Communications aspects of cooperation in the forestry waste processing cluster

E V Melnikova¹, A A Melnikova², Yu A Anikina¹ and Yu N Malanina³

¹ Reshetnev Siberian State University of Science and Technology, 31, Krasnoyarsky Rabochy Av., Krasnoyarsk, Russia
² Moscow State Institute of International Relations (MGIMO University), 76, Vernadskogo Av., Moscow, Russia
³ Irkutsk State Transport University, 15 Chernyshevsky St., Irkutsk, Russia

E-mail: melena6921@mail.ru, yuliamalanina@mail.ru

Abstract. The article is devoted to the study of communications in the cluster for forest waste processing as a factor and indicator of cooperation development. The article provides an overview of 4 groups of clusters with ecological, forestry, biotechnological and agricultural specialization; in total 21 clusters are studied. The cluster communication field is considered through a number of general scientific approaches. An algorithm for systematizing and replicating the experience of successful communication building in a cluster is proposed. The communication field of clusters using renewable natural resources is reviewed. From the perspective of an outside researcher, the conditions for effective and free interaction in the considered cases have not been created. The used communication practices are summarized. The target characteristics of the cluster communication model as an open network with an external and internal contour, with public involvement are formulated. The dependence of the functional content of communications on the stage of evolution in the cluster, on the ratio of the goals of innovation and efficiency is shown. The achievement of innovative cluster-specific effects is determined by the nature of relationships between participants and largely depends on the organization of the cluster's communication field.

1. Introduction

The topic of forming territorial, industrial, and innovative clusters has been on the agenda of Russia's economic development for quite a long time, and certain results have been obtained that allow us to formulate the problems of cluster development and the recipe for cluster success. Among the problems, it should be noted that the mechanisms for replicating the experience of successful clusters and organizing "knowledge" exchange are not formed, and it is difficult to carry out inter-cluster comparison. The diversity in terms of the industry affiliation of participants, methods and stages of cluster formation makes it difficult to compare clusters, use benchmarking tools, and evaluate performance, and therefore calls into question the possibility of replicating the experience of successful cluster initiatives.

In assessing the success of clusters, analysis of the dynamics of individual quantitative indicators that depend on the composition of participants prevails. Among the indicators available for inter-cluster comparison are the growth rate of the number of participants, the volume and dynamics of exports, the number of jointly produced innovative products, total revenue (including mutual supplies), the value of
mutual supplies and the rate of change, and the degree of diversification of activities. Meanwhile, the potential of a cluster depends to a greater extent on the technological connectivity of production, the frequency of contacts, the degree of mutual trust, setting joint goals and organizing joint work to achieve them, that is, all the parameters that characterize the level of cooperation in the cluster.

It is the discussion and awareness of the future / existing effects of cooperation that drives the company's management when making decisions about joining / continuing to participate in the cluster. Assessing the level of cooperation in a cluster allows you to distinguish "real" clusters from declared ones, and assess the stage of their development in dynamics, following the graph of an inverted U-shaped curve. Irregular, chaotic communication links of companies localized in the region should turn into stable collaborative links of a mature cluster. And getting a synergistic effect in a cluster involves intensive coordination of interaction. Following the well-known postulate "there was a word in the beginning", we aim to study the role of communications in the origin and development of cluster interaction, systematize approaches to the study of information aspects of cooperation and form a communication model of the cluster that claims a sufficient degree of universality. The materials are tested using the example of a cluster being formed for processing forest waste in the Yenisei Siberia macro-region. The need to take into account environmental goals complicates the research tasks and makes it more relevant.

2. Methods

Considering a cluster as a self-developing and self-organizing system, it is important to include not only the elements of the system (cluster members), but also the connections between them - material, financial and information flows [1]. The latter are the most difficult to study and require the selection of specific tools, indicators, and approaches [2]. Repeated, time-stable information flows both between business participants and connecting them with other actors of quad spirals form a communication field that supports not only the development of cooperation in the cluster, but also creates conditions for the innovative vector of its development.

The methodological basis of the article includes system, process, stakeholder, target, situational and evolutionary approaches [3]. Among the theoretical concepts that formed the "framework" of the authors' views on the problems of cluster development it is worth noting the fundamental postulates of M. Porter's theory [4], the concept of "triple helix" [5], complemented by the inclusion of public institutions in the promotion of innovative interactions in the cluster (the quad spirals concept [6]), the theory of stakeholders, the system-integration theory [7].

