

# COMMERCIALIZATION OF UNIVERSITY INNOVATIVE DEVELOPMENTS: A RETROSPECTIVE ANALYSIS OF THEORETICAL APPROACHES TO RESEARCH

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## Abstract

**Purpose:** This study discusses a brief summary of a retrospective content analysis of scientific literature related to the commercialization of university scientists' innovative developments.

**Methodology:** A retrospective content analysis of the main theoretical concepts related to the research problem was used to achieve this goal. The source of information for the study was two search engines.

**Result:** The Data Source for the study is two search engines – Google Scholar and eLIBRARY.RU. As a result of the study, a semantic subject research area is identified including a system of concepts interrelated with the commercialization of innovations: diffusion of innovations, innovations transfer, technologies transfer and spillover of innovations.

**Applications:** This research can be used for universities, teachers, and students.

**Novelty/Originality:** In this research, the model of Commercialization of University Innovative Developments: A Retrospective Analysis of Theoretical Approaches to Research is presented in a comprehensive and complete manner.

**Keywords:** *Content Analysis, Semantic Model, Subject Area, Innovations, Commercialization, Diffusion of Innovations.*

## INTRODUCTION

The urgency of the research problem is due to significant changes in the functioning conditions of the higher vocational education system related to the development of the following trends: the formation of the digital economy and the education system; the development of online educational platforms and educational courses; active essence transformation of the universities functioning and management has a responsibility for generate and transfer knowledge (realization of the educational function), commercialize own developments and participate in economic relations (to perform the functions of full market entities making a specific product – innovative development – and promoting it to the market). A change of the external conditions and internal patterns of the university development affirms and enhances the practical significance of research in this direction.

The problem of the research is the contradiction caused by the objective need to form new theoretical and practical approaches to improving the efficiency and effectiveness of universities management in the new functions implement process related to the commercialization of innovative developments.

The purpose of the study is to define the subject area and clarify the context (correct understanding) of the processes is associated with the transformation of the university scientist innovative development into a product having a consumer property, required in the market and brought the material benefits to the creator or rights holder (e.g. university).

## METHODS

A retrospective content analysis of the main theoretical concepts related to the research problem was used to achieve this goal. The source of information for the study was two search engines:

- The foreign scientific literature analysis – Google Scholar (the largest search platform Google, including scientific works from peer-reviewed sources, including electronic, in all languages);
- The Russian sources analysis – the scientific electronic library eLIBRARY.RU data (the largest Russian information and analytical portal in the science, technology, medicine, and education field, containing reports and full texts of more than 29 million scientific articles and publications, including electronic versions of more than 5600 Russian scientific and technical journals).

A retrospective content analysis was used as a research method to determine the frequency and mentioning context of a scientific concept; and to analyze individual cause-and-effect relations between them to build a semantic model of the subject area study (Krippendorff, 2004). Information obtained by content analysis of data from several search engines allows, on the one hand, to highlight the main features, interpretation options and conceptual apparatus use trends of the research problem in a scientific context; on the other hand, to understand the market processes accompanying the innovative development commercialization (Moskovkin, 2013, Moskovkin, et al. 2014). Foreign sources were used (and partially presented in the article) for the study, as for further research, the positive experience of universities in leading countries in the field of research commercialization was used.

## RESULTS AND ITS DISCUSSION

We analyzed data from the Russian-language Google Scholar search engine and the most quoted sources for the commercialization notion to conduct a retrospective content analysis and clarify the conceptual apparatus of the study. The results of the analysis showed that the “commercialization” concept in the Russian-language scientific literature being introduced in the second half of the 20th century (the first term references in the scientific literature took place in the 1950-1960s). Until 1990 the commercialization term was practically not used (24 references between 1950 and 1990). From 1991 until 2000 the number of thematic scientific publications has increased up to 360 times; for the period between 2001 and 2010 – 5900 publications (tests were conducted 07.05.2019). Moreover, until 1990 most of the time the concept of “commercialization” has a negative character, directed at a critical analysis of the market Western country's economy.

Since 1990 the rhetoric and context of the “commercialization” term use have sharply changed and begun using to characterize the innovative development processes of the Russian economy.

