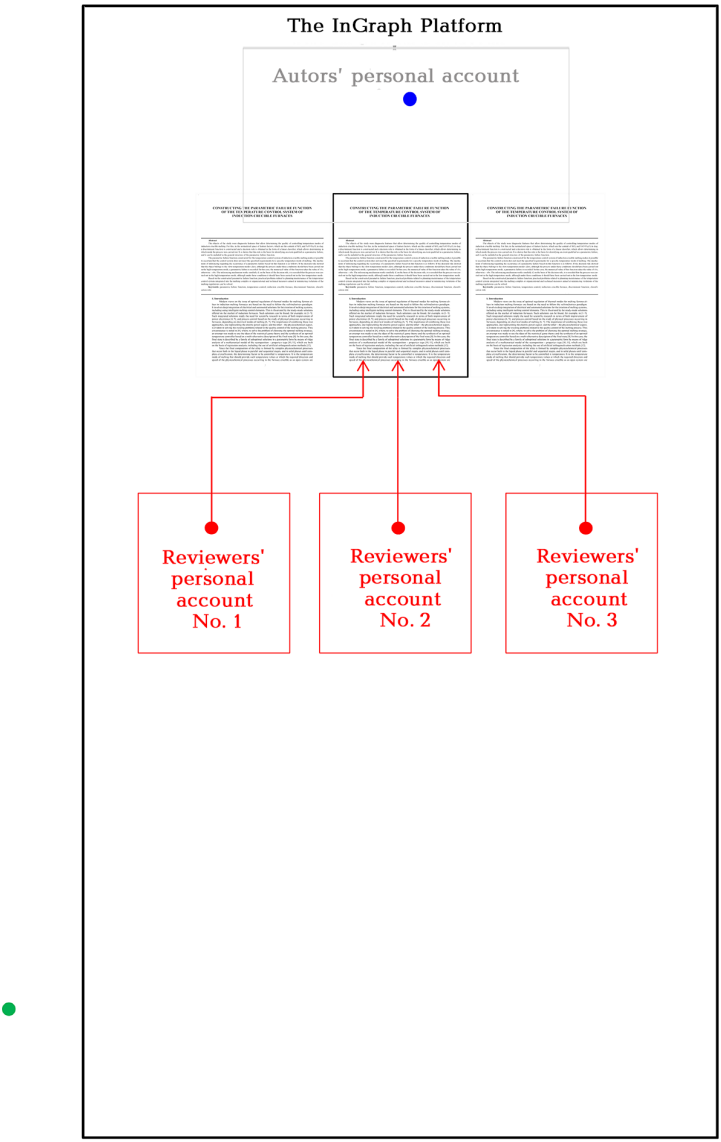


Fig. 2.16 Step 3: Providing reviewers with available scientific papers and selecting a paper to be reviewed

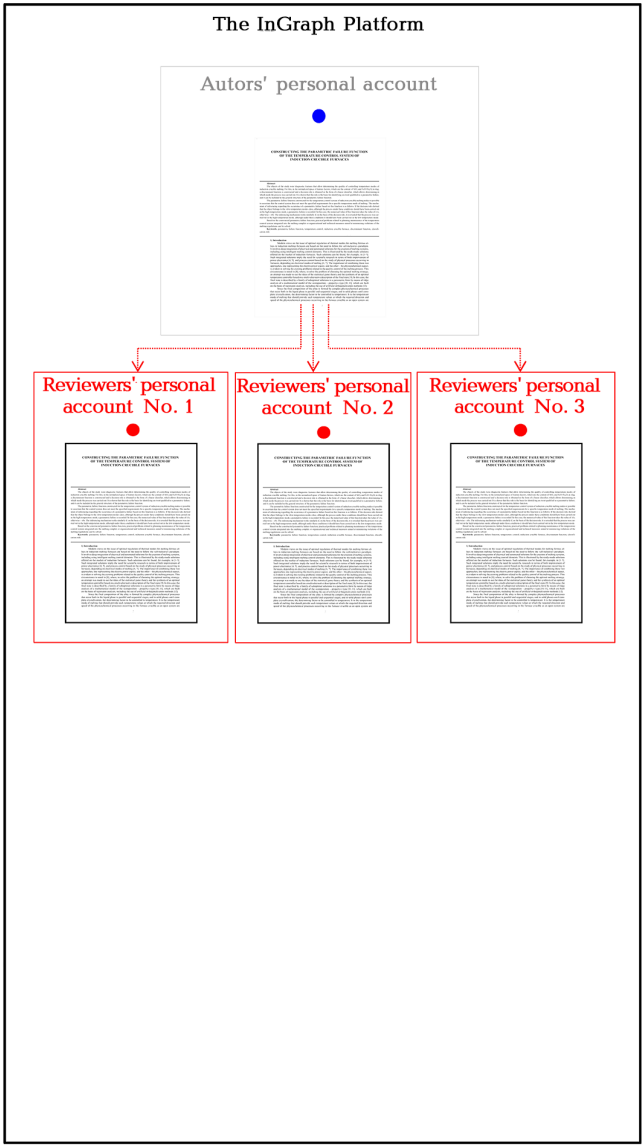


Fig. 2.17 Step 4: Providing reviewers with an access to the full text of the selected scientific paper

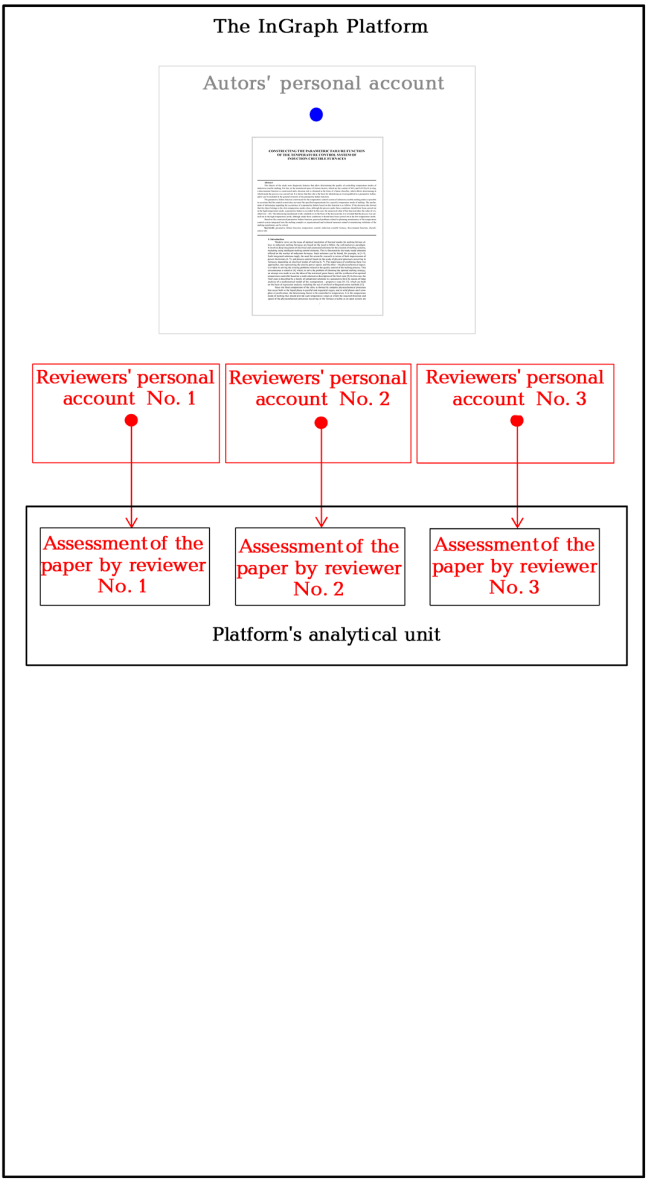


Fig. 2.18 Step 5: Reviewing the selected scientific paper by three reviewers

The result of the review is the assignment by each reviewer of numerical indicators in the range [0; 1] for each of the evaluation criteria contained in the reviewer's form. If desired, the reviewer has the opportunity to provide each assessment with a text comment. Based on the three estimates obtained, the Platform's analytical unit calculates the average estimate from the reviewers and, depending on it and the level of scientific novelty, forms the price of the work (**Fig. 2.19**), which is the basis of the cost at which this work enters **Products** (**Fig. 2.20)**. Similar procedures occur if the author, when uploading the work, chose **Open access** as a form of access to it for end users. In this case, when one gets into **Products**, a cost equal to USD 0 is indicated.

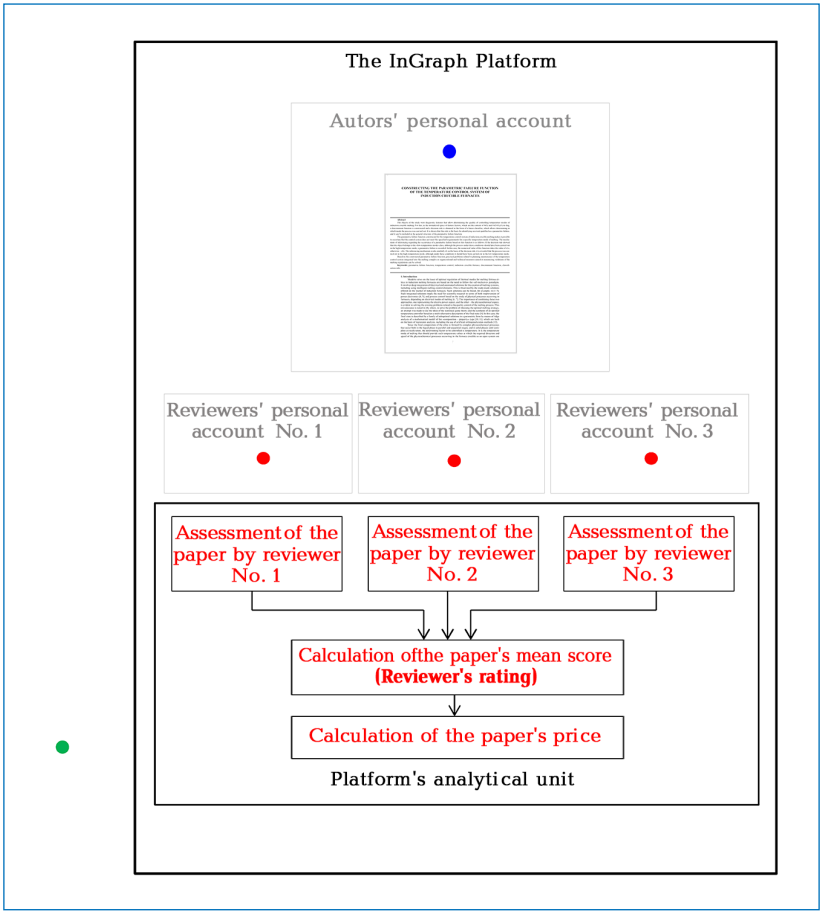


Fig. 2.19 Step 6: Determining the paper's score based on the reviewing, and estimating its price

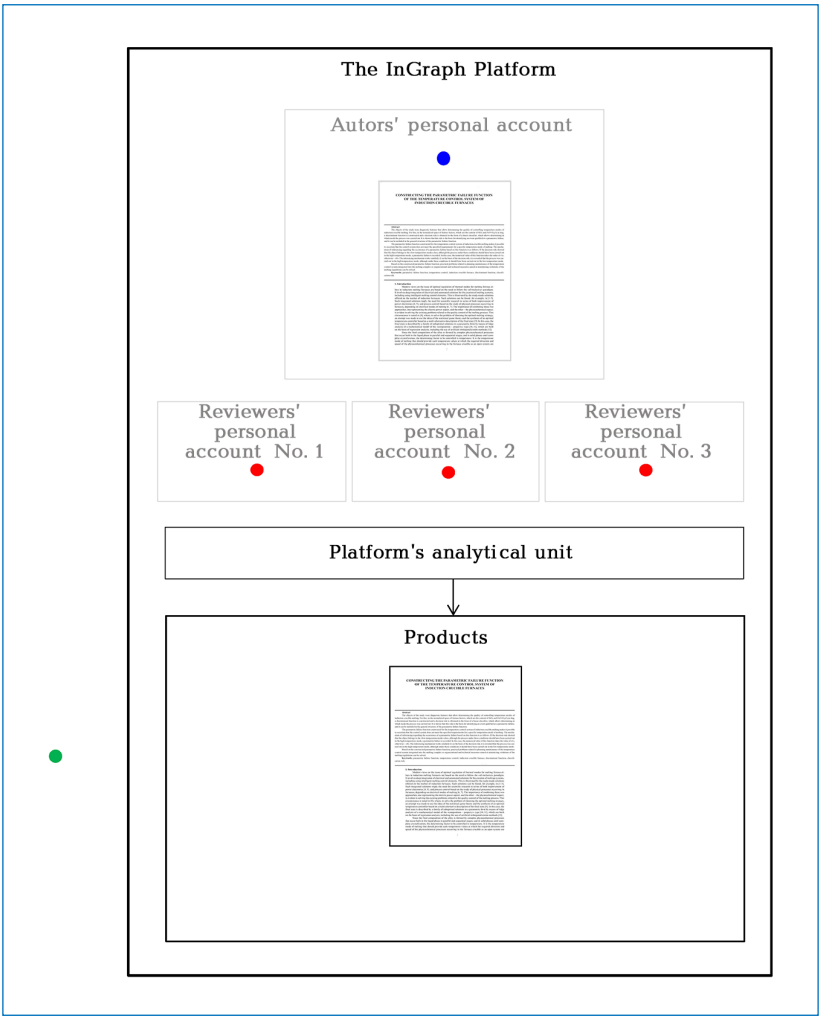


Fig. 2.20 Step 7: Assigning a paper to products

All works that have been reviewed and evaluated by the Platform for their scientific and financial value are in the **Products** of the Platform in the form of three components: Cover Letter, Resume, Full text. The title of the work and Cover Letter (**Fig. 2.21**) are freely available to the end user if the work has **Closed access** as a form of access. Resume and Full text of works with the **Open access** form are available to the End User for free download.

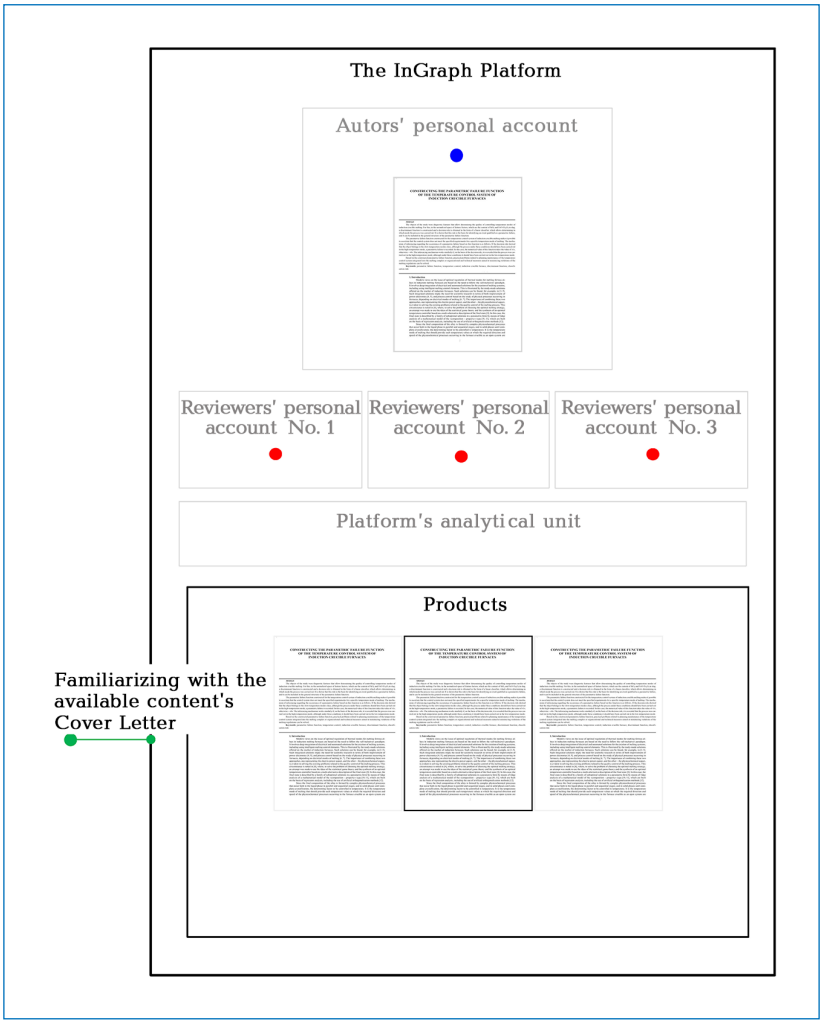


Fig. 2.21 Step 8: End-users' activities at the Platform: familiarizing with the available content

By selecting a work of interest to him/her, the End User can download it if the form of access to it is **Open access**, or send a request for the purchase of **Full text** or **Resume** if the data on the work are not enough to make a decision on its usefulness and purchase (**Fig. 2.22**). At the same time, the Platform offers the End User to register. The result of registration is the formation of the End User's personal account.

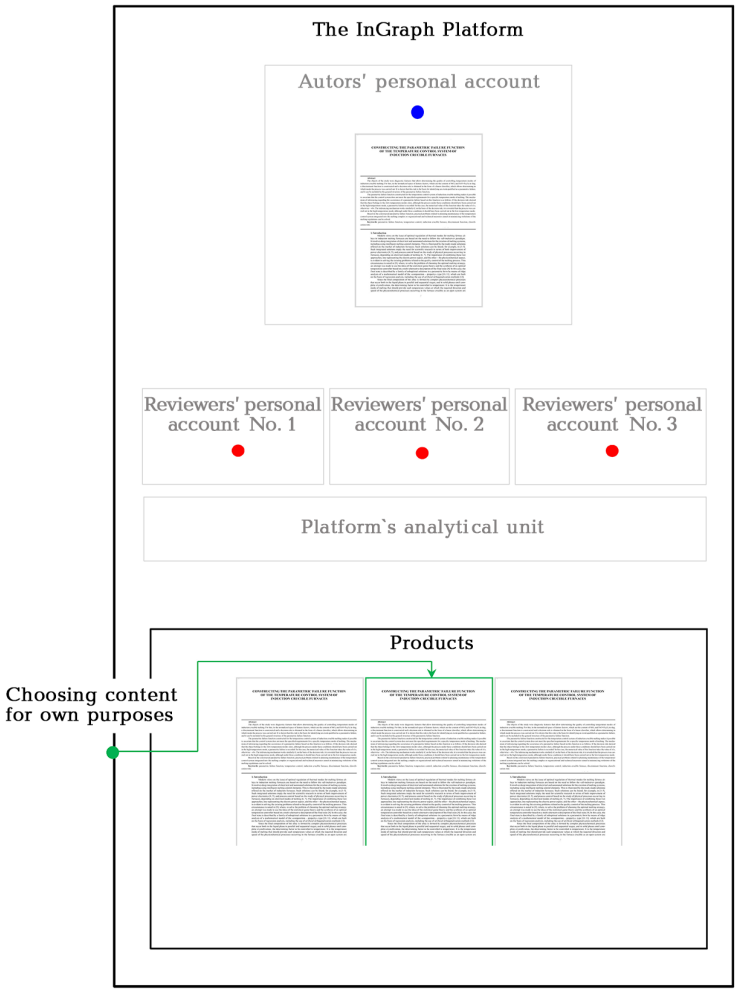


Fig. 2.22 Step 9: End-users' activities at the Platform: choosing content

If the End User decides to purchase a **Full text** of a work, s/he pays for it the amount specified for this work in **Products**. As a result of the implementation of the **Payment system** mechanisms, a transaction is effected, and the funds are transferred to the author and reviewers who reviewed this work (**Fig. 2.23**).

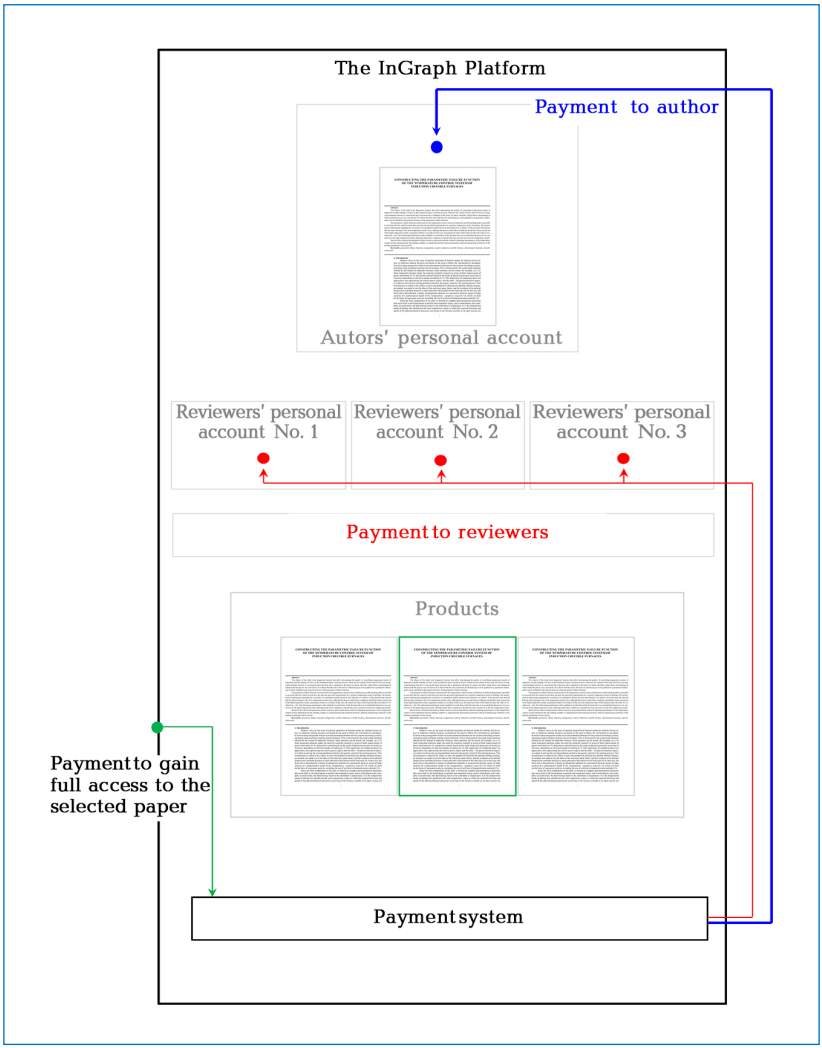


Fig. 2.23 Step 10: End-users' activities at the Platform: transactions

After gaining access to the selected work, the End User can download it by saving it in his/her account. After that, s/he has the opportunity to evaluate the work. This procedure can be done at any time, after a detailed acquaintance with its content. The result of the assessment is to obtain numerical assessments of the quality of work and the level of objectivity of the reviewers (**Fig. 2.24**).

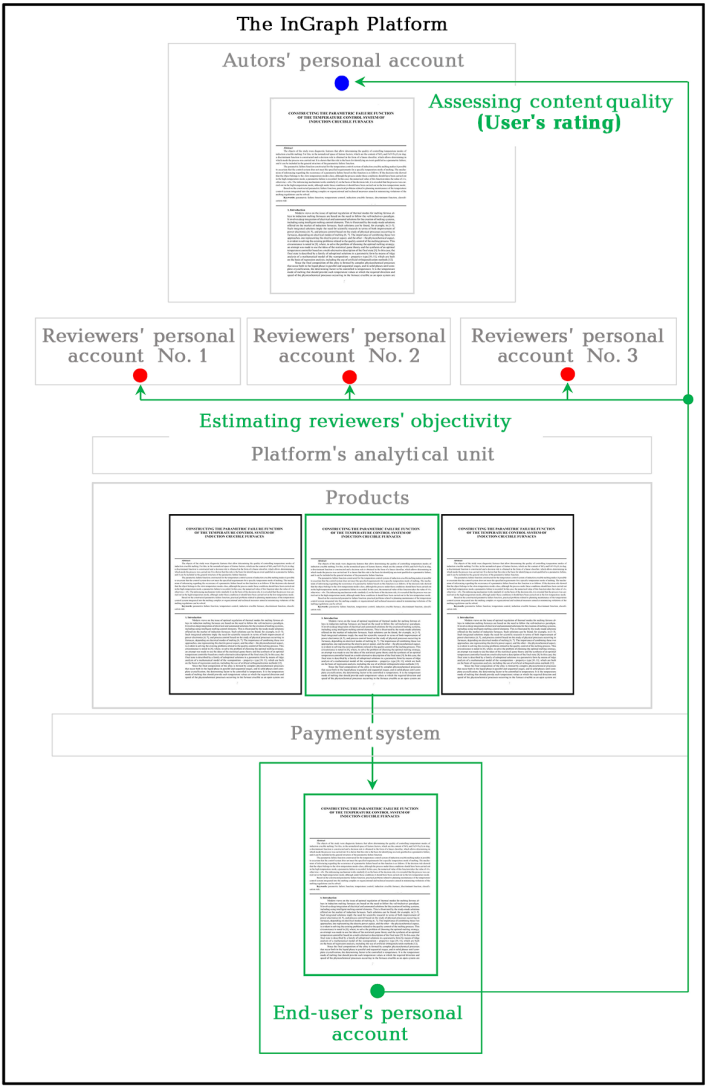


Fig. 2.24 Step 11: End-users' activities at the Platform: personal account

Combining the content of the scheme that displays the logic of the Platform (**Fig. 2.12**) and the visualization of the principles of the Platform's

functioning in the form of a sequential interaction procedure «Actor — Platform» for Actors 1—5 (**Fig. 2.14–2.24**) makes it possible to represent a simplified scheme that displays the principles of operation of the **InGraph** Platform (**Fig. 2.25**).

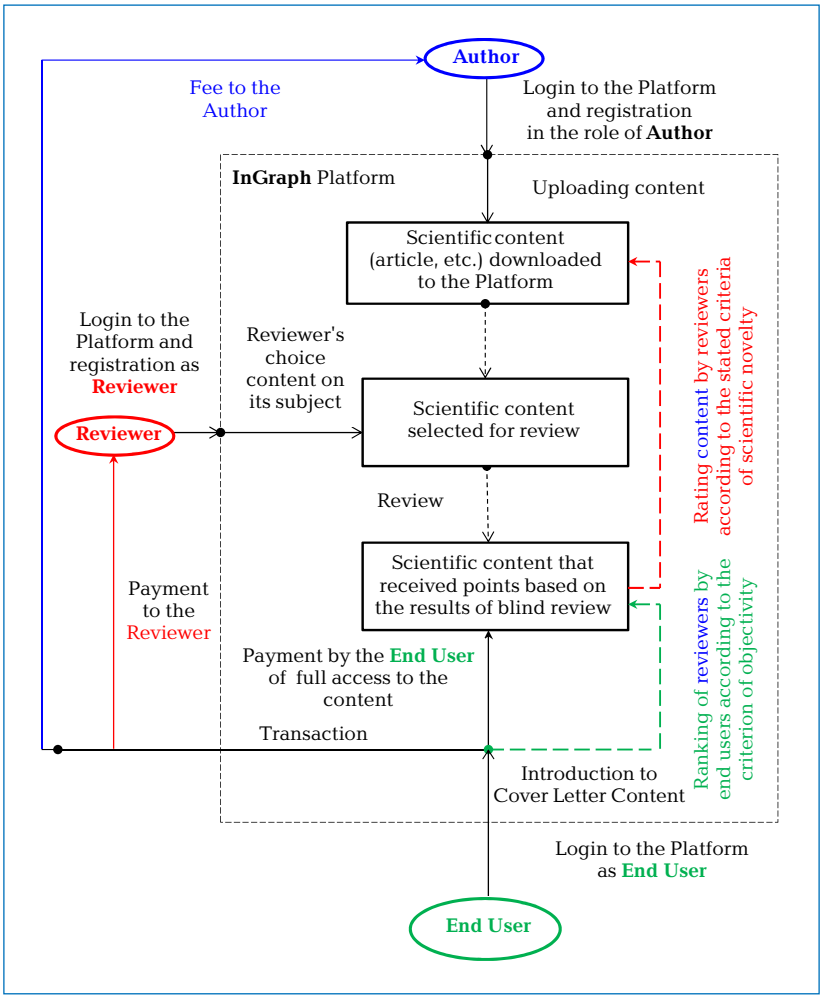


Fig. 2.25 Simplified diagram showing how the **InGraph** Platform works

Thus, the Platform's operation includes two components:
Part I: Technological operations involving content.
Part II: Transactions.

Part I: Technological operations involving content

Author of a scientific work. An author uploads his/her scientific work to the Platform. To this end, s/he follows the step-by-step guidelines enabling the following:

- choosing a subject area;
- choosing the field of practical application of his/her scientific work;
- choosing the type of unloaded content;
- choosing the nature of his/her scientific work;
- choosing the level of scientific novelty that the author believes is claimed by his/her work;
- uploading the information fields assigned for the chosen type of uploaded content;
- choosing the type of access to his/her scientific work: open or closed.

Reviewer:

- selects a paper for reviewing, based on his/her research area, from corresponding works hosted by the Platform;
- reviews the chosen paper based on the proposed criteria, which depend on the level of scientific novelty claimed by the author; provides estimates and, if desired, adds text comments.

The Platform's internal algorithm:

- calculates the average estimate of a paper by three reviewers;
- displays the estimate in the author's window, the reviewer's window, and the user's window;
- computes the evaluation of reviewer's objectivity based on the estimates by different categories of end users/readers.

The end user/reader:

- sees a freely-accessible **Cover Letter** about scientific content and chooses it according to his/her criteria;
- sees the estimates by reviewers;
- takes a decision to pay for full access to content;
- if it is difficult to make a decision to pay for full access due to lack of information, he/she decides to pay USD 3.40 to access the detailed **Resume**;
- if the detailed abstract appears convincing, he/she decides to pay for full access to the content;
- sees all content that is in the public domain, downloads the **Full text**, which is if interest to him/her, for free;
- assesses quality of the purchased content by rating it according to the proposed criteria.

Part II: transactions

End User/Reader: pays for full access to content or, if s/he cannot make a decision, pays USD 3.40 for access to **Resume**, on the basis of which s/he decides whether to pay for full access.

Author of scientific work: receives payment of 90 % of the declared value of the content after each of the three reviewers receives USD 30 for reviewing this content. Up to this point, the amount paid by the end user, minus 10 %, is divided into 50:50, of which 50 % is received by the author and 50 % is received by three reviewers. For example: a scientific article is estimated at USD 10. Of these, when downloading, USD 1 remains in the system to cover the costs of maintaining the Platform, and USD 9 are distributed between the author and reviewers, respectively, USD 4.50 and USD 4.50. After the number of downloads of the article exceeds 20 (that is, the amount received for the downloaded article exceeds USD 200, of which USD 180 is in favor of the author and three reviewers in the proportion of USD 90:90), the author will receive USD 9 from each subsequent download during his/her lifetime.

Reviewer: receives a percentage of the payment for the content purchased by the end user/reader. The principle of calculation is as follows: the amount paid by the end user, minus 10 %, is divided into 50:50, of which 50 % is received by the author and 50 % is received by three reviewers. For example: a scientific article is estimated at USD 10. Of these, when downloading, USD 1 remains in the system to cover the costs of maintaining the Platform, and USD 9 are distributed between the author and reviewers, respectively, USD 4.50 and USD 4.50. That is, from each downloaded article, each reviewer receives USD 1.50 until the total amount of the reviewer's fee reaches USD 30, which will be equal to 20 downloads of the article.

When the reviewer gains experience on the Platform and in the case of his/her high-quality work, which is monitored by the Platform on the basis of the reviewer's objectivity indicators, it is further envisaged to introduce increase coefficients to the reviewer's fee.

Conclusions to Chapter 2

Conceptual solutions in terms of the structure and logic of the relationships of the **InGraph** Platform contain the basis for creating an useful service for all Actors through the information technology implementation of the Platform. This provides a set of opportunities for all Actors:

- self-realization;
- altruistic possibilities;
- social opportunities;
- economic opportunities;
- organizational capabilities.

This allows us to argue about the multi-vector nature of the Platform, which creates an alternative model for the dissemination of scientific knowledge. The concept of the **InGraph** Platform implements the transition from a one-dimensional model of «scientist for scientist» or «science for

science» to a two-dimensional model of «science to improve human well-being», with the priority for science to meet practical needs for the results of scientific research. Such needs can be considered in the context of improving human well-being.

To implement such opportunities, the solutions and architecture of the Platform involve the communication of seven Actors, each of whom pursues his/her own goals. These goals are achieved by each Actor through mechanisms of interaction with the Platform.

In the center is the Author, as the creator of a scientific work. S/he is given the full right to choose the field of science, type of work, its nature, independent assessment of the level of scientific novelty and practical significance, the way of access to his/her work. In fact, the Author gets the opportunity to present through the Platform to the world community all his/her scientific works created by him/her during his/her life, provided that s/he has copyright to these works. It should be especially noted that the **InGraph** Platform retains copyright for the Author, while providing the opportunity to choose the type of access to copyright content — open or closed, and the possibility of capitalizing on his/her intellectual work in the latter case.