With regard to the considered object of the cluster initiative (a cluster for forestry waste processing), however, like most clusters being created, the need for moderate diversification [8] and penetration into related industries [9], in combination with the feasibility of preventing technological blocking of cluster development, the value of innovation and technological maturity of processes is highlighted [10-12]. This highlights the need to maintain innovative activity with the involvement, to one degree or another, of all cluster members. In essence, we are talking about the formation of an intra-cluster spiral of innovative interaction, the creation of an appropriate communication and motivational environment.

Understanding the role of communications in the development of cooperation in the cluster and the cluster itself sets researchers the task of searching for tools and indicators that allow them to systematize and translate the successful experience of forming the cluster's communication field, its internal (interaction of participants) and external (connections of quad spirals actors) contours. Of course, this task is very complex for an external researcher in relation to the network of connections and can be organized as follows:

- identification of available types of sources and methods for collecting information about the communication field of clusters (situational approach to research);
- selection of approaches to cluster typing that allow forming "meanings" of communications in the cluster (target approach);
• typologization of cluster "components" and their impact on the content of communications (system approach);
• consideration of the specifics of communication and cooperation in the cluster depending on the stages of its development (evolutionary approach);
• study of ways to identify the interests of participants in the communication field of the cluster and their coordination, with subsequent systematization of possible information distortions and communication barriers (stakeholder approach);
• consideration of communications in a streaming way, in dynamics, with the identification of the trend of universal indicators of the communication field (process approach).

In practical terms, the researcher's position external to the network of connections allows to observe what a potential cluster participant is studying, what information is available to them, how complete and reliable it is, how it affects the decision to participate in cooperation, and how it affects the parameters of cooperation.

Among general scientific and field methods, adequate to the goals and objectives of the study, it should be noted methods of classification, comparison, analysis and synthesis, interviews and questioning, constructing mental maps and game models, expert assessments, case studies, benchmarking, analysis of causal relationships, analysis of indicators roadmaps, plans and their implementation. Among the sources available to third-party researchers for collecting information about the communication field of clusters, one should note analytical materials of the Russian Cluster Observatory, the monthly news digest "Territorial clusters", news feeds, industry publications, information from official sites of clusters and/or anchor enterprises of clusters, information about investment projects being implemented, data from scientific periodicals, materials from expert sessions involving the scientific community, statistics, and Internet metadata. To collect and analyze the information obtained, we use survey methods, questionnaires, expert assessments, case studies, benchmarking, big data analysis, statistical methods, and analysis of Internet search queries.

3. Results
Analysis of the practical experience of clustering has shown that scientists and entrepreneurs underestimate the importance of the communication component by paying considerable attention to the production and technological and, in particular, financial and investment aspects of interaction in the cluster for processing forest waste. For example, the sites of existing clusters, even if they formally exist, overwhelmingly reflect outdated information that is updated from time to time. This may mean, at a minimum, that the cluster is closed to new participants and is not involved in the quad spirals of innovative interaction with society, government agencies, and scientific and educational organizations. A declaration of a cluster initiative based only on technological solutions that require and allow for joint efforts can only be considered a prerequisite for a dialogue of stakeholders, which can result in the formation of a cluster.

Based on the data from the HSE cluster map [13] and open Internet data, a review of 4 cluster groups was conducted: those with environmental and forest specialization, biotechnological and agricultural. One of the tasks is to identify benchmarks for benchmarking. 21 clusters were studied, only 1 had a high level of organizational development, and 4 clusters had an average one, the share of clusters at the initial stage of development was 80.95%. In comparison with clusters of other industry specializations, the development of collaborations in the forest complex is rather slow. One of the reasons, in our opinion, is that the interaction environment is not formed. Only 42.9% of clusters declare goals for developing cooperation, only half of them have communication tools for this purpose (in addition to the website), 47.6% do not have an active website, and tools for environmental (multilateral) interaction are not offered. Only two clusters as a tool for developing cooperation offer the formation of communication platforms with the expected effects in terms of communication development, joint educational programs, exchange of experience, interaction with quad spirals actors and initiation of joint projects. Only 3 clusters out of 21 offer free access to proposals for specific cooperation projects. The
agrobiotechnological cluster of the Omsk region helps in organizing communications with the French-speaking community.

