Abstract

Background/Objectives: The objective of the paper is to identify marketing tools that enhance the effectiveness of the commercialization processes, promote the formation of methodological approaches to the construction of the complex of marketing tools for commercialization of intellectual property items. Methods: The retrospective content analysis was selected as the main method of investigation for structuring categorical apparatus of the research, portfolio analysis was applied to identify and evaluate the structure of intellectual property items at the Ogarev Mordovia State University. Application of hierarchical decomposition allowed building a pyramid of the intellectual property commercialization objectives. Using a process approach helped to integrate the marketing tools in the process of intellectual property commercialization and form a complex of marketing support for this process based on the principles of integrity and systemativity. Findings: The study carried out a deep analysis of the theory and practice of intellectual property commercialization at the research universities, identified the main marketing tools that enhance the effectiveness of the commercialization process. This allowed forming methodical grounds of to ensure marketing support in the commercialization of intellectual property items. The structure of intellectual property was evaluated; marketing tools were classified and segmented as exemplified by the Ogarev Mordovia State University, with the aim of prioritizing the commercialization and singling out the possibilities to apply marketing tools. The authors’ approach to the formation of a complex of marketing tools for commercialization at the research university has been proposed. Applications: Implementation a marketing complex will provide the market launch of intellectual property items sought after by the consumers, it will enhance the effectiveness of the university’s research activities, will integrate the needs of industrial sector and the possibilities of the research sector of the economy, which will ensure the construction of an innovative economy.

Keywords: Commercialization, Intellectual Property Items, Intellectual Activity Results, Research University, Marketing Tools

1. Introduction

1.1 Introduce the Problem
A research university is a fully legitimate economic entity, it makes a proposal at the market in the form of educational services, patents, inventions, technologies, defines a pricing strategy, and is competitive. This requires from the college to improve its infrastructure, conduct research aiming at satisfying any needs of the state and society, and ensure competitive power of college’s product. All this makes the necessity to develop Intellectual Property Item (IPI) commercialization marketing tools actual.

1.2 Explore Importance of the Problem
Research universities lie at the center of global knowledge economics and hold exclusive rights to a vast number of
IPIs. Establishment of a network of national research universities in Russia allowed to ensure growth of a number of IPIs that are recognized as non-tangible assets in 2010–2014 by 2.85 times, 540 small investment companies were incorporated within the innovative zone of the NRU and 3105 jobs were created, and orders to the amount of USD 102.193 mln were fulfilled. Product sales of companies of the innovative zone of colleges totaled to USD 350.695 mln in 2013.

A high share of IPIs that are not demanded by the production sector of the national economy is poses a serious problem. This is due to lacking interaction between industrial production needs and research and development results of a NRU. Therefore, marketing support of research and development and innovation activity of a NRU is a basic condition for successful implementation of any innovations.

This issue calls for further investigation that will be aimed at estimating IPI commercialization marketing tools that are used and developed at the NRU, the degree of efficiency of applied tools, and that will allow us to determine a set of IPI commercialization marketing tools that will allow us to fill the gap between industry needs and research and development results expressed in certain IPIs.

1.3 Background/Literature Review
Theoretical and methodical approaches to developing IPI commercialization marketing tools are presented in works3-7.

Certain marketing tools that are used at various stages of the commercialization process are considered in the scientific literature. Thus identify the tools that are used in IPI commercialization with classic marketing tools, while not distinguishing any novelties and innovations that are specific to the area8,9. Mechanical transfer, together with a partial adaptation, of modern marketing tools to a new item, that is commercialization area, does not allow for considering the complexity and uniqueness of this process, does not solve a lot of issues that arise in the process of IPI commercialization and does not present the possibility to elaborate universal recommendations for marketing support of such processes.

Consider the use of marketing functions to be a key for successful implementation of any IPI commercialization project10-13. The authors develop theoretical basis for innovation marketing, establish a system of marketing tools and demonstrate the necessity of marketing support of IPI commercialization.

According to the analysis of works of Russian scientists, the main focus lands on educational activity marketing, while little importance is attached to research and development and innovation activity, and the possibility of applying marketing tools in such activity14,15,16,17.