Reviewers have the opportunity to choose scientific works in their scientific area and their preferences regarding the type and nature of the work offered to them for review, and the option of access to it. In the case of reviewing works that are in closed access, the reviewer gets the opportunity to receive a fee upon downloading by End Users.

Evaluation of the quality of scientific content, as the basis for creating trust in scientific works and the importance of scientific research for society, occurs at two levels — reviewers-scientists and users. At the same time, the presence of a feedback mechanism makes it possible to assess additionally both the practical usefulness of scientific works and the objectivity of reviewers.

The expectations of End Users regarding the practical usefulness of scientific works should be justified by the correct positioning of works at the stage of their upload to the Platform. This is provided by the mechanisms of the Platform, which implement relationships such as: «Fields of science — Scope of application», «Fields of science/Cluster — Sectors of national economy», «Fields of science/Subcluster — Structural unit of the Company».

The role of the Translator on the Platform provides opportunities for mutually beneficial communications with other Actors.

The grantee (funding organizations) has the opportunity to see the level of scientific developments, ratings of scientists, the effectiveness of various research teams, trends, etc., which allows him/her to choose priority areas for financing scientific research and invest in scientific developments. This is ensured by the transparency of the process of assessing the quality of scientific works at both levels — reviewing and evaluation by End Users.

Chapter 3
Information technology solutions for the Author's cabinet

3.1 Algorithmic support

Information and technological solutions for the Author's cabinet are implemented by two types of functionalities:

- registration functionality;
- content upload functionality.

The registration algorithm is shown in **Fig. 3.1**.

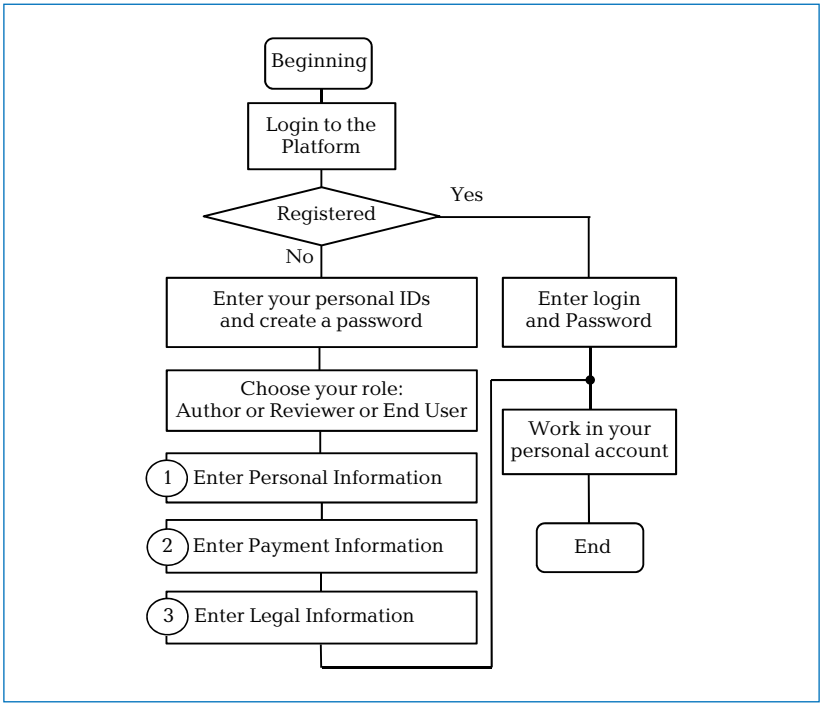


Fig. 3.1 Algorithm of registration on the Platform in the selected role

By choosing one of the roles during registration, Actor can add roles to himself from his personal account, while entering the necessary additional information.

In block 1 (Step 1), when one selects Author as the role, the following information must be entered:

- Name.
- Birth date.
- Citizenship.
- Country of residence.
- Science degree.
- Organization's name.
- Organization's website.
- Department.
- Phone.

All these data are necessary to identify the Author within the framework of the provision of the service on the **Ingraph** Platform. By filling in the appropriate fields in the registration form in Step 1, the Author thereby gives his consent to the collection and processing of personal data in order to exercise the user's rights on the **Ingraph** Platform. The collected data are used exclusively for the provision of the service and is not transferred to third parties. The Platform provides the safety and security of the collected personal data; their collection and processing are carried out exclusively in accordance with the norms of applicable law, including the GDPR requirements.

In block 2 (Step 2), the following data should be entered:

- Bank account.
- SWIFT.
- Bank address.
- Personal address.

These data are necessary for the implementation of transactions — the withdrawal of funds to the Author's account if his works are placed in **Products** in closed access and the End User pays for access to the **Full text** of these works.

In block 3 (Step 3), it is necessary to confirm acceptance of all legal conditions:

- Scientific Copyright.
- Copyright Disclaimer.
- Tax Disclaimer.

The algorithm of registration on the Platform in the selected role (**Fig. 3.1**) implements STAGE 0 «Login of Actor 1 and acceptance» of the general procedure «REGISTRATION OF ALL ACTORS ON THE PLATFORM» (A1, **Fig. 2.12**).

The algorithm for downloading content is shown in **Fig. 3.2**.

In block 1 (Step 1), the following data should be entered: Field of science and Scope of application.

The fields of science at the «Cluster» level are shown in **Fig. 3.3**. Each Cluster is expanded additionally to subclusters (not shown in **Fig. 3.3**, example for Chemical Engineering cluster is shown in **Fig. 2.8**).

Scope of application at the level of the main tree is shown in **Fig. 3.4**. Each area unfolds into several levels, the number of which depends on the branch of the National Economy.

The result of the correct choice of Field of science and Scope of application is the correct positioning of scientific work in **Products**. The match between the Field of science field selected by the Author and the Field of science field selected by the Reviewer at the registration stage on the Platform is one of the identifiers for the selection of the Reviewers by Platform.

In block 2 (Step 2), Type of downloaded content (**Fig. 2.3**) should be entered.

In block 3 (Step 3), the following data should be entered: Character of research and The level of scientific novelty claimed by a given research.

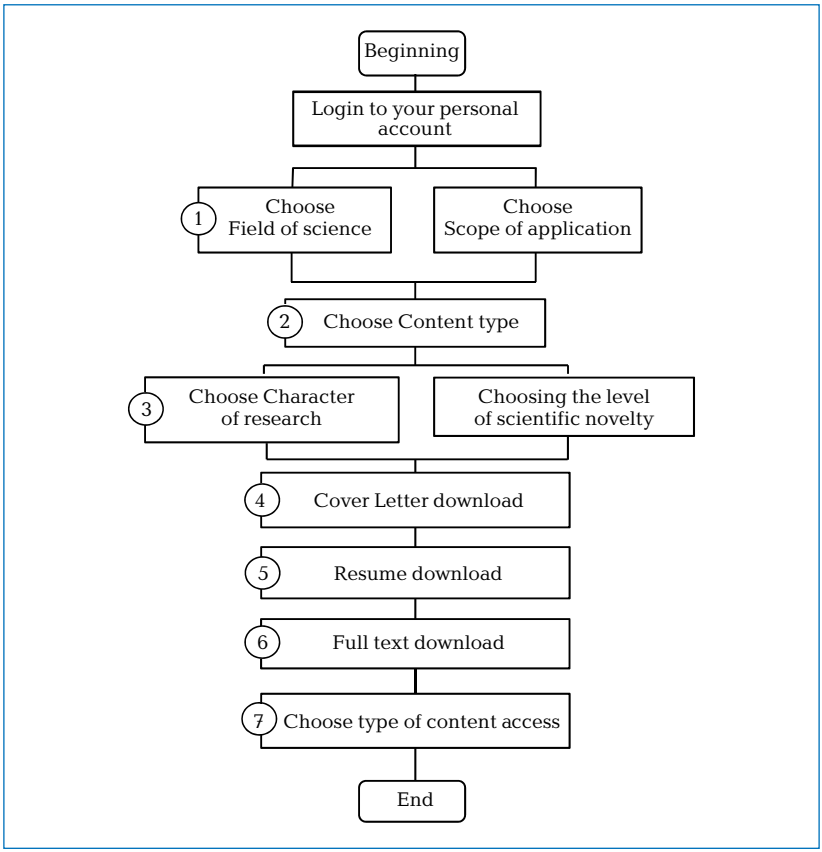


Fig. 3.2 Content download algorithm

Physical Sciences and Engineering
- Chemical Engineering
- Chemistry
- Computer Science
- Earth and Planetary Sciences
- Energy
- Engineering
- Materials Science
- Mathematics
- Physics and Astronomy

Social Sciences and Humanities
- Arts and Humanities
- Business, Management and Accounting
- Decision Sciences
- Economics, Econometrics and Finance
- Psychology
- Social Sciences

Health Sciences
- Dentistry
- Health Professions
- Medicine
- Nursing
- Pharmacology, Toxicology and Pharmaceutics
- Veterinary

Life Sciences
- Agricultural and Biological Sciences
- Biochemistry, Genetics and Molecular Biology
- Environmental Science
- Immunology and Microbiology
- Neuroscience

Fig. 3.3 Areas of science at the «Cluster» level

There are 5 types of a study character:
- Theoretical.
- Experimental.
- Combined.
- Educational and reference.
- Regulatory documents.

Depending on the nature of the study, 6 levels of scientific novelty are provided. Each level, except for the 6th, has its own set of identifying criteria. Assignment of level 6 is possible only for scientific works that receive unconditional worldwide recognition.

The result of the correct choice of the study character is the correct positioning of the work for the choice of reviewers by the Platform. This is due to the fact that one of the identifiers for the selection of reviewers by

the Platform is the match between the field «Nature of the study» selected by the Author and the field «Nature of the study», with which the Reviewer is ready to work. The latter is selected by the Reviewer at the stage of registration on the Platform.

The result of an adequate assessment of the level of the work is the possibility of its adequate assessment by reviewers.

Scope of application

- Industry
- Agriculture
- Forestry
- Fishing
- Transportation
- Communication
- Construction
- Trade
- Public catering
- Procurement and sales
- Workpieces
- Information and computing
- Real estate transactions
- Total commercial activity to ensure the functioning of the market
- Geology and geodesy
- Other activities in the material industry
- Housing and utilities
- Non-productive domestic services
- Health service
- Physical culture
- Social Security
- Education
- Arts and culture
- Science and scientific services
- Finances
- Micro-economy finance
- Modern portfolio theory and risk management
- Financial services
- Financial market
- Business finances
- State finances
- Financial economy
- Credit
- Insurance
- Pension benefits
- Management
- Public associations
- Extraterritorial organizations and bodies

Fig. 3.4 Scope of application main tree

Block 4 (Step 4) should include data briefly presenting the work (**Cover Letter**). This title is due to the fact that this document should give the End User the opportunity to quickly get an idea of the direction and content of the scientific work in **Products**. That is, in the usual sense, Cover Letter is a document accompanying the manuscript when requested by the editorial board for its consideration for the possibility of publication in a scientific journal, while **Cover Letter** in the sense of the component of uploading to the Platform should present this scientific work as briefly but succinctly as possible to its potential user.

The data tree contained in **Cover Letter** is shown in **Fig. 3.5**.

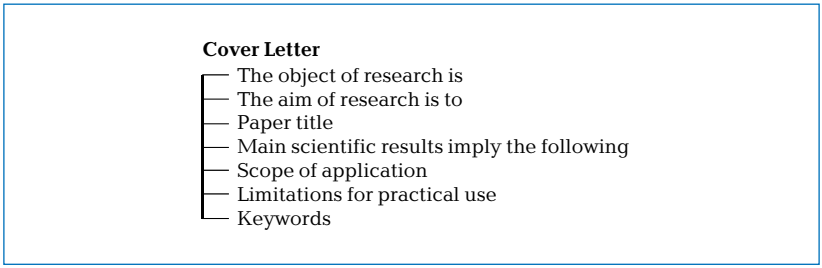


Fig. 3.5 Cover Letter structure

The object of research this is the object for which the research is undertaken.

The Aim of research this is the activity whose result produces scientific novelty for the Author, which may be applied theoretically of practically implemented.

Paper title must contain the following components:

- Research object.
- Research subject this relates to scientific novelty.
- Aim of research.
- What practical purpose is expected from applying the paper's results this is what indicates the expected result of practical application).

The apparent complexity of the required structure of the work title is due to the need to position the work in **Products** as accurately as possible for end users.

Main scientific results should contain a brief description of the main scientific results obtained.

Scope of application should contain a description of the area of practical use of the scientific results obtained.

Limitations for practical use should contain a description of the boundaries of the theoretical and/or practical applicability of the scientific results obtained.

Keywords should reflect the main semantic content of the work (**Fig. 3.6**).

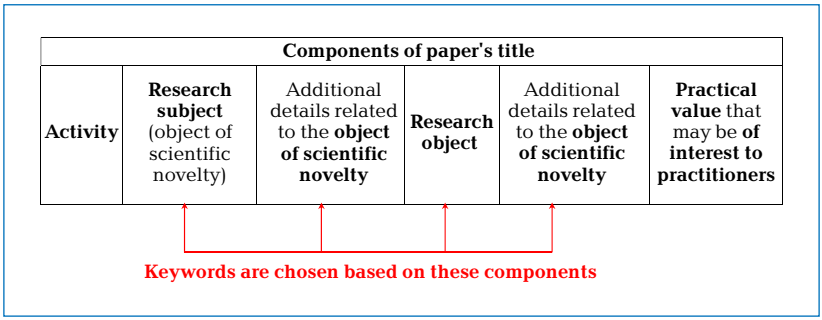


Fig. 3.6 Keywords guidelines recommendations

Block 5 (Step 5) should include data that present the work in a broader form than **Cover Letter**. Such an extended view, called **Resume**, should give the End User the fullest possible idea of the usefulness of this particular work for him if there is insufficient information about it in **Cover Letter**. In this sense, the name differs from the traditional Summary since it is designed to create an analogy with the document submitted by the job seeker to a potential employer. That is, in such a sense, usual for understanding, Resume is a document that should present the applicant to the employer as presentably as possible, while **Resume** in the sense of the component of uploading to the Platform should present this scientific work to its potential user as presentably as possible.

The data tree contained in **Resume** is shown in **Fig. 3.7**.

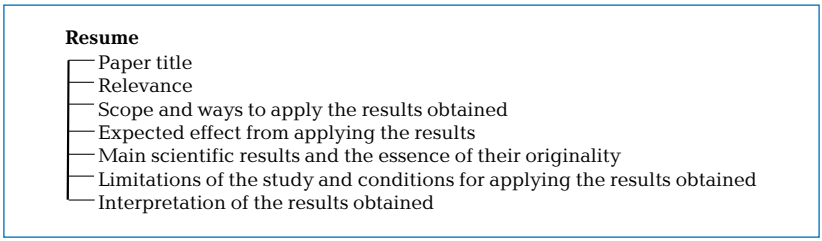


Fig. 3.7 Resume structure

Paper title automatically pulls up from **Cover Letter**.

Relevance should contain a justification of the theoretical and practical relevance of the work, built on the basis of an answer to two main questions: why scientific research on this topic is needed and what the results of these studies will give to practice.

Scope and ways to apply the results obtained should contain a description of the scope and ways of practical application of the research results contained in a given work.

Expected effect from applying the results should contain a description of the effects expected from the use/implementation of the results obtained, preferably using quantitative/comparative assessments, according to the selected performance criteria.

Main scientific results and the essence of their originality should contain a description of the main scientific results contained in a given work, and the essence of their originality.

Limitations of the study and conditions for applying the results obtained should contain a description of the boundaries and conditions for the applicability of the scientific results obtained in the specified field of practical application, which must necessarily be taken into account so that the expectations of practitioners from the use/implementation of these results are justified.

Interpretation of the results obtained should contain a brief interpretation of the research results contained in a given work, suggesting an answer to the question «how can the results be explained?»

In block 6 (Step 6), the following data should be entered: Full text of the paper (in the .pdf format) and Upload in parts.

Upload in parts requires filling in the following fields:

- Title (automatically acquired from **Cover Letter**).
- Keywords (automatically acquired from **Cover Letter**).
- Introduction.
- Methods.
- Results.
- Discussion.
- Conclusions.
- Acknowledgments (not necessary).
- References.

In block 7 (Step 7), the option of access to the content should be selected: **Open access** or **Closed access**. The result of choosing the type of access is the positioning of the scientific work in **Products**, in addition, the coincidence of the selected option with the option selected by the Reviewer at the stage of registration on the Platform is one of the identifiers for the selection of the Reviewers by Platform. Having passed all 7 steps, the Author sees in his personal account confirmation of the fact of uploading his work to the Platform and can expect the following events:

- selection of his work for peer review;
- getting the work into **Products**;
- obtaining marks for this work from the Reviewers;
- receiving ratings for this work from End Users;
- formation of the rating indicator for a given work;
- formation of an indicator of the demand for the work on the part of End Users if the **Open access** option is selected;
- receipt of funds upon downloading a given work by End Users if the **Closed access** option is selected.

The end of the content loading algorithm (**Fig. 3.2**) implements STAGE 1 «Loading by Actor 1 of all information» (**Fig. 2.12**). This corresponds to the entry point in the SCIENTIFIC QUALITY CONTROL BLOCK (**Fig. 2.12**).

3.2 Information technology implementation of the «Registration» process

Fig. 3.8–3.18 show a visualization of the registration process as windows according to the algorithm depicted in **Fig. 3.1**.

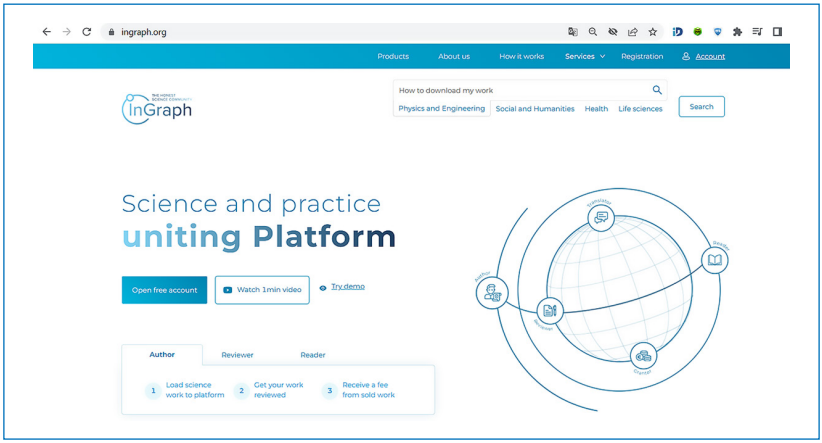


Fig. 3.8 Platform Login window

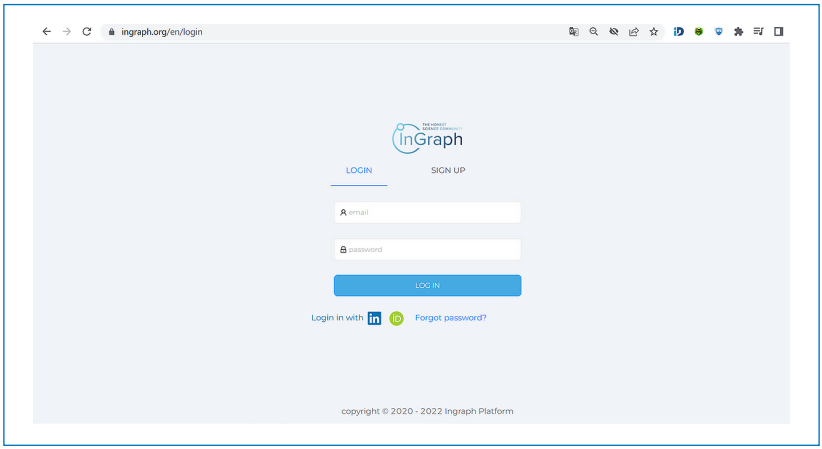


Fig. 3.9 Enter Login and Password window

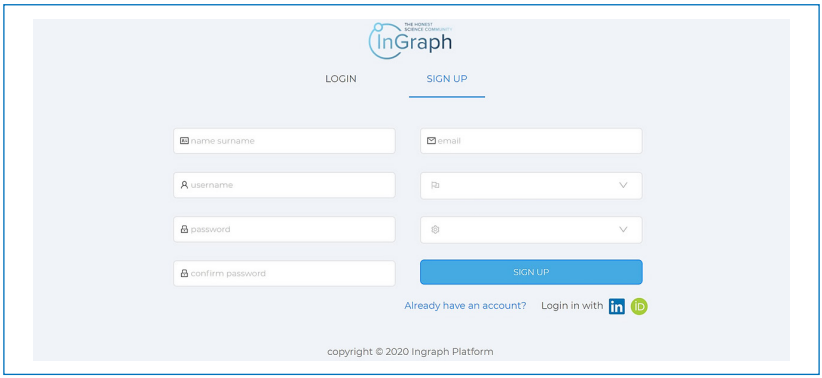


Fig. 3.10 Enter Personal IDs and Create Password window

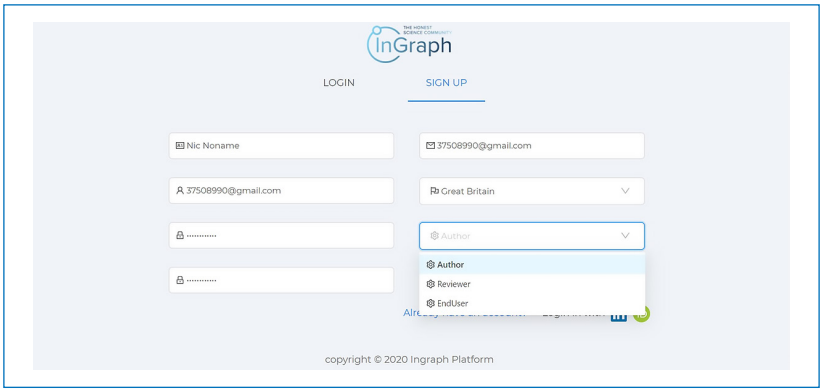


Fig. 3.11 Choose a Role window: Author or Reviewer or End User

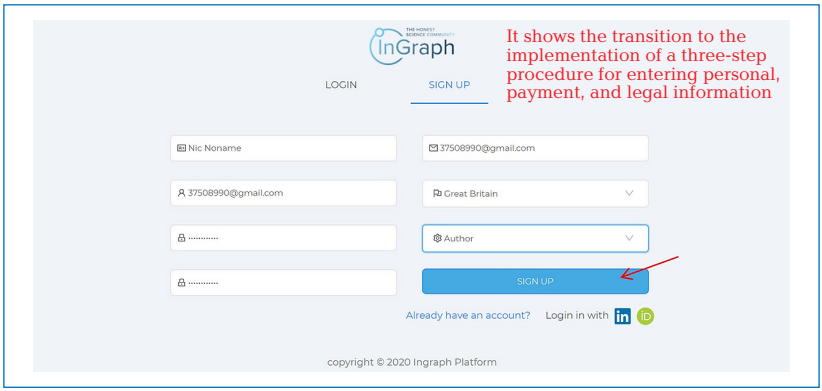


Fig. 3.12 Registration window with filled personal identifiers

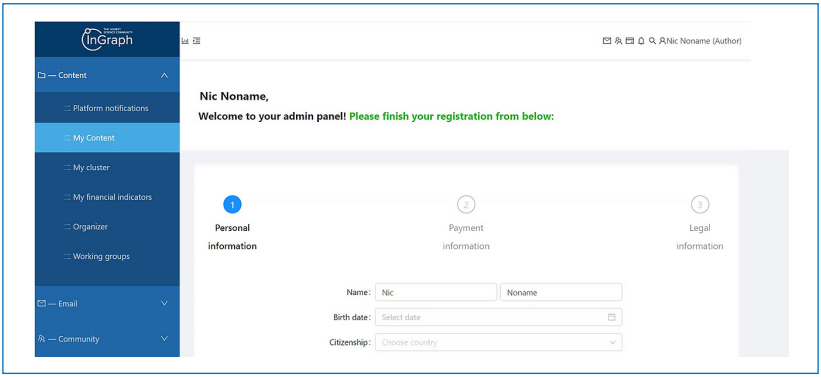


Fig. 3.13 Enter Personal Information window

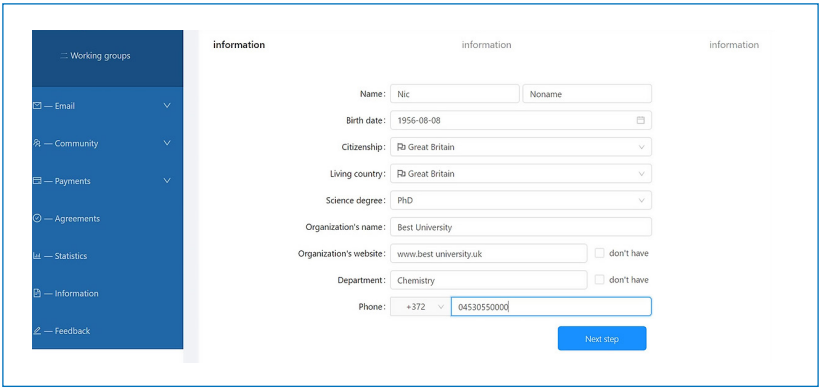


Fig. 3.14 Enter Personal Information window with an example of filling in with data

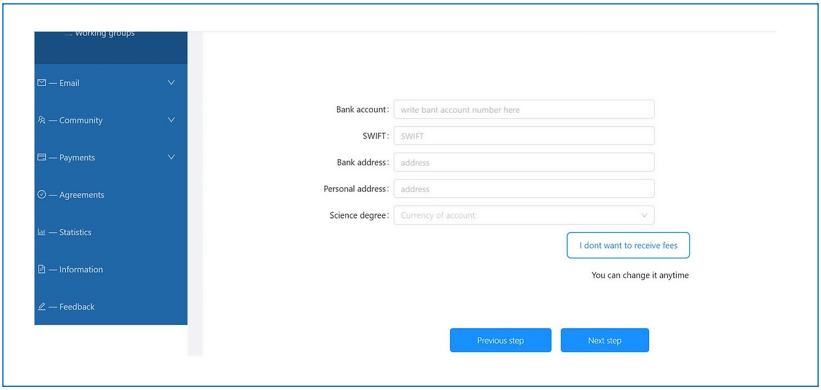


Fig. 3.15 Enter Payment Information window

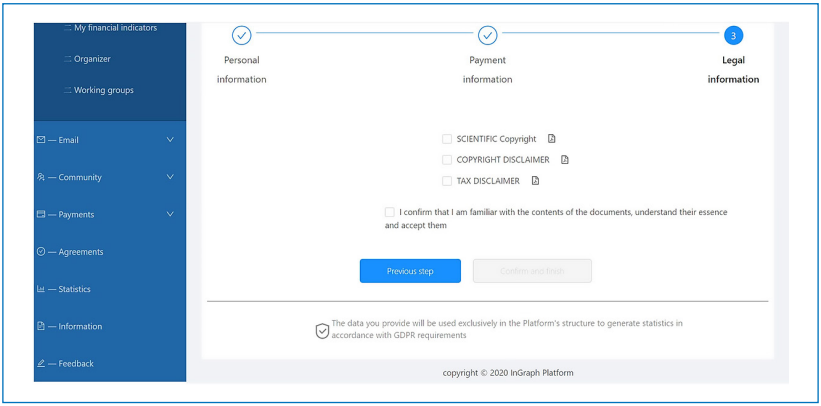


Fig. 3.16 Enter Legal Information window

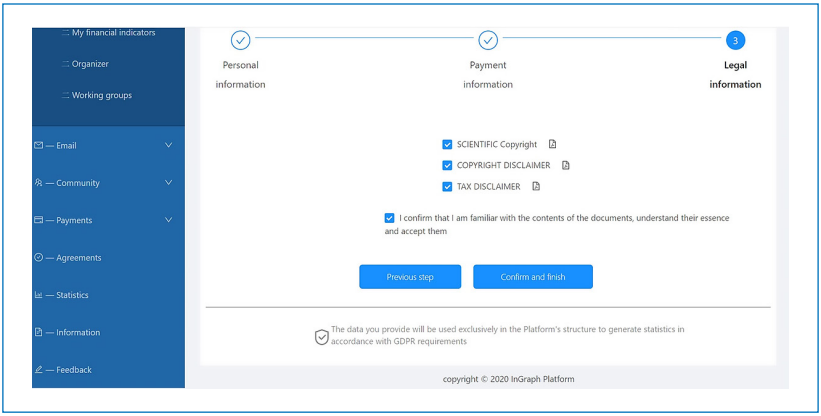


Fig. 3.17 Enter Legal Information window with filled in data on Legal Information

The end of the registration procedure is getting into the Author's personal account (**Fig. 3.18**).

Alternative login options are provided — through ORCID [66] if the Actor is registered in ORCID, or through LinkedIn if the Author has a profile in it (**Fig. 3.9**).

There is also a mechanism for recovering/changing the password in case the password is forgotten by the Actor (**Fig. 3.9**).

It should be noted that the registration procedure (**Fig. 3.8–3.18**) is simple and takes minimal time. If one needs to change the role, there is a mechanism for adding a role (Reviewer, End User) or going to the appropriate cabinet (Reviewer, End User). The option is available in the upper right corner of the window (shown by the red box in **Fig. 3.18**).

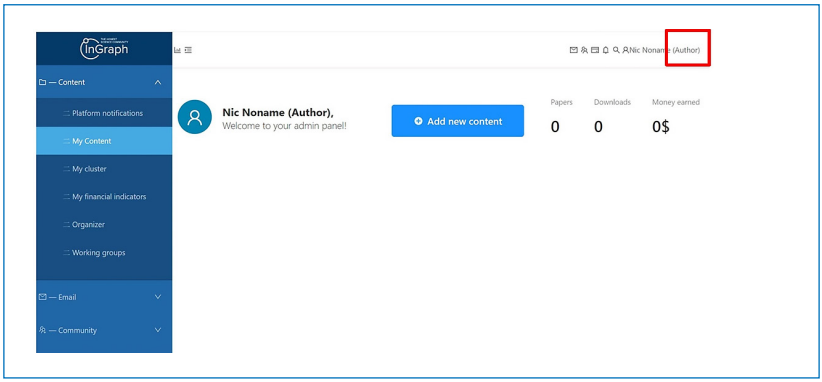


Fig. 3.18 Window «Work in the personal account» (starting position when no work is uploaded by the Author)

The information technology implementation of the «Registration» process ensures the implementation of STAGE 0 «Login of Actor 1 and acceptance» of the general procedure «REGISTRATION OF ALL ACTORS ON THE PLATFORM» (**Fig. 2.12**).

In the event that the Author already has uploaded works, the following information is displayed in his personal account (**Fig. 3.19**):

- ID of unloaded work, automatically assigned by the Platform;
- the type of content uploaded;
- the number of personal works uploaded to the Platform;
- the total amount of funds received for downloading full access by End Users (for works that are in closed access).

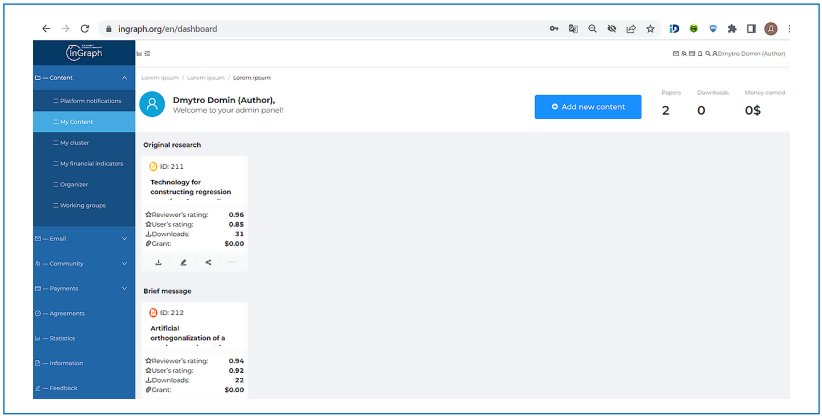


Fig. 3.19 Window «Work in the personal account» (position when the Author has uploaded works)

For each type of uploaded content, the following information is displayed in the personal account (**Fig. 3.20**):

- Reviewer's rating.
- User's rating.
- Number of downloads by End Users.
- The amount of funds received for downloading full access by End Users (for works that are in closed access).

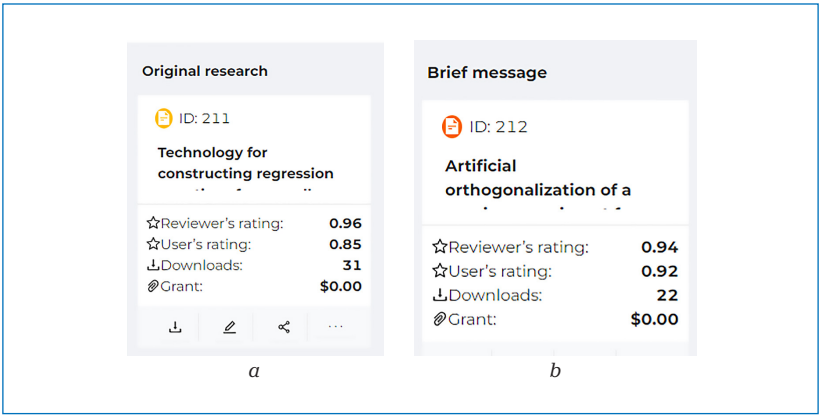


Fig. 3.20 Blocks of available information are differentiated by content types: *a* — content type «Original research», *b* — fragment for content type «Brief message»

There is a mechanism for downloading your work and the ability to make corrections at any of the upload steps (**Fig. 3.19, 3.20**).

