

# Development of the regional innovation system in the Forest industry of Irkutsk province based on institutional changes

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**Abstract.** The work presents innovative development issues in the Forest industry of Irkutsk province. The development of the regional innovation system is suggested for sustainable Forest industry management. The key components of which are technological, product, institutional, and ecological innovations, as well as, innovative entrepreneurship. The main hypothesis stated is the assumption that analysis and evaluation of effectiveness of innovations and institutional changes is an important tool for strategic planning of the innovative development of the Forest industry. The cross-sectional regression models are presented for evaluation of innovations in the Forest industry based on the expert's opinions, derived via direct questionnaires. The prospective directions of institutional changes in the Forest industry and program of innovative and institutional changes are suggested for implementation.

## 1. Introduction

The object of this research are innovations and innovation activities in the Forest industry. The subject of the research is evaluation of the effectiveness of innovations and institutional changes in the Forest industry considered as the main direction of innovation activities. The necessity of the development of the regional innovation system in the Forest industry (FI) based on institutional changes is substantiated and its proper implementation is discussed.

The relevance of the study of these issues is getting higher as the importance of regions increases, starting with development of complex programs and finishing with solution of operative questions of current activities to implement science and technology innovations in production cycle. With the ongoing economic transformations in the background, problems of the regional Forest industry formation and development are obvious and very important.

Thereat, the regional aspect of related studies is especially important. The stem of which is the development of complex measures directed to facilitate development and successful functioning of innovative entrepreneurship of the region in the whole and especially in particular branches contributing to the regional and national economy of the Federation.

The existing institutional structure of the Forest industry has not allowed the forest business to work effectively and facilitate sustainable social and economic development of the territory for many years. Though, the FI management system has encountered significant transformations as a result of reforms. It relates to the ownership issues, to organizational changes, and to the forest legislature.



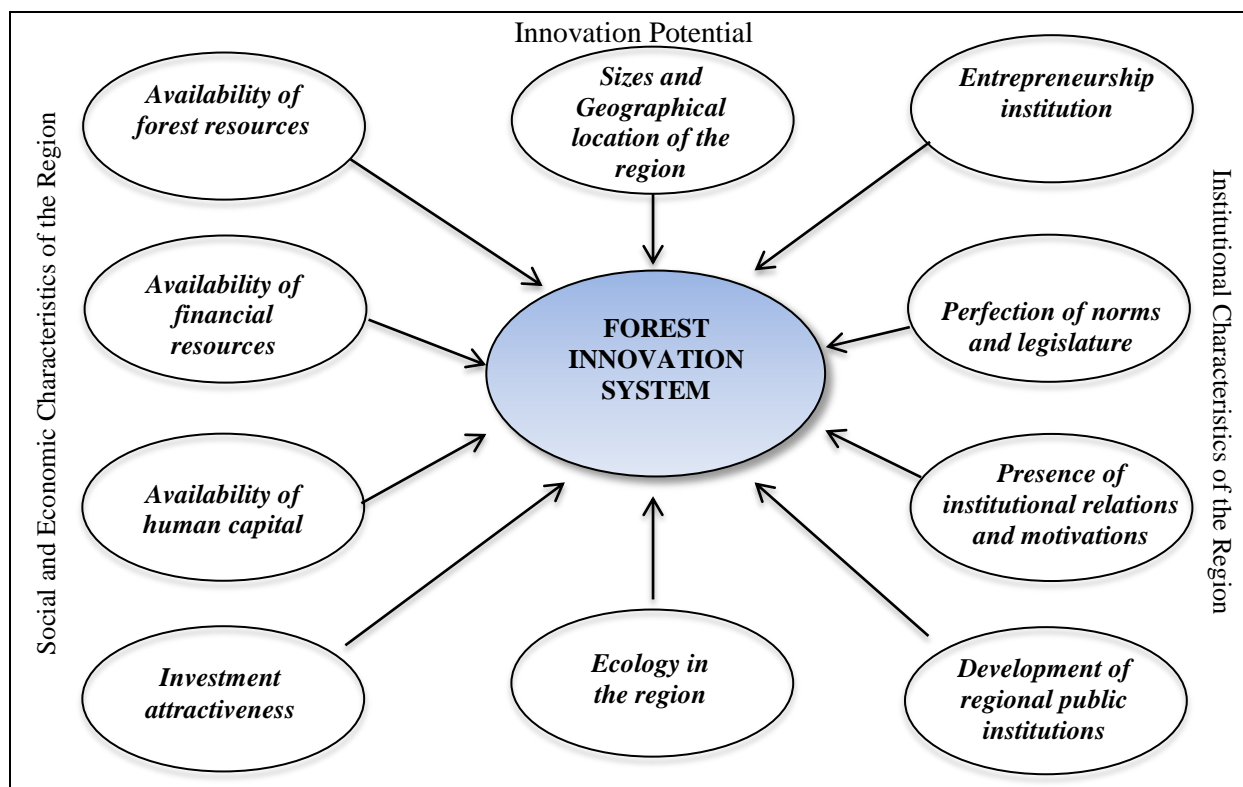
Institutional structure and institutional changes in the FI are tightly related to the forest policy, which is a set of institutions regulating economic, ecological and social consequences of the forests usage, including issues of the ownership and management. There is a need for the whole system of measures to stimulate effective entrepreneurship in the Forest industry, which is an integral part of the national and regional forest policy. Hence, it precludes a necessity for institutional innovations in the Forest industry of Irkutsk province [1].

