

Methodological concept of dissertation

**“RESEARCH-BASED SPIN-OFF ENTREPRENEURSHIP IN FORMATION OF NATIONAL
INNOVATION SYSTEM IN BELARUS”**

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Abstract

The methodological issues of research into role of research-based spin-off firms in a National Innovation System (NIS) will be dealt with, in specific context of the NIS formation from the stately-ordered S&T sphere in a transformation economy of Belarus. This young but exceedingly critical aspect of S&T activity organisation requires close insight, while having no relevant empirical in-depth studies being done till now. Similarly, no theory is developed explaining the essence of transformations undergoing in scientific sphere in period of transition, and still less for reasoning of the role of entrepreneurship in academic sphere in a wider context of the innovation system.

Approach applied in current research is theory building from case studies (Eisenhardt, 1989), built on system analyses. The empirical basis of the given research are the case studies with opportunistic data collection of the innovative technology-based enterprises grounded by public research laboratories (research-based spin-off firms – RSOs). In dissertation, studied into are the processes of their emergence, performance and relationships to the parent institutions and industry, with the aim to find out the their functions and impact to NIS. In the current paper, the reasons of deciding for the given approach will be produced, tools and strategies of data collection discussed, milestones and reefs of research analysed.

Keywords: *Research-based Spin-offs (RSO); technological and knowledge transfer; lean management, core competence and outsourcing; “quasi”-spinning-off; lock-ins and path dependency; competence-based networking in NIS; institutional structure; shaping the NIS’ technological profile; education of innovating managers; corporate innovation culture.*

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1. Introduction: Relevance and goals-setting

1.1. History and actuality

Studies into entrepreneurship in science-intensive industries often detect the key role, which the new firms do play in development of these industries. Activity of these firms serves as the source of innovations, which drives the intensive dynamics of science-intensive industries' development. In most post-Soviet countries the question stands not as how to support the current innovation dynamics, but as how to create the national innovation system, whereas the S&T potential accumulated during the Soviet time would not get lost.

Radical changes in economic, social and political systems after gaining the independency of Belarus in 1991 caused significant transformation in scientific and technical (S&T) sphere. This is a process of new actors entering on the scene, but also of the functions and authorities being shifted in the system. As the former S&T system gets transformed into the National Innovation System (NIS), role of innovation creators and drivers is supposed to shift to private sector.

Social recognition and political awareness of the role of innovation trace for transitional economy of Belarus by restructuring the technological basis of industry and overcoming the economic gap have begun to develop. Nevertheless, there is still little sequence in political decisions and also little readiness to bear the anti-electorate social costs of actual restructuring of industrial sector, and whole palette of economic relations. Private business is still out of favour of government, and financial flows are over passing science and research.

Synergetics argues, that the lack of stability is the fruitful soil for the new stabilizing structures would be born in the open non-linear systems (CIPIN, 1996). Academic science, where the knowledge serves as input and output, is inherently such a system. One of grounds to study the economic, institutional and social transformations having taken place in the scientific sphere of transitive economies (and occurring till now) is to estimate their role as the system's mechanisms of self-regulation.

1.2. Research aim, objects and subject of research

In current research, the economic but also "socio-historical" role is to be investigated, which the newly emerged phenomena of originating from research institutions innovative firms does perform by institutional transformations of the National Innovation System.

Objects of research

Having started the empirical case studies from Physical-Technical Institute of the National Academy of Sciences of Belarus (PTI) and the small innovative enterprises, among the founders of which are the representatives of this public research institute (Gordienko et al., 2002), I have extended it to other research institutes in a R&D system of Belarus. Furthermore, the range of RSOs operating in sector of machinery and metalprocessing sector in Belarus is expected to be covered. Reasons for such choice will be closer explained in 3.2. For comparative analyses and cross-national explorations the empirical study of cases of European Spin-Off firms and organisations supporting innovative SMEs is done.

Subjects of research

Subjected to research are the processes of **institutional transformations** of the scientific sphere, structural changes in scientific potential, budget, thematic directions of research and developments at the academic scientific institution, its collaborative links with other spheres. Organisation and operation activities of research-based spin-off companies, the schemes of their cooperation with parent institutions and networking (incl. technological cooperation) in the innovation process are analysed.