The most interesting is the experience of the innovative and industrial cluster of renewable natural resources of the Tomsk region [14], where there are clear signs of paired interactions of quad spirals actors, there is an increase in performance and an increase in the number of participants. Cluster communication activities include informing cluster participants about the opportunities provided and conducting training seminars. One of the forms of communication between cluster participants and partners is project and strategic sessions involving members of the scientific and educational community and government agencies. It is important that these sessions are regular. Note that the development of the cluster is estimated at the increase of participants, the goal of development cooperation declared, are examples of successful cooperation in the production of fermented tea from fireweed in bringing new branded products to the international market, in the processing of pine needles. In the latter case, it is possible to increase the volume of processing of secondary raw materials by 100 times, but this requires changing the technological process of logging, this is impossible without close cooperation. So, a number of steps have been taken in the cluster aimed at rational use of natural resources and commercial returns are already visible. Thus, despite the complexity of implementing environmental and innovation goals, cluster interaction makes it possible to achieve this.

It is interesting that in the Tomsk region there are 2 clusters in the forest industry. In 2017, the opening of a timber industry cluster was announced, but the website does not allow to see the goals, results of work, and even more so to assess the level of cooperation. The implementation of several interdependent projects in the same industry within the same region cannot be considered a cluster. this requires clear and appropriate mechanisms for cooperation. Minimal information about the purpose, objectives, and specialized organization of the cluster (no site) is available on the website of the Forestry department of the Tomsk region [15]. The list of participants presented there also includes 21 organizations and has not been updated since its publication in 2017. The absence of explicit mechanisms of cooperation allows us to conclude that the cluster is not formed, and the decision to create a cluster “top down” is not supported by regular cooperative connections. In research on the forest cluster of the Tomsk region, attention is paid to industrial cooperation, and the mechanisms for implementing such interaction are out of sight, and not only in the production sphere. Comparison of the communication field of these two clusters allowed to formulate a number of significant characteristics.

The universal communication model of the cluster should include an open network of communications that operates on the basis of self-government. In the external interaction loop, it is important for environmental clusters and clusters operating in nature-exploiting industries to provide tools for organizing regular communications with the local community, which corresponds to the quadrilateral of interaction and supports motivation to solve environmental problems and problems of rational nature management. In terms of content, intra-cluster communication platforms can perform different functions, depending on the goals and stage of cluster development. As the cluster evolves, there is a gradual transition from the information function to the coordination of financial and non-financial interests, coordination of actions (object-object interactions, paired or multiple). In the future, communications support integration into existing projects (project systems), contribute to the creation of a single value chain (process systems), involve quad spirals actors in it on a permanent basis, and create a homogeneous and friendly technological, research, educational, and knowledge space for participants (environment system) [16-17]. A properly and freely organized communication field creates a favorable environment for cooperation.

The semantic load of communications in a cluster depends on a combination of target indicators of efficiency and innovation [18-19]. The evolutionary approach to the study of clusters allowed to build a “trajectory of meanings” of communication:

- getting the first effects of cooperation against the background of broad informal contacts leads to a decrease in the level of environmental uncertainty and an increase in trust;
• the flow of unformalized knowledge creates a favorable communication environment, which leads to an increase in the intensity of communication, the formation of relational contracts;
• efficiency goals are achieved, results are analyzed and discussed;
• growth is supported by innovative interaction effects, but over time, a plateau in efficiency is reached, which inevitably affects the level of trust in the cluster;
• reduced openness against the background of the struggle for a greater share of added value and reduced innovation activity leads to the collapse of the cluster.

Since most of the considered clusters are at the initial stage of their development, and the cluster for processing forest waste is only being designed [20], the semantic content of communication development in the cluster should be aimed at increasing the intensity, openness of the communication field, expanding the number of participants, and moving from informing to coordinating interests. To do this, we need communication platforms that allow us to build multi-sided, synchronous and asynchronous interactions, attract new participants, and involve specialists and the middle management of companies in informal communications. The leading role in the development of communications in the cluster should belong to specialized organizations in the cluster.

4. Discussion
In the context of the goals of this research, we couldn’t find a benchmark, but the analysis of the experience, declared goals and values of the studied clusters allows forming a set of existing successful practices for the development of communications in the cluster:

• holding strategic sessions on goal setting for cluster development with the participation of all quad spirals actors, including members of the public;
• availability of an updated site with the ability to establish at least paired contacts, activity in social networks;
• creation of communication platforms based on remote team support technologies;
• organization of exchange of experience and information about cooperation opportunities, maintaining databases.