3.3 Information and technological implementation of the process «Uploading content»

Fig. 3.21–3.33 show a visualization of the process of uploading a work to the Platform in the form of windows, according to the algorithm depicted in **Fig. 3.2**.

The addition of a work is initiated in the upper right corner, which also contains counters that display the number of works uploaded by the Author, the number of uploads of works, the amount of financial resources earned from full access to their closed content (shown in **Fig. 3.21** in red boxes).

When one initiates the upload process (+Add new content), a window opens to implement Procedures 1–7 (**Fig. 3.2**) to proceed to Step 1 — Selecting Field of science and Scope of application (**Fig. 3.22**).

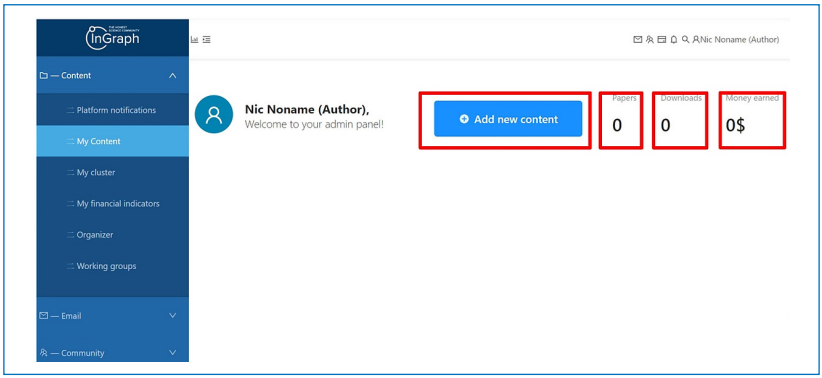


Fig. 3.21 «Personal account» window (unloaded works are not yet available)

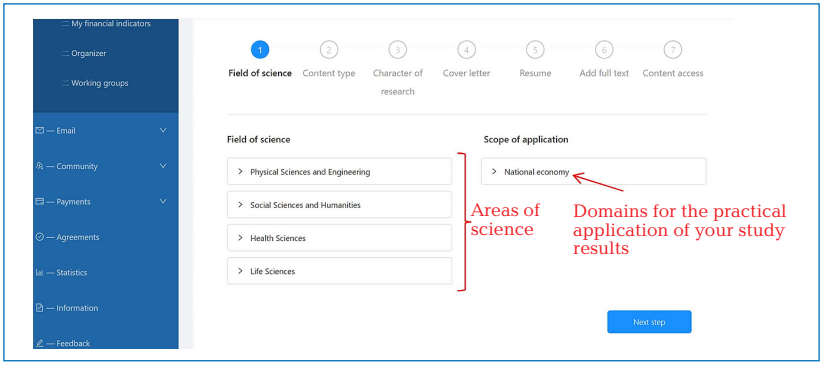


Fig. 3.22 Field of science and Scope of application selection window (the fields of science and the field of practical use of the results shown in scientific works are indicated)

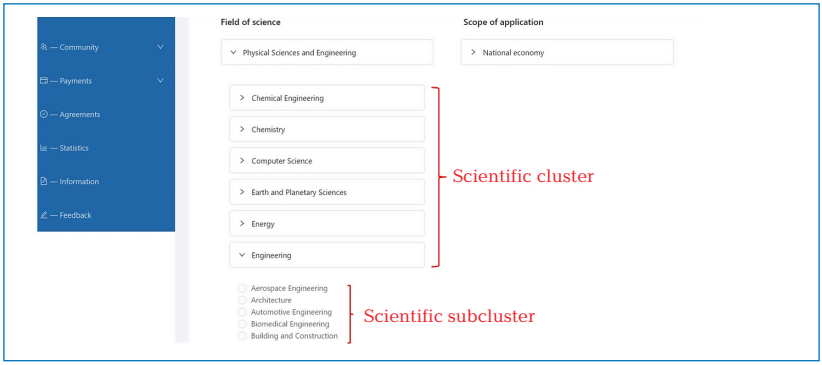


Fig. 3.23 Select Field of science and Scope of application window (Clusters and Subclusters specified)

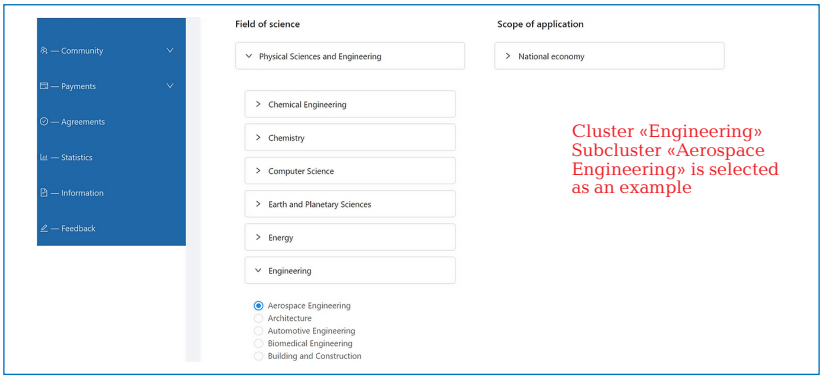


Fig. 3.24 Field of Science and Scope of Application Selection window

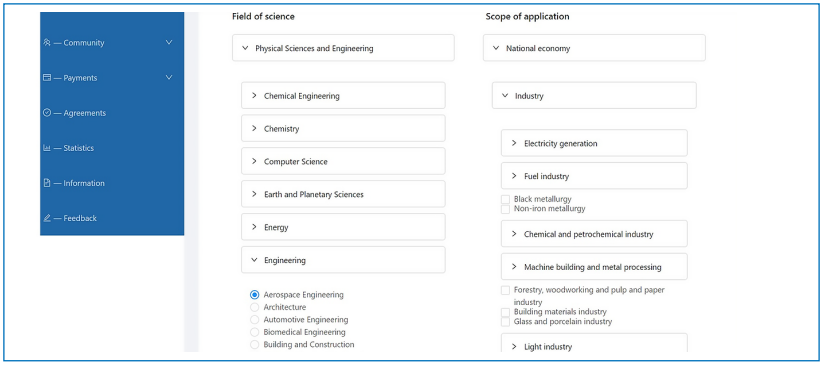


Fig. 3.25 Select Field of science and Scope of application window (shows the Scope of application selection tree from Industry)

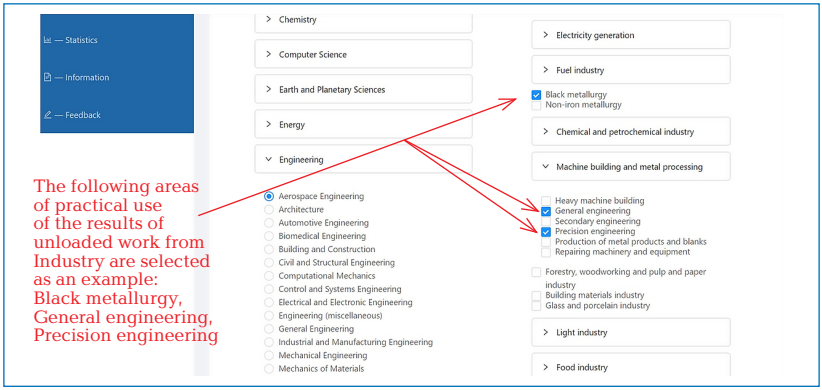


Fig. 3.26 Field of Science and Scope of Application Selection window

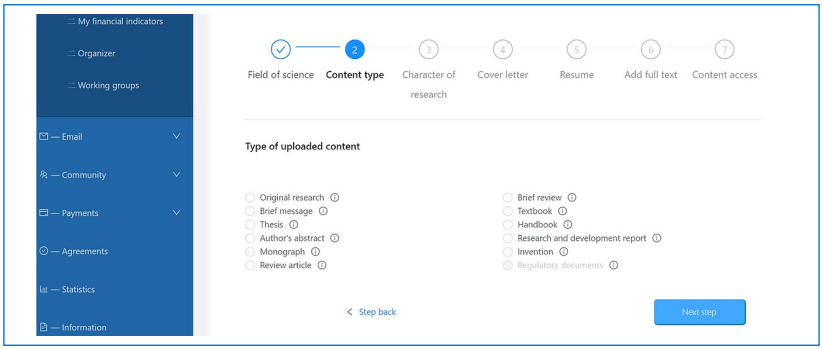


Fig. 3.27 Choose Content type window

Each Content type is accompanied by a brief hint information available for free download.

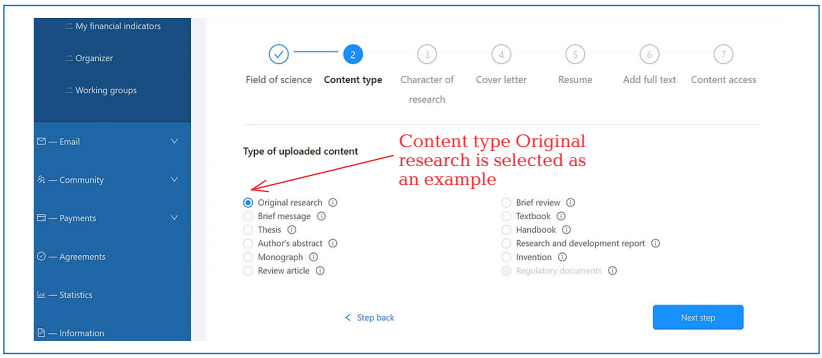


Fig. 3.28 Content Type Selection window

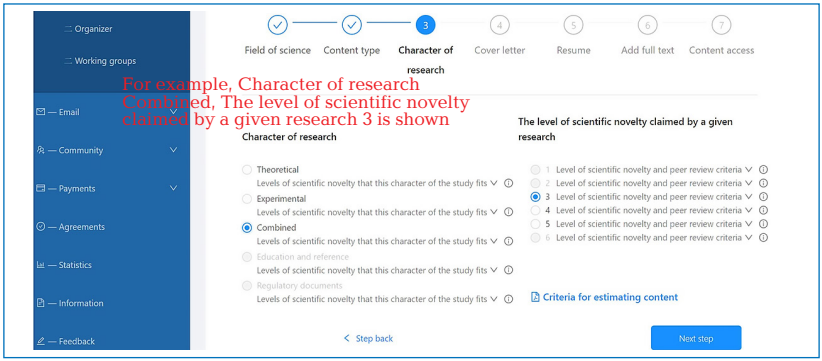


Fig. 3.29 Character of Research Selection window

Character of research and The level of scientific novelty claimed by a given research are accompanied by brief hint information available for free download.

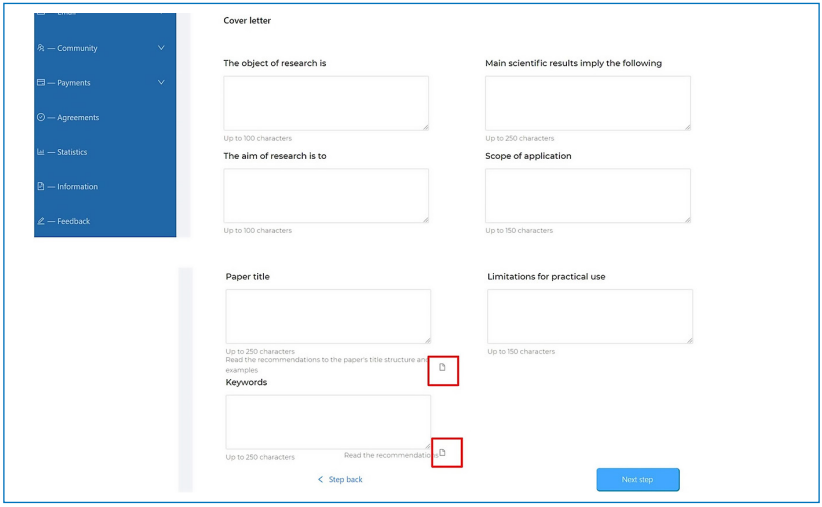


Fig. 3.30 Download Cover Letter window

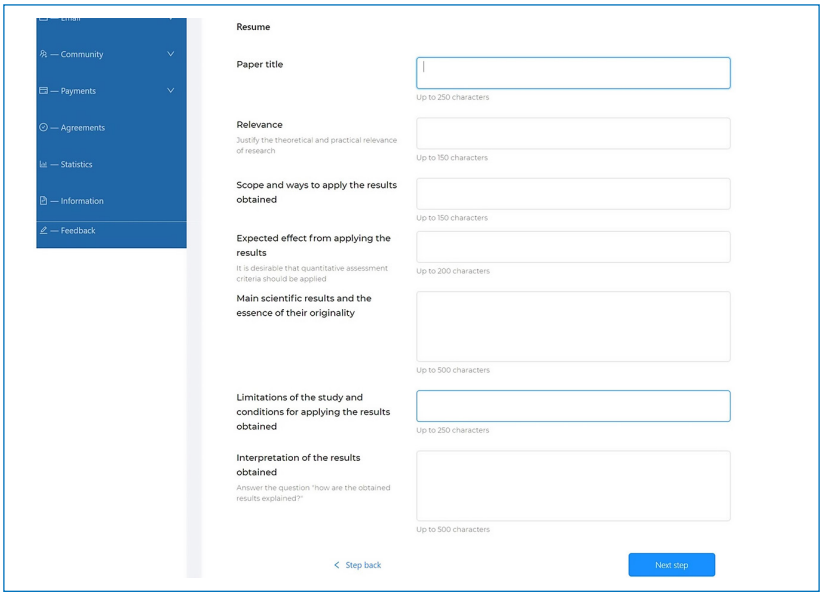


Fig. 3.31 Download Resume window

Paper title and Keywords guidelines in the form of .pdf files, as hint instructions, are available for free download (**Fig. 3.30** shows a red frame).

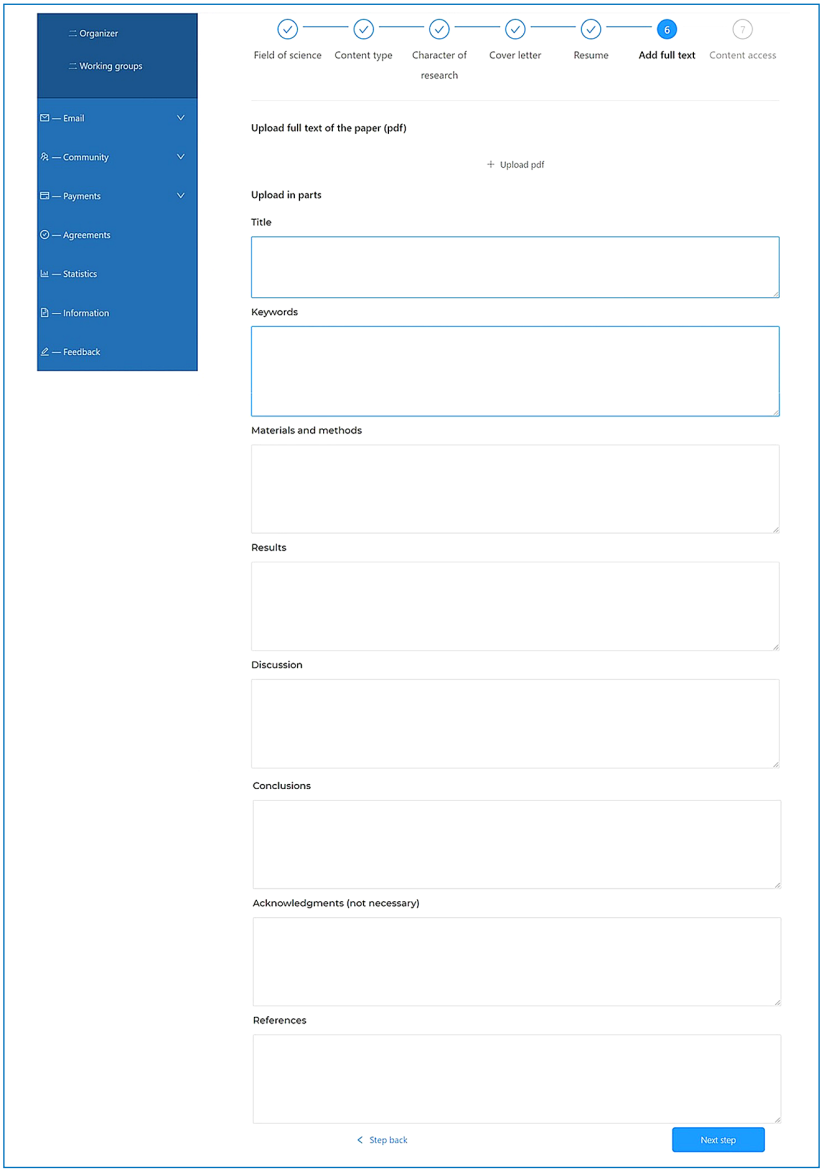


Fig. 3.32 Download Full text window

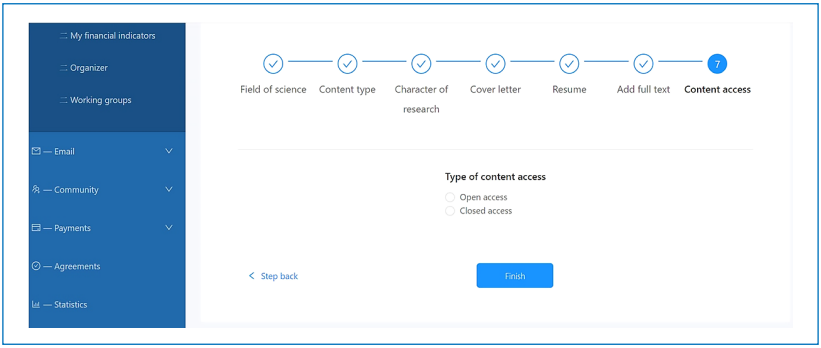


Fig. 3.33 Choose Type of content access window

The display of the ID of the uploaded work on the Platform takes the form shown in **Fig. 3.34**.

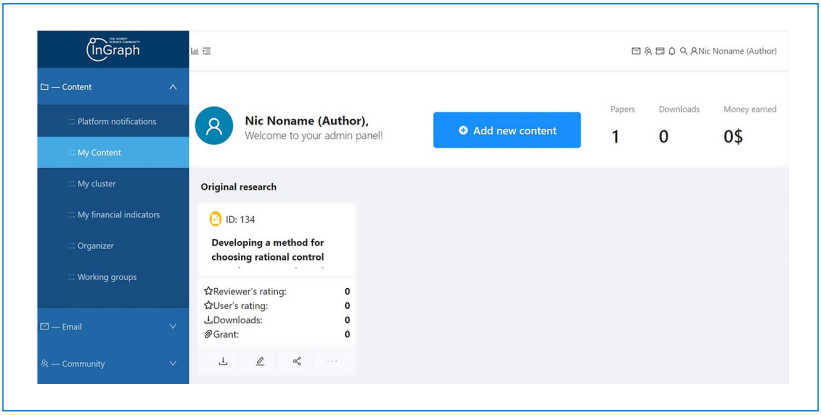


Fig. 3.34 «My Account» window with the display of the ID of the uploaded work

The end result of the implementation of procedure 1—7 is the event involving the appearance of unloaded work on the Platform and the display of the characteristics that determine it in the reviewers' accounts. The condition for such a representation is the match between a set of fields of characteristics of the uploaded work and the characteristics of the works selected as preferences by reviewers in this subject area when they were registered on the Platform.

The information technology implementation of the «Upload Content» process ensures the execution of STAGE 1 «Loading by Actor 1 of all information», which corresponds to the entry point to the SCIENTIFIC QUALITY CONTROL BLOCK (**Fig. 2.12**).

Conclusions to Chapter 3

The key result of information technology solutions for the Author's account is the creation of a working tool for Actor 1 as the creator of scientific work. This tool, which has mechanisms for intra-platform integration, allows him to present his scientific work to the world community without searching for a journal as a source through which it could be done. A simple interface and intuitive actions at the stage of registration and uploading of content minimize time costs to interact with the Platform with the maximum possible informativeness.

The comfort zone for the Author is created by additional registration opportunities through external resources and a login mechanism in case of a forgotten password.

The design of the Author's account does not contain unnecessary elements, and the information displayed in it is key that makes it possible to evaluate the output parameters of the effectiveness of the scientist's activities in the context of the quantity and quality of his scientific content:

- the number of works uploaded to the Platform;
- the number of downloads of each work by End Users;
- rating of each work from reviewers and from End Users;
- the number of financial resources received for providing access to full texts for works that are in closed access.

The difficulty for the Author may be to prepare the work for uploading since the presentation of a number of components of the work requires comprehension and time. Despite the apparent complexity of the requirements for the structure and content of Paper title, Keywords, **Cover Letter**, **Resume**, it is dictated by the need to position each work as accurately as possible and create a comfort zone for the End User.

The comfort zone is understood as an opportunity for the End User to evaluate the usefulness of the work for his needs with minimal time.

The most accurate positioning of each work is understood as an opportunity for the End User to find a scientific work that is practically significant for him with minimal time cost.

At the level of information technology implementation, these opportunities should be provided by extracting information when searching for works not only by keywords but also by content in terms of the expected practical effects of using the results of a given work. For example, the presence in the Paper title of both the scientific and practical components, taking into account the relationship «Field of science — Scope of application», implemented at several levels, should meet the expectations of the End User. These expectations are determined by the desire to achieve specific goals pursued: increasing productivity, reducing production costs, increasing the effectiveness of treatment, reducing tensions in society, obtaining maximum return on investment, etc., depending on the sector of the National Economy.

Additional information about the main scientific results, the scope and conditions of their application, the predicted effects of the application, briefly disclosed in **Cover Letter**, makes it possible to get an idea of the usefulness of the work. If this is not enough for such an idea, the opportunities for the End User are expanded by providing him with **Resume**.

Further development of information technology solutions for the Author's cabinet involves the development of mechanisms for interaction with Translators and Funders, as well as the development of integrative solutions in terms of communications with other participants for the creation of joint working groups, joint implementation of projects, etc.

Chapter 4
Information-technological solutions for the Reviewer's account

4.1 Algorithmic support and review criteria

Information-technological solutions for the Reviewer's account are implemented by two types of functionalities:

- registration functionality;
- review functionality.

The registration algorithm is shown in **Fig. 4.1**.

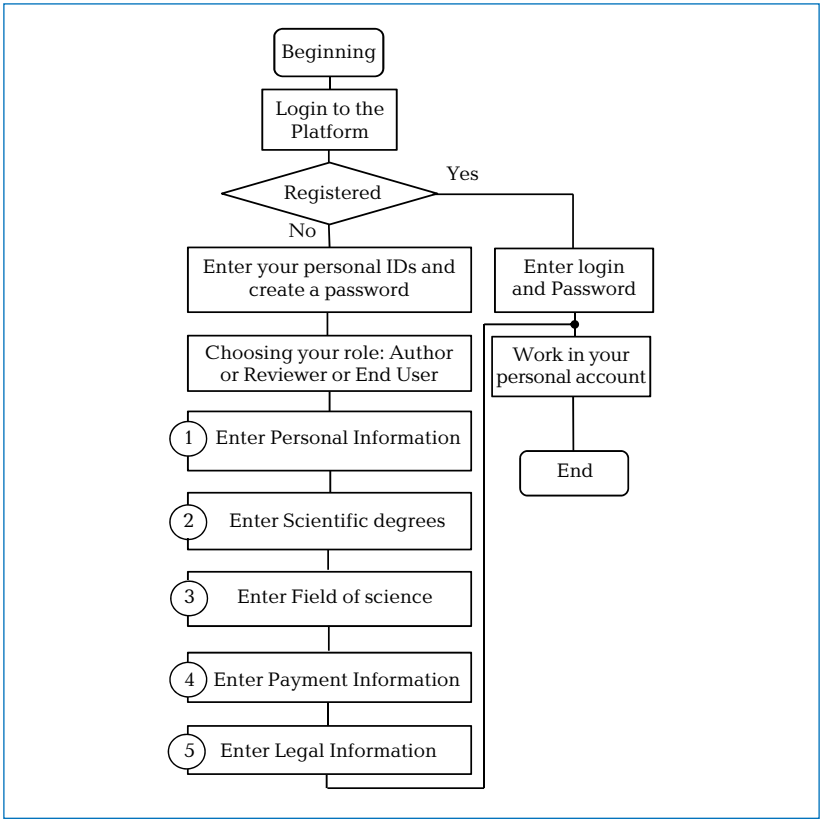


Fig. 4.1 Algorithm of registration on the Platform in the selected role (Reviewer)

By choosing the role of the Reviewer during registration, in the future one can add roles to from one's personal account.

In block 1 (Step 1), when selecting Reviewer as the role, the following data must be entered:

- Name.
- Birth date.
- Citizenship.
- Country of residence.
- Science degree.
- Organization's name.
- Organization's website.
- Department.
- Phone.

All these data are necessary to identify the Reviewer as part of the provision of the service on the **InGraph** Platform. By filling in the appropriate fields in the registration form in Step 1, the Reviewer thereby gives his/her consent to the collection and processing of personal data in order to exercise the user's rights on the **InGraph** Platform. The collected data are used exclusively to provide the service and are not transferred to third parties. The Platform ensures security and safety of collected personal data, the collection and processing of which are carried out exclusively in accordance with the norms of applicable law, including the requirements of GDPR.

In block 2 (Step 2), the following data should be entered:

- Link to Scopus profile.
- Link to Google Scholar profile (optional field).
- Upload a copy of PhD Diploma or Upload a copy of Candidate of Sciences Diploma or Upload a copy of Doctor of Sciences Diploma.
- Upload a copy of Professor Diploma.
- Years of your teaching at a University, or working at a scientific organization.
- Upload DOI of the most important work (optional field).

The possibility of uploading several of the most significant works published earlier, provided that there is copyright on them, is foreseen.

At this step, it is also necessary to confirm the guarantees that the data provided confirming the competence as a potential reviewer correspond to reality, with the awareness of personal responsibility for intentionally false or distorted data.

These data are necessary to confirm the competencies of potential researchers and verify their compliance with certain scientific areas, as well as the existing experience as the author of scientific publications in the relevant scientific areas.

In block 3 (Step 3), it is necessary to enter data relating to:

- subject areas in which the reviewer has sufficient scientific qualifications, a set of competencies, and work experience;

- the nature of the research that the reviewer would like to review;
- the type of content that the reviewer would like to review.

The coincidence of the information entered by the potential Reviewer in this step with the information entered by the Author when uploading his/her work in Steps 1 — 3 (blocks 1 — 3 in **Fig. 3.2**) is a marker for the Platform for the reviewer's choice for this work.

In block 4 (Step 4), the following data should be entered:

- Bank account.
- SWIFT.
- Bank address.
- Personal address.

At the same step, the Reviewer must also make a choice — whether s/he is ready to work with scientific works for free or only on a paid basis. There is an option to select both alternatives at the same time. Despite the possibility of choice based on one's personal convictions, preference should be given to the choice of both options. This is due to the fact that by choosing the option of free review of works, the Reviewer thereby makes his/her volunteer contribution to the development of science.

The data entered in this step are necessary for the implementation of transactions — withdrawal of funds to the Reviewer's account if the works that s/he reviewed, posted in **Products** in closed access, are downloaded by End Users.

In block 5 (Step 5), it is necessary to confirm acceptance of all legal conditions:

- Scientific Copyright.
- Copyright Disclaimer.
- Tax Disclaimer.

The result of entering all the data according to the algorithm given in **Fig. 4.1** is the opening of the Personal Account of the Reviewer.

The algorithm of registration on the Platform in the selected role of the Reviewer (**Fig. 4.1**) implements STAGE 0 «Login of Actor 2 and acceptance» of the general procedure «REGISTRATION OF ALL ACTORS ON THE PLATFORM» (A2, **Fig. 2.12**).

The review algorithm is shown in **Fig. 4.2**.

Block 1 (Step 1) contains data on works available for review in the fields of science selected by the Reviewer at the registration stage, provided that the fields «Type of content», «Character of research», «Type of content access» coincide.

In blocks 2, 3 (Steps 2, 3), the review process is initiated and a request to familiarize with **Resume** and **Full text** of the work is carried out in accordance with the deadlines set by the Platform. This is the period of time allotted to the reviewer to carefully familiarize himself/herself with the content of the reviewed work and compile his/her expert opinion regarding its scientific novelty and practical significance.

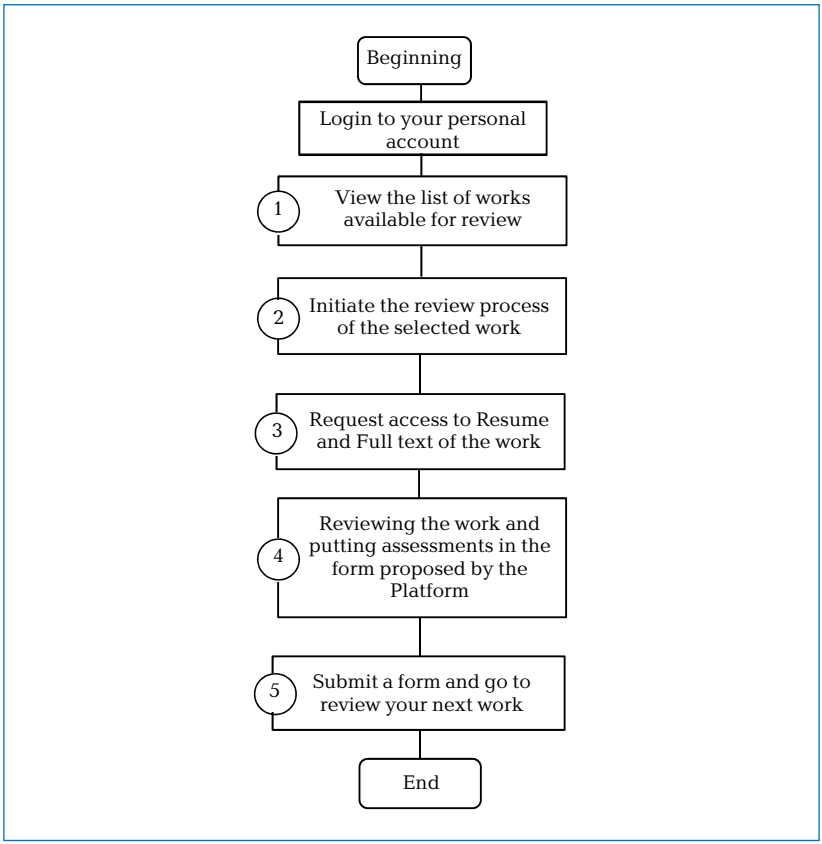


Fig. 4.2 Review algorithm

In block 4 (Step 4), the work is estimated by placing points for its quality in accordance with the evaluation criteria proposed in the form. The type and set of these criteria depend on the level of scientific novelty stated by the author in Step 3 of the loading of the work (**Fig. 3.2**). Variants of the forms in which the assessments are placed are given in **Fig. 4.3–4.8**. The assessment is set for each evaluation criterion given in the appropriate form.

The following estimates are suggested:

- **1** — actual quality of research corresponds to the stated;
- **0.75** — the paper requires minor refinement, but the shortcomings of the existing variant do not affect the overall quality of the work and its potential attractiveness to the end user;
- **0.5** — the paper requires refinement, but the existing variant may be of potential interest to the end user;

- **0.25** — the paper requires substantial refinement, without which the existing variant will not be interesting or will be incomprehensible to the potential user;
- **0** — negative response.

LEVEL OF SCIENTIFIC NOVELTY		1
Identification	NEW INTERESTING EVIDENCE OF KNOWN RESULTS, INCLUDING FOR BRIEF MESSAGES	
For research of "Experimental" type		
Quality of the research presentation		
Is the purpose of the research well formulated?		
Research results		
Are there real experimental data?		
Is the description of the experimental part correct in terms of the materials used, methods, equipment, conditions of experiments?		
Arguments about the results obtained		
Is the evidence in the paper sufficient for the conclusions the author draws?		

Fig. 4.3 Reviewer form for scientific novelty level 1 (for research of «Experimental» type)

LEVEL OF SCIENTIFIC NOVELTY		1
Identification	NEW INTERESTING EVIDENCE OF KNOWN RESULTS, INCLUDING FOR BRIEF MESSAGES	
For research of «Theoretical» type		
Quality of the research presentation		
Is the purpose of the research well formulated?		
Research results		
Is known fundamental knowledge used **OR** the original variant of the theoretical solution was proposed **OR** is a combined variant of the theoretical justification applied: known fundamental knowledge and the original variant of theoretical solution are used?		
Is the evidence base convincing in terms of the correctness of the fundamental knowledge used or in terms of the originality of the proposed theoretical solution?		
Arguments about the results obtained		
Is the evidence in the paper sufficient for the conclusions the author draws?		