Research aims

Till now, no theory has been developed to research-based spin-off firms (RSO) and their particular role in national systems of innovation. The targeted developments in my doctoral research will be:

- *Methodologically*: development of a coherent structure of **categorical apparatus** (tool-box of categories), necessary to describe the variety of appropriate relationships. Especially relevant this task is for a post-Soviet science because till now there exists a large gap between categories sets (for example many categories from knowledge economy branch have not entered the common practice),
- *Conceptually*: disclosure of deeper relationships (linkages and contradictions) around innovation process organisation in Belarus. The matter is, state interference into the processes of knowledge and technology transfer has enjoyed vast spread in these latter days, with “best practices” disseminating all over the borders. However, lack of **conceptual understanding of the processes** and of specific shapes attributed to them by (national) context of a transformation economy on a fundamental level of interconnections might obviously lead to policy decisions being prejudiced and biased.
- *Policy implications*: integration of various theories in a given study for an objective, composite, multi-layer and many sided insight into the matter, which will add value to policy-making for both sides. For Belarus, it will be pursuing the knowledge and innovation understanding dynamics of developed economies. And for the latter, successful validation of new concepts on a transitive economy’ example will be a perfect background for further advances in both concepts development and policy tuning: because in a transitive economy all the processes develop faster and more intensive, thus easy to assess.

1.3. Initial hypotheses

My **presupposition** is, that responsible for the effectiveness of the innovation system are the interactions and mobility of knowledge between the participants of the innovation process (high educational establishments (HEE), research institutions, and industry (esp. SMEs), and innovation infrastructure organisations). Thus, the **core thesis** claimed in the project considers the emergence of a stratum of innovating-for-market researchers to be a valuable linking chain strengthening the weak linkages „university-science-industry“. The **initial hypothesis** was that in organising of a NIS, Spin-Off firms prove to be the highly relevant phenomena contributing to coherence and adhesion in between the participants of the innovation process (high educational establishments, research institutions, and industry (esp. SMEs), and innovation infrastructure organisations) due to mobility of knowledge, schemes of interactions they implement, and because they link together the spheres of fundamental, applied research, and bring the R&D results close to market.

That means, that role of RSO in NIS is not merely restricted to technology transfer, - it is a remarkable stage in institutional transformations required for developing of a coherent and sustainable (in both economic and social senses) NIS. The innovation competencies and culture fostered by them in an innovation system serve as the catalyst for developing of a knowledge-based economy. Further I try to operationalise these assumptions in order to check their validity.

2. Preconditions of research

2.1. Defining the borders of research object. Population to be studied into

Investigation of entrepreneurship in scientific and technical sphere has become one of the critical issues in current scientology and innovation policy. Category of **academic**

entrepreneurship might involve several groups and subdivisions. In it, the definition “spin-off” is the core one. It explains the **process of functions’ re-distribution** between old type of organisations (universities, public research, industrial R&D) and organisations of new type (small innovative firms) in the whole process from fundamental research to applied research and development introduction in industry. Term “spin-off” is actually used in different contexts, but in essence means the same process, underlying particular forms of its existence. For the purpose of grasping the general frame and specifics of context as appropriate in a given research of mine (entrepreneurship in academic sphere), let me make a short excursion into the palette of these definitions.

i. The most “scientific” definition belongs to institutional theory:

Spin-off is an *institute* (a system of relationships, which performs definite functions) *with changed functions, when such a change doesn’t lead to automatic change of its internal essence*. The author of this definition gives an example of many commercial banks in Russia which have been the spin-offs of the State Bank of USSR, and proposes the “more appropriate for Russian language term “werewolf”, or “turnskin” (wolfman)(URL: <http://olegevs.narod.ru/>, 2004).

ii. On definition of a **New York Centre for Entrepreneurial Management** (Neshitov, 1999) spin-off is a method of creation a firm (and similarly the firm created in such a way) by former employees of the firm (organisation) already active in this sphere of industry. This definition reflects the process which, alongside with mergers and acquisitions, has a long history. Nevertheless, to distinguish the comparatively recent phenomena, in Technopolis (2001) a division has been made between *corporate-based spin-offs*, which have branched-off from business (typically from large corporations during their transition to “lean management” and concentration on core competences, with side activities or by-product lines being separated into a special legal entity), and *research-based spin-offs*.