The meaningful (semantic) interrelationships assess of the notion “commercialization” in the subject context of the research (innovative university activity) the scientific publications of the English-language version of Google Scholar were analyzed. The main content analysis parameters at this stage were:

- The occurrence period and frequency of concepts mentioning in scientific publications;
- Citation indicators of the publication and the author;
- The essence and context of the concept mention.

Separate intermediate results of the study allow showing the semantic interrelationship of concepts and presented in Table 1.

**Table 1:** Selected intermediate content analysis results of terms characterizing the process of transferring innovation development from creator to consumer (in the English version of Google Scholar search engine; tests were conducted 20.04 - 07.05.2019)

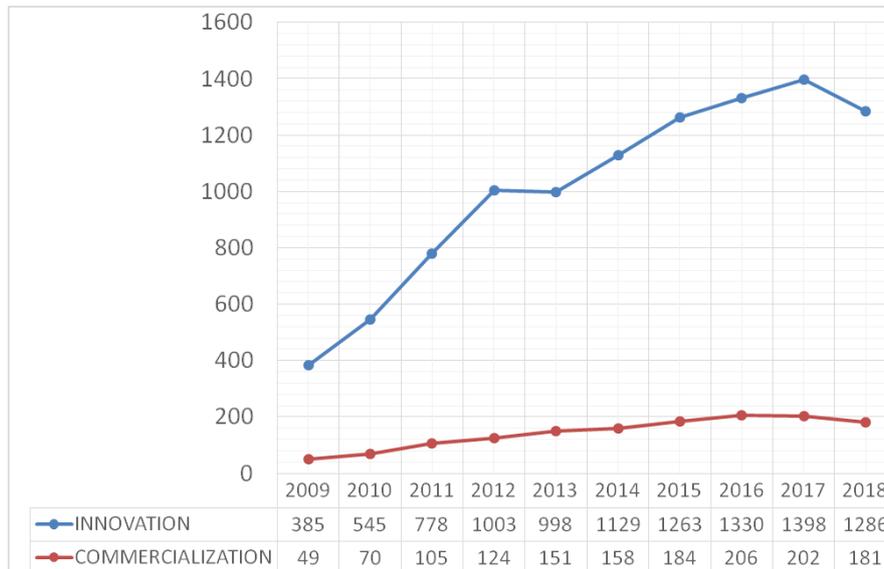
Publication name	Source / Citation	Context of mention
Traditions of research on the <b>diffusion innovation</b>	<a href="#">Katz</a> E., <a href="#">Levin</a> M.L., Hamilton H. – American sociological review, <b>1963</b> , pp. 237-252 – JSTOR <a href="#">Cited: 657</a>	<b>Diffusion of innovation</b> is used in the context of the adoption process of some concrete objects, ideas or practices by individuals or groups related to specific communication channels for the social structure and system.
The process of <b>innovation diffusion innovation</b>	<a href="#">Robertson</a> T.S. – Journal of marketing, <b>1967</b> , pp. journals.sagepub.com <a href="#">Cited: 672</a>	<b>Diffusion of innovation</b> is used in the marketing aspect; the time taken to adopt the innovation and other parameters of its penetration is estimated from the market position.
Policy entrepreneurs and the <b>diffusion innovation</b>	<a href="#">Mintrom</a> M. – American journal of political science, <b>1997</b> , pp. 738-770 – JSTOR <a href="#">Cited: 1485</a>	<b>Diffusion of innovations</b> is used in the context of the innovation ideas dissemination in government programs, based on the analysis of historical events related to the research problem.
Modeling and forecasting the <b>diffusion innovation</b> – A 25-year review	<a href="#">Meade</a> N., <a href="#">Islam</a> T. – International Journal of forecasting, <b>2006</b> , pp. 519-545 – Elsevier <a href="#">Cited: 753</a>	<b>The diffusion of innovations</b> is used in the context of the dynamics of the main modeling and forecasting the innovations spread models.
<b>Spillover</b> effects of FDI on <b>innovation</b> in China: Evidence from the provincial data	<a href="#">Cheung</a> K., Ping L. – China economic review, <b>2004</b> , pp. 25-44 – Elsevier <a href="#">Cited: 838</a>	<b>Spillover innovation</b> (the side effects) is used in the context of the innovation ability to result in the additional (side) effects development (e.g. the growth of foreign direct investment could promote the innovation activities in the host country through reverse engineering, staff reshuffles, demonstration effects, and supplier-customer relationship.
Value cocreation and wealth <b>spillover</b> in open <b>innovation</b> alliances	<a href="#">Han</a> K., Oh W., <a href="#">Im</a> K.S., <a href="#">Oh</a> H., <a href="#">Pinsonneault</a> A. – MIS Quarterly, <b>2012</b> , pp. 1-25 – academia.edu <a href="#">Cited: 195</a>	<b>Spillover innovation</b> is used in the context of the effect of increasing the economic and strategic value alliances of open innovation, in which competitors unite to make possible the development and implementation of technological innovations.
A model of <b>innovation</b> , technology	<a href="#">Krugman</a> P. – Journal of political economy, <b>1979</b> , pp. 252-266 –	<b>Technology transfer</b> is used in the two poles context of development - the innovative North and the non-innovative South. According to the authors' opinion,