Fig. 4.4 Reviewer form for scientific novelty level 1 (for research of «Theoretical» type)

LEVEL OF SCIENTIFIC NOVELTY	2
Identification	**EXTENSING THE SCOPE OF RESEARCH OBJECT TO A WIDER AREA OF DATA, INCLUDING FOR BRIEF MESSAGES**
Quality of the research presentation	
Were existing data (scientific periodicals, reports, hands-on experience, etc.) analyzed to identify the problem part and the wording of the problem detected?	
Is the purpose of the research well formulated?	
Research results	
Are there real experimental data?	
Is the experimental data processing procedure described?	
Are the results of experimental data processing given?	
Is the description of the experimental part correct in terms of the materials used, methods, equipment, conditions of experiments?	
Arguments about the results obtained	
Are the results analyzed and interpreted correctly?	
Are the limits of applicability of the results described?	
Practical significance of research	
Practical testing has not been carried out or its volume is insufficient for final judgments about the effect of implementation, but the potential is present	

Fig. 4.5 Reviewer form for level of scientific novelty 2

LEVEL OF SCIENTIFIC NOVELTY	3
Identification	**IDENTIFYING NEW PROBLEMS (PARADOXES) IN SEEMINGLY KNOWN TRUTHS OR JUDGMENTS, INCLUDING FOR BRIEF MESSAGES**
Quality of the research presentation	
Were existing data (scientific periodicals, reports, hands-on experience, etc.) analyzed to identify the problem part and the wording of the problem detected?	
Research results	
Theoretical aspects	
Is known fundamental knowledge used **OR** Is the original variant of the theoretical solution suggested **OR** Is a combined variant of the theoretical justification applied: known fundamental knowledge and the original variant of theoretical solution are used?	
Experimental aspects	
Are there real experimental data?	
Is the experimental data processing procedure described?	
Are the results of experimental data processing given?	
Is the description of the experimental part correct in terms of the materials used, methods, equipment, conditions of experiments?	
Arguments about the results obtained	
Are there alternative data or theoretical basis that would be the evidence for the results obtained in a given research?	
Are the results analyzed and interpreted correctly?	
Is the evidence in the paper sufficient for the conclusions the author draws?	
Are the limits of applicability of the results described?	

Fig. 4.6 Reviewer form for level of scientific novelty 3

LEVEL OF SCIENTIFIC NOVELTY	4
Identification	**IDENTIFICATION AND EXPLANATION OF THE ESSENCE OF THE STUDIED PROCESSES AT A QUALITATIVE LEVEL, PERHAPS BASED ON THE QUANTITATIVE INDICATORS DESCRIBING A GIVEN PROCESS, AND THE RESULTS OF PRACTICAL CONFIRMATION OF THE CONCLUSIONS DRAWN**
Only for original research or systemic research	
Quality of the research presentation	
Do the authors provide sufficient reasoning as to the relevance of the research?	
Is the problem clearly formulated, the existence of which can be considered justification for the feasibility of a given research and the potential demand for its results?	
Research results	
Theoretical aspects	
Is known fundamental knowledge used **OR** Is the original variant of the theoretical solution suggested **OR** Is a combined variant of the theoretical justification applied: known fundamental knowledge and the original variant of theoretical solution are used?	
Experimental aspects	
Are there real experimental data?	
Is the experimental data processing procedure described?	
Are the results of experimental data processing given?	
Arguments about the results obtained	
Are there alternative data or theoretical basis that would be the evidence for the results obtained in a given research?	
Are the results analyzed and interpreted correctly?	
Is the evidence in the paper sufficient for the conclusions the author draws?	
Are the limits of applicability of the results described?	
Practical significance of research	
The main results of the research were obtained directly under practical conditions for which they are intended (experimental-industrial, etc. conditions)	
There are documented positive results of practical application of results in any part of them with a determined effect for any criterion	

Fig. 4.7 Reviewer form for level of scientific novelty 4

LEVEL OF SCIENTIFIC NOVELTY	5
Identification	**CREATING A SOLID FOUNDATION THAT SETS THE VECTOR FOR FURTHER RESEARCH AND IMPLEMENTATION**
Only for systemic research	
Quality of the research presentation	
Do the authors provide sufficient reasoning as to the relevance of the research?	
Is the problem clearly formulated, the existence of which can be considered justification for the feasibility of the research and the potential demand for its results?	
Were existing data (scientific periodicals, reports, hands-on experience, etc.) analyzed to identify the problem part and the wording of the problem detected?	
Is the purpose of the research well formulated?	
Research results	
Theoretical aspects	
Is known fundamental knowledge used **OR** Is the original variant of the theoretical solution proposed **OR** Is a combined variant of the theoretical justification applied: known fundamental knowledge and the original variant theoretical solution are used?	
Is the evidence base convincing in terms of the originality of the proposed theoretical solution?	
Experimental aspects	
Are there real experimental data?	
Is the experimental data processing procedure described?	
Are the results of experimental data processing given?	
Is the description of the experimental part correct in terms of the materials used, methods, equipment, conditions of experiments?	
Arguments about the results obtained	
Are there alternative data or theoretical basis that would be the evidence for the results obtained in this research?	
Are the results analyzed and interpreted correctly?	
Is the evidence in the paper sufficient for the conclusions the author draws?	
Are the limits of applicability of the results described?	
Practical significance of research	
There are documented positive results of practical application of results in any part of them with a determined effect for any criterion OR Is a significant effect of implementation predicted, giving grounds to capitalize the advancement (patenting)	

Fig. 4.8 Reviewer's form for level of scientific novelty 5

A formula for calculating the ratings of content from each reviewer:

$$R_k^{(j)} = \frac{R_\Sigma^{(j)}}{R_{\max}^{(j)}}, \tag{4.1}$$

where $R_{\max}^{(j)}$ is the maximum number of criteria by which the quality of work is evaluated, depending on the level of scientific novelty; $R_\Sigma^{(j)}$ is the numerical value of the i-th criterion, which is mandatory for the claimed level of scientific novelty,

$$R_\Sigma^{(j)} = \sum_{i=1}^{R_{\max}^{(j)}} r_i. \tag{4.2}$$

Here r_i is the numerical value of the score given by the reviewer on the i-th criterion.

The levels of scientific novelty available when loading the work in Step 3 of the algorithm (**Fig. 3.2**) are related to the type and nature of the research. Therefore, the type and nature of research chosen by the Author, through the «Level of scientific novelty» parameter, are implicitly included in formula (4.1). This implicit relationship in the form of correspondences is shown in **Table 4.1**.

Table 4.1 Criteria for estimating (rating) content by reviewers

For which type of content used	Level of scientific novelty	The maximum number of points depending on the chosen level of scientific novelty, $R_{\max}^{(j)}$	A formula for calculating the ratings of content from each reviewer (1)
Original research, brief messages, Review article, Brief review, Research and development report (theoretical, experimental)	1	4	$R_k^{(j)} = \frac{R_\Sigma^{(j)}}{4}$
Original research, brief messages, Research and development report (experimental)	2	9	$R_k^{(j)} = \frac{R_\Sigma^{(j)}}{9}$
Original research, brief messages, Review article, Brief review, Research and development report, Invention (combined)	3	10	$R_k^{(j)} = \frac{R_\Sigma^{(j)}}{10}$
Original research, systemic studies (combined): authors' abstracts, thesis, monographs, Research and development report, Invention)	4	12	$R_k^{(j)} = \frac{R_\Sigma^{(j)}}{12}$
Original research, systemic studies (combined): authors' abstracts, thesis, monographs, Research and development report, Invention	5	15	$R_k^{(j)} = \frac{R_\Sigma^{(j)}}{15}$
Community decision only	6	–	–

The use of formula (4.1) to quantify the quality of scientific papers allows for the introduction of simple and intuitive interval estimates for quality gradation, which makes it possible to form text recommendations for the End User (**Table 4.2**).

Table 4.2 Interval assessments of the quality of scientific works based on the average assessment $\overline{R_{\Sigma}^{(j)}}$

$\overline{R_{\Sigma}^{(j)}}$	Text
0 – 0.1	Not recommended by reviewers at all. If one pays for a full access to this paper, one does it at one's discretion: the paper is unlikely to meet your needs.
0.11 – 0.2	Not recommended by reviewers. If one pays for a full access to this paper, one does it at one's discretion: the paper is unlikely to meet your needs.
0.21 – 0.3	Not recommended by reviewers as it requires fundamental re-working. If one pays for a full access to this paper, one does it at one's discretion: the paper may not meet your needs.
0.31 – 0.4	Not recommended by reviewers as the paper is not fully compliant with the required quality. If one pays for a full access to this paper, one does it at one's discretion: the paper may not meet your needs.
0.41 – 0.5	Based on reviewing, this paper meets the minimal threshold. The work may prove useful in specific aspects.
0.51 – 0.6	The paper has been favorably reviewed and may prove useful in several aspects.
0.61 – 0.7	Based on reviewing, this paper complies with quality requirements.
0.71 – 0.8	Based on reviewing, this paper complies with high quality requirements.
0.81 – 0.9	Based on reviewing, this paper complies with very high quality requirements.
0.91 – 1	Based on reviewing, this paper complies with the requirements to the best quality in a given field.

Thus, blocks 1, 2 of the review algorithm (**Fig. 4.2**) implement STAGE 2 «Review + rating» in the part relating to familiarization with all works available for review in their subject area (**Fig. 2.12**). This corresponds to the entrance to the SCIENTIFIC QUALITY CONTROL BLOCK (**Fig. 2.12**).

Block 3 of the review algorithm (**Fig. 4.2**) implements STAGE 2 «Review + rating» in the part concerning the Resume and Full text request for the selected work. This corresponds to the «Consent to review from Actor 2 received» event in the SCIENTIFIC QUALITY CONTROL BLOCK (**Fig. 2.12**).

Block 4 of the review algorithm (**Fig. 4.2**) implements STAGE 2 «Review + rating» in the part concerning the grading of the selected work in the form proposed by the Platform according to the level of scientific

novelty (**Fig. 4.2–4.7**). This corresponds to the event «Rating by Actor 2» in the SCIENTIFIC QUALITY CONTROL BLOCK (**Fig. 2.12**).

Block 5 of the review algorithm (**Fig. 4.2**) implements the end of STAGE 2 «Review+rating», fixed by sending a completed form with grades, corresponding to the level of scientific novelty (**Fig. 4.2–4.7**). This corresponds to the exit from the SCIENTIFIC QUALITY CONTROL BLOCK (**Fig. 2.12**). In the case when the work is reviewed by all three reviewers, the work is transferred to Products (CA-BLOCK, **Fig. 2.12**).

4.2 Information-technological implementation of the «Registration» process

Fig. 4.9–4.17 show a visualization of the registration process in the form of windows, according to the algorithm shown in **Fig. 4.1**. The registration begins by passing the steps similar to the operations shown in **Fig. 3.8–3.12**, with the choice of the «Reviewer» role. After that, one must go through procedure 1 – 5 (**Fig. 4.1**).

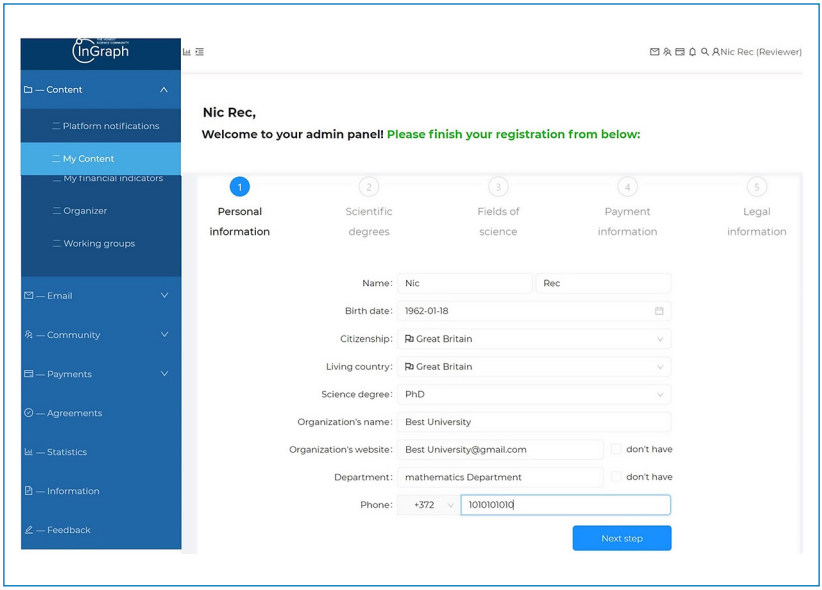


Fig. 4.9 Enter Personal Information window

In the «Enter Scientific Degrees» step, the competence of Actor 2 as a potential reviewer must be personally confirmed (shown in **Fig. 4.10** by the lower red arrow).

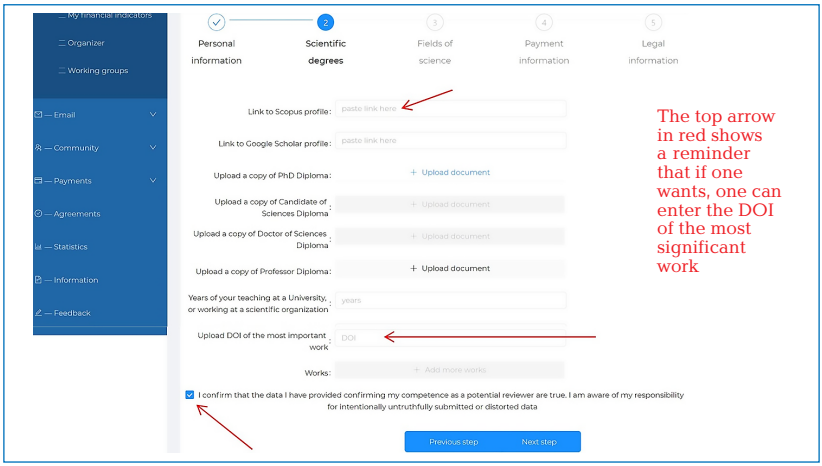


Fig. 4.10 Enter Scientific Degrees window with an example of filling in with data

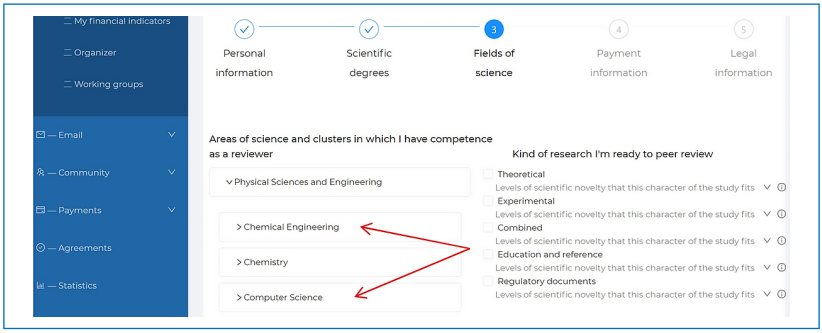


Fig. 4.11 Enter Field of Science window

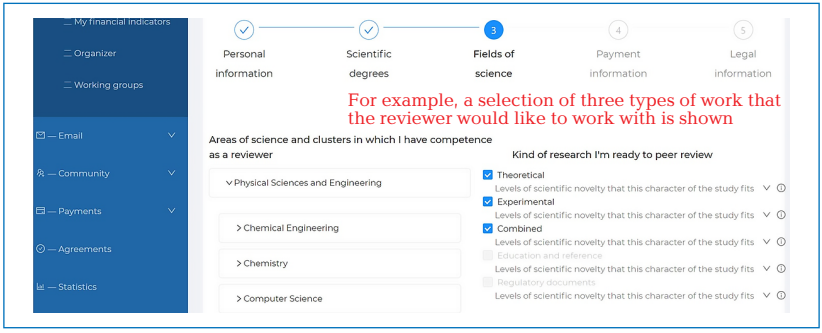


Fig. 4.12 «Field of Science» window with completed data «Kind of research I'm ready to peer review»

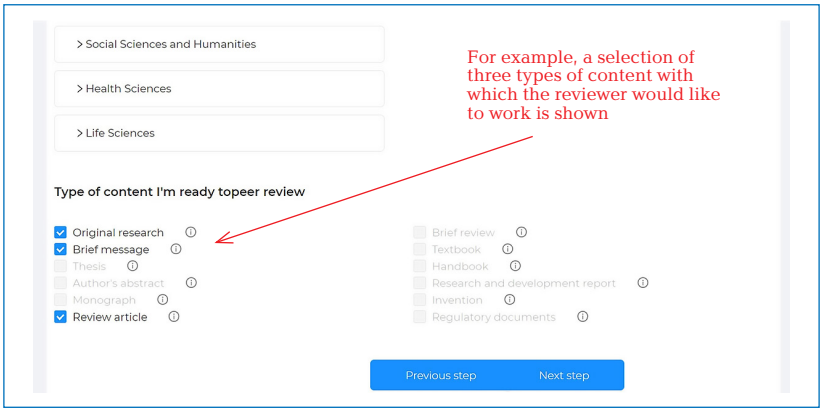


Fig. 4.13 Fragment of the «Enter Field of Science» window with the filled data «Type of content I'm ready to peer review»

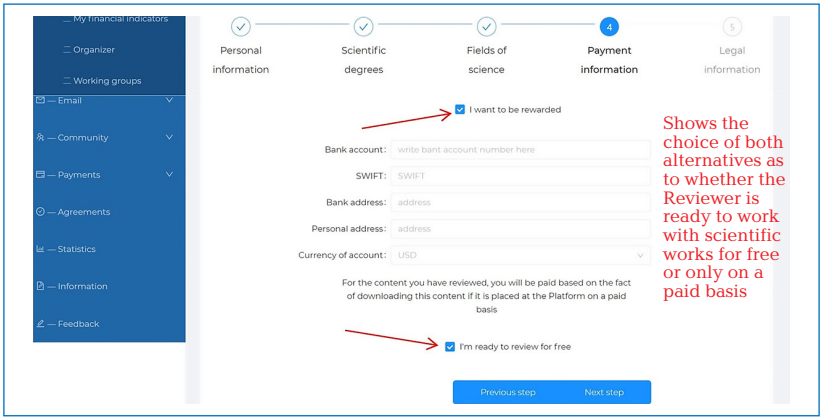


Fig. 4.14 «Payment Information» window

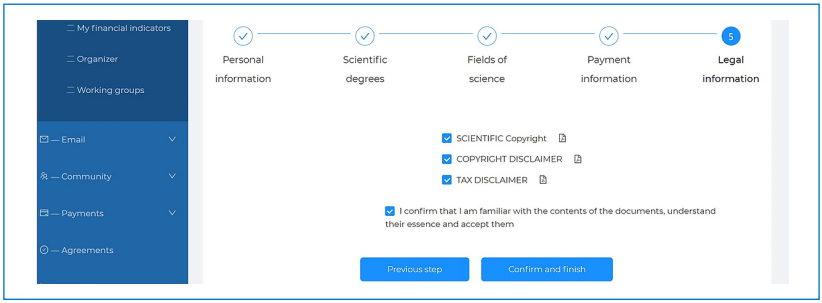


Fig. 4.15 Legal information window

The end of the registration procedure is entering the personal account of the Reviewer (**Fig. 4.16**).

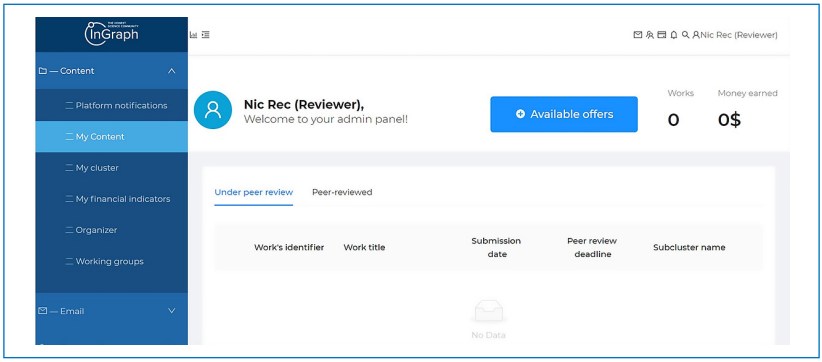


Fig. 4.16 Fragment of the «Reviewer's Personal Account» window

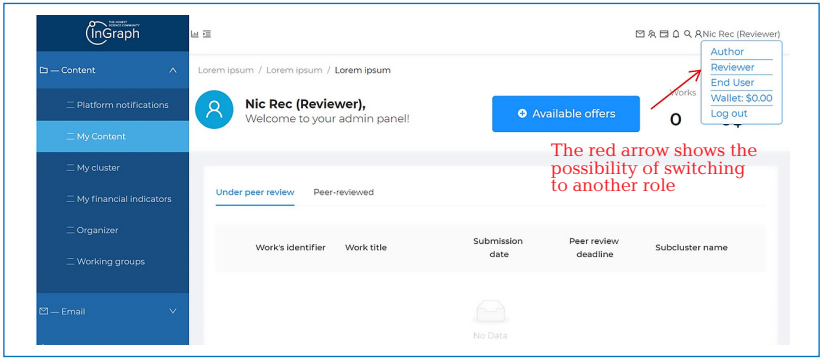


Fig. 4.17 Reviewer's Personal Account window: switching to another role

The information-technological implementation of the «Registration» process ensures the implementation of STAGE 0 «Login of Actor 2 and acceptance» of the general procedure «REGISTRATION OF ALL ACTORS ON THE PLATFORM» (A2, **Fig. 2.12**).

4.3 Information-technological implementation of the review process

Fig. 4.18–4.30 show a visualization of the review process in the form of windows, according to the algorithm depicted in **Fig. 4.2**.

Review of the works available for review is initiated in the upper right corner (+Available offers) where data on the number of already personally

reviewed works and the amount of financial resources earned by reviewing are also displayed (**Fig. 4.18**).

When the **+Available** offers process is initiated, a window opens with works available for review (**Fig. 4.19**) in the field of sciences in which the reviewer confirmed his/her competence in Step 3 (**Fig. 4.1**).

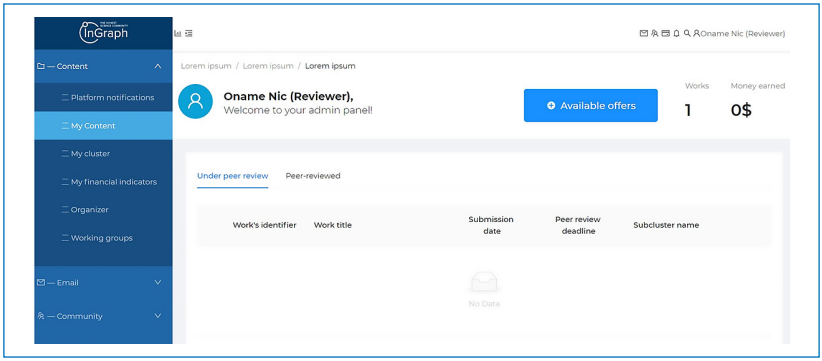


Fig. 4.18 Under Peer Review window

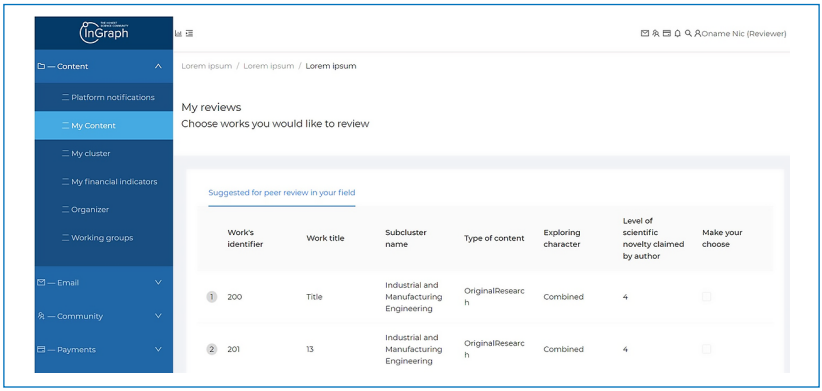


Fig. 4.19 Reviewable Works window

At this step, the following information about the works is available to the Reviewer: Work's identifier, Work title, Subcluster name, Type of content, Exploring character, Level scientific novelty claimed by author.

Based on this data, the Reviewer can make a choice (for example, ID200 — **Fig. 4.20**), confirming it with an action on the Platform (Make your choice + The object of research is) — **Fig. 4.21**.

In response to the reviewer's choice of work, the Platform offers to familiarize himself/herself with **Cover letter** and provides **Resume** and **Full text** (**Fig. 4.22–4.25**) upon request.

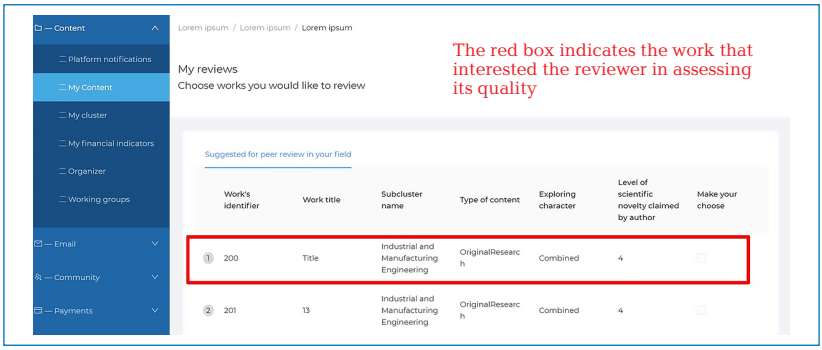


Fig. 4.20 Works available for review window: the work that interested the reviewer

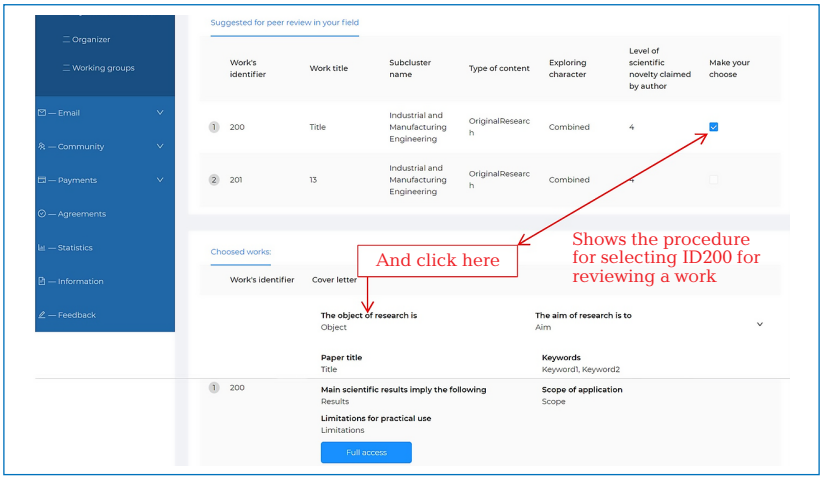


Fig. 4.21 Works available for review window: the procedure for selecting a work

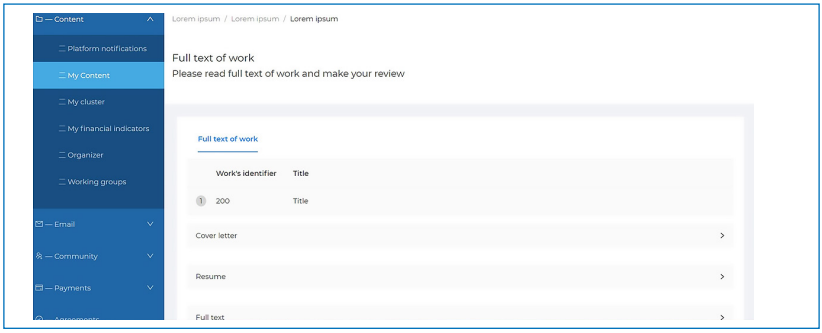


Fig. 4.22 Choose **Cover letter**, **Resume**, **Full text** window

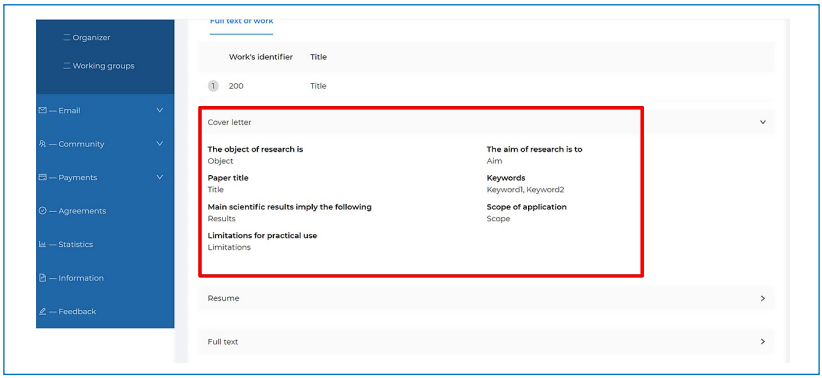


Fig. 4.23 Cover **Letter** window

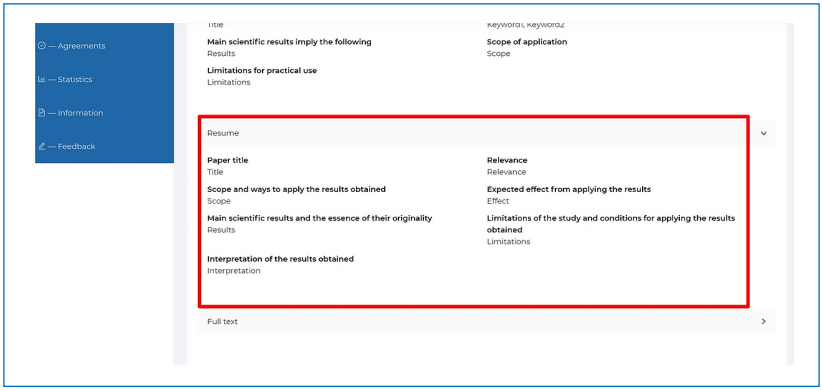


Fig. 4.24 Resume window

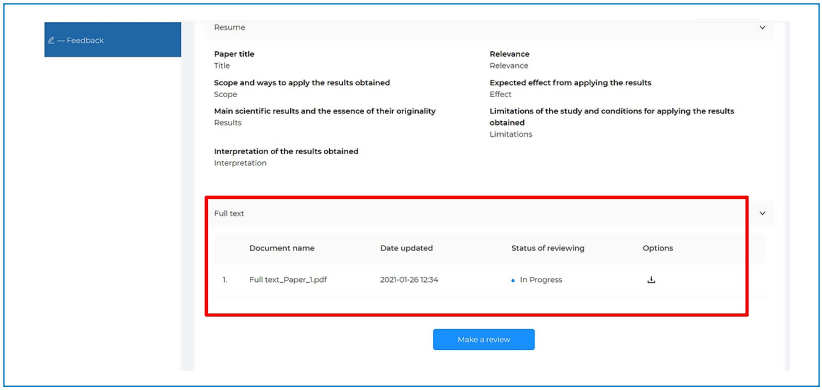
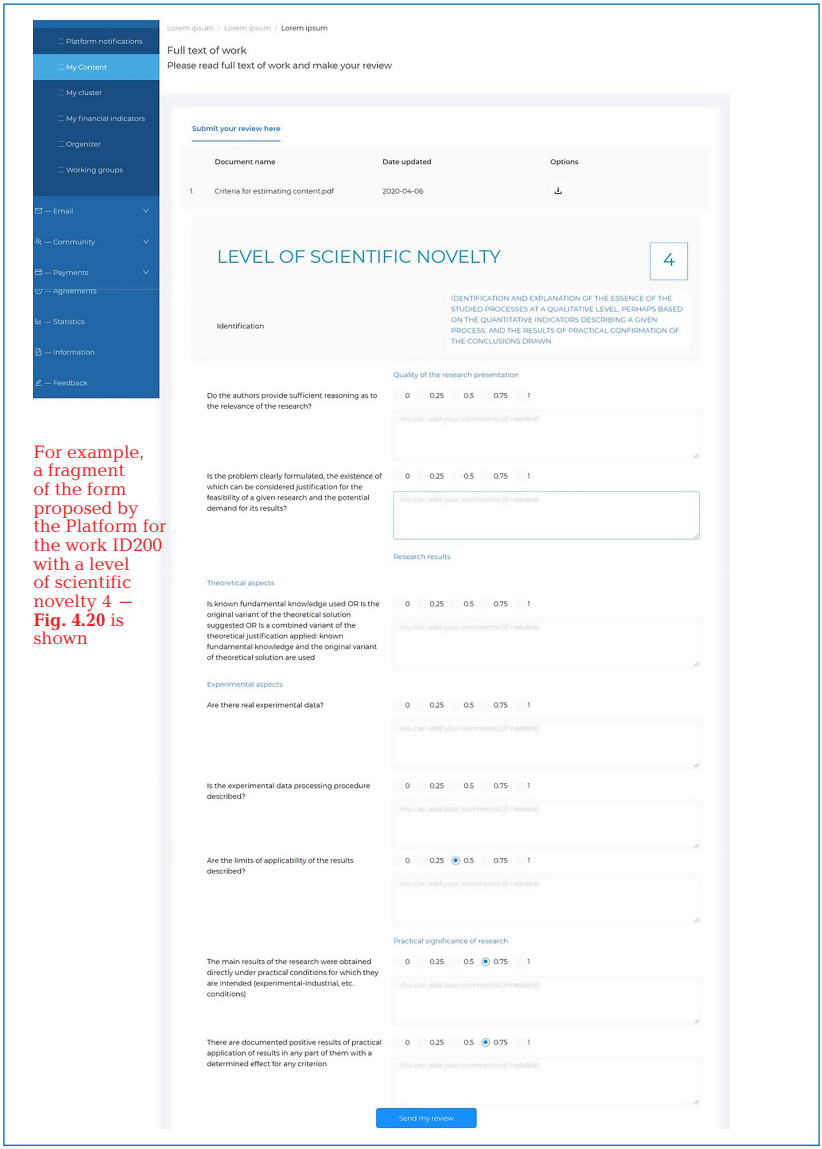


Fig. 4.25 Full **Text** window

In response to the confirmed consent of the reviewer, the Platform offers a review form according to the level of scientific novelty chosen by the author (**Fig. 4.26**).