iii. Some “legal” definition (in legislation document “*National innovation system of Russia and major directions of its development*”) only recognises the title “spin-offs” for firms which have **been** paternalistically **created by** “state scientific organisations and high educational establishments for promotion on market of scientific and research developments and incubation of them” (Innovatica 2003).

iv. In the context of my research, research-based spin-off is an enterprise **grounded by scientists** who have left the university or laboratory in order to develop commercial opportunities for research work they carry. Thus, it is the founder of a firm who matters, together with his previous scientific involvement and current R&D being the core of current activity as an entrepreneur. Often these firms are directed at untested technologies and rely on gaining the high economic yield from these.

v. Besides, a definition of “conversion” times is interesting, which implies the possibility of **cross-sector transfer** and suggests that Spin-off is employment of inventions and discoveries made during military projects, for production of goods oriented on a civil market, in particular “*transfer of technologies from cosmic research sphere to other industries*”(Poisk NN, 2000).

vi. Finally, the expressive definition of spin-off which reflects the **shift of major roles** is provided by movie-industry (<http://www.formulakino.ru/>, 2004): “One should take a hero from a popular movie (except the main hero, otherwise it will be a “sickwell”), and let him become the main hero of the new movie”, as for example “The woman-cat” as spin-off of “Batman comes back”, or “Evoki: battle for Endorr” as the spin-off for the six episode of “Star wars”.

vii. And, perhaps the most succinct and expressive definition, which reflects the bottom-line (pragmatic) matter of the phenomena, is an exclamation of a disappointed moviegoer: “**Spin-off is only an attempt to earn money on success of the original version...**” – which is a simplified expression of incentives standing behind spin-off process.

For the objectives of relying on valid data it is necessary to strictly define which kinds of entrepreneurship in scientific and technical sphere will be studied in my dissertation.

Recently, Zentrum für Europäische Wirtschaftsforschung (ZEW) has suggested the following classification to determine Spin-offs:

I. New firms in all industries	II. New firms in research- and knowledge-intensive industries	IV. New firms created by Academicians	VI. Spin-offs Are based on new knowledge /new technologies from public research.	VIII. Realization-aimed Spin-offs	
			VII. (Other) academic Startups Knowledge-/technology transfer is a side effect and is for the enterprise not indispensable	IX. Competence-based Spin-offs	
		V. New firms created by not academicians			X. (other) Start-ups with transfer-impact
					XI. (other) Start-ups without transfer impact
III. New firms in other industries				XII. With R&D activities	
				XIII. Without R&D activities	

Source: Adapted from BMBF (2002) Spin-off Gründungen aus der öffentlichen Forschung in Deutschland. Zentrum für Europäische Wirtschaftsforschungen (ZEW), Bonn.

This differentiation is based on the **basic functions** that enterprises fulfill in the economy - whether they transfer the knowledge and technologies, and if it is the core of their activity.

Obviously, category of academic entrepreneurship comprehends all the range of enterprises launched by academicians. Whereas status of an academician has been defined as a person “having the *academic background: course of study at high educational establishment or professional activity in science*” (BMBF, 2002, pp. 6, 9). With respect to the classification of new firms according to their knowledge dissemination and technology transfer impact on the economy, I have decided to accept the somewhat differing distinction, which more adequately reflects the reality (the context) of my empirical knowledge pool.

First, from point of view of knowledge and technology *transfer* quadrant XI is to my mind irrelevant, while imposing none; a pure definition of one belonging to ‘academic entrepreneurship’ made exclusively by principle of founder’s employment path doesn’t respect the essence of matter. Second, in fact, the EXIST division *sets equal* these firms launched in research- and knowledge-intensive industry (which are given notice of being very broadly defined) by gradutors from universities, *to* firms in the same industries launched by experienced researchers (likens them with one another).