This literature review is the evidence of the categorical apparatus of IPI commercialization being studied rather deeply, and certain marketing tools being applied in the research and development and innovation activity of colleges. At the same time, the use of available theories in the practical study is difficult, due to their fractionality, poor methodological and methodical exploration, insufficient consideration of IPI market development factors and available barriers in the conditions of transforming the technological structure of the Russian economy.

A marketing approach to the IPI commercialization process is often left beyond scientific research devoted to issues of commercialization, as well as innovation activity of a college as a whole.

1.4 State Hypotheses and their Correspondence to Research Design
With view to fractionality of the theoretical basis of studies in the investigated area and the necessity to identify marketing tools and specifics of practical application of such tools at a NRU, one must not only develop a set of IPI commercialization marketing tools, but also integrate such tools into various stages of IPI commercialization process at the college. We believe the availability of a marketing system to be the main condition for IPI commercialization efficiency.

This study aims at solving the following issues:
- Systematizing a categorical apparatus that is used to describe and identify IPI marketing tools;
- Distinguishing key marketing tools for IPI commercialization at a college;
- Developing an IPI commercialization process at the Ogarev Mordovia State University; and
- Developing a set of IPI commercialization marketing tools.

Application of this model will improve the efficiency of IPI commercialization process, due to obtained knowledge of market needs that lead to reduced risks and uncertainty, coming from market supply and demand.
2. Method

The use of content analysis is determined by a significant stratification of scientific approaches to defining IPI commercialization. The content analysis, which was done retrospectively, allowed us to structure the complicated concept of IPI, distinguish IPI commercialization specifics at a college and formulate an original definition.

Expansion of theoretical concepts of the marketing tool structure allowed us to integrate such tools into the IPI commercialization process at a college.

A portfolio analysis was used in this study to identify and estimate the IPI structure of the Ogarev Mordovia State University in order to determine priorities for commercialization of such IPIs and the possibility of applying marketing tools.

Development of an IPI commercialization goal pyramid, based on the performance and efficiency indicators was the main result of applying a hierarchical decomposition method.

The use of this process approach allowed us to embed certain marketing tools in the IPI commercialization process and establish marketing support for such process, based on the principles of complexity and systematicity.

3. Results and Discussion

3.1 Intellectual Property Items at a Research University

Being a new form of organization of college’s scientific and educational activity, NRUs are established to activate innovative activity at colleges of the Russian Federation. With the help of such universities, advanced scientific achievements are translated in practice of companies and organizations of high-tech economic sectors. IPIs are among other results of research and development activity of a NRU.

Categorical analysis of IPI meaning includes a great number of definitions and interpretations. According to a number of leading scientists in the area of economics, management and marketing, intellectual property items are defined as an intellectual capital that is under legal protection shown in Table 1.

<table>
<thead>
<tr>
<th>Authors</th>
<th>IPI definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.N. Ustinova18</td>
<td>An intellectual stock of any country and one of major development resources of such country</td>
</tr>
<tr>
<td>V.I. Mukhopad3</td>
<td>Products of intellectual activity that are not a special multi-functional property item themselves.</td>
</tr>
<tr>
<td>S.V. Domnina19</td>
<td>Rights to results of intellectual activity</td>
</tr>
</tbody>
</table>

While summarizing various definitions of the IPI, one can point out some aspects that characterize this concept. First of all, results of creative activity are subject matters of intellectual property rights, second of all, the unique nature of IPIs, and third of all, a special legal regime of exclusive (intellectual property) rights has been established for them.

IPI is an intellectual capital that serves as one of the leading stimuli of further development and improvement of research and development activity of a NRU. That said, selection of types of commercial introduction of IPIs is a key task. There are two forms of IPI usage at a NRU available, i.e. capitalization and commercialization.

Commercialization is interpreted in most scientific studies as a number of measures to turn IPIs into profit. Basic commercialization definitions have been presented in Table 2.

According to these interpretations, processes of transforming IPIs into profit and attracting investment that stimulate research and development activity at a university via the multiplication effect play a key role in commercialization.