For example, a fragment of the form proposed by the Platform for the work ID200 with a level of scientific novelty 4 — **Fig. 4.20** is shown

Fig. 4.26 Fragment of the «Reviewer's Form» window

After sending the review, the fact of the review was completed is displayed in the Reviewer's personal account (**Fig. 4.27**).

Data on the peer-reviewed work are visible when one goes from «Under peer review» to «Peer reviewed». In particular, one can see (**Fig. 4.28, 4.29**):

- your assessment;
- scores given by two other reviewers;
- the average score for this work at the end of the review;
- an average rating for this work from End Users.

Fig. 4.27 «Personal Account» window

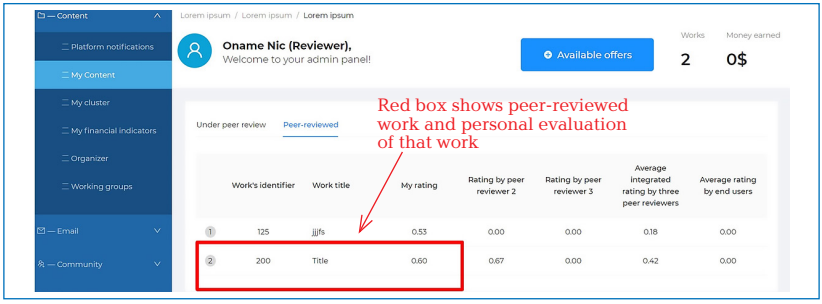


Fig. 4.28 Peer Reviewed window

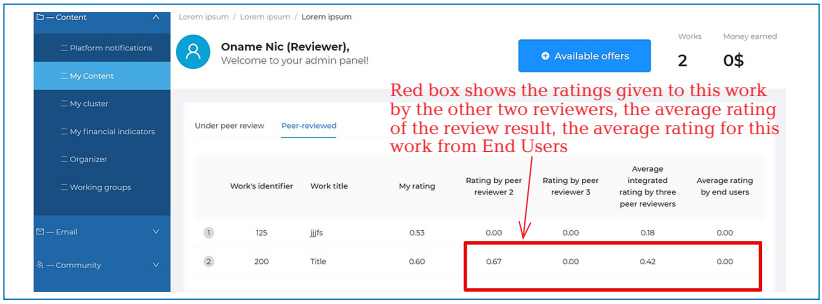


Fig. 4.29 Peer Reviewed window: the ratings given to this work

After reviewing this work, one can proceed to review the next one. The date of submission and the deadline for its review can be seen in the personal account (**Fig. 4.30**).

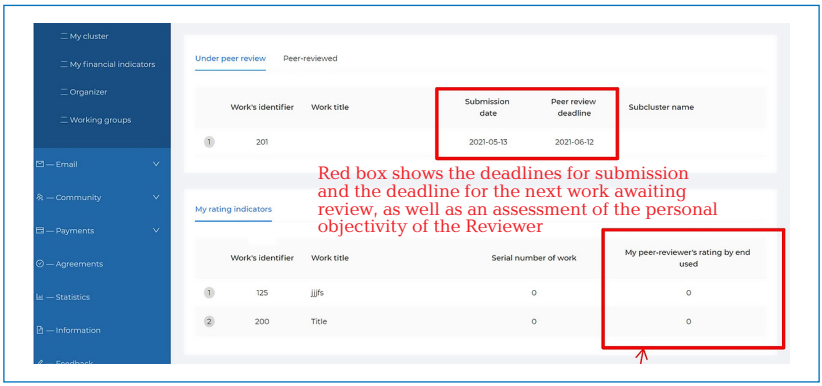


Fig. 4.30 Peer reviewed window: the deadlines and objectivity

The end result of implementing Procedure 1 – 5 is the event that the work enters **Products** if it has received ratings from two other reviewers. Thus, the information technology implementation of the review process ensures that STAGE 2 «Review + rating» is executed, which corresponds to the CA-BLOCK input (**Fig. 2.12**).

Conclusions to Chapter 4

The main result of information-technological solutions for the Reviewer's account is the creation of a working tool for Actor 2, which allows him/her to assess the quality of scientific work. Given the fact that the quality of scientific works is decisive in the evaluation of sources publishing these works, the review process is fundamental from the point of view of forming a «brand» of a scientific publication. Ensuring the review process requires the organization of work in terms of attracting reviewers and following the requirements of specific editions regarding the assessment of the quality of manuscripts. For a scientist who does not come into contact with a single scientific journal or publisher, such requirements are mostly not transparent. In addition, the final resolutions of reviewers regarding recommendations whether to accept the manuscript, reject, or finalize it are mainly subjective. The **InGraph** Platform tool creates transparency, both in the review process itself and in the formation of assessments of the quality of scientific works. The use of quantitative values in a dimensionless scale [0; 1] makes it possible to introduce simple interval assessments for

grading the quality. This is how the proposed solutions differ from the existing ones in terms of quality control of scientific works and have obvious advantages over them:

- transparency;
- simplicity;
- quantitative assessment according to different criteria depending on the scientific and practical significance, which makes it possible to carry out further procedures for verifying the objectivity of reviewers.

The proposed forms of reviewing make it possible to focus the attention of reviewers on those criteria that are especially important for End Users, regardless of whether they are theorists or practitioners. At the same time, the structuring of these forms in accordance with the logic of the construction of scientific work — from substantiating the relevance of scientific problems to conclusions regarding scientific novelty and practical significance — create a comfort zone for reviewers. This, in turn, minimizes the time spent on the review process. The validity of these forms is obvious to the Authors who have the opportunity to see by what criteria their works will be evaluated. This creates full transparency for the Author in terms of understanding how exactly his/her work is evaluated, reducing the risks of claims from the Author in the direction of reviewers, based on reproaches in the bias of reviewing.

The Reviewer's Account has mechanisms for intra-platform integration, which allows him/her to track the quality of the work reviewed by him/her and see the ratings of other reviewers for it. This makes it possible to conduct self-assessment in terms of compliance with your role, assessing the personal objectivity, and objectivity of your colleagues.

The objectivity of the review process itself, from the point of view of external evaluation, is ensured by a feedback mechanism — based on a comparison of End User ratings and the rating given by the reviewer for this work.

A simple interface and intuitive actions at the stage of registration and the review process ensure minimization of time spent on interaction with the Platform. It should be emphasized here that the procedure proposed at the registration stage for confirming the competence of the reviewer can be flexible. For example, instead of Scopus identifiers, Google Scholar, one can use Research Gate, or some other, more accurately positioning the scientific directions of a potential reviewer. This issue requires further increased attention since the wide representation of the same scientist in different teams of authors, and in different subjects, almost always complicates the procedure for identifying the determining scientific area of this scientist.

The design of the Reviewer's account does not contain unnecessary elements, and the information displayed in it makes it possible to track the effectiveness of activities in the role of the Reviewer:

- works on their subjects available for review, uploaded to the Platform by the Authors;
- the characteristics of each proposed work;

- terms of review;
- the number of works personally reviewed on the Platform;
- the number of financial resources received for the peer-reviewed works that are in closed access.

The information-technological implementation of the peer review algorithm ensures the transfer of scientific works to **Products**.

Further development of information technology solutions for the Reviewer's account, as well as for the Author's account, involves the development of mechanisms for interaction with Translators and Grant-givers, as well as the development of integrative solutions in terms of communication with other participants to create joint working groups, joint implementation of projects, since the Reviewer is also a potential Author.

Chapter 5
Efficiency of feedback-based scientific and practical communication technology provided by the InGraph Platform solutions

5.1 Communication and analytical block: Products and modules integrated with it

Products is the central part of the communication and analytical unit and contains all the scientific content that has been reviewed and is available for download. All content is represented in **Products** at three levels: **Cover Letter, Resume, Full text.**

Cover Letter is freely available, **Resume** and **Full text**, depending on the type of access chosen by the Author, are available either freely or for a fee. The legal module and the transaction module integrated with **Products** provide the transfer of funds using one or more payment systems. The choice of the type and number of payment systems integrated with the Platform is due to the need to meet the requests of Actors from different countries.

The logic of **Products** structure is based on the principle of meeting the needs of all Actors as much as possible and creating a zone of maximum comfort for each of them. This is reflected in the algorithm shown in **Fig. 5.1**.

Unit 1 provides the opportunity to select content based on one's status: a random user who is neither a scientist nor a practitioner; scientist; practitioner.

In the first case, the user searches based on the tasks that s/he faces. For example, a student looking for information on a specific topic for educational purposes.

If the user is a scientist, s/he is given the opportunity to select works from the field of science of interest to him/her with a depth of up to Subcluster.

If the user is a practitioner, s/he is given the opportunity to select works from the area of practical application of interest to him/her.

Additional alternatives for filtering query parameters are represented by the following options:

- All.
- Free to download this week.
- All free to download.
- TOP downloaded works.

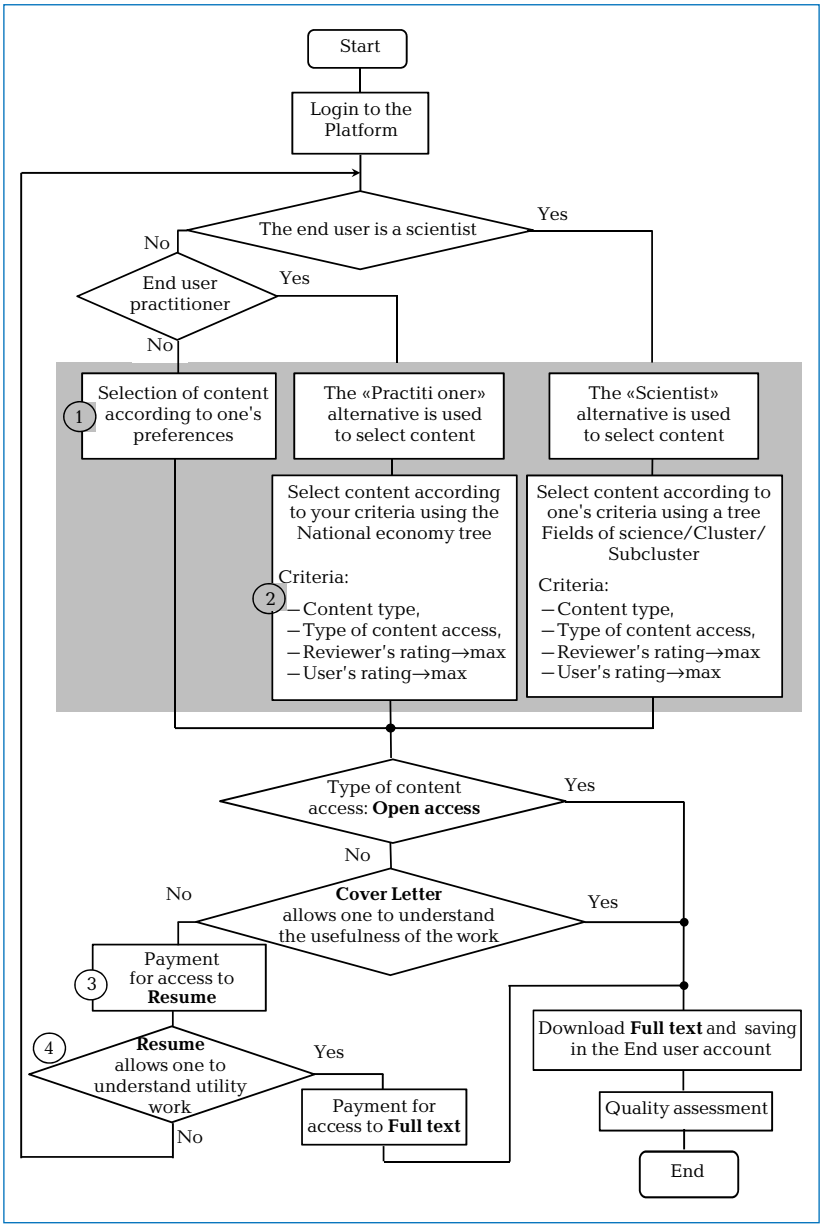


Fig. 5.1 The algorithm of work in **Products** reflecting the opportunities provided by the Platform to users

Unit 2 provides the ability to select the type of access to content. If access is free, the user has the opportunity to get acquainted with **Resume** and download **Full text** to a convenient place on a computer. When downloading, the work also automatically enters the End user's personal account, so when requesting a download, the registration procedure for the «End User» role is mandatory.

Unit 3 provides an opportunity to make a request and pay for access to **Resume** in case the work is in the public domain and **Cover Letter** is not informative enough to make a decision on its download.

Unit 4 provides an opportunity to evaluate the informativeness of **Resume** in terms of the usefulness of this work for one's purposes. If the informativeness is sufficient and the potential expectations from the full text are justified, payment is made for full access to the work. After the transaction is made, the work can be downloaded.

The result of the interaction of the Actor — Platform, according to the algorithm given in **Fig. 5.1**, is the receipt of work by the End User for his/her needs and the transfer of funds in favor of the Author and the Reviewer if the work is in closed access.

The algorithm implements STAGE 3 «End user access to **Resume** and creates an order» and STAGE 4 «Transaction — Access» (**Fig. 2.12**).

Fig. 5.2–5.9 show a visualization of the **Products** information technology implementation in the form of windows when two alternatives are selected — «Scientist» and «Practitioner» and with different filter parameters.

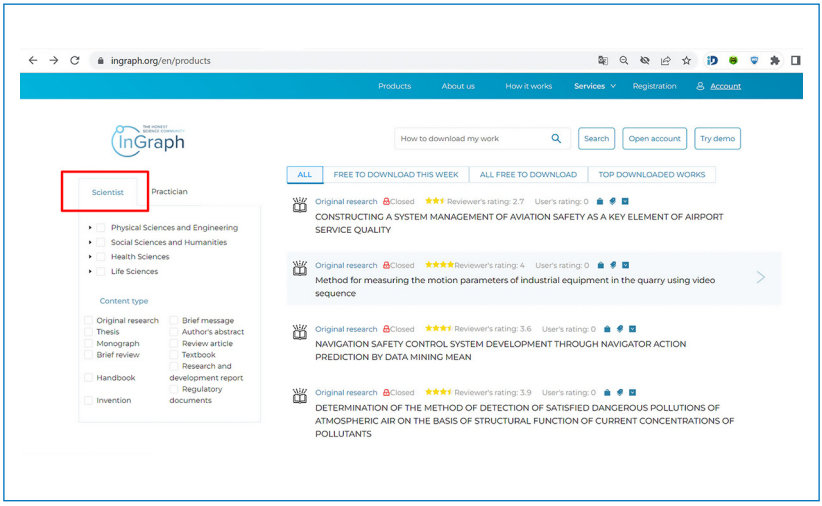


Fig. 5.2 Products window (displayed by default, alternative to «Scientist», unit 1 **Fig. 5.1**)

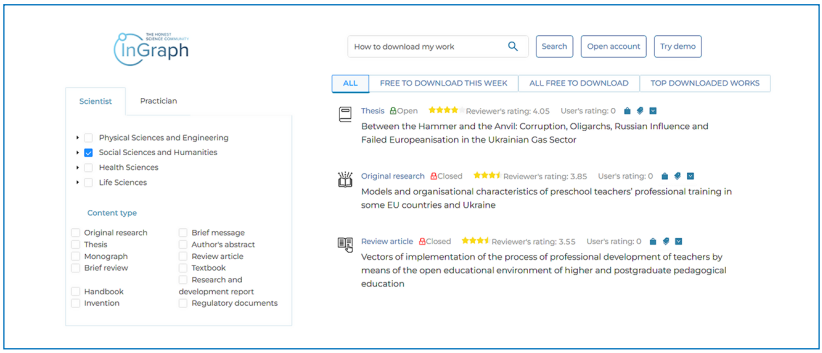


Fig. 5.3 Products window (alternative to «Scientist», Fields of science — Social Sciences and Humanities, default filter All, all content types)

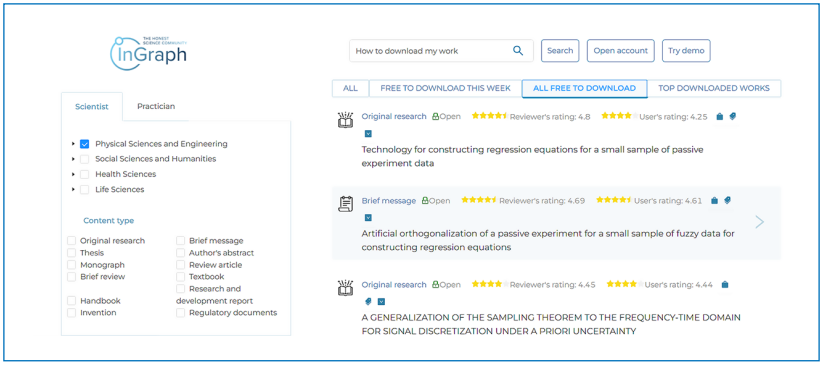


Fig. 5.4 Products window (alternative to «Scientist», Fields of science — Physical Sciences and Engineering, filter All free to download, all types of content)

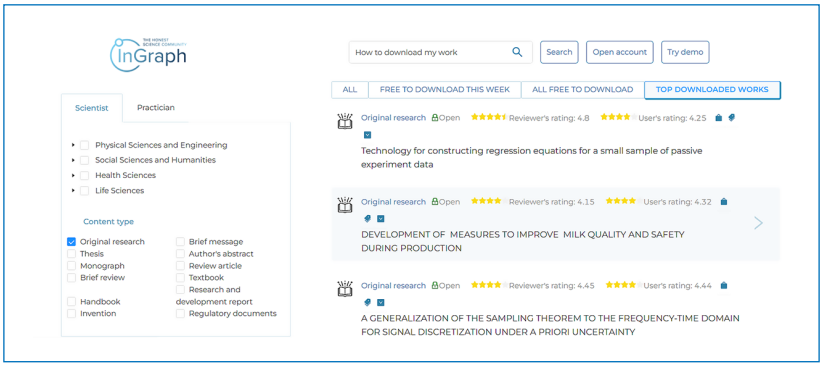


Fig. 5.5 Products window (alternative to «Scientist», Fields of science — not selected, filter TOP downloaded works, Content type — Original research)

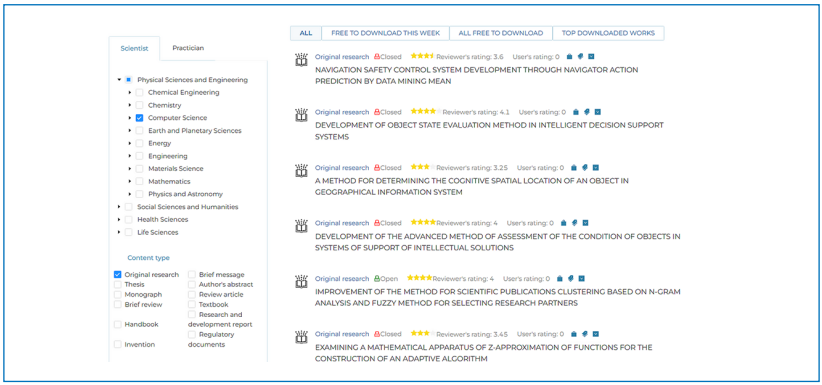


Fig. 5.6 Products window (Alternative to «Scientist», Fields of science — Physical Sciences and Engineering, Cluster — Computer Science, Filter All, Content type — Original research)

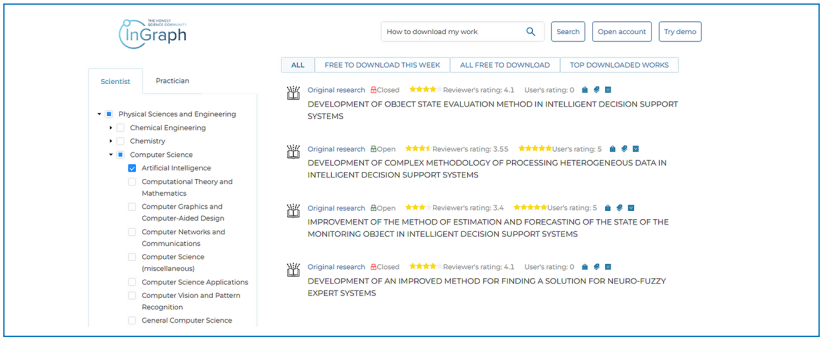


Fig. 5.7 Products window (Alternative to «Scientist», Fields of science — Physical Sciences and Engineering, Cluster — Computer Science, Subcluster — Artificial Intelligence, Filter All, Content type — Original research)

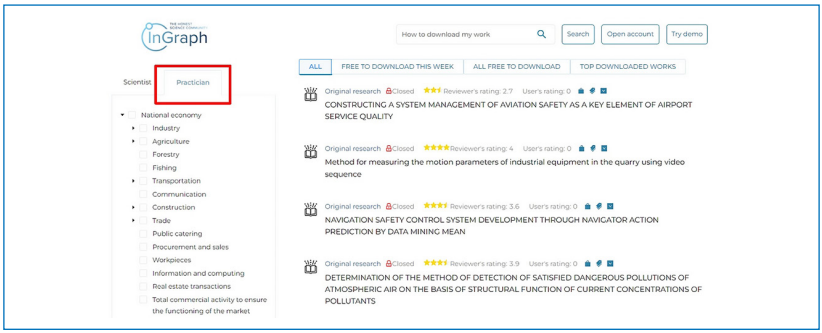


Fig. 5.8 Products window (alternative to «Practitioner», unit 1 **Fig. 5.1**)

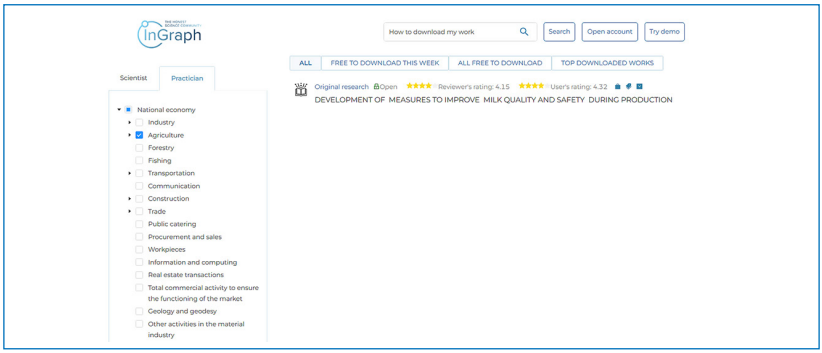


Fig. 5.9 Products window (alternative to «Practitioner», Scope of application — Agriculture)

Fig. 5.10, **5.11** show a visualization of the **Products** information technology implementation in the form of a window that expands when a specific work is selected:

- **Fig. 5.10** shows the window when selecting a work that is in the public domain;
- **Fig. 5.11** shows the window when selecting a work that is in the closed domain.

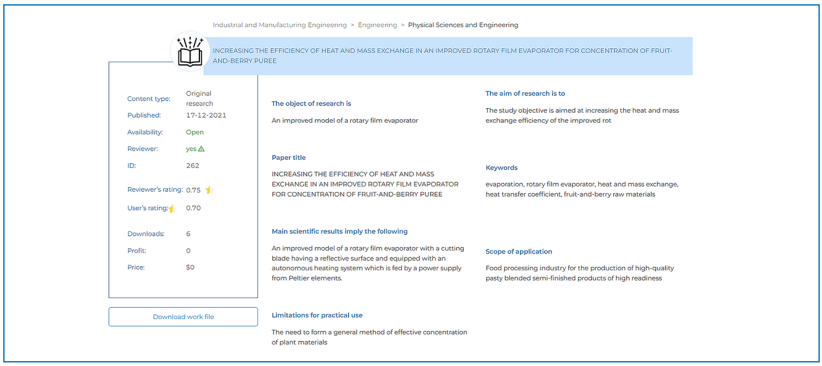


Fig. 5.10 Products window (expanded information about the work, access type — open)

This page contains more complete information about the selected work:

- Content type.
- Publication date.
- Access type.
- ID.
- Reviewer's rating.

- User's rating.
- Profit.
- Price.

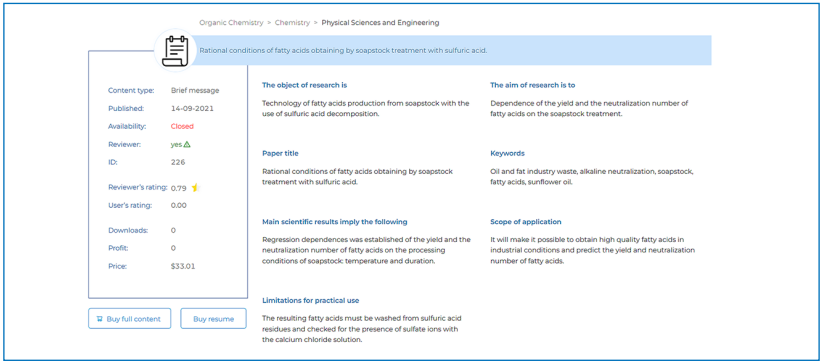


Fig. 5.11 Products window (expanded information about the work, access type — closed)

The quality of a work is visualized in the usual way for the user of any IT product — in the form of filled «stars». The maximum number of stars is 5. This scale corresponds to the numerical scale [0; 1], according to which reviewers rate works (**Table 5.1**).

The average score from three reviewers is calculated by the formula:

$$\overline{R_{\Sigma}^{(j)}} = \frac{1}{3}\sum_{k=1}^{3} R_k^{(j)}, \tag{5.1}$$

j — level of scientific novelty (j=1,...,5).

Table 5.1 Compliance of scales of quantitative and user assessments of the quality of work from reviewers

$\overline{R_{\Sigma}^{(j)}}$	«Stars» by reviewers
0 — 0.1	0.5
0.11 — 0.2	1
0.21 — 0.3	1.5
0.31 — 0.4	2
0.41 — 0.5	2.5
0.51 — 0.6	3
0.61 — 0.7	3.5
0.71 — 0.8	4
0.81 — 0.9	4.5
0.91 — 1	5

The textual comments accompanying each assessment outcome are shown in **Table 4.2**.

It should be noted that for the convenience of users, the numerical value of Reviewer's rating and User's rating, accompanying the visualization of stars, is given in a five-point scale [0; 5], which, thus, also corresponds to the dimensionless scale [0; 1]. However, in the extended information — on the second page of **Products** — the results of the assessment in the five-point scale are given in a version recalculated to dimensionless values, that is, in the range [0; 1]. This is done for reasons of convenience for using numerical estimates for different purposes:

- for the visual perception of the rating of works when directly familiarizing with them in **Products**, it is easier for the End User to operate with «stars» and a five-point scale that has an obvious correspondence with the number of stars;
- to evaluate the integral ratings of scientists (authors, reviewers), research teams, scientific organizations, universities, countries, it is convenient to operate with simple numerical estimates in the dimensionless range [0; 1], making it possible to determine the efficiency of scientific activity in percentage terms.

Thus, Reviewer's rating is calculated using formula (5.1) and, depending on the range of values in which it falls, **Products** is rated in the form of «stars» and a numerical value on a five-point scale.

To calculate the User's rating, a procedure is used that is based on determining the average ratings for a given work from End Users, taking into account weights, the values of which depend on the category of End Users. The introduction of weighting coefficients according to this principle helps prevent an event related to the evaluation of work by incompetent users:

$$R^{user} = \frac{\sum_{i=1}^{3} k_i \overline{R_i}}{\sum_{i=1}^{3} k_i} = \frac{\left(k_1 \overline{R_1} + k_2 \overline{R_2} + k_3 \overline{R_3}\right)}{\left(k_1 + k_2 + k_2\right)}, \tag{5.2}$$

where

$$\overline{R_1} = \frac{1}{m_1} \sum_{l=1}^{m_1} R_1^l,\ l = 1,..,\infty;\ \overline{R_2} = \frac{1}{m_2} \sum_{l=1}^{m_2} R_2^l,\ l = 1,..,\infty;\ \overline{R_3} = \frac{1}{m_3} \sum_{l=1}^{m_3} R_3^l,\ l = 1,..,\infty.$$

Here, k_i — weight coefficient of content's estimate by end users from different categories, $i = 1,2,3$; $k_1 = 0.25$ — if the end user is a scientist but is not registered at the **InGraph** Platform as a reviewer; $k_1 = 0.5$ — if the end user is not a scientist but is a practitioner buying content for own professional activities; $k_3 = 1$ — if the end user is a scientist who is registered at the **InGraph** Platform as a reviewer, or is a practitioner who is registered at the **InGraph** Platform as a reviewer; $\overline{R_i}$ — averaged estimate by end users from

different categories, $i = 1,2,3$; $\overline{R_1}$ — averaged estimate by end users who are scientists but are not registered at the **InGraph** Platform as reviewers; $\overline{R_2}$ — averaged estimate by end users who are not scientists but are practitioners who buy content for their professional activities; $\overline{R_3}$ — averaged estimate by end users who are scientists and are registered at the **InGraph** Platform as reviewers or are practitioners registered at the **InGraph** Platform as reviewers; m_i — number of end users from different categories who rate this content, $i = 1,2,3$; m_1 — number of end users who rate this content and are scientists but are not registered at the **InGraph** Platform as reviewers; m_2 — number of end users who rate this content and are not scientists but are practitioners who buy content for their professional activities; m_3 — number of end users who rate this content and are scientists registered at the **InGraph** Platform.

The calculation procedure includes the conversion of values from the user scale in the form of «stars», which End Users «put» in their account for the work being evaluated using a numerical scale. This scale is formed by a dimensionless range [0; 1] (**Table 5.2**).

Interval estimates in the normalized range [0; 1] corresponding to user estimates are shown in the last column of **Table 5.2**.

Table 5.2 Alignment of quantitative and User quality rating scales from End Users

«Stars» from End users	Text comment on ratings from End Users	Dimensionless interval estimates [0; 1]
0.5	The paper is not interesting at all	0 — 0.1
1	Very poor paper	0.11 — 0.2
1.5	Poor paper	0.21 — 0.3
2	It might be useful for other readers, but it did not meet my expectations	0.31 — 0.4
2.5	This paper is useful in specific aspects	0.41 — 0.5
3	This paper is useful in several aspects	0.51 — 0.6
3.5	This is a paper of quality but it did not fully meet my expectations	0.61 — 0.7
4	This paper is of high quality as it is useful for practice (and/or) theory. It met my expectations	0.71 — 0.8
4.5	This paper is of very high quality and it is useful for my practical activities. It met all my expectations	0.81 — 0.9
5	This paper is very relevant for practice (and/or) theory. It fully met my expectations while its concepts and/or results have the potential for practice (patenting) or deserve wide recognition in its scientific field	0.91 — 1

Values calculated by formula (5.2) in the range [0; 1] are converted to a five-point scale [0; 5] for display on the first **Products** page. On the second

Products page, they are displayed in a dimensionless form calculated by formula (5.2). These operations are performed through the End user rating module of the communication and analytical unit of the Platform (**Fig. 2.12**).

Summary data on Reviewer's rating and User's rating in the form of a correspondence between the scales of quantitative (in the dimensionless range [0; 1]) and user ratings (in the form of «stars»), accompanied by text comments, are shown in **Table 5.3**.

Table 5.3 Summary of Reviewer's rating and User's rating as a correspondence between quantitative and user rating scales

Dimensionless interval estimates [0; 1]	Text comment on ratings from reviewers	«Stars» from End users	Text comment on ratings from End Users
1	2	3	4
0 – 0.1	Not recommended by reviewers at all. If you pay for a full access to this paper, you do it at your discretion: the paper is unlikely to meet your needs	0.5	The paper is not interesting at all
0.11 – 0.2	Not recommended by reviewers. If you pay for a full access to this paper, you do it at your discretion: the paper is unlikely to meet your needs	1	Very poor paper
0.21 – 0.3	Not recommended by reviewers as it requires fundamental re-working. If you pay for a full access to this paper, you do it at your discretion: the paper may not meet your needs	1.5	Poor paper
0.31 – 0.4	Not recommended by reviewers as the paper is not fully compliant with the required quality. If you pay for a full access to this paper, you do it at your discretion: the paper may not meet your needs	2	It might be useful for other readers. but it did not meet my expectations
0.41 – 0.5	Based on reviewing, this paper meets the minimal threshold. The work may prove useful in specific aspects	2.5	This paper is useful in specific aspects
0.51 – 0.6	The paper has been favorably reviewed and may prove useful in several aspects	3	This paper is useful in several aspects
0.61 – 0.7	Based on reviewing, this paper complies with quality requirements	3.5	This is a paper of quality but it did not fully meet my expectations

Continuation of Table 5.3

1	2	3	4
0.71 – 0.8	Based on reviewing, this paper complies with high quality requirements	4	This paper is of high quality as it is useful for practice (and/or) theory. It met my expectations
0.81 – 0.9	Based on reviewing, this paper complies with very high quality requirements	4.5	This paper is of very high quality and it is useful for my practical activities. It met all my expectations
0.91 – 1	Based on reviewing, this paper complies with the requirements to the best quality in a given field	5	This paper is very relevant for practice (and/or) theory. It fully met my expectations while its concepts and/or results have the potential for practice (patenting) or deserve wide recognition in its scientific field

Summary data on Reviewer's rating and User's rating in the form of correspondence of quantitative rating scales in the normalized range [0; 1], in the five-point scale [0; 5] and user ratings in the form of «stars», accompanied by text comments, are given in **Tables 5.4**, **5.5**, respectively.