Recognizing, that in particular cases this might be true, and some gradutors of universities are truly genius, I would argue that the general tendency is not as bright. Much of sustainability to academic entrepreneurship is attached by the relatively long and deep involvement of its founders into research, and the pure desire of launching an innovative high-tech firm from university board is not sufficient to be successful in a continuous knowledge and technology transfer. One of the basic criteria to run a sustainable RSO is the ability of its founders **to create knowledge**. It is this ability, laying in base of combination from plenty of skills, which earns to the firm the right of being called a **research-based spin-off**, and beautify the diadem of innovative economy.

For the purpose of my study, if not indicated other, I mean under spin-off the (non corporate but) research-based firms launched by researchers, and distinguish between:

- the spin-offs founded by (with share of equity and/or research staff of) universities, and
- these founded by (with share of equity and/or research staff of) public research organisations.

2.2. Theoretical conceptual framework

The knowledge of the Spin-Off as a phenomena is not so much advanced even in developed countries. What is already fundamentally known from the research in the European Union (for example Corporate and Research-based Spin-Offs, EU, 2001) and transformation economies (Smallbone et al., 2002), is that Spin-Offs, being a small subset of new technology based firms, and a very small subset of new firms, are the innovation-oriented enterprises, which as a rule are established by the scientists and researchers from public research institutes and universities, who develop in their entrepreneurial activity the ideas of the fundamental research level, with the purpose of finding a market application for the R&D results of them, sometimes using the equity investments from the parent organisation. In such a manner the Spin-Offs turn into the reliable linkage between the science and industry. Some generalizing research has been made apropos the spin-offs as technologies originating from military sector and their new application in civil industry (Alic, 1992).

Still, no theory exists apropos the RSO in general, and the role they play in the NIS in particular. Development of generalised systematised knowledge about entrepreneurship in (former) academic sector undoubtedly needs knowledge in such domains as knowledge transfer and technology transfer, theories of national innovation system, new growth theory, technoglobalism concept, knowledge-based economy, and frameworking knowledge as technology monitoring, foresight and forecasting, socioeconomic acceptability of technology, sustainability issues, knowledge management.

2.3. Discourse in previous (up-to-date) empirical studies. Why further analyses is required.

Though ever more attention is paid to support of innovative and new technology-based firms on the state and international (EC) level, and in some countries significant steps towards educating entrepreneurial culture already in universities are made (for instance, BEGiN - Brandenburger ExistenzGründer im Netzwerk, <http://www.begin-brandenburg.de/>), *only few empirical studies* have been made addressing the vital issues of RSOs functioning. Actually, the wide variety of innovation-policy level actions to support and promote academic entrepreneurship are extremely high in agenda of the striving to innovative leadership Europe. It may be put as a paradoxical case that the importance of some new institute has begun to be *financially* supported on the policy level even before the academic knowledge of it has been developed – while common practice is that professors have to teach several generations of students about necessary economic reforms before these achieve the policy decision-making positions.

The most advanced evidences (in sense of scale and depth of the data collected) about spin-off creation in **public research sphere** has been conducted in Germany by BMBF (Bundesministerium für Bildung und Forschung – Ministry for Education and Research) in October-December 2001. It aimed at full-scale qualitative assessment of RSO-phenomena in Germany, about the scale and development of spin-off creation; important features of structure, as for instance to which industry it is affiliated, institutional and specialty origin or research intensity. Also the linkages to science and specific problems have been studied, and incentives for spin-off creation. Because of high statistical correctness (20.000 enterprises have been interviewed) and depth of inquiries in comparison to other studies up to this day of such a scale, I consider EXIST study to be a highly valuable source of quantitative data, which can serve as a powerful empirical evidence in support (or against) of hypotheses put forward by researcher whose major tool are the case studies, for his goal is gaining of qualitative knowledge.

The most recent large-scale political initiative addressing the needs of research-based spin-offs has become the **EXSIF** project which has been executed under 5th Framework Programme of the European Commission. EXSIF stands for **EX**pertise in **Setting-up Innovative Firms**. The goal of this project was not disclosure of any scientific issues – it was rather the complex of

activities addressing spin-offs. In the project, the six main European public research organisations¹ united to transfer best expertises, in order to improve their competences in promotion of technology transfer and creation of spin-offs. As far as it was