Table 2. Scientific interpretations of IPI commercialization

<table>
<thead>
<tr>
<th>Authors</th>
<th>IPI commercialization definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.I. Mukhopad20</td>
<td>An entrepreneurial activity that is associated with turning intellectual property and means of individualization into profit, using various forms and means of trade</td>
</tr>
<tr>
<td>Ya. N. Grik, Ye. A. Monastyriy21</td>
<td>Generating income from selling an innovative idea or using such idea in ones’ own production</td>
</tr>
<tr>
<td>B. Krutik, L.V. Ilina22</td>
<td>A form of attracting financing for implementing an idea or using such idea in ones’ own production</td>
</tr>
<tr>
<td>V.A. Antonets, N.V. Nechaeva23</td>
<td>A form of technological transfer with a consumer (buyer) to acquire rights to use and pay a remuneration to the holder of such rights (technology developer) in the amount that is defined by terms and conditions of a license agreement (or agreement of any other type) between them.</td>
</tr>
</tbody>
</table>
The IPI commercialization process has been described in this study, using the Ogarev Mordovia State University, which is one of leading research universities of the Russian Federation, as an example. IPI generation is ensured by a developed infrastructure of research and development and innovative activity: 7 youth innovation centers, 12 commercialization offices, prototyping and technology transfer centers, a business incubator, and a regional patenting center. A chain of establishment and commercial introduction of IPIs at the university, which is technologically complete, allows for improvement of activity of researchers in terms of quality.

451 IPIs were presented for legal protection by the university in 2010-2015. 440 titles of protection were obtained for such IPIs shown in Table 3.

At the moment, the university supports 343 IPIs24. (Gvozdetskaia I.V. Salnikova A.I. (2015). University’s IPI portfolio structure has been presented in Figure 1.

Figure 1. IPI portfolio structure of the Ogarev Mordovia State University.

According to the Program of improving competitive power of the university, the number of IPIs that are included in the commercialization portfolio will be 181 before 2020.

78 items of non-tangible assets are on the books, 25 license agreements on granting the right to use IPI is in progress in the current IPI structure shown in Figure 2.

Figure 2. Number and cost of IPIs entered in the books of the university.

At the moment, a qualitative change of the IPI portfolio structure is in progress, aiming at increasing the share of used items and abandoning those items that are not demanded by the economy.

For the last five years, the university obtained 50 patents for inventions and utility models annually on the average. Patents that were contributed to the authorized capital of SICs and recognized as tangible assets are the only ones supported. Other patents are supported for 5 - 7 years on the average24.

A license strategy has been formed now at the university. 23 license agreements were concluded in 2015 by the university with the university acting as a licensor shown in Figure 3.

### Table 3. Number of applications presented and titles of protection obtained at the Ogarev Mordovia State University

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of presented applications: for inventions</td>
<td>23</td>
<td>28</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>utility models</td>
<td>27</td>
<td>21</td>
<td>17</td>
<td>28</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>for PC applications and databases</td>
<td>6</td>
<td>16</td>
<td>29</td>
<td>38</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>Number of obtained patents: for inventions</td>
<td>24</td>
<td>24</td>
<td>21</td>
<td>33</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>for utility models</td>
<td>22</td>
<td>22</td>
<td>21</td>
<td>30</td>
<td>29</td>
<td>13</td>
</tr>
<tr>
<td>for PC applications</td>
<td>6</td>
<td>15</td>
<td>32</td>
<td>42</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Number of supported patents</td>
<td>143</td>
<td>157</td>
<td>175</td>
<td>153</td>
<td>158</td>
<td>154</td>
</tr>
<tr>
<td>Number of concluded license agreements</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Number of used innovation proposals</td>
<td>15</td>
<td>7</td>
<td>16</td>
<td>5</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Number of registered trademarks</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

For the last five years, the university obtained 50 patents for inventions and utility models annually on the average. Patents that were contributed to the authorized capital of SICs and recognized as tangible assets are the only ones supported. Other patents are supported for 5 - 7 years on the average24.

A license strategy has been formed now at the university. 23 license agreements were concluded in 2015 by the university with the university acting as a licensor shown in Figure 3.
The biggest number of license agreements was concluded in 2011. A decrease in the number of such agreements in 2014-2015 was due to a reduced commercial activity in the economy and qualitative changes in the IPI portfolio structure of the university.