## 2. Results and Discussion

### 2.1. Innovations and Regional Innovation System of the Forest Industry

The necessity to conduct the research further is substantiated by the fact that changes happening in Irkutsk province are frequently spontaneous and inconsistent. Experts also stress some difficulties while realizing innovative policies in the industry, and contradictions in norms and legislature documents with the Forest law.

An innovation system is always formed in accordance with many factors objective for a territory. Such as, sizes, availability of natural and labor resources, specifics of the institutional development of the State as a whole and forms of entrepreneurial activity in particular [2]. Regional innovation system shows such regional peculiarities of innovative processes as traditions, experience, economic scales and other. The aggregate of factors, influencing regional innovation system is presented in Figure 1.



**Figure 1.** Factors influencing regional innovation system.

Regional innovative system is an integral part of the national innovation system, which shall provide accumulation of efforts of the State management bodies at all levels, of science and technical sphere organizations, and of entrepreneurs, which is required to accelerate the implementation of science and technologies achievements to improve the quality of life of the population and provide sustainable economic development of the country. [3]

An innovation system in the region is created to provide conditions favorable for sustainable economic development of the region via an effective use of labor and intellectual potential, generation,

dissemination and realization of new knowledge [4]. An effective regional innovation system assumes presence of favorable conditions for all its compounds functioning, including institutional innovations and innovative entrepreneurship [5].

In fact, the role of entrepreneurship is shown already in very simple models of the innovation system, which is to design a new product based on the development and practical implementation of innovations. The role of the State precludes facilitation of creation of the fundamental knowledge and of the complex of technologies of strategic character, as well as, infrastructure and favorable institutional conditions development required for innovative activities of the entrepreneurship [6].

Thus, the core of the innovative entrepreneurship are innovative activities. Innovative activities are a set of scientific, technological, organizational, financial and commercial activities directed to commercialize the accumulated knowledge, technologies and equipment. The result of innovative activities are new and extra goods and services or goods and services with new qualities. Innovation activities are activities of economic entities to create, disseminate and to use innovations [7].

We use the term innovation system in the Forest industry to name a number of different entities and institutions, which make its contribution into the development and dissemination of innovations in the Forest industry. It is a set of interrelated entities, which form this system, the capacity of which is defined by individual activity of each entity, as well as, by their interaction with each other, as of elements of the collective system. The perception and activity of entities is managed and restricted by institutions, which set the rules of the game in the Forest industry. We talk of the innovative system when interactions and interrelations are saved for a longer time, rather than during a single innovation project.