5. Conclusion
In general, the assumption about the insufficient level of communication development in the cluster is confirmed, which slows down the processes of cluster formation. Since the cluster for forestry waste processing formed in Yenisei Siberia assumes the presence of innovative opportunities, which are primarily due to the collaboration of participants at the institutional level, achieving innovation involves organizing a cluster on the model of the "triple helix". At the same time, it does not matter whether this cluster is declared as innovative or not, whether it is created in a high-tech industry or in a traditional one, or whether there are high-tech enterprises in the cluster. Innovative effects are explained by the nature of relationships between participants and the synergy of their actions. Non-receipt of innovative effects is explained either by the immaturity of the cluster in terms of the development of network connections, or by the fact that this agglomeration formation is not a cluster. A true cluster is intended to become the core of a regional innovation system and actively contribute to the creation of new networks in related areas of activity.

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References
[1] Kostenko O V and Olenin O A 2018 Life cycle of an economic cluster: development criteria
[2] Shcherbatov I A 2019 Intellectualization of information for power plants repair management systems *Modern Technologies System Analysis. Modelling* 3(63) 31-7

[3] Solvell O, Lindqvist G and Ketels Ch 2003 *The Cluster Initiative Greenbook* (Stockholm: Ivory Tower Publ.) p 94

[4] Porter M and Ketels C 2018 *Growing a Cluster: The Singapore Biomedical Sciences Initiative* (Harvard Business School) p 20

[5] Smorodinskaya N V 2011 Triple Helix as a New Matrix of Economic Systems *Innovation* 4 66-78

[6] Karayannis E and Grigoroudis E 2016 The four-link spiral of innovation and "smart specialization": knowledge production and national competitiveness *Foresight* 10(1) 31-42

[7] Kleiner G B, Kachalov R M and Nagrydnaya N B 2008 Cluster strategy synthesis based on system integration theory *Science Education Innovations* 7 9-39

[8] Luhas J, Mikkilä M, Uusitalo V and Linnanen L 2019 Product Diversification in Sustainability Transition: The Forest-Based Bioeconomy in Finland *Sustainability* 11(12) 3293

[9] Prokhorov V, Melnikova E, Zelenskaya T, Patrina M and Bezrukkh Yu 2020 Cluster configuration for waste treatment of forest complex of the Yenisei Siberia *Revista Inclusiones* 7 394-410

[10] Melnikova E V, Zelenskaya T V, Prokhorov V V, Patrina M S and Bezrukkh Yu A 2020 Cluster cooperation mechanisms evaluation for waste processing of the Forest Complex of Siberia *Revista S&G* 15(1) 70-9

[11] Perkins R 2003 Technological “Lock-In” *International Society for Ecological Economics* http://isecoeco.org/pdf/techlkin.pdf

[12] Amineva V P, Kuzichkin A S and Melnikova E V 2015 Innovative and technological maturity in assessing the competitiveness of forestry waste processing enterprises in the Krasnoyarsk territory *Bulletin of KrasGAU* 4(103) 211-4

[13] Map of clusters in Russia 2019 *HSE Russian Cluster Observatory* https://map.cluster.hse.ru/

[14] Kozhukhov N I, Kozhemyako N P and Fitchin A A 2017 Conceptual approaches to the formation of forest industry clusters in Russia *Forest Engineering Journal* 3(27) 236-53

[15] Timber industry cluster of the Tomsk region https://deples.tomsk.gov.ru/lesopromyshlennyj-klaster-tomskoj-oblasti

[16] Li Pengfei 2018 A tale of two clusters: knowledge and emergence *Entrepreneurship & Regional Development* 30(7-8) 822-47

[17] Kleyner G B 2010 *Development of the theory of economic systems and its application in corporate and strategic management* (Moscow: CEMI RAS) p 43

[18] Jankowska B, Götz M and Główka C 2017 Intra-cluster cooperation enhancing SMEs’ competitiveness the role of cluster organisations in Poland *Regionales - Journal of Regional Research* 39 195-214

[19] Anikina Yu A, Ragozina M A, Malalina Yu N and Kurako D V 2019 Assessment of innovative projects in the rocket and space engineering *Journal of Physics: Conference Series* 1399 033056

[20] Medvedev S O, Bezrukkh Yu A, Zelenskaya T V and Melnikova E V 2019 Secondary wood resources as the basis for the development of forestry clusters *RISK: Resources, Information, Supply, Competition* 4 107-12