The use of IPIs as a contribution into the authorized capital of established SICs is the main type of commercial execution of rights to such IPIs. 81 IPIs are on the books as non-tangible assets at the moment. Adoption of Federal Law No 217-ФЗ dated August 2, 2009 opened prospects of practical implementation of IPIs of Russian universities that were created within the research and development activity. The Mordovia State University is a co-founder of 25 SICs that operate in the area of power-saving technologies and production of new highly effective construction materials, biological preparations, radio electronic software and hardware and new telecommunication technologies. The scope of scientific and technical product that was produced and services that were provided by these SICs for the last 5 years is over 871K US dollars, and over 170 jobs were created. Execution of rights to IPIs in the form of issuing licenses to use to third-party organizations and gaining extra income (in the form of royalty) should be a basic form of commercial use in the long view.

Figure 3. Correlation of the number of IPIs, concluded license agreements and IPIs placed on the balance sheet of the Ogarev Mordovia State University.

3.2 IPI Commercialization Process at a University
Understanding of IPI commercialization implies treating this process as a difficult and multi-stage one, with new knowledge acquiring consumer-oriented qualities and being implemented at the market to achieve a positive commercial effect by creating a demand and stimulating sales.

Determination of efficiency indicators of IPI commercialization is an important strategic aspect of such commercialization. By using a hierarchical decomposition method, college's IPI commercialization goals can be placed in a certain order shown in Figure 4. Values of commercialization efficiency estimation are the foundation of this structure. Earnings yield is a basic indicator and determines the essence of commercialization, i.e. achieving commercial effect. Goals aiming at research and development activation at a college are presented next. Achievement of multiplication effect of knowledge from various scientific areas to obtain requested IPIs is the apex of this pyramid and it is associated with the development of a scientific and innovative culture at a college, and is a key condition for enhancing efficiency of innovative processes.

Figure 4. Hierarchy of IPI commercialization process of a National Research University.

We believe that such hierarchy of goals and successive achievement of such goals will ensure the effect of synergy in the part of upgrading qualitative properties of IPIs and more extensive application of such IPIs not only in a private, but also governmental economic sector. It is especially critical to ensure integrity and cyclicity of all commercialization stages at a college, in which case relevance of the IPI portfolio will be constantly growing. IPI commercialization process at the university has been...
The analysis of IPI commercialization process at the university allowed us to detect key issues, such as:

- Poor involvement of the Technology Transfer Center in scientific research;
- Small share of commercially attractive scientific development;
- Dependence of research and development activity of the university on governmental investment;
- Low royalty interest on sales of licenses to use IPIs that are on university’s books.

We believe insufficient exploitation of marketing tools in the process of IPI commercialization to be one of the biggest issues.

### 3.3 Define and Provide Structure Of Marketing Tools for IPI Commercialization

By developing an effective IPI commercialization marketing support system, one can fit together satisfaction of consumer’s needs of a new product and achievement of commercialization targets in a consistent process shown in Table 4.

<table>
<thead>
<tr>
<th>Marketing function</th>
<th>Methods and tools</th>
<th>Tasks and goals of application of marketing methods and tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of marketing environment</td>
<td>PEST</td>
<td>Market analysis and readiness of market players to appreciate a new product to discover any commercialization issues</td>
</tr>
<tr>
<td></td>
<td>PESTLE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TEMPLES</td>
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<tr>
<td></td>
<td>SNW</td>
<td></td>
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<tr>
<td></td>
<td>SWOT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GE-McKinsey matrix</td>
<td></td>
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<tr>
<td></td>
<td>Conjoint-analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Foresight</td>
<td></td>
</tr>
<tr>
<td>Marketing audit of college’s innovative potential</td>
<td>Audit of financial, HR, intellectual, organizational and educational potential, material and technical base, and innovative infrastructure</td>
<td>Determine the possibility of IPI commercialization, based on the available resources and capabilities of the college</td>
</tr>
<tr>
<td>Marketing research of innovative market</td>
<td>Market segmentation.</td>
<td>Determine market type in terms of development dynamics, type of competitive structure, degree of integration and diversification of market players</td>
</tr>
</tbody>
</table>
Selection of marketing tools that aim at effective IPI promotion at the market and achievement of commercial effect is the key.

### 3.4 Analyze Marketing Tools for IPI Commercialization at the Ogarev Mordovia State University

Marketing tools for IPI commercialization, such as:
- SWOT analysis of IPI commercialization strategy;
- Analysis of IPI commercialization potential and portfolio structure;
- Business and marketing planning;
- Cost plus method for pricing;
- Placing information at specialized web-sites and catalogs;
- Direct sales;
- Participation in forums, fairs, competitions and exhibitions; and
- Experimental marketing are used at the university.