The quality of works that are in closed access is the basis for the formation of their basic cost for representation in **Products**. This approach to estimating the cost is intuitive — the better the quality of any product, the higher its cost. In addition, this approach provides transparency of the principle of pricing according to uniform rules. Based on this reasoning, the basic cost of any work for representation in **Products** is a quality function. It should be noted that:

- works can have a different level of scientific novelty, that is, a different level of significance;
- the level of scientific novelty depends on the type of content.

Under such conditions, the base value (S) can be represented as a function of two input variables — the assessment of quality and the level of scientific novelty. The quality assessment, in this case, is the average assessment from the reviewers ($\overline{R_{\Sigma}^{(j)}}$), and the level of scientific novelty is chosen by the authors when uploading their works (l_{SN}) under the constraints imposed by the content type. However, it should be noted that such a representation is possible only if the work receives a minimum «passing score» for representation in **Products**.

According to **Tables 5.3–5.5**, this score is determined by the following values of the average score from the reviewers:

$$\overline{R_{\Sigma}^{(j)}}_{\min} = \begin{cases} 0.41 \text{ for Scale}[0;1], \\ 2.00 \text{ for Scale}[0;5], \\ 2.5 \text{ for Scale «Stars by reviewers».} \end{cases} \quad (5.3)$$

Table 5.4 Summary of Reviewer's rating as a correspondence between dimensionless rating scales [0; 1], a five-point scale [0; 5], and user ratings in the form of «stars»

Paper's mean score on the reviewing (Reviewer's rating) $\overline{R_{\Sigma}^{(j)}}$		Stars by reviewers	Content quality assessment
The scale			
[0; 1]	[0; 5]		
0 – 0.1	0 – 0.5	0.5	Not recommended by reviewers at all. If you pay for a full access to this paper, you do it at your discretion: the paper is unlikely to meet your needs
0.11 – 0.2	0.5 – 1.0	1	Not recommended by reviewers. If you pay for a full access to this paper, you do it at your discretion: the paper is unlikely to meet your needs
0.21 – 0.3	1.0 – 1.5	1.5	Not recommended by reviewers as it requires fundamental re-working. If you pay for a full access to this paper, you do it at your discretion: the paper may not meet your needs
0.31 – 0.4	1.5 – 2.0	2	Not recommended by reviewers as the paper is not fully compliant with the required quality. If you pay for a full access to this paper, you do it at your discretion: the paper may not meet your needs
0.41 – 0.5	2.0 – 2.5	2.5	Based on reviewing, this paper meets the minimal threshold. The work may prove useful in specific aspects
0.51 – 0.6	2.5 – 3.0	3	The paper has been favorably reviewed and may prove useful in several aspects
0.61 – 0.7	3.0 – 3.5	3.5	Based on reviewing, this paper complies with quality requirements
0.71 – 0.8	3.5 – 4.0	4	Based on reviewing, this paper complies with high quality requirements
0.81 – 0.9	4.0 – 4.5	4.5	Based on reviewing, this paper complies with very high quality requirements
0.91 – 1	4.5 – 5.0	5	Based on reviewing, this paper complies with the requirements to the best quality in a given field

Table 5.5 Summary data on User's rating as a correspondence between the scales of quantitative ratings in the dimensionless range [0; 1], in the five-point scale [0; 5], and user ratings in the form of «stars»

«Stars» from end users	Content quality assessment	User's rating	
		Scale	
		[0; 5]	[0; 1]
0.5	The paper is not interesting at all	0 – 0.5	0 – 0.1
1	Very poor paper	0.5 – 1.0	0.11 – 0.2
1.5	Poor paper	1.0 – 1.5	0.21 – 0.3
2	It might be useful for other readers, but it did not meet my expectations	1.5 – 2.0	0.31 – 0.4
2.5	This paper is useful in specific aspects	2.0 – 2.5	0.41 – 0.5
3	This paper is useful in several aspects	2.5 – 3.0	0.51 – 0.6
3.5	This is a paper of quality but it did not fully meet my expectations	3.0 – 3.5	0.61 – 0.7
4	This paper is of high quality as it is useful for practice (and/or) theory. It met my expectations	3.5 – 4.0	0.71 – 0.8
4.5	This paper is of very high quality and it is useful for my practical activities. It met all my expectations	4.0 – 4.5	0.81 – 0.9
5	This paper is very relevant for practice (and/or) theory. It fully met my expectations while its concepts and/or results have the potential for practice (patenting) or deserve wide recognition in its scientific field	4.5 – 5.0	0.91 – 1

Taking into account the fact that the works uploaded to the Platform are not rejected by reviewers in case of their low quality, there is a lower cost threshold. Grades for such works, which are in the range (0 – 0.4), and visualized in **Products,** inform the End User that these are low-quality works and payment for full access to them are the risks of the End User. The lower threshold of their cost is taken to be USD 3. If the dependence $S = f(\overline{R_{\Sigma}^{(j)}})$ is accepted as the base level of scientific novelty equal to 1 for calculating the cost, introducing restrictions of type (5.4), then the basic cost of a work represented in **Products** is described by the linear equation (5.5):

$$S_{\min} \le S \le \left[S^{(1)} \right], \tag{5.4}$$

where $S_{\min}$ is the minimum cost of the work, the quality assessment of which according to the results of the review falls into the range USD (0 – 0.4), adopted $S_{\min}=3$ – the limit of the materiality of the cost for the user-individual who pays for access to content from personal funds is accepted as $\left[S^{(1)} \right]=15$.

A superscript indicates that the calculation is for $l_{SN}=1$:

$$S^{(1)} = -5.339 + 20.339\overline{R_{\Sigma}^{(j)}}. \quad (5.5)$$

If, for the levels of scientific novelty $l_{SN}=2,..,\ l_{SN}=5$, an increasing coefficient (2...5) is introduced, then the base cost, respectively, can be determined by the formula:

$$S^{(l_{SN})} = \xi S^{(1)}, \quad (5.6)$$

where ξ is the increasing coefficient, $\xi=2,...,5$.

In this case and taking into account the constraints on the content type, the base cost of the work for the formation of the price at which it is presented in **Products** can be determined from **Table 5.6**.

Table 5.6 Price based on reviewing, recommended by the Platform

Averaged reviewers' estimate $\overline{R_{\Sigma}^{(j)}}$	Recommended price, USD, *S*, for the level of scientific novelty				
	1	2	3	4	5
0 – 0.1	3	3	3	3	3
0.11 – 0.2	3	3	3	3	3
0.21 – 0.3	3	3	3	3	3
0.31 – 0.4	3	3	3	3	3
0.41 – 0.5	3	6	9	12	15
0.51 – 0.6	6	12	18	24	30
0.61 – 0.7	8	16	24	32	40
0.71 – 0.8	10	20	30	40	50
0.81 – 0.9	12	24	36	48	60
0.91 – 0.95	13	26	39	52	65
0.96 – 1	15	30	45	60	75

* – Only for content types: Original research, Brief message, Review article**, Brief review**, Research and development report**;
** – Only for $l_{SN}=1$, $l_{SN}=2$, $l_{SN}=3$

The data given in **Table 5.6** can be formalized by a general regression equation [67]:

$$y = a_0 + 2\mathbf{a}^{\mathrm{T}}\mathbf{x} + \mathbf{x}^{\mathrm{T}}\mathbf{A}\mathbf{x}, \quad (5.7)$$

where y is the base cost of the content (S); $\mathbf{x}$ is a matrix of input variables with components x_1 (input variable $\overline{R_{\Sigma}^{(j)}}$), and x_2 (input variable l_{SN}), in normalized form; $\mathbf{x}^{\mathrm{T}}$ is a transposed matrix of input variables; a_0 is the initial

term of the regression equation; $\mathbf{a}^{\mathrm{T}}$ is the transposed matrix of linear terms of the regression equation; **A** is a matrix of nonlinear coefficients of the regression equation.

Normalized values of input variables are calculated in two alternative ways.

Method 1 [68, 69]:

$$x_i = \frac{x_{in} - \overline{x}_i}{I_i}, \tag{5.8}$$

where x_i is the normalized value of the input variables; i are the indices that identify the input variables: $i=1$ for $\overline{R}_{\Sigma}^{(j)}$, $i=2$ for l_{SN}; x_{in} are the natural values of the input variables; $\overline{x}_i$ are the average values of the input variables; I_i is the variation intervals of the input variables, $I_i = x_{in}^{\max} - \overline{x}_i = \overline{x}_i - x_{in}^{\min}$.

Method 2 [70]:

$$x_i = \frac{2x_{in} - \left(\mathrm{x}_{in\max} + x_{in\min}\right)}{x_{in\max} - x_{in\min}}, \; i = 1,2,\ldots,N, \tag{5.9}$$

where $x_{in\max}$ is the maximum value of the i-th input variable in the selected range of variation in its natural form; $x_{in\min}$ — the minimum value of the i-th input variable in the selected variation area in its natural form; x_{in} is the value of the i-th input variable in its natural form; x_i is the value of the i-th input variable in the normalized form. Thus, the cost function can be represented by hypersurface in the factor space $\overline{R}_{\Sigma}^{(j)} - l_{SN}$.

The coefficients of equation (5.7) are generally determined by the least-square method (LSM). The functionality of the least squares is as follows:

$$J = (\mathbf{FA} - \mathbf{Y})^{\mathbf{T}} (\mathbf{FA} - \mathbf{Y}), \tag{5.10}$$

and the vector of coefficient estimates that minimizes (5.10) is calculated using the formula [71 — 73]:

$$\mathbf{A} = \left(\mathbf{F}^{\mathbf{T}}\mathbf{F}\right)^{-1} \mathbf{F}^{\mathbf{T}}\mathbf{Y} = \mathbf{C}\mathbf{F}^{\mathbf{T}}\mathbf{Y}. \tag{5.11}$$

Here, **F** is the matrix of the plan of the experiment (**Table 5.7**), $\mathbf{F}^{\mathrm{T}}$ is the transposed matrix of the experiment plan, **A** is the matrix of estimates of the coefficients of the regression equation, **Y** is the matrix of values of the output variable (S), **C** is the dispersion matrix.

However, based on the form of the data represented in **Table 5.6**, in order to construct a mathematical description in the form of (5.7), it is possible to implement the central orthogonal compositional plan of the complete factor experiment. According to [74], the general form of such a plan corresponds to that shown in **Table 5.7**.

For the case of two variables, such a plan takes the form shown in **Table 5.8**.

Table 5.7 General view of the central orthogonal compositional plan of a complete factor experiment

Structural location of the plan	Experiment number	Plan F matrix										
		x_0	Plan X Matrix				$x_1^2-\beta$	...	$x_n^2-\beta$	x_1x_2	...	$x_{n-1}x_n$
			x_1	x_2	...	x_n						
Nucleus	1	+1	+1	+1	.	+1	$1-\beta$	...	$1-\beta$	+1	...	.
	2	+1	−1	+1	.	+1	$1-\beta$	...	$1-\beta$	−1	...	.
	3	+1	+1	−1	.	+1	$1-\beta$	...	$1-\beta$	−1	...	.
	4	+1	−1	−1	.	+1	$1-\beta$	...	$1-\beta$	+1	...	.
	5	+1	+1	+1	.	+1	$1-\beta$	...	$1-\beta$	.	...	.
	6	+1	−1	+1	.	+1	$1-\beta$	...	$1-\beta$	.	...	.
	.	.	.	.	.	.	.	...	.	.	...	.
	.	.	.	.	.	.	.	...	.	.	...	.
	2^{n-p}	+1	.	.	.	.	$1-\beta$	...	$1-\beta$	.	...	.
Star points	$2^{n-p}+1$	+1	+α	0	...	0	$\alpha^2-\beta$	...	$-\beta$	0	...	0
	$2^{n-p}+2$	+1	−α	0	...	0	$\alpha^2-\beta$	...	$-\beta$	0	...	0
	.	+1	0	+α	...	0	$-\beta$	...	.	.	...	.
	.	+1	0	−α	...	0	$-\beta$	...	.	.	...	.
	.	.	.	.	...	.	.	...	.	.	...	.
	.	.	.	.	...	.	.	...	.	.	...	.
	.	.	.	.	...	.	.	...	.	.	...	.
	.	+1	0	0	...	+α	$-\beta$	...	$\alpha^2-\beta$	0	...	0
	$2^{n-p}+2n$	+1	0	0	...	−α	$-\beta$	...	$\alpha^2-\beta$	0	...	0
Center	$N=2^{n-p}+2n+1$	+1	0	0	...	0	$-\beta$	...	$-\beta$	0	...	0

Table 5.8 Central orthogonal compositional plan of a complete factor experiment for constructing a regression equation $S=f(\overline{R_\Sigma^{(j)}}, l_{SN})$

Experiment No.	x_0	x_1	x_2	$x_1^2-\beta$	$x_2^2-\beta$	x_1x_2	y
1	+1	+1	+1	0.33	0.33	+1	y_1
2	+1	−1	+1	0.33	0.33	−1	y_2
3	+1	+1	−1	0.33	0.33	−1	y_3
4	+1	−1	−1	0.33	0.33	+1	y_4
5	+1	+1	0	0.33	−0.67	0	y_5
6	+1	−1	0	0.33	−0.67	0	y_6
7	+1	0	+1	−0.67	0.33	0	y_7
8	+1	0	−1	−0.67	0.33	0	y_8
9	+1	0	0	−0.67	−0.67	0	y_9

In **Table 5.8**, β is the parameter calculated by the formula:

$$b = \frac{\sum_{j=1}^{N} (x_i^j)^2}{N} = \frac{2^{n-p} + a}{N}. \quad (5.12)$$

The central orthogonal compositional plan of a complete factor experiment makes it possible to simplify the obtaining of the regression equation by dispensing with the calculation of the dispersion matrix due to its orthogonality. If non-essential input variables are identified, their elimination from the regression equation does not cause the need to recalculate the coefficient estimates, therefore, with the appropriate distribution of data, such plans are justified and used in different applications [75, 76]. Estimates of coefficients (5.7) in this case are determined by the formulas [77]:

$$a_i = c_1 \sum_{j=1}^{N} x^j y^j, \; i = 1,\ldots,n, \quad (5.13)$$

$$a_i = c_2[(x_{i-n}^j)^2 - b]y^j, \; i = n+1,\ldots,2n, \quad (5.14)$$

$$a_i = c_3 \sum_{j=1}^{N} x_\mu^j x_\lambda^j y^j, \; i = 1,\ldots,n, \; \mu, \lambda, \; i = 2n+1,\ldots,k, \quad (5.15)$$

$$a_0 = \frac{1}{N} \sum_{j=1}^{N} y^j - b \sum_{j=1}^{N} a_{n+i}. \quad (5.16)$$

In formulas (5.13) to (5.16). c_1, c_2, c_3 are the coefficients for linear, quadratic, and paired relationships, respectively, n — the number of linear terms of the equation (n=2), N — the number of experiments (N=9).

The general form of the regression equation based on the results of the calculation of coefficient estimates according to formulas (5.13) to (5.16) for a plan constructed according to the data of **Table 5.6** taking into account constraints (5.4) and with discarded non-essential factors x_1^2 and x_2^2 is as follows:

$$y = 27 + 18.0036x_1 + 18.0036x_2 + 12x_1x_2. \quad (5.17)$$

Estimates of the coefficients of the regression equation presented as (5.7) are shown in **Table 5.9**.

Table 5.9 Estimates of the coefficients of the regression equation presented as (5.7)

Initial coefficient, a_0	Coefficient estimation matrix for linear terms, **a**	Coefficient estimation matrix for nonlinear terms, **A**
27	$\begin{pmatrix} 9.0018 \\ 9.0018 \end{pmatrix}$	$\begin{pmatrix} 0 & 6 \\ 6 & 0 \end{pmatrix}$

Statistical analysis of the accuracy according to the procedures given in [78, 79] confirms the high accuracy of equation (5.17) — when rounded to integers, the S values calculated from (5.17) coincide with the S values given in **Table 5.6**.

Equation (5.17) can be used to predict the value of the base cost of a work as a function of $\overline{R_{\Sigma}^{(j)}}$ and l_{SN} in the following ranges of variation: $\overline{R_{\Sigma}^{(j)}} \in [0.455; 0.98]$ and $l_{SN} \in [1; 3]$. The relationship between the normalized and natural values of input variables is:

$$x_1 = \frac{\left(\overline{R_{\Sigma}^{(j)}}\right)_i - 0.7175}{0.2625}, \tag{5.18}$$

$$x_2 = \frac{(l_{SN})_i - 3}{2}. \tag{5.19}$$

Taking into account (5.18) and (5.19), equation (5.17) is transformed from the normalized form to the natural form as follows:

$$S = 27 + 18.0036\left(\frac{\left(\overline{R_{\Sigma}^{(j)}}\right)_i - 0.7175}{0.2625}\right) + 18.0036\left(\frac{(l_{SN})_i - 3}{2}\right) +$$
$$+ 12\left(\frac{\left(\overline{R_{\Sigma}^{(j)}}\right)_i - 0.7175}{0.2625}\right)\left(\frac{(l_{SN})_i - 3}{2}\right). \tag{5.20}$$

The procedure for calculating the basic cost of content is described by a simple algorithm given in **Fig. 5.12**.

It should be noted that the inverse problem may be of interest — the choice of such values $\overline{R_{\Sigma}^{(j)}}$ and l_{SN} that would maximize the value of S:

$$S \to \max. \tag{5.21}$$

Formally, the solution to this problem is an optimization procedure. For this purpose, either the ridge analysis of the response surface described by equation (5.17) or the transformation of the response surface to the canonical form can be used. This is due to the fact that the factor space is limited by intervals of variation of input variables, and, for this reason, there is no need to use experimental optimization methods involving movement along the surface towards the gradient [80]. In this case, the choice of methods is justified by their effectiveness, proved by their application when solving optimization problems in different applications:

- in chemical-technological processes [81, 82];
- in the synthesis of composite materials [83];

- in metallurgical processes [72, 84, 85];
- in the management of organizational and technical systems [86] or technological processes [87];
- in automation systems [75];
- in marketing [67, 88].

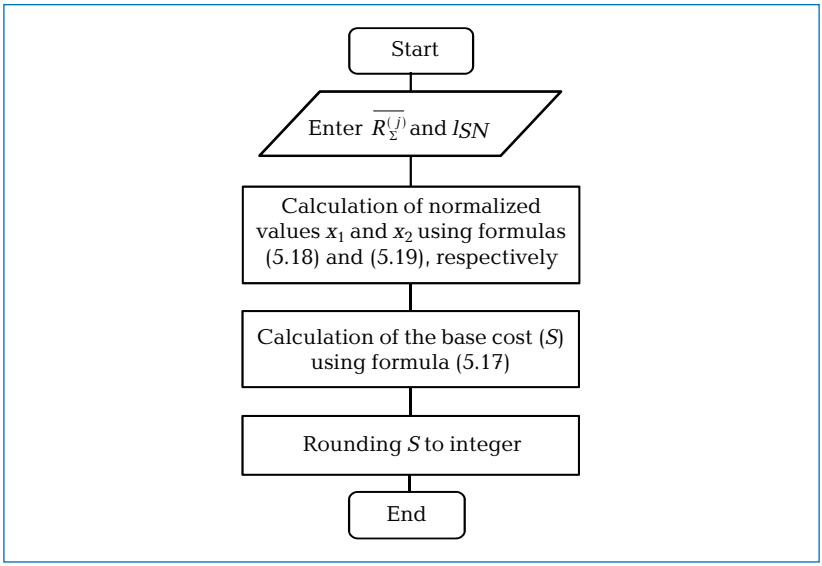


Fig. 5.12 Algorithm for calculating the basic cost of content

The canonical transformation of equation (5.17) brings it to the form:

$$y - y^{\star} = \lambda_1 \xi_1^2 + \lambda_2 \xi_2^2, \tag{5.22}$$

where λ_1, λ_2 are the eigenvalues of the matrix **A** (**Table 5.9**), $\lambda_1 = -6$, $\lambda_2 = 6$, ξ_1, ξ_2 are the coordinates obtained by rotating the x_1 and x_2 axes during canonical transformation.

The results of the ridge analysis of the response surface described by (5.17), which allows obtaining suboptimal solutions in parametric form (5.23), are given in **Fig. 5.13–5.15**.

$$\begin{cases} \mathbf{x}^{\star}(\lambda) = (\lambda \mathbf{I} - \mathbf{A})^{-1} \mathbf{a}, \\ r^{\star}(\lambda) = \sqrt{\mathbf{x}^{\star \mathrm{T}} \mathbf{x}^{\star}}, \\ y^{\star}(\lambda) = \mathbf{a}_0 + 2\mathbf{a}^{\mathrm{T}} \mathbf{x}^{\star} + \mathbf{x}^{\star \mathrm{T}} \mathbf{A} \mathbf{x}^{\star}, \end{cases} \tag{5.23}$$

where $\mathbf{x}^{*}(\lambda)$ is a matrix of suboptimal values of input variables in the normalized form depending on the parameter λ; $\mathbf{x}^{*\mathrm{T}}(\lambda)$ is a transposed matrix

of suboptimal values of input variables; $r^*(\lambda)$ is the radius of the circle that limits the area of the input variables; **I** is a unit matrix; $\mathbf{a_0}$, $\mathbf{a_1}$, **A** are the coefficient estimate matrices; $\mathbf{a}^T$ is the transposed coefficient estimate matrix for linear terms.

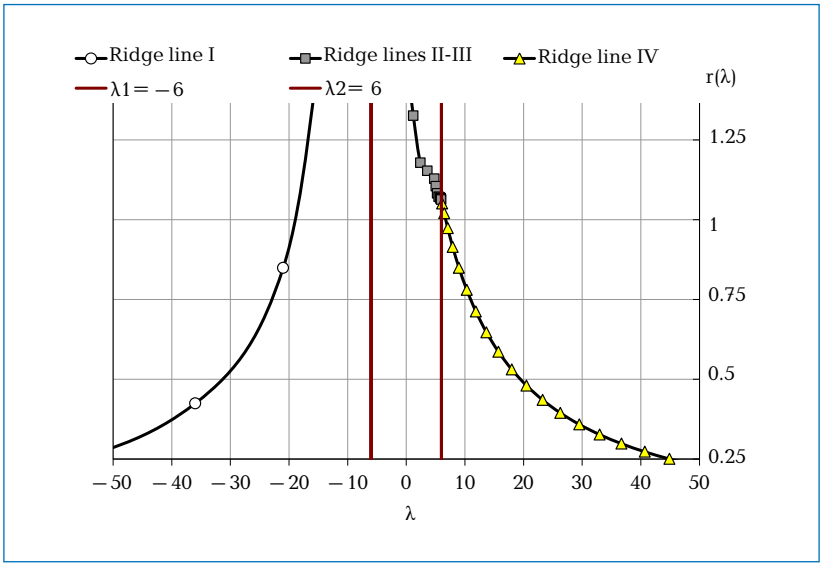


Fig. 5.13 Dependence $r(\lambda)$

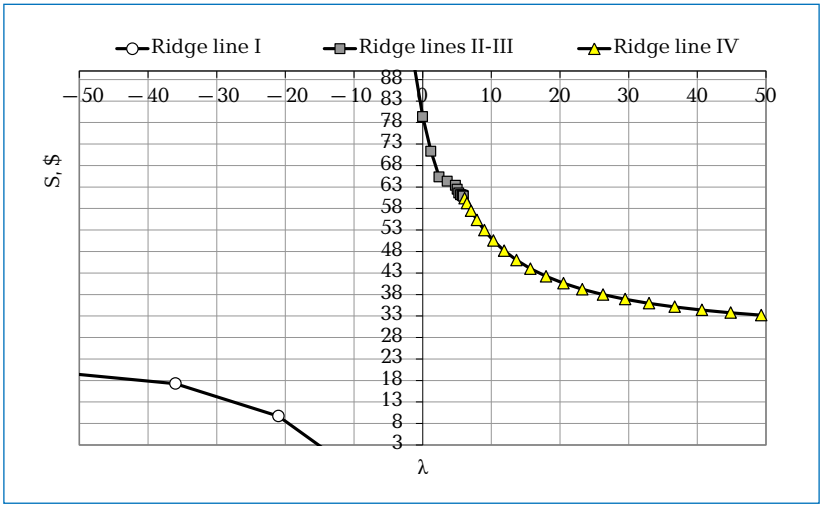


Fig. 5.14 Dependence $y(\lambda)$

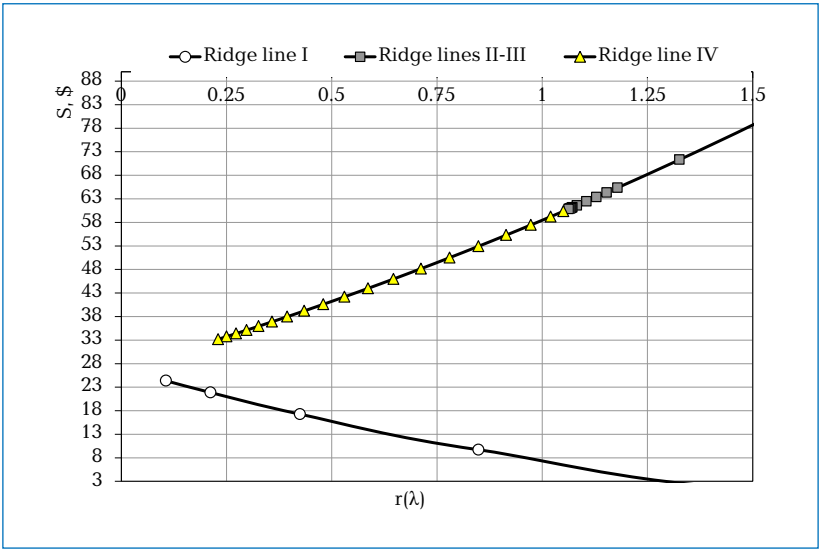


Fig. 5.15 Dependence $y(r)$

Fig. 5.15 demonstrates that $S_{\max}$ is achieved on the ridge lines II – III and IV and the value of $S_{\max}$ depends on the radius of the circle describing the restriction imposed on the region of the input variables. Since the experimental plan (**Table 5.8**) was limited by the range of normalized values [1; 1], $r_{\max}=1.414$, from which it follows that $S_{\max}=75$ \$. This value is determined by the intersection of the line $r_{\max}=1.414$ and the curve $y(r)$ corresponding to the ridge lines II – III of the range $\lambda \in]-6;6[$.

The selection of values $\overline{R_{\Sigma}^{(j)}}$ and l_{SN} to ensure execution of (5.21) is based on **Fig. 5.13–5.15** in accordance with the algorithm shown in **Fig. 5.16**.

Obviously, it is impossible to determine the assessment $\overline{R_{\Sigma}^{(j)}}$ at the stage of unloading the work but it is possible to reasonably choose l_{SN}. This process is subjective, and its outcome is determined by the level of ambition of the authors. Overestimation of the scientific significance of their work does not guarantee the achievement of criterion (5.21) since with an increase in l_{SN} the number of criteria for assessing the quality and the exactingness of reviewers are increasing. Therefore, it should be borne in mind that there is a relationship between the probability of falling into each range of values $\overline{R_{\Sigma}^{(j)}}$ (**Table 5.6**) and the value of l_{SN}.

The use of the algorithm given in **Fig. 5.16** is related to the complexity of calculating the $\mathbf{x}^{*}(\lambda)$ matrix, so it is preferable to use the algorithm for calculating the base content value, given in **Fig. 5.12**, or equations (5.5) and (5.6) at the selected level of scientific novelty. The response surface described in this way has the form shown in **Fig. 5.17**.

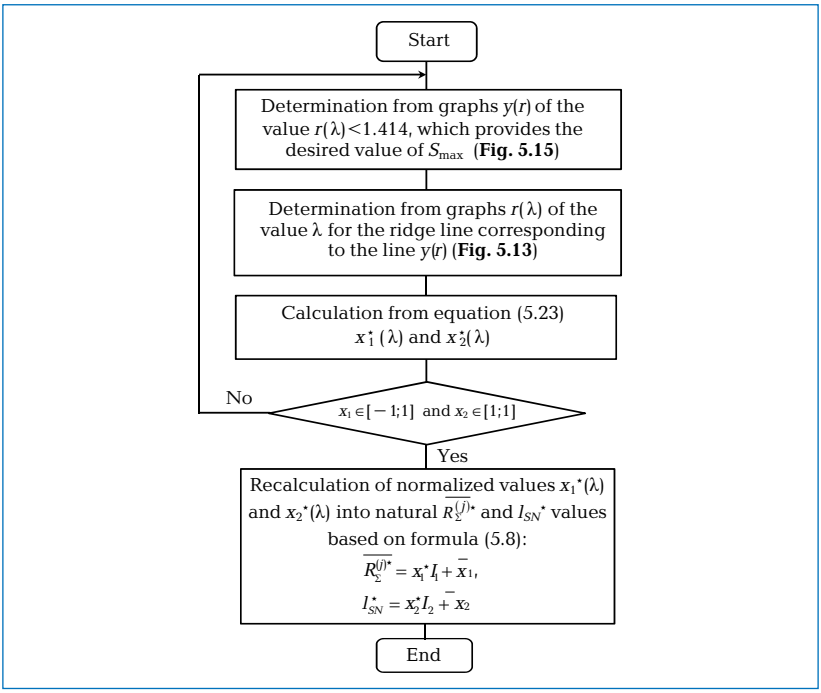


Fig. 5.16 Algorithm for calculating the $\overline{R_\Sigma^{(j)*}}$ and l_{SN}^* values ensuring the fulfillment of criterion (5.21) taking into account the restrictions

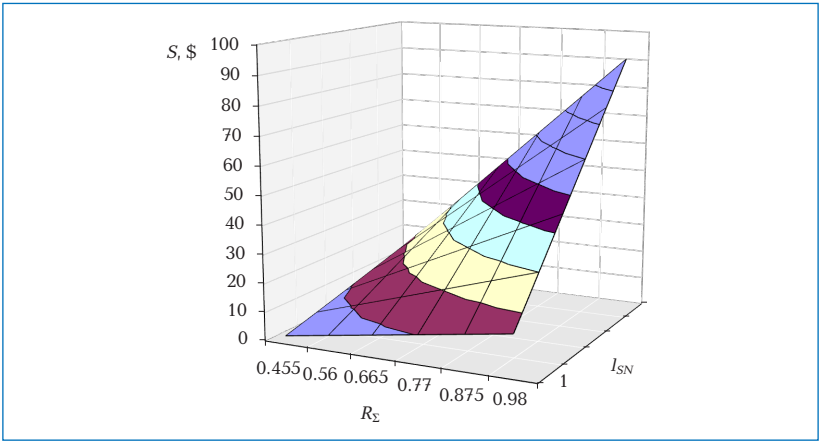


Fig. 5.17 Response surface described by the regression equation $S = f(\overline{R_\Sigma^{(j)}}, l_{SN})$ in the form of (5.17)

It should be noted that the calculated value $S = f(\overline{R_{\Sigma}^{(j)}}, l_{SN})$ forms the basis for calculating the amount of funds withdrawn to the author and reviewer:

$$S_A^{\mathrm{I}} = 0.5(S - 0.1S), \tag{5.24}$$

$$S_R^{\mathrm{I}} = \frac{1}{3}0.5(S - 0.1S),\ S_{R\Sigma} \le 30, \tag{5.25}$$

$$S_A^{\mathrm{II}} = 0.9(S - 0.1S), \tag{5.26}$$

where S_A^{I} is the amount of funds withdrawn to Author at stage I (until the reviewer has chosen his/her limit amount $S_{R\Sigma}$=30 $); S_R^{I} — the amount of funds allocated to each Reviewer at stage I ($S_{R\Sigma} \le 30$); S_A^{II} — the amount of funds transferred to Author at stage II.

The general form of the formula for calculating funds that the Author/Reviewer should receive, based on (5.24) to (5.26), is as follows:

$$S^{-} = \mu_1(S - 0.1S), \tag{5.27}$$

where

$$\mu_1 = \begin{cases} 0.5 & \text{for } S_A^{\mathrm{I}}, \\ 0.9 & \text{for } S_A^{\mathrm{II}}, \\ 0.1667 & \text{for } S_R^{\mathrm{I}}. \end{cases}$$

Taking into account transaction costs, the cost of work represented in **Products** is calculated using the formula:

$$S^{+} = \mu_2 S, \tag{5.28}$$

where μ_2 is a coefficient that takes into account the costs associated with the transaction, depending on the payment system used on the Platform.