<p><b>transfer</b>, and the world distribution of income</p>	<p>journals.uchicago.edu  <a href="#">Cited: 1869</a></p>	<p>innovations may be created only in the North, and only afterward, production technologies become available in the South. This process of innovation movement is used in the meaning of transfer.</p>
<p>Knowledge <b>transfer</b> in Intra-organizational networks: Effects of network position and absorptive capacity on business unit <b>innovation</b> and performance</p>	<p><a href="#">Tsai</a> W. – Academy of management journal, <b>2001</b>, pp. 995-1004 – journals.aom.org  <a href="#">Cited: 4896</a></p>	<p><b>Innovations transfer</b> is used in the context of the increasing possibility effects of the implementation of the innovation developed in the Intra-organizational networks depending on the network developer position and access to new knowledge.</p>
<p>A theory of economic development</p>	<p><a href="#">Ranis</a> G., Fei J.C.H. – The American economic review, <b>1961</b>, pp. 533-565 – JSTOR  <a href="#">Cited: 2508</a></p>	<p><b>Commercialization of innovation</b> is used in the context of conditions to increase the efficiency of labor use and wages (e.g., agricultural workers)</p>
<p>Innovation strategies for successful product and process <b>commercialization</b> in Government R&amp;D</p>	<p><a href="#">Higgins</a> T. – R&amp;D Management, <b>1977</b> – Wiley Online Library  <a href="#">Cited: 17</a></p>	<p><b>Commercialization of innovation</b> is used in the context of the innovation transfer process (speed and sales efficiency) from government research centers to industry (e.g., the Irish dairy industry).</p>
<p>Shareholder value creation during R&amp;D innovation and <b>commercialization</b> stages</p>	<p><a href="#">Kelm</a> K.M., Narayanan V.K. – Academy of Management, <b>1995</b>, pp. 770-786 – journals.aom.org  <a href="#">Cited: 293</a></p>	<p><b>Commercialization of innovations</b> is used in the context of the impact on the market value of the firm's shares when announcing the introduction (commercialization) of R&amp;D. The main variables in the commercialization of R&amp;D were the parameters related to technology and the market.</p>
<p>A model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the <b>commercialization</b> of university technologies</p>	<p><a href="#">Siegel</a> D.S., Waldman D.A., Atwater L.E., Link A.N. – Journal of engineering, <b>2004</b>, pp. 115-142 – Elsevier  <a href="#">Cited: 838</a></p>	<p><b>Commercialization of innovations</b> is used in the context of transfer (the concepts of commercialization and transfer alternate in the work) of innovative technologies developed in research universities by means of newly created units - technology transfer offices.</p>
<p>Universities in the marketplace: The <b>commercialization</b> of higher education</p>	<p><a href="#">Bok</a> D. – <b>2009</b> – books.google.com  <a href="#">Cited: 3436</a></p>	<p><b>Commercialization of innovation</b> is used in the context of extended collaboration between academic and corporate research, which followed the Bey-Dole Act estimated in 1980. The focus is on risk awareness to the integrity and independence of research in medical schools resulting from sponsorship industry. The study was conducted at Harvard University Medical College.</p>
<p>Perspectives on disruptive <b>innovations</b></p>	<p><a href="#">Kumaraswamy</a> A., <a href="#">Garud</a> R. – Journal of Management Studies, <b>2018</b>, pp. 1025-1042 – Wiley Online Library  <a href="#">Cited: 6</a></p>	<p><b>Commercialization of innovations</b> is used in the context of additional income receive and a necessity to use additional assets to successfully promote innovation on the market.</p>