The SWOT-analysis determines competitive assets, strong points of the college to level out any external threats and possibilities. However, this analysis is
fractionary and not complex. No marketing strategy and no implementation plan for strategic development areas can be developed on the basis of such analysis. No systematic monitoring of the innovation market is done. Non-availability of potential IPI consumer analysis is a weak link of marketing analytical function at a university.

IPIs are rated in accordance with their level of commercial success, as a result of IPI commercialization analysis and potential estimation. Impossibility to solve the issue of IPIs being highly specialized, low inventive activity and disbalance between expenses and income for service of legal protection of IPIs is a disadvantage of applying marketing. Insufficient attention is paid to peripheral service (‘the third level of goods’). The IPI portfolio analysis revealed no license strategy, which is a significant barrier for optimum topic statement development for applied research, aiming at the ultimate commercial result.

Business planning of perspective development, preparation for participation in competitions, grants, presentation of applications for project financing has been implemented at commercialization offices. Business plans for just 9 projects were developed in 2015.

The cost plus method for IPI pricing does not ensure full realization of rights of authors to remuneration, which affect adversely expansion of applied research. Limited application of market and income approach to IPI cost determination is a disadvantage of the pricing policy. This is associated with lack of information about the IPI market and expectations for their commercial application.

The Internet-resource (www.inno13.ru) is a promotion tool of the college's IPIs and the current IPI portfolio of the college has been developed there.

A development catalog is compiled each year at the university. This allowed establishing contacts with 50 companies and conclude 12 agreements to the amount of 176 K US dollars in 2014-2015. However, information in the catalog is difficult to read, it contains highly specialized terminology, and it does not reflect information about the necessary investment and economic performance indicators.

The university participates in all-Russian and international innovative forums, exhibitions and competitions. The university participated in 285 events in 2010-2015, presented 695 items for display and concluded 21 license agreements.

The analysis of IPI commercialization marketing tools shows that different elements of the marketing complex are not used sufficiently. Advertisement, sales promotion by means of active participation in scientific events, venture fairs etc. are the ones that are used the most. The following issues of IPI commercialization marketing support can be pointed out: a high degree of dependence on the budget financing; poor cooperation with international capital, technology and intellectual property markets; and low is operating efficiency of SICs.

### 3.4 Develop a Set of Marketing Tools for IPI Commercialization at a University

Let us develop a marketing support model for solving the issues of college's IPI commercialization shown in Figure 6. It will allow us to integrate marketing tools in all stages of the commercialization process and eliminate fractionality of analysis of the external environment and discover consumer’s needs, develop the optimum IPI portfolio aiming at the commercial result, and eliminate the disbalance of expenses for developing non-demanded IPIs and results of their practical application.

Development of an information environment for effective IPI commercialization, based on the use of marketing communication tools, is also important.

Implementation of the marketing complex will ensure market launch of IPIs that are in demand by the consumers, improve efficiency of research and development and innovative activity of the university, integrate the needs of industrial economic sector and abilities of research and development economic sector, ultimately ensuring development of the innovative economy.

### 4. Conclusion

Developing knowledge-intensive productions, increasing the role of non-material forms of capital in the development of modern productions and satisfying current needs at a whole new level are distinguishing features of the modern global economy. Application of new knowledge in the form of IPI is a key element of this process. A categorical apparatus that was used for describing and identifying IPI marketing tools have been systematized as a result, which allowed for outlining key IPI commercialization marketing tools that are used at a college.

The analysis of IPI commercialization process at
the Ogarev Mordovia State University and the level of efficiency of applying marketing tools at different stages of this process allowed for discovering challenges of marketing support. They may be solved by means of developing a model that reflects the set of IPI commercialization marketing tools that is adapted to the specifics of a research university. Application of this model will improve the efficiency of IPI commercialization process, due to obtained knowledge of market needs that lead to reduced risks and uncertainty, coming from market supply and demand.

5. References

2. Vdovin SM, Okunev DV, Golovushkin IA. Integrating the process of generating new tasks and commercializing research outcomes at a National Research University. Integrating Education. 2011; 3:3-9.