Thus, the calculation of numerical assessments of the quality of a work, performed on the basis of (5.2) in the End user rating module, implements STAGE 5 «End-user rating».

The obtained result forms the initial data for the calculation by the Platform of the basic cost of content and the amount of funds withdrawn to the Author and the Reviewer.

The **Products** information technology implementation provides the following implementation: STAGE 3 «End user access to **Resume** and creates an order», STAGE 4 «Transaction — Access», and STAGE 5 «End-user rating» (**Fig. 2.12**).

5.2 Information-technological implementation of the End User account and feedback in assessing the quality of content

Information-technological solutions for the End User account are implemented by two types of functionalities:

- registration functionality;
- functionality of work in the personal account.

The functionality of registration of the End User does not differ in the functionality of registration of the Author and the Reviewer and is possible either directly by selecting the role of «End user» at the registration stage (the windows correspond to those shown in **Fig. 3.9–3.12**), or through ORCID or LinkedIn.

The functionality of work in the personal account provides an opportunity for the safety of all downloaded content and an assessment of its quality.

Fig. 5.18 shows a visualization of the End User account, which already contains one downloaded work (ID210).

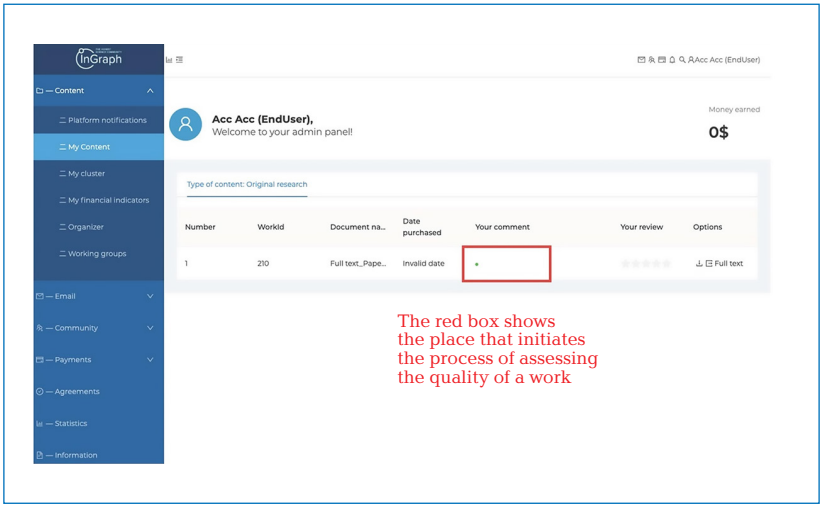


Fig. 5.18 End User Account window

The Platform offers the End User to rate the quality of work using a custom scale (**Fig. 5.19**).

The End user evaluates a work using a custom scale (**Fig. 5.20**).

The result of the work assessment is displayed in the «Your review» tab (**Fig. 5.21**).

In the End User account, downloaded works are grouped by content type (**Fig. 5.22**).

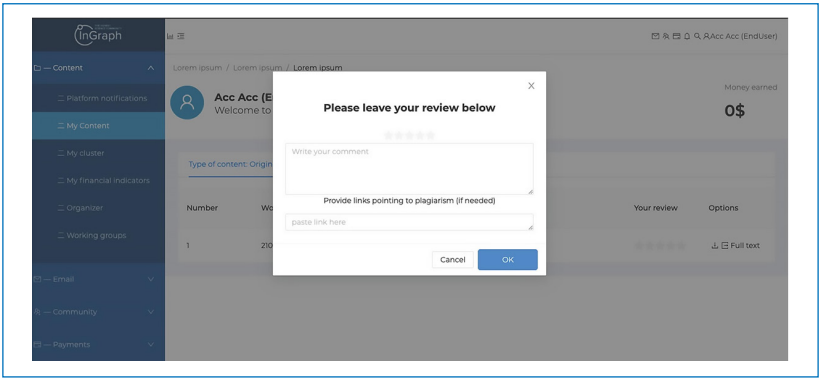


Fig. 5.19 End User's Personal Account window (the Platform offers to assess the quality of a work)

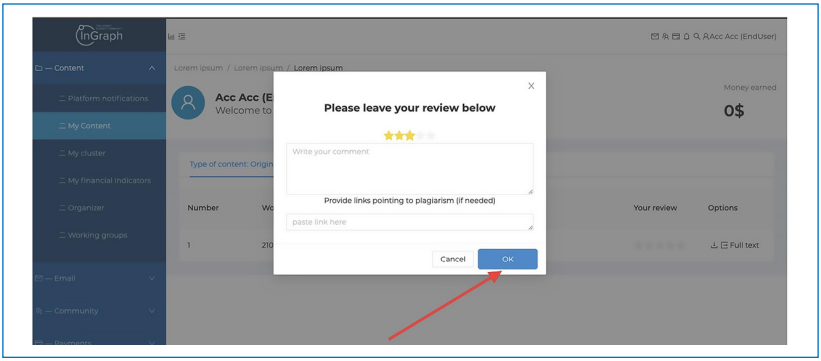


Fig. 5.20 End User Account window (a work rated three «stars»)

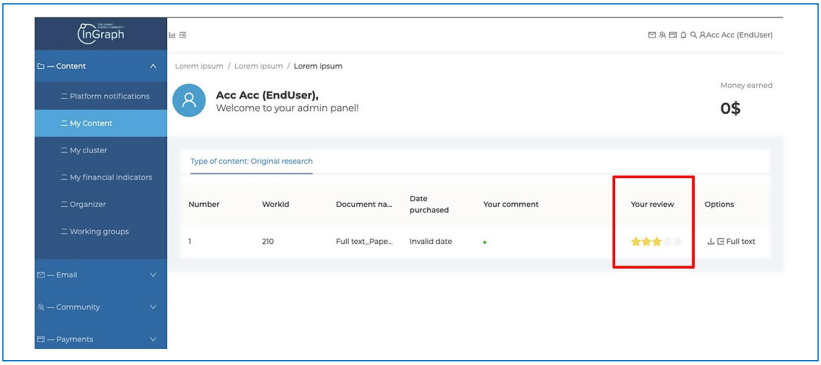


Fig. 5.21 End User's Personal Account window (the red box shows the result of the quality of work assessment)

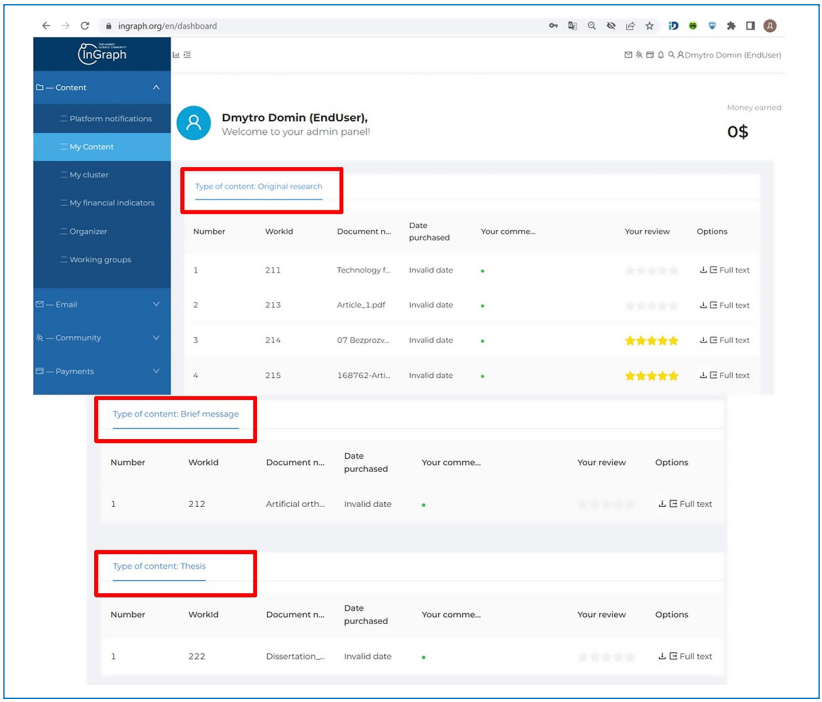


Fig. 5.22 Fragments of the End User's Personal Account window (grouping of downloaded works)

The user rating is recalculated in the End user rating module of the communication and analytical unit of the Platform (**Fig. 2.12**) into a numerical value of the dimensionless range [0; 1], based on formula (5.2). The results obtained are used to implement a feedback mechanism for quality assessment. At the same time, quality assessment is understood as the quality of scientific work, according to m users, taking into account their category, and the quality of the review process itself. The latter is determined on the basis of the ratings given for this work by reviewers, and makes it possible to assess the objectivity of each of the three reviewers using the criterion:

$$R^{rev} = \frac{R_k^{(j)}}{R^{user}} \to 1, \tag{5.29}$$

where $R_k^{(j)}$ is the average rating of the content given by the k-th reviewer; R^{user} — the average rating of content given by end users, determined by formula (5.2); R^{rev} — rating of the k-th reviewer on the basis of the evaluation of the work by end users.

To assess the objectivity of the reviewer in this case, it is necessary to use the following rule:

1) $R^{rev} < 1$ — the reviewer is very principled or shows excessive caution in the assessment (knowingly does not want to risk his/her reputation if the assessment of the end user/ reader happens to be much lower);

2) $R^{rev} = 1$ — the reviewer is fully objective in assessing content in terms of meeting end user/reader requests;

3) $R^{rev} > 1$ — the reviewer is either very supportive in evaluating the content according to his/her internal beliefs (always ready to help the author in the desire to support him/her and stimulate the authors' interest in the creation of scientific works), or he/she saw big potential in the peer-reviewed content that others have not revealed or is interested in creating the most attractive picture for end user due to personal motives.

An example of assessing the objectivity of a reviewer.

Following the reviewing, the paper received such results from reviewers:

- estimate from Reviewer No. 1: $R_k^{(j)} = 0.55$.

Other reviewers estimated this paper as follows:

- Reviewer No. 2: $R_k^{(j)} = 0.35$.
- Reviewer No. 3: $R_k^{(j)} = 0.75$.

The paper was rated by 100 end users/readers, of which:

- scientists who are not registered at the Platform as reviewers — 66 people ($m_1 = 66$);
- practitioners who bought this paper for their professional activities — 16 people ($m_2 = 16$);
- scientists who are registered at the Platform as reviewers — 18 people ($m_3 = 18$).

The sequence and results of the calculations for such inputs are shown in **Table 5.10**. According to (5.2),

$$R^{user} = \frac{\sum_{i=1}^{3} k_i \overline{R_i}}{\sum_{i=1}^{3} k_i} = \frac{\left(k_1 \overline{R_1} + k_2 \overline{R_2} + k_3 \overline{R_3}\right)}{\left(k_1 + k_2 + k_3\right)} =$$

$$= \frac{1}{1.75}\left(0.25 \times 0.419 + 0.5 \times 0.406 + 1 \times 0.575\right) = 0.504.$$

Calculating the objectivity of reviewer No. 1:

$$R^{rev} = \frac{R_1^{(j)}}{R^{user}} = \frac{0.55}{0.504} = 1.09 \approx 1.$$

Calculating the objectivity of reviewer No. 2:

$$R^{rev} = \frac{R_2^{(j)}}{R^{user}} = \frac{0.35}{0.504} = 0.69 < 1.$$

Calculating the objectivity of reviewer No. 3:

$$R^{rev} = \frac{R_3^{(j)}}{R^{user}} = \frac{0.75}{0.504} = 1.49 > 1.$$

Conclusion regarding the objectivity of reviewers:

1. Reviewer No. 1 — objective.
2. Reviewer No. 2 is very principled or overly cautious in assessing.
3. Reviewer No. 3 is very supportive, either he/she saw big potential in the peer-reviewed content, which others did not reveal, or is interested in creating the most attractive picture for end user due to personal motives.

Table 5.10 Example of calculating content ratings from users of different categories to determine the objectivity of reviewers by criterion (5.29)

Estimates from end users/readers who **are not registered** at the Platform **as reviewers**	
Number of users who rated content	Numerical value
10	0.66
34	0.36
22	0.4
Total	$\overline{R_1} = \frac{1}{66}(10 \times 0.66 + 34 \times 0.36 + 22 \times 0.4) = 0.419$
Estimates from end users/readers who are **practitioners** who bought this paper for their professional activities	
Number of users who rated content	Numerical value
10	0.35
6	0.5
Total	$\overline{R_2} = \frac{1}{16}(10 \times 0.35 + 6 \times 0.5) = 0.406$
Ratings from end users/readers who are **registered** at the Platform **as reviewers**	
Number of users who rated content	Numerical value
5	0.8
5	0.7
5	0.45
3	0.2
Total	$\overline{R_3} = \frac{1}{18}(5 \times 0.8 + 5 \times 0.7 + 5 \times 0.45 + 3 \times 0.2) = 0.575$

Checking the objectivity of the review process is determined similarly to (5.29), however, not the score from the k-th reviewer but the average score from three reviewers, calculated by formula (5.1):

$$R^{rev\_proc} = \frac{\overline{R_{\Sigma}^{(j)}}}{R^{user}} \to 1, \tag{5.30}$$

where R^{rev_proc} is the assessment of the objectivity of the review process.

The structure of criterion (5.29) or (5.30) has a simple justification — it expresses the principle of equilibrium of assessments from experts in this subject area and from users of scientific content. In this case, it is assumed that users are competent enough to adequately evaluate the content. This assumption is justified by the following reasoning. On the one hand, competence is expressed through the weightings included in formula (5.2) — users who are reviewers registered on the **InGraph** Platform as reviewers, or practitioners registered on the **InGraph** Platform as reviewers, have a greater weight. That is, their competencies are sufficient to assess both the scientific and practical significance of a work in specific subject areas as applied to the sectors of the National Economy. On the other hand, a potentially large number of users who give ratings form a potentially representative sample that allows for a statistical assessment of the distribution of the numerical value of the score. This, in turn, minimizes the impact on the accuracy of estimates by insufficiently competent users, due to their expected smallness in the total sample size. The latter assumption is based on the fact that **InGraph** is a specialized scientific and practical Platform for registered scientists and practitioners communicating in a single professional field, in which connections are based on practical interest in the results of scientific activity and ethical principles.

All this allows us to conclude that feedback in assessing the quality of content stimulates all communicating participants:

- the author is interested in creating high-quality scientific content since his/her image as a scientist, as well as possible earnings, depend on this;
- the reviewer is interested in an objective review of scientific content since his/her image as an expert in these subject areas, as well as possible earnings, depend on this;
- users are interested in high-quality scientific content as they consider it as a means of solving their practical problems or achieving professional goals.

It should also be noted that the transparency of content quality assessments and objectivity of both reviewers and the review process form markers for funding organizations — grantors. This circumstance is an additional incentive for scientists acting either in the role of authors or in the role of reviewers.

Due to this motivation for each participant in the communication technology through the proposed **InGraph** Platform solutions, the risks of collusive schemes pursuing selfish goals are minimized, for example, in the system of «author-reviewer» relations. One of the options for implementing such schemes can be described as follows. The author, uploading his/her work to the Platform, can warn about this to pre-related persons who have

the status of reviewers, that is, colleagues, registered on the Platform as a reviewer. Receiving high marks with closed access to the work in Products, such an author can count on a large amount of earnings when the work is downloaded by end users. However, the fact of unfair review and poor-quality work will be detected by the feedback mechanism for assessing the quality of content. In this case, both the image of the author as a scientist and the image of the reviewer as a scientist and an expert will suffer.

On the other hand, the honesty of both the author and the reviewer become visible on the Platform and can form personal ratings with subsequent additional incentives.

Thus, the information-technological implementation of the End User account, which includes a feedback mechanism in assessing the quality of content, ensures the implementation of STAGE 5 «End-user rating» (**Fig. 2.12**).

5.3. Evaluation of the effectiveness of scientific activity: analytics indicators and the procedure for their calculation

The effectiveness of the technology of scientific and practical communications, which is based on the model of interaction of Actors without intermediaries, is assessed at two main levels:

- the level of scientific significance of the scientist's works;
- the level of practical value of the scientist's works.

The level of scientific significance of the scientist's works is based on communication through the Platform in the «Author — Reviewer» system.

The level of practical value of the scientist's works is based on communication through the Platform in the «Author — End User» system.

Both levels may also include Actors 6 and 7 in the communication chain, but they do not participate in the formation of ratings if they are not end users of the content. These Actors are only consumers of the technology, tracking the rating indicators of Actors 1 and 2 and choosing on the basis of them priority strategies for their communications.

Evaluation of the effectiveness of scientific activity through the **InGraph** Platform tools is carried out on the basis of determining the indicators of analytics in two aspects: in the aspect of personal ratings and in the aspect of demand in its cluster. However, the proposed principles of rating can be scaled to assess the effectiveness of scientific activities of individual scientific teams, universities, countries, as they are based on a single structure for presenting rating criteria.

Performance indicators in the aspect of personal ratings:

- the assessment given to the ν-th work by the k-th reviewer, $R_k^{(j)}$;
- the average score of the ν-th work from three reviewers, $\overline{R_\Sigma^{(j)}}$;
- the number of users who rated the ν-th work, by categories of users, m_i;

- the average score given to the ν-th work from the end users of the *i*-th category, $\overline{R_i}$;
- evaluation from end users, R^{user};
- overall rating of the ν-th work, *Rating*;
- integral rating of the scientist according to the reviewers' estimates, R_R;
- integral rating of the scientist according to end-user assessments, R_{EUS};
- the overall rating of the scientist, evaluated on all his/her content, Σ*Rating*;
- the average integral rating of the scientist according to the assessments of reviewers, $\overline{R_{\Sigma R}^{(j)}}$;
- average integral rating according to end-user ratings, $\overline{R_{\Sigma EUS}^{(j)}}$.

Performance indicators in terms of demand in one's cluster:

- the number of works in the cluster, *M*;
- the highest score from three reviewers in the cluster, $\max \overline{R_{\Sigma}^{(j)}}$;
- coefficient of scientific significance of the ν-th work in the cluster, k_s;
- scientific rating of the ν-th work in the cluster, R_s;
- the number of downloads of the ν-th work by end users, n_ν;
- the number of downloads of the most downloaded work in Cluster, *N*;
- the coefficient of demand for ν-th work in this cluster, k_n;
- rating of the ν-th work from end users, without division into categories, $\overline{R_{EUS}}$;
- evaluation from end users, R^{user};
- rating of the ν-th work in the cluster, R_ν;
- an integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the assessments of reviewers, $R_{R\Sigma}$;
- an integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the assessments of end users, $R_{EUS\Sigma}$;
- the average integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the assessments of reviewers $\overline{R_{\Sigma RC}^{(j)}}$;
- the average integral indicator of the effectiveness of the scientific activity of a scientist in the cluster according to end-user assessments, $\overline{R_{\Sigma EUSC}^{(j)}}$;
- the effectiveness of the scientific activity of the scientist in the cluster, *SE*.

Below are the principles for calculating these indicators and options for visualizing the results of these calculations.

Calculation of performance indicators in terms of personal ratings: $R_k^{(j)}$ is calculated from formula (4.1), $\overline{R_{\Sigma}^{(j)}}$ is calculated from formula (5.1).

Visualization of the results can be represented in the form of a diagram (**Fig. 5.23**).

The average score given to the *v*-th work from the end users of the *i*-th category is calculated by the formula:

$$\overline{R_i} = \frac{1}{m_i} \sum_{l=1}^{m_i} R_i^l,\ l = 1,..\infty,\ i = 1,2,3. \tag{5.31}$$

An example of the calculation using formula (5.31) is given in **Table 5.10**. The visualization of $\overline{R_i}$ can be represented in the form of a diagram (**Fig. 5.24**).

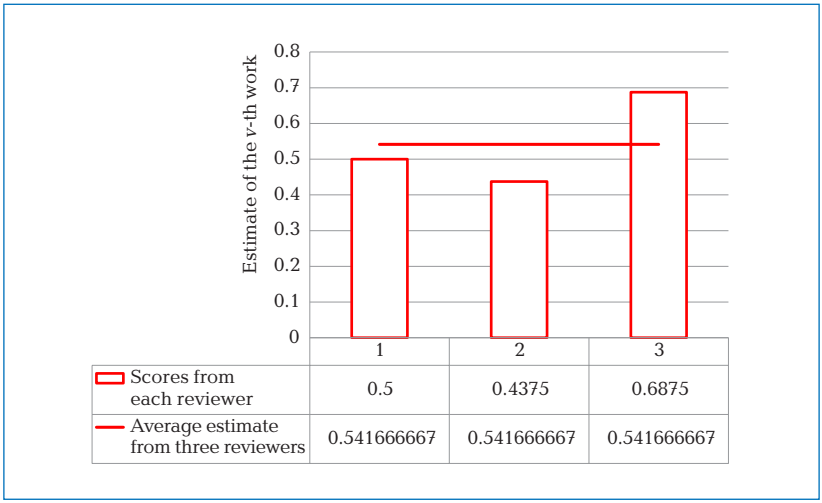


Fig. 5.23 Visualizing the estimate of the *v*-th work from reviewers $R_k^{(j)}$ and average estimate $\overline{R_\Sigma^{(j)}}$ (example)

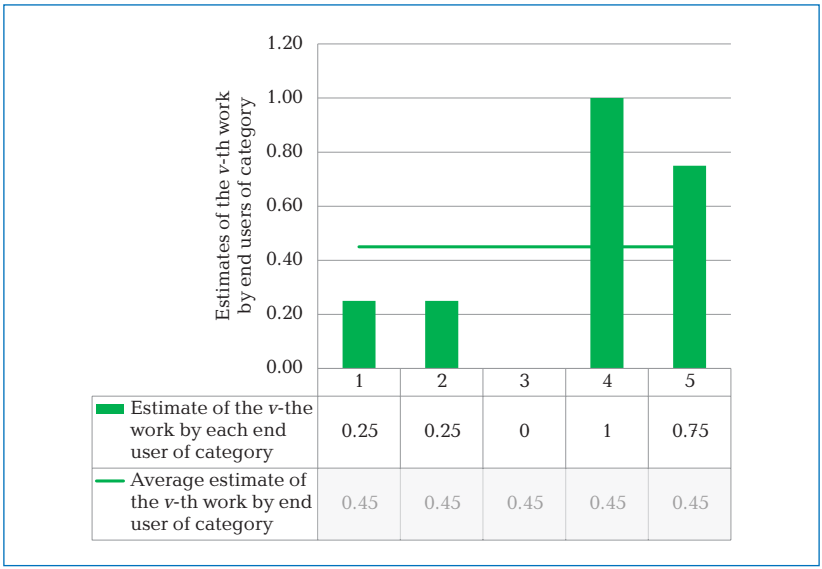
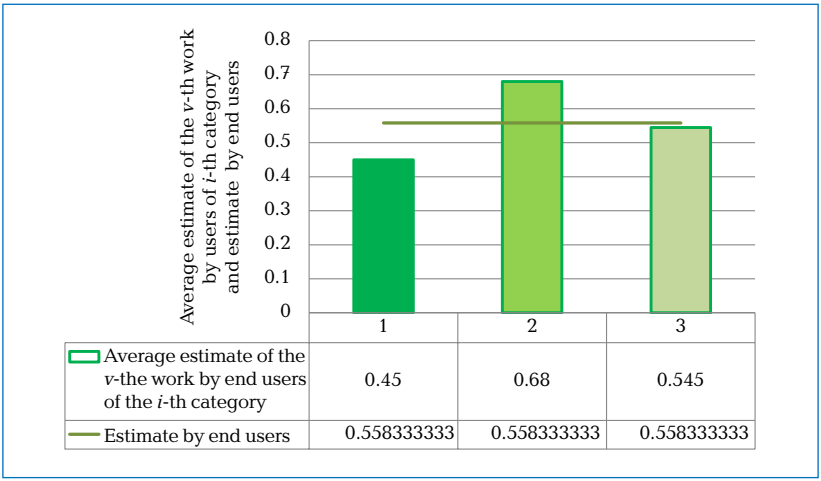


Fig. 5.24 Visualization of the average score given to the v-th work from the end users of the *i*-th category (example)

The end-user estimate based on the calculations using (5.31) is based on formula (5.2). The R^{user} visualization can be represented as a diagram (**Fig. 5.25**).



	1	2	3
Average estimate of the *v*-the work by end users of the *i*-th category	0.45	0.68	0.545
Estimate by end users	0.558333333	0.558333333	0.558333333

Fig. 5.25 Visualization of the average rating given to the v-th work by end users of all categories, and the evaluation of the end users R^{user} (example)

The overall rating of the v-th work is calculated by the formula:

$$Rating = \overline{R_{\Sigma}^{(j)}} \cdot R^{user}. \tag{5.32}$$

This formula (5.32) structure is justified as follows. Each work uploaded to the Platform and presented to the End User in **Products** includes two components: scientific and applied. The first of them is evaluated by reviewers, the second by users. The level of each of these components is evaluated in a dimensionless scale [0; 1]. If you arrange these values along the axes of the Cartesian coordinate system, a square is formed with a side length equal to 1. The maximum possible score for any v-th work from both reviewers and users is 1. Therefore, the best work has the highest $Rating=1$, which corresponds to the area S_{Σ} of a square constructed in the coordinates $\overline{R_{\Sigma}^{(j)}} - R^{user}$. But the area of the square is equal to the product of its sides, which leads to the structure of formula (5.32).

The overall rating of the v-th work, based on (5.32) and its geometric image, is the area of a rectangle with side lengths equal to $\overline{R_{\Sigma}^{(j)}}$ and R^{user} (5.26).

The integral rating of the scientist according to the assessments of reviewers is calculated by the formula:

$$R_R = \sum_{v=1}^{M_A} \overline{R_{\Sigma_v}^{(j)}}. \tag{5.33}$$

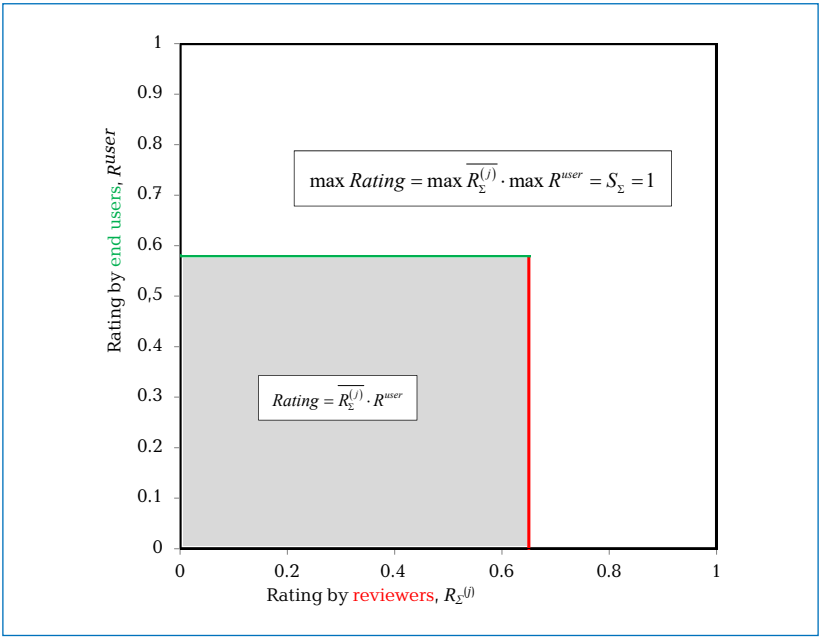


Fig. 5.26 Geometric image of the overall rating of the ν-th work

The integral rating of the scientist according to the estimates of end users is calculated by the formula:

$$R_{EUS} = \sum_{\nu=1}^{M_A} \overline{R_{\Sigma_\nu}^{(j)}}. \tag{5.34}$$

In formulas (5.33) and (5.34), M_A is the number of works by the author in this cluster.

From the formulas (5.33) and (5.34), it follows that the calculation is carried out for all the works of this scientist located in this cluster. Therefore, the visualization of the formation of an integral rating can be represented in the form of a diagram (**Fig. 5.27**).

The overall rating of a scientist, evaluated throughout his/her content, is calculated using a formula that has a structure similar to (5.32):

$$\Sigma Rating = \overline{R_{\Sigma R}^{(j)}} \cdot \overline{R_{\Sigma EUS}^{(j)}}, \tag{5.35}$$

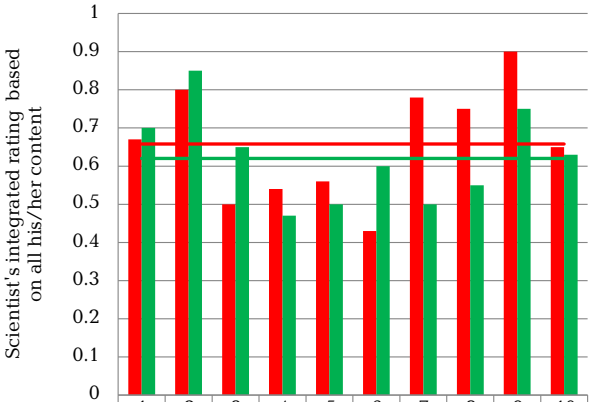
where $\overline{R_{\Sigma R}^{(j)}}$ is the average integrated rating of the scientist according to the assessments of reviewers, calculated by formula (5.36); $\overline{R_{\Sigma EUS}^{(j)}}$ is the average

integrated rating of the scientist according to the estimates of end users, calculated by formula (5.37):

$$\overline{R_{\Sigma R}^{(j)}} = \frac{R_R}{M_A}. \tag{5.36}$$

$$\overline{R_{\Sigma EUS}^{(j)}} = \frac{R_{EUS}}{M_A}. \tag{5.37}$$

The geometric image of the overall rating of the scientist, evaluated throughout his/her content, corresponds to the one given in **Fig. 5.26**, with the difference that the abscissa and ordinate axes are not the ratings of the v-th work from reviewers and end users but the average integral ratings of the scientist from reviewers and end users, calculated according to formulas (5.36) and (5.37), respectively.



	1	2	3	4	5	6	7	8	9	10
Rating by reviewers	0.67	0.8	0.5	0.54	0.56	0.43	0.78	0.75	0.9	0.65
Rating by end users	0.7	0.85	0.65	0.47	0.5	0.6	0.5	0.55	0.75	0.63
Average integrated rating by reviewers	0.658	0.658	0.658	0.658	0.658	0.658	0.658	0.658	0.658	0.658
Average integrated rating by end users	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62

Fig. 5.27 Visualization of the formation of the integrated rating of a scientist

An example of the calculation of performance indicators (5.31) to (5.37) is given in **Table 5.11**.

Table 5.11 Example of calculating performance indicators in terms of personal ratings

Indicator	Designation	Formula	Value
Evaluation of content by reviewers			
Reviewer's score	$R_k^{(j)}$	(4.1)	
1	$R_1^{(j)}$		0.5
2	$R_2^{(j)}$		0.4375
3	$R_3^{(j)}$		0.6875
Average rating from three reviewers	$\overline{R_\Sigma^{(j)}}$	(5.1)	**0.5417**
End-user evaluation of content			
Evaluation from the end user			
1		–	0.25
2		–	0.25
3		–	0
4		–	1
5		–	0.75
Rating from end users, without categorization	$\overline{R_{EUS}}$	(5.34)	**0.45**
Overall rating of work	*Rating*	(5.32)	**0.244**
Number of works of the author in this cluster	M_A	–	10
Integral rating of a scientist according to reviewers' estimates	R_R	(5.33)	6.58
Integral rating of a scientist according to end users	R_{EUS}	(5.34)	6.2
Average integral rating of a scientist according to reviewers' estimates	$\overline{R_{\Sigma R}^{(j)}}$	(5.36)	0.658
Average integral rating of a scientist according to end users	$\overline{R_{\Sigma EUS}^{(j)}}$	(5.37)	0.62
A scientist's overall rating, rated across all his/her content	$\Sigma Rating$	(5.35)	**0.41**

Calculation of performance indicators in terms of demand in one's cluster. The coefficient of scientific significance of the ν-th work in the cluster is calculated by the formula:

$$k_s = \frac{\overline{R_{\Sigma\ \nu}^{(j)}}}{\max \overline{R_\Sigma^{(j)}}}, \tag{5.38}$$

where $\overline{R_{\Sigma\ \nu}^{(j)}}$ is the average score of the ν-th work from three reviewers.

This structure of formula (5.38) is justified as follows. The most significant from a scientific point of view is the work in the cluster that received the highest rating according to the results of the review. Therefore, it can be taken as a basis for assessing scientific significance. Since the ratings for author's content are generally different, the scientific significance of each work is a fraction of the maximum scientific significance $\max \overline{R_{\Sigma}^{(j)}}$ throughout the cluster.