Thus, the content analysis of the scientific literature on the research problem showed that the term “commercialization” in English-language scientific publications began to be used (displayed in Google Scholar search engines) at the beginning of the last century. In the first half of the 20th century the most frequent term used was related to the processes of obtaining additional income in various scientific activity fields, e.g., the construction field, biology, and literature. From the second half of the 20th century the term “commercialization” has increasingly become widely used in the context of the generating

income process from introducing innovations into the company’s activities. Moreover, the context analysis of mentioning the “commercialization” concept allowed designating the research subject area and determining the concepts related to the subject (used in the context of the research problem): diffusion of innovations, innovations transfer, technologies transfer of and spillover innovations.

The analysis of the concepts data by information and analytical portal eLIBRARY.RU showed a significant increase in Russian author’s publications included in the database of Russian science citation index (RSCI) related to the research problem for the last 10 years of research. Visualized content analysis of portal data eLIBRARY.RU represented in figures 1 and 2.



**Figure 1:** Dynamics of thematic publications based on data compiled by the Russian information and analytical portal eLIBRARY.RU

According to the presented data follows the positive dynamics of the thematic Russian publications, including the key concepts that form the problem research field. In the period under study review (10 years), the number of publications devoted to innovations and the possibility of their commercialization increased, in the first case, in 3.3 times, in the second case – 3.6 times.



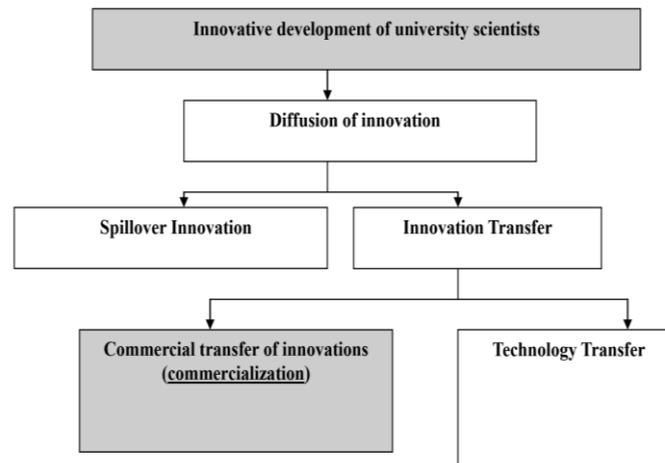
**Figure 2:** Publications dynamics of the subject study field based on data compiled by the Russian information and analytical portal eLIBRARY.RU

The semantic analysis showed that, as in the case with the English version results of the Google Scholar search engine data, in the Russian authors’ scientific publications can be distinguished several interrelated concepts. They are characterized by the transferring innovation process from the developer (university scientists) to the consumer. Moreover, in most cases, the innovation source is the university or scientific unit comprising the university structure. As an

innovations consumer may be enterprises or high-technology business (commercialization of innovations); different industries (innovation and technology transfer); the market, and society in general (spillover innovation).

## FINDINGS

1. The analysis of the mentioned context of the term “commercialization” in respect of the research problem in Google Scholar and eLIBRARY.RU search engines allowed to implement a semantic model of the study subject area (Fig. 3).



**Figure 3:** Semantic model of the subject area related to the “commercialization” concept

2. The main concepts that characterize the transfer process (implementation) of innovation from the developer (university or university research department) to the consumer – business were allocated based on a retrospective content analysis of the subject area study.
3. The variety and features of the commercialization processes of universities' innovative developments need to be accounted in methodology rationale of research in this direction, as well as in the practical recommendation's development related to the university's management.
4. A retrospective content analysis demonstrated the commercialization process of the university's development is largely represented in the English-language scientific literature, making it possible to enable Russian universities the positive experience of leading countries in the field of commercialization of their own developments.

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