The model of innovation system was divided into four different levels for survey and analysis: personnel, firm, b2b, institutional. Systems tend to achieve certain more or less defined goals, for which various components perform related functions. During the last years different typologies of systems' functions had been developed with different degrees of details and stresses. General typology of innovation systems' functions was suggested in 1997 by Edquist and Johnson, who had narrowed innovation systems' functions into three categories [8]: 1) to reduce uncertainty of information provision; 2) to manage conflicts and cooperation; 3) to provide financial and non-financial initiatives. Components of innovation system and their interactions perform these three functions all together, which in turn influence the quality and quantity of innovations in the sphere, which is covered by the system.

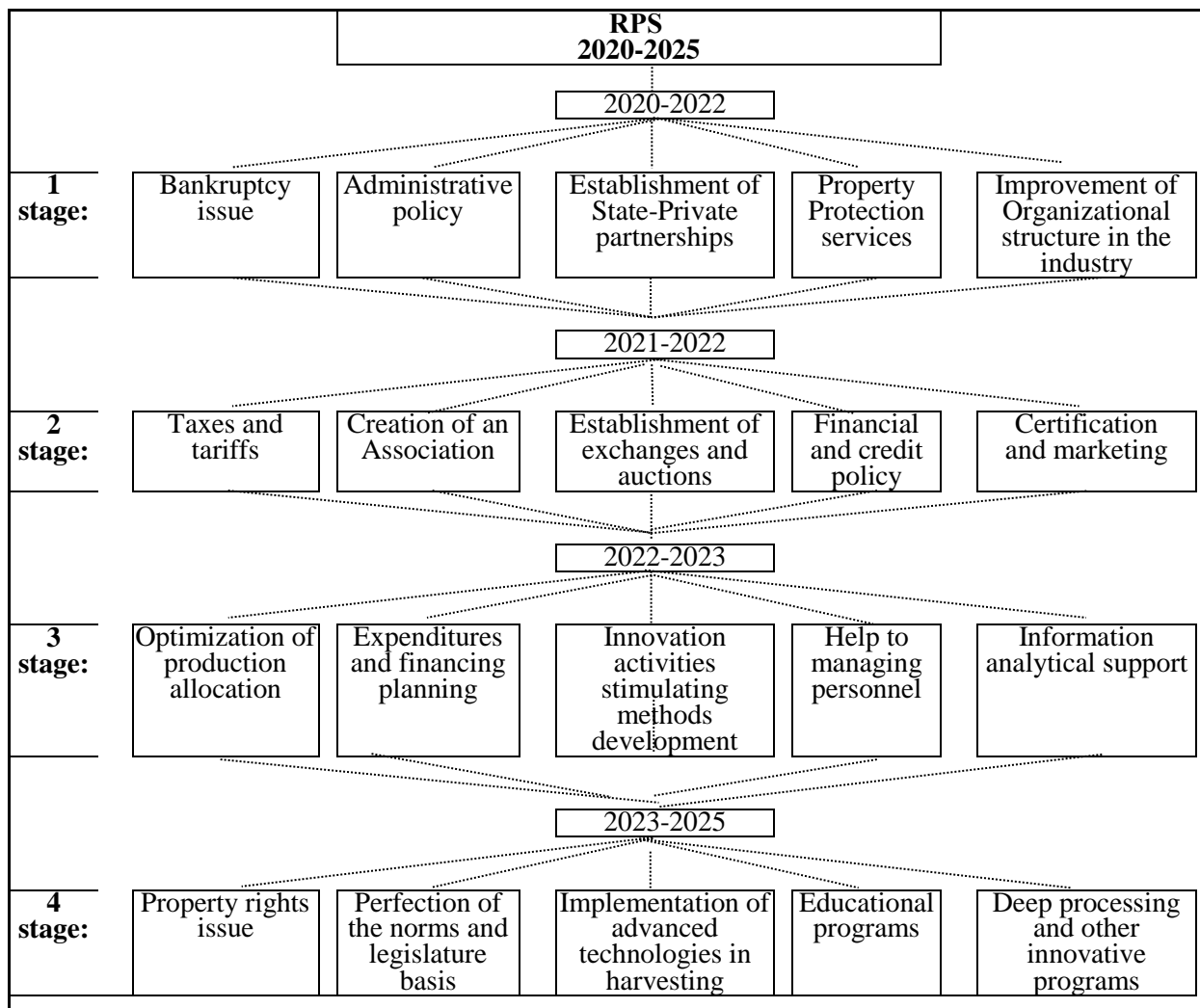
## 2.2. Program of Institutional and Innovative Changes in the Forest Industry of Irkutsk Province

We suggest the following program of the prospective innovative and institutional changes for years 2020-2025 in the Forest industry. The program includes four steps and is addressed to provide methodical help to managers of the enterprises and State authorities in implementation of measures for the industry reforming.

Organizational and economic strengthening of the Forest industry should be supported by management system integration activities: holdings establishment, property protection mechanisms, administrative policy, improvement of organizational structure. We suggest the concept of both vertical and horizontal integration of the industry. The important are: realization of exchanges and auctions; improvement of the financial and credit policy and perfection of norms and legislature base; provision of information and analytical support and realization of specialized educational programs, and other activities (please, see Figure 2).

The stimulus for the process of modernization of production and output of high value-added products in the Forest industry can serve the following measures:

- abolition of taxes for import of high tech equipment, which is not produced in Russia and is required for the Forest industry;
- cancelation of export taxes for all deep processed forest products, including over 300 types of wood and paper-based products with high added value (panels, plywood, mass brands of paper and cardboard) and simultaneous increase of taxes for export of raw wood;



**Figure 2.** Program of innovative and institutional changes in the Forest industry.

- cancelation of export taxes for all types of wood processed goods;
- implementation of measures to protect forest products domestic market;
- support of small and medium size businesses in development of deep processing of wood capacities via privileged credits and interest rates subsidies;
  - development of the State target program for the forest roads construction to deliver the timber with the federal financing, including construction of logging roads in Irkutsk province.

In the years ahead the following is required for sustainable development of the Forest industry of Russia and Irkutsk province in particular:

- it is important to develop a suite of measures to create conditions to use natural forest recovery capability and to facilitate their self-regeneration;
  - it is important to determine methods to estimate the allowable volume of the wood logging considering commodity composition of woodlands and forecast of the breeds and age structure of the forests;
    - specify logging parameters according to territories' classification based on their ecological importance and biological diversity of the forests;
    - to perform obligingly forest recovery procedures in logging sites;
    - to develop a program of the forest seed breeding development, which has to cover formation of specialized enterprises network, which have personnel required, technological, technical, and financial

resources for sustainable development of the forest seed breeding;

- to take measures to renew the personnel in the Forest industry, to create professional study centers equipped by modern educational, machining facilities and educational and laboratory equipment;
- to provide modern monitoring and improvement of the norms and legislature provision at the federal and regional levels, identify irregularities in the provincial norms to the federal legislature;
- to create in Russia and in Irkutsk province an official structure to monitor, forecast, and stimulate not only the supply but the demand for the forest products;
- it is important to notice the necessity to follow the forest recovery procedures. Therefore, the vertical integration of the industry and improvement of the related norms and legislature provision is required to be speeded up.

Besides that, experts notice: the necessity of the timely development of master plans of fires suppression and their implementation at the time of peak fires every year; introduction of authorities responsibility for untimely performance of duties; licensing of the activities involving forest fires extinction according to the law and within the stipulated dateline and other.

### 3. Methods and Calculations

According to the study and as stated above, we can conclude that the system study of innovations and institutional changes' influence onto the effectiveness of the FI enterprises is important and relevant. The particular importance of the study of this issue relates to the evaluation of institutional changes and institutional activities effectiveness during the crisis.

#### 3.1. Evaluation of Innovations Effectiveness

The issue of innovations' effectiveness evaluation is one of the most difficult and challenging tasks for the economists. The most complicated task is evaluation of institutional changes effectiveness. In this paper we take an attempt to figure out the basic problems related to the transformation of the institutional structure, and will determine major factors and conditions influencing dynamics of institutional structure transformation in the FI. The major task of the research is to find out the ways to evaluate and measure Institutional Changes at the regional level. Therefore a profound methodical and theoretical substantiation is required. There is a need to determine the levels of Institutional Changes Effectiveness and to measure the Institutional Changes applying different methodologies, Q-methods, for example. A special questionnaire was developed and distributed among local officials, authorities and business people who's work is related to the development of the Forest industry. Other measures applied could be Polity IV, Comparative Institutional Analysis (CIA), Institutional Analysis Development Framework (IADF), and Cross-sectional models.

The suggested tool for evaluation of innovations effectiveness, including institutional innovations, is the cross-sectional analysis. Considering a case study of Irkutsk province the following model is suggested:

$$Eff = f(I_{tz}, I_{to}, I_{IT}, I_{pro}, I_{nano}, I_{bio}, I_{instform}, I_{instinform}, I_{org}, I_{eco}) \quad (3.1)$$

where  $Eff$  is a generalized indicator evaluating effectiveness of the Forest industry development. As the explaining variables the following evaluating characteristics of particular innovations usage in the Forest industry are used:  $I_{tz}$  – technological innovations in forest harvesting,  $I_{to}$  – technological innovations in wood processing,  $I_{IT}$  – IT-innovations,  $I_{pro}$  – product innovations,  $I_{nano}$  – product nano-innovation,  $I_{bio}$  – product bioinnovation;  $I_{instform}$  – institutional innovations in formal institutions,  $I_{instinform}$  – institutional innovations in informal institutions;  $I_{org}$  – organizational innovations;  $I_{eco}$  – eco-innovations.

The numerical identification of (1.1) allows us: 1) to evaluate how effectively the innovations are realized in the forest business of a region or a country; 2) determine the importance of various types of innovations in the development of the Forest industry.

The model of institutional innovations in the Forest industry is presented in the following way:

$$IMP = f(N_{fed}, N_{reg}, G_{fed}, G_{reg}, I_{fin}, I_{prof}, I_{org}, I_{info}, I_{infinst}) \quad (3.2)$$

where indicator  $IMP$  is a generalized estimation of the progress in the sphere of the industry reforming under the terms of the markets globalization, which is obtained as an expert value of the volume and quality of the new legislature and institutions. As the potential factors influencing  $IMP$  indicator the following estimators of the development can be selected:  $N_{reg}$  – regional norms and legislature;  $N_{fed}$  – federal norms and legislature base;  $G_{fed}$  – role of the federal government;  $G_{reg}$  – role of the regional government (the market orientation and effectiveness of the State sector management by the government);  $I_{fin}$  – financial sector (the degree of independence, business skills, and practices of credit resources allocation, as well as, level of monitoring and payment system);  $I_{org}$  – organizational structure of industry and of enterprises in general;  $I_{prof}$  – professional training and educational programs for employees;  $I_{info}$  – information and analysis support;  $I_{infinst}$  – informal institutions (methods of contracting and contractual obligations, norms of ethics and morality, traditions).

The following depending regressions have been developed based on the survey of over 50 experts opinions in the Forest industry of Irkutsk province:

$$Eff = 0.103I_{tz} + 0.295I_{to} + 0.117I_{IT} + 0.987I_{pro} + 0.634I_{bio} + 0.152I_{nano} + 0.359I_{instform} + 0.368I_{instinform} + 0.069I_{org} - 0.037I_{eco} \quad (3.3)$$

$$R^2 = 0.986.$$

The value of the multiple determination coefficient ( $R^2$ ) confirms the precision of the model build, which allows to interpret its content. This model shows the summed influence of innovations based on variations of values obtained. This model shows, and according to experts' opinions, that the sustainable development of the Forest Industry of Irkutsk province requires the development of new products, including bio- and nano- products. The most important to mention for improvement are the wood processing technologies, and further implementation of the modern forest harvesting methods and using IT technologies in the Forest industry.

The  $I_{eco}$  coefficient has a negative sign in this regression dependence, which is finally presented without the free term. It can be explained by a weak correlation of the sustainable development of the FI with eco-innovations in the short run and even by its negative influence onto the economic development of the whole FI. In case of the long-run development of the FI of Irkutsk province, and considering many other factors not included into the final model and influencing the Forest industry sustainability, a special attention should be paid to the eco-innovations in particular. The negative value also shows the ecological load and Forest industry business people responsibility, which requires extra investments into the ecological projects. There is a need to increase the expenses related to high technology eco-oriented projects, directed to recover and multiply the forest resources.

$$IMP = -0.046N_{fed} + 0.394N_{reg} + 0.699G_{fed} + 0.043G_{reg} + 0.317I_{fin} + 0.284I_{prof} - 0.244I_{org} - 0.055I_{info} + 0.513I_{infinst} \quad (3.4)$$

$$R^2 = 0.972.$$

The value of the multiple determination coefficient ( $R^2$ ) for this model confirms quite a precise model for evaluation of institutional changes developed. The calculated Fisher coefficient is 184.46. It also confirms the high value of the factors included and good characteristics of the regression dependency.

This model shows the summed influence of the changes in the institutions selected as a result of variations of the values derived. According to the experts evaluations, innovative and sustainable development of the Forest industry of Irkutsk province depends more on the informal institutions, including agreements and traditions of the forest business in the region. The decisions of the federal government play a crucial role in the development of the Forest industry, whereas, the regional power is significantly less important in the forest business development according to the model.

The  $N_{fed}$  coefficient has a negative value, which confirms the imperfectness of the norms and legislature provision of the federal level. Whereas, the decrees and regulations of the local authorities,

according to the experts opinions, have strict and consequent realization. The local financial institutions reliability is of a particular importance for sustainable work of the FI. The educational programs implementation and informational support of the industry, as well as, improvement of the organizational structure are very important in the Forest industry of Irkutsk province.

#### 4. Conclusions

Since Russia and Russian industries had changed to the market-driven economy, where Forest industry of Irkutsk province sustainable development is number one priority for the socio-economic growth of the region, the need for innovations increased, including modern technologies and management practices and proper institutional adjustments to run the businesses with the required so much in the country today entrepreneurship. This is one of the major problems in Russia today, the lack of up-to-date innovations and constrains in their implementation. In this regard an implementation of modern innovation system presented is required in Irkutsk province.

The process of innovations including institutional innovations and sanctions happening in the Forest industry of Irkutsk province will be accompanied by changes in the role and responsibilities of a wide range of institutions, such as, families, social groups, business corporations, and government organizations. Sanctions are associated with many socio-economic problems for Russia. Here we can specify immediate, short-term, and long-term impacts, which are very different from each other. These are inflation, stagnation, outflows of capital, investment, skills and entrepreneurship, income inequalities and poverty. As a result, the issue of the sustainable development of the Russian economy, a case study of the Forest industry in Irkutsk province is the most up-to-date and challenging in many respects.

In our expert opinion to solve this problem a new wave of import of modern technologies and institutions is required. Some of the modern technologies, including IT-methods and modern harvesting practices have been implemented successfully in the region. These days there is a need for modern deep processing technologies of the wood in Irkutsk province. Besides that, the ecological problems and potential depletion of the renewable forest resources require and implementation of a more eco-oriented approach. Now, there is a need to import new Western institutions related to the Forest industry. Though, it is important to modify and tailor them to the local demand first, in order for an institution to be accepted by the local communities. Another issue of the Forest industry sustainability in Irkutsk province is the development and application of the coherent and up-to-date lawful prosecuting procedures for the violation of the Forest laws.

There is a need for further activities at the federal and regional levels in a format of counsel, where interested parties can discuss current problems and hot topics of the Forest industry. Such as, for example, issues of forests reproduction, establishment of wood deep processing enterprises, forest fires protection, settlement of forest colonies and technological parks based on Forest industry enterprises and other. It is possible to set up permanent work groups to develop specific legislative initiatives, creating favorable conditions for stimulating of the Forest industry development.

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