The scientific rating of the ν-th work of the author's content in the cluster is calculated by the formula:

$$R_s = k_s \cdot \overline{R_{\Sigma}^{(j)}}_{\nu}. \tag{5.39}$$

The justification of the form of formula (5.39) is similar to the justification of formula (5.32): $k_{s\max}=1$ if the ν-th work in this cluster is the most significant from a scientific point of view ($\overline{R_{\Sigma}^{(j)}}_{\nu} = \max \overline{R_{\Sigma}^{(j)}}$), and if $\overline{R_{\Sigma}^{(j)}}=1$, then $R_s=R_{s\max}=1$. And this corresponds to the formation in the $k_s - \overline{R_{\Sigma}^{(j)}}$ coordinates of a square with an area equal to 1. Then R_s, determined by formula (5.39), characterizes the level of scientific significance of the ν-th work in a given cluster.

The coefficient of demand for the ν-th work in this cluster is calculated by the formula:

$$k_n = \frac{n_{\nu}}{N}. \tag{5.40}$$

This formula (5.40) structure is justified as follows. If we assume that the most popular is the work in this cluster that is downloaded most often, then the number of downloads of such work is a measure of demand. Then the share of downloads of the ν-th work in relation to the number of downloads of such a most popular work will determine the demand for the ν-th work. The structure of formula (5.33) also makes it possible to operate with the unit of measurement, %, in assessing the demand for the ν-th work in the cluster.

The rating of the ν-th work from end users, without division into categories, is calculated by the formula:

$$\overline{R_{EUS}} = \frac{1}{L}\sum_{l=1}^{L} R_l, \tag{5.41}$$

where R_l — a score for the work from the l-th user; L is the number of users who rated the work.

The rating of the ν-th work in the cluster is calculated by the formula:

$$R_{\nu} = k_n \cdot R^{user}. \tag{5.42}$$

The rationale for the form of formula (5.42) is similar to the justification of formula (5.32): $k_{n\max}=1$ if the ν-th work in this cluster is the most

popular ($n_\nu = N$), and if $R^{user}_{\max} = 1$, then $R_{\nu\max} = 1$. And this corresponds to the formation of a square in the $k_n - R^{user}$ coordinates with an area equal to 1. Then R_ν, determined by formula (5.42), characterizes the share of demand for the ν-th work in this cluster.

Fig. 5.28 shows the distribution of the number of clusters, %, to the total number of clusters in all four areas of science, differentiated by field of science.

It can be seen that the main share is occupied by Physical Sciences and Engineering, Social Sciences and Humanities and Health Sciences have an equal share, the Life Sciences cluster is the least represented. Obviously, such an uneven distribution should be taken into account when calculating the ratings of scientists for reasons of equalizing the chances because competition within the cluster is greater if the cluster has a larger share.

Fig. 5.29–5.32 show the distribution of the number of subclusters, %, to the total number of subclusters in each cluster for each of the four areas of science.

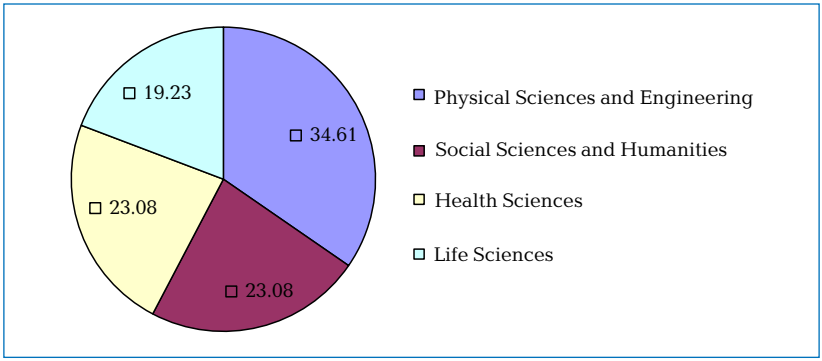


Fig. 5.28 Distribution of the number of clusters differentiated by field of science

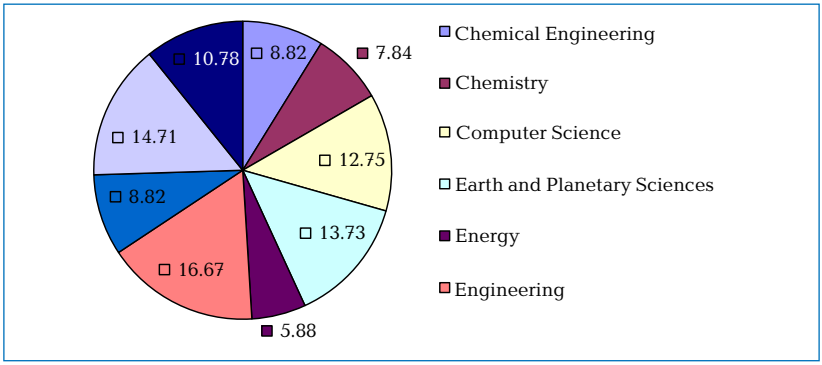


Fig. 5.29 Distribution of the number of subclusters, %, to the total number of subclusters in each cluster for Physical Sciences and Engineering

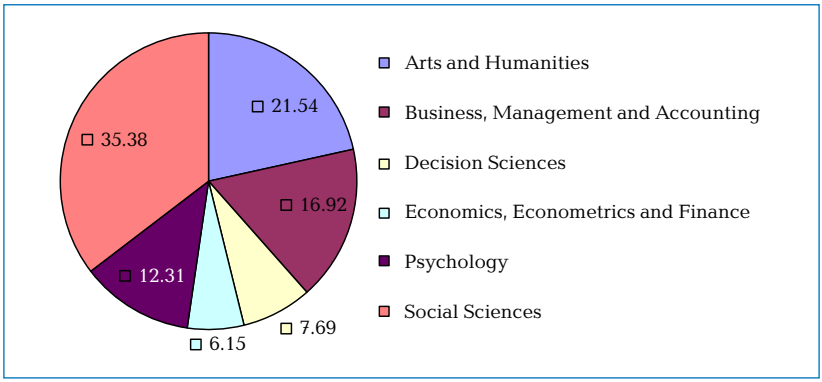


Fig. 5.30 Distribution of the number of subclusters, %, to the total number of subclusters in each cluster for Social Sciences and Humanities

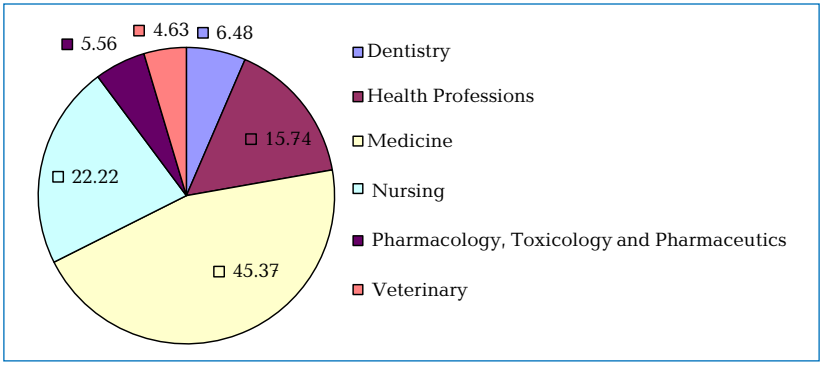


Fig. 5.31 Distribution of the number of subclusters, %, to the total number of subclusters in each cluster for Health Sciences

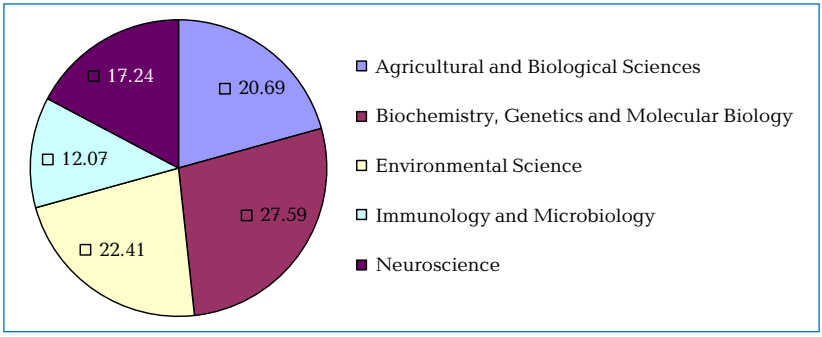


Fig. 5.32 Distribution of the number of subclusters, %, to the total number of subclusters in each cluster for Life Sciences

The conclusion regarding the distribution of subclusters is similar — when comparing the rating indicators of scientists within the cluster, one should take into account the uneven representation of subclusters.

The integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the assessments of reviewers is calculated by the formula:

$$R_{R\Sigma} = \sum_{v=1}^{M_A} R_{s_v}. \tag{5.43}$$

The integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the estimates of end users is calculated by the formula:

$$R_{EUS\Sigma} = \sum_{v=1}^{M_A} R_{v_v}. \tag{5.44}$$

From formulas (5.43) and (5.44), it follows that the calculation is carried out for all the works of this scientist located in this cluster. Therefore, visualization of the formation of an integral indicator of the effectiveness of the scientific activity of a scientist in the cluster can be represented in a form similar to **Fig. 5.32**. The only difference is that the ordinate axis does not display ratings from reviewers and end users but integral indicators that take into account the coefficients of scientific significance and relevance of works of all author's content.

The average integral indicator of the effectiveness of a scientist's scientific activity in the cluster according to reviewers' estimates is calculated by the formula:

$$\overline{R^{(j)}_{\Sigma RC}} = \frac{R_{R\Sigma}}{M_A}. \tag{5.45}$$

The average integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the estimates of end users is calculated by the formula:

$$\overline{R^{(j)}_{\Sigma EUSC}} = \frac{R_{EUS\Sigma}}{M_A}. \tag{5.46}$$

The effectiveness of the scientific activity of the scientist in the cluster is calculated by the formula:

$$SE = \overline{R^{(j)}_{\Sigma RC}} \cdot \overline{R^{(j)}_{\Sigma EUSC}}. \tag{5.47}$$

An example of calculating performance indicators in terms of demand in one's cluster is given in **Table 5.12**.

Table 5.12 An example of calculating performance indicators in terms of demand in one's cluster

Indicator	Designation	Formula	Value
Evaluation of content by reviewers			
Average score from three reviewers of the v-th work in the cluster	$\overline{R_{\Sigma\,v}^{(j)}}$	(5.1)	**0.5417**
Highest score from three reviewers in the cluster	$\max \overline{R_{\Sigma}^{(j)}}$	–	**0.95**
Indicators of scientific significance and relevance of works			
Number of author's works in the cluster	M_A	–	10
Coefficient of scientific significance of the v-th work in the cluster	k_s	(5.38)	0.57
Scientific rating of the v-th work in the cluster	R_s	(5.39)	0.31
Number of downloads of v-th work by end users	n_v	–	15
Number of downloads of the most downloaded work in Cluster	N	–	50
The coefficient of demand for v-th work in this cluster	k_n	(5.40)	0.3
End-user evaluation of content			
Evaluation from end users	R^{user}	(5.2)	**0.45**
Rating of the v-th work in the cluster	R_v	(5.42)	0.135
Evaluation of the effectiveness of scientific activity			
Integral indicator of the effectiveness of scientific activity of a scientist in the cluster according to reviewers	$R_{R\Sigma}$	(5.43)	6.5
Integral indicator of the effectiveness of scientific activity of a scientist in the cluster according to end-user assessments	$R_{EUS\Sigma}$	(5.44)	5.8
The average integral indicator of the effectiveness of the scientific activity of the scientist in the cluster according to the assessments of reviewers	$\overline{R_{\Sigma RC}^{(j)}}$	(5.45)	0.65
Average integral indicator of the effectiveness of scientific activity of a scientist in the cluster according to end-user assessments	$\overline{R_{\Sigma EUSC}^{(j)}}$	(5.46)	0.58
The effectiveness of the scientific activity of the scientist in the cluster	SE	(5.47)	**0.377**

Fig. 5.33 shows the principle of assessing the effectiveness of a scientist's scientific activity in a cluster.

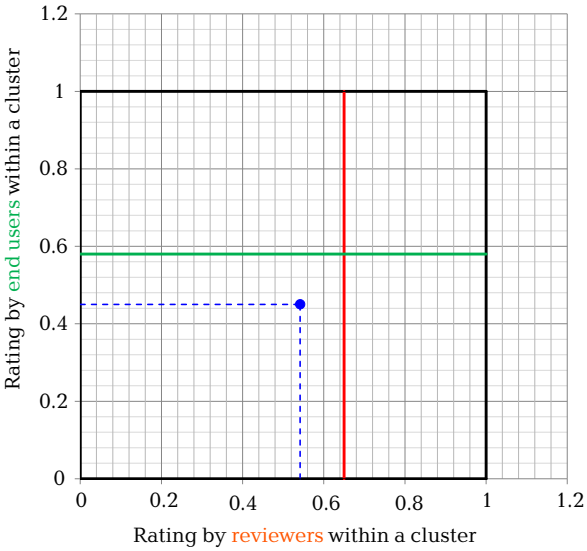


Fig. 5.33 The principle of assessing the effectiveness of the scientific activity of a scientist in the cluster

The red vertical line shows the average value of the integral indicator of the effectiveness of scientific activity in the cluster based on the assessments of reviewers, the green horizontal line shows the average value of the integral indicator of the effectiveness of scientific activity in the cluster based on the assessments of end users. The blue dot has coordinates $(\overline{R_{\Sigma RC}^{(j)}}; \overline{R_{\Sigma EUSC}^{(j)}})$ and displays the actual position of the scientist in the cluster. If it lies to the left of the red vertical line, the scientific level of the scientist's work is lower than the average for the cluster. Similarly, if it lies below the green vertical line, the practical significance of the work of this scientist is lower than the average for the cluster.

Position of the dot in the $(\overline{R_{\Sigma RC}^{(j)}}; \overline{R_{\Sigma EUSC}^{(j)}})$ coordinates also makes it possible to understand what the stronger side of the scientist is — science or practice. If $\overline{R_{\Sigma RC}^{(j)}} > \overline{R_{\Sigma EUSC}^{(j)}}$, then the scientist is more of a theorist than a practitioner, otherwise it is the opposite.

Fig. 5.34–5.36 show the structure of the visual-numerical representation of the main indicators of the effectiveness of scientific activity. It provides for the presence of three main units with indicators:

- UNIT My work's statistics;
- UNIT My cluster's statistics;
- UNIT My financial indicators.

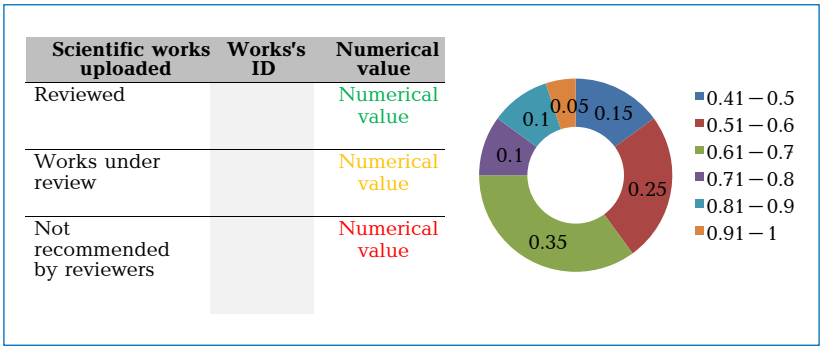


Fig. 5.34 UNIT My work's statistics

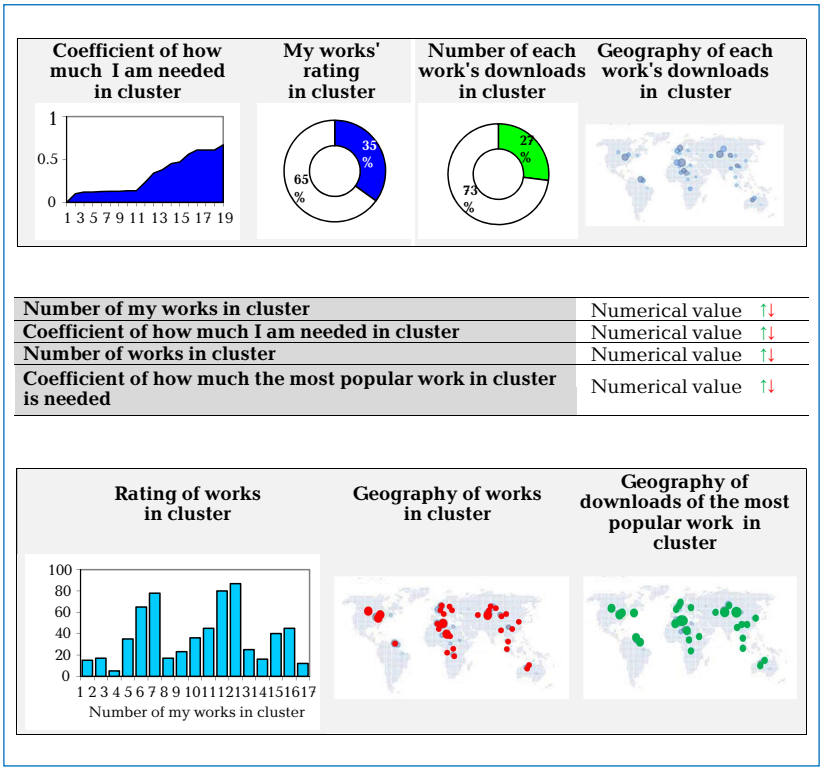
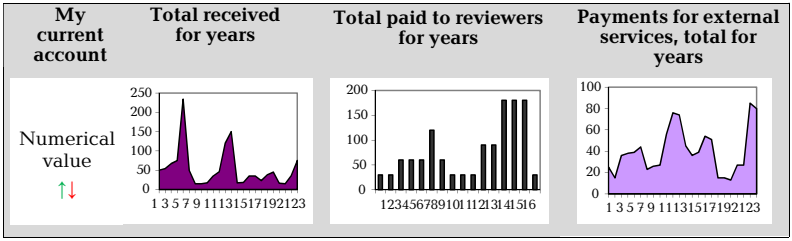


Fig. 5.35 UNIT My cluster's statistics

Fig. 5.34–5.36 demonstrate that it is possible to operate with simple indicators into which the values of the performance indicators of scien-

tific activity obtained by the implementation of the calculation procedure according to formulas (4.1), (5.1), (5.31) to (5.47) are transformed. These indicators have a visualized and numerical form and are easy to understand.



	Previous month	Quarter	6 months	Year
Received totally over the period	Numerical value ↑ ↓	Numerical value ↑ ↓	Numerical value ↑ ↓	Numerical value ↑ ↓
Paid to reviewers	Numerical value ↑ ↓	Numerical value ↑ ↓	Numerical value ↑ ↓	Numerical value ↑ ↓
Payments for external services	Numerical value ↑ ↓	Numerical value ↑ ↓	Numerical value ↑ ↓	Numerical value ↑ ↓

	Periodicals	Books
Min price of work (all content)	Numerical value ↑ ↓	Numerical value ↑ ↓
Max price of work (all content)	Numerical value ↑ ↓	Numerical value ↑ ↓
Average work price (all content)	Numerical value ↑ ↓	Numerical value ↑ ↓

Fig. 5.36 UNIT My financial indicators

UNIT My work's statistics (**Fig. 5.34**) in the left part contains data on the status of works according to the ID-number, specified by a numerical indicator in absolute units or as a percentage of the number of works corresponding to each status. In the right part, there is a visualization of the results of the review in the form of a doughnut chart consisting of 6 sectors according to the rating ranges of reviewers, but only for works that have received a minimum score of the quality level (0.41). That is each sector corresponds to one range of quality assessments from reviewers in the [0; 1] range (**Table 5.1**).

The numerical values within each sector reflect the proportion of works that fall within the corresponding evaluation interval. An additional numerical scale is possible with an average value of ratings within each interval (sector).

UNIT My cluster's statistics (**Fig. 5.35**) is divided into three subunits:

- Subunit 1 makes it possible to understand the idea of the cluster.
- Subunit 2 makes it possible to understand an idea of the demand for personal work in the cluster.
- Subunit 3 makes it possible to understand an idea of the personal rating in the cluster, evaluated by downloading works and the geography of downloads.

UNIT My financial indicators (**Fig. 5.35**) is divided into three subunits:

- Subunit 1 makes it possible to form an idea of the dynamics of the financial attractiveness of personal work in the cluster.
- Subunit 2 makes it possible to understand an idea of the financial attractiveness of personal works in a chronological scale.
- Subunit 3 makes it possible to understand an idea of the cost of personal works that are in closed access in **Products**, which indirectly indicates their scientific level.

All these indicators are dynamic and can be tracked continuously from one's personal account.

Thus, the proposed indicators of the effectiveness of scientific activity and the procedures for their evaluation create transparent and convenient indicators for authors and reviewers to track their rating positions. The same analytics can be in demand by funding organizations and become a marker when choosing scientists or research teams to solve their actual problems, allocate grants, etc.

Procedures for calculating performance indicators of scientific activity actually implement at the formal level a feedback mechanism in assessing the quality of scientific content (STAGE 5 «End-user rating», **Fig. 2.12**).

Conclusions to Chapter 5

The central part of the communication and analytical unit, which contains all the scientific content that has been reviewed and is available for download, is **Products**. All content in it is represented at three levels: **Cover Letter, Resume, Full text**.

Cover Letter is freely available, **Resume** and **Full text**, depending on the type of access chosen by the Author, are available either freely or for a fee. A legal module and a transaction module integrated with **Products** enable the transfer of funds using one or more payment systems. With this information presentation structure, **Products** provides the ability to meet the needs of all actors.

The use of three scales for assessing the quality of scientific content — dimensionless [0; 1], user-generated, visualized by «stars», and five-point — provides the ability to rate scientists, teams, institutions, while creating a comfort zone for users of scientific content.

The procedure for assessing the quality of the content presented in **Products,** based on determining the average ratings of each work from End Users, taking into account weighting coefficients, makes it possible to implement feedback and determine the objectivity of reviewers. The introduction of weights can also prevent an event associated with the evaluation of content by incompetent users.

The quality of works that are in closed access is the basis for the formation of their basic cost for representation in **Products**. The basic cost S of any work represented in **Products** is a function of two input variables — the assessment of quality $\overline{R_{\Sigma}^{(j)}}$ and the level of scientific novelty l_{SN}. The mathematical description of this function is a regression equation $S = f(\overline{R_{\Sigma}^{(j)}}, l_{SN})$, in which the linear terms and the factor of mutual influence of the assessment of the quality $\overline{R_{\Sigma}^{(j)}}$ and level of scientific novelty l_{SN} are significant.

The calculated value $S = f(\overline{R_{\Sigma}^{(j)}}, l_{SN})$ forms the basis for calculating the amount of funds withdrawn to the author and reviewer (S^-), as well as the basis for calculating the cost from which it is submitted to **Products**, taking into account transaction costs (S^+).

The study of the response surface describing the regression equation $S = f(\overline{R_{\Sigma}^{(j)}}, l_{SN})$ on the basis of canonical transformation or ridge analysis makes it possible to determine the values of $\overline{R_{\Sigma}^{(j)}}$ and l_{SN} that ensure the achievement of the maximum value of the base value. However, due to the uncertainty regarding the expected values of $\overline{R_{\Sigma}^{(j)}}$, it is more convenient to use the equation of dependence of the base value on the average assessment of reviewers for the level of scientific significance l_{SN}=1 and the introduction of increasing coefficients corresponding to the level of scientific novelty $S = f(\overline{R_{\Sigma}^{(j)}})$. This approach to value assessment is justified and ensures the transparency of the principle of price formation according to uniform rules.

The feedback mechanism in assessing the quality of content minimizes the risks of collusive schemes between communicating Actors, as it makes it possible to establish the fact of unfair reviewing and poor-quality work passed off as high-quality. It will be detected by the feedback mechanism for assessing the quality of content.

The effectiveness of the technology of scientific and practical communications, which is based on the model of interaction of Actors without intermediaries, is assessed at two main levels: scientific significance and practical value of the scientist's works.

The level of scientific significance of the scientist's works is based on communication through the Platform in the «Author — Reviewer» system.

The level of practical value of the scientist's works is based on communication through the Platform in the «Author — End User» system.

Despite the fact that the proposed principles for assessing the effectiveness of scientific activity are applied on the basis of determining analytics indicators in terms of personal ratings and in the aspect of demand

in their cluster, they can scale to assess the effectiveness of scientific activities of individual research teams, universities, countries. This is argued by the fact that they are based on a single structure of the representation of rating criteria.

Thus, the proposed indicators of the effectiveness of scientific activity and the procedures for their evaluation create transparent and convenient indicators for authors and reviewers to track their rating positions. At the same time, new opportunities are created for funding organizations that can build their priority communication strategies on the basis of tracked ratings.

General conclusions

1. The modern model for assessing the effectiveness of the scientific activity of all its subjects is based on the calculation of citation indices of their publications. This approach to the choice of the effectiveness criterion has one significant drawback. This is a basic idea of the usefulness and significance of scientific work, based only on the number of its citations. In fact, the citation index embodies only a one-dimensional model of «scientist to scientist» or «science to science».

New conceptual and information-technological solutions based on them, which would eliminate the main drawback of such a model of dissemination and acquisition of scientific knowledge, can be considered as mechanisms that make it possible to return scientific activity to the status of practical significance.

The transformation of the one-dimensional model «scientist for scientist» or «science for science» into a two-dimensional model «science for improving human well-being» with the help of such solutions will create new opportunities for the scientist, as a subject of scientific activity, and for science, and for the areas of the practical application of scientific knowledge.

Such information-technological solutions should reduce the significance of the subjective factor, as well as ensure transparency in the processes for assessing the quality of scientific content. Increasing the degree of objectivity in assessing the effectiveness of scientific activity based on its transparency will provide the honesty of scientific and practical communications. At the same time, honesty should be understood not only as transparency in assessing the quality of scientific works but also as honesty in the distribution of goods. The availability of information-technological tools that enable the communication of all actors in the creation, dissemination, and acquisition of scientific knowledge is an opportunity for scientists to cash on on their intellectual work while retaining copyright.

The developed and implemented information-technological product, the **InGraph** Platform, is the solution that closes the scientific and applied problem area in the modern system of scientific communications.

2. Conceptual solutions, in terms of the structure and logic of the interrelations at the **InGraph** Platform, form the basis for creating a usable service for all Actors through the information-technological implementation of the Platform. Such Actors are Author, Reviewer, End User of scientific work, Grantor (funding organization), Translator (a subject of society representing multilingual communication services). Achievement of their goals by each Actor becomes possible owing to the mechanisms of the Platform, which enable their interaction with each other, thereby forming a communication technology on the principle of «everyone gets what s/he needs, at a minimal time cost». Such technology, implemented through the Platform, creates the

following opportunities for Actors: self-realization, altruistic opportunities, social prospects, economic opportunities, and organizational capabilities.

This allows us to argue about the multi-vector nature of the Platform, which creates an alternative model for the dissemination of scientific knowledge. The concept of the **InGraph** Platform implements the transition from a one-dimensional model of «scientist for scientist» or «science for science» to a two-dimensional model of «science to improve human well-being», with the priority for science to meet practical needs based on the results of scientific research. Such needs can be considered in the context of improving human well-being.

3. The main result of information-technological solutions for the Author's cabinet/account is the creation of a working tool for this Actor that has mechanisms for intra-platform integration, owing to which s/he can present his/her scientific work to the world community without searching for a journal as a source through which it could be done. A simple interface and intuitive actions at the stage of registration and uploading of content minimize the time spent on interaction with the Platform with the highest possible informativeness.

The information-technological implementation of the **InGraph** Platform creates a comfort zone for the End User as well since the extraction of information in the search for works is carried out not only by keywords but also by content in terms of the expected practical effects of using the results of this work. This is especially important since practitioners' expectations of the results of scientific research are due to their justified desire to obtain the most important information for their practical activities in minimal time.

4. The main result of information-technological solutions for the Reviewer's account is the creation of a working tool for Actor 2, which allows him/her to assess the quality of scientific work. Given the fact that the quality of scientific works is decisive in the evaluation of sources publishing these works, the review process is fundamental from the point of view of forming the «brand» of a scientific publication. However, the lack of uniform transparent mechanisms for assessing quality does not make it possible to unequivocally judge the consistency of the statement about the «brand» of the carrier of scientific information because the policy of each editorial board regarding the review process is different. The final decision on publication always remains with the editorial board, and feedback in confirming the quality of scientific content, which makes it possible to assess the effectiveness of the review process, confirming or refuting the «branding» of the publication, is always absent.

The tools of the **InGraph** Platform create transparency, both in the review process itself and in the formation of assessments of the quality of scientific works. The use of quantitative values in a dimensionless scale [0;1] makes it possible to introduce simple interval assessments for quality gradation. This is how the proposed solutions differ from the existing ones

in terms of quality control of scientific works and have obvious advantages over them. Among them are transparency, simplicity, and quantitative assessment according to different criteria, depending on the scientific and practical significance, which allows for further procedures for verifying the objectivity of reviewers.

The developed forms of review, depending on the level of scientific novelty claimed by the authors who upload their scientific works to the Platform, allow reviewers to focus on those criteria that are especially important for End Users, regardless of whether they are theorists or practitioners. At the same time, the structuring of these forms in accordance with the logic of the construction of scientific work — from substantiating the relevance of scientific problems to conclusions regarding scientific novelty and practical significance — creates a comfort zone for reviewers. This, in turn, minimizes the time spent on the review process.

The Reviewer's account has mechanisms for intra-platform integration, which allows him/her to track the quality of the work reviewed by him/her and see the ratings of other reviewers for it. This makes it possible to conduct self-assessment in terms of compliance with one's role, assessing the personal objectivity and objectivity of one's colleagues. The objectivity of the review process itself, from the point of view of external evaluation, is ensured by a feedback mechanism based on a comparison of End User ratings and the assessment given by the reviewer for a given work.

Thus, the information-technological implementation of the review algorithm ensures the transfer of scientific works to **Products,** providing the End User not only with the works themselves but also with an integrated assessment of the scientific quality of the work, which has a textual correspondence in terms of the recommendations of the reviewers.

5. The devised principle of providing scientific works to the End User, based on three levels of access to content, is the most informative as it includes a clearly structured form **Cover Letter** (level 1) and **Resume** (level 2). Owing to this, the End User is given the opportunity, with minimal waste of time, to get an idea at the first level of whether this work will meet his/her expectations (level 1). If this information is not enough, before deciding on the usefulness of this work for himself/herself, s/he can go to level 2, which is especially important from the point of view of the optimal use of his/her funds if the work is in **Products** in closed access.

The use of three scales for assessing the quality of scientific content — dimensionless [0; 1], user-defined, visualized by «stars», and five-point — provides an opportunity to rate scientists, teams, and institutions, while creating a comfort zone for users of scientific content.

The procedure for assessing the quality of the content presented in **Products,** based on the determination of the average ratings of each work from End Users, taking into account weighting coefficients, makes it possible to implement feedback and determine the objectivity of reviewers.

The introduction of weights can also prevent an event associated with the evaluation of content by incompetent users.

The proposed procedure for assessing the price of scientific works as a function of their scientific quality and level of scientific novelty makes it possible to provide all Actors with a single transparent principle for forming the cost of scientific content that enters **Products** after the review process. This approach to cost assessment is justified and ensures transparency of the principle of price formation according to uniform rules.

The feedback mechanism in assessing the quality of content minimizes the risks of collusive schemes between communicating Actors as it makes it possible to establish the fact of unfair reviewing and poor-quality work passed off as high-quality. This fact will be detected by the feedback mechanism for assessing the quality of content.

The effectiveness of the technology of scientific and practical communications, which is based on the model of interaction of Actors without intermediaries, is assessed at two main levels: scientific significance and practical value of the scientist's works.

The level of the scientific significance of the scientist's works is based on communication through the Platform in the «Author-Reviewer» system.

The level of the practical value of the scientist's works is based on communication through the Platform in the «Author-End User» system.

Despite the fact that the proposed principles for assessing the effectiveness of scientific activity are implemented on the basis of determining analytics indicators in terms of personal ratings and in terms of demand in their cluster, they can be scaled to assess the effectiveness of scientific activities of individual research teams, universities, and countries. This is stressed by the fact that they are based on a single structure of the representation of rating criteria.

Thus, the proposed indicators of the effectiveness of scientific activity and the procedures for their evaluation create transparent and convenient indicators for authors and reviewers to track their rating positions. At the same time, new opportunities are created for funding organizations that can build their priority communication strategies on the basis of tracked ratings.

It should be noted that the information-technological implementation of the **InGraph** Platform is introduced and implemented at the level of the α version, a characteristic feature of which is the creation of full functionality that provides all the principles and capabilities of work for three Actors: Author, Reviewer, End User. Further advancement involves information-technological implementation for such Actors as Grant-giver and Translator. In addition, subject to realization is the part of the Platform relating to scientometrics tools, in accordance with the devised principles for assessing the effectiveness of scientific activity based on the analytics indicators proposed in Chapter 5.3, as well as a procedure for their calculation (β version).

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- for consultations at the stage of development of the project concept and providing its base for testing and implementation of the Platform from the moment of launch of the α version;
- for assistance in establishing communications between subjects of scientific activity and consultations in the process of working with the Platform at the level of authors and reviewers;
- for the support to authors and reviewers at the initial stage of work with the Platform.

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From the team of authors,

Professor,
Dmytro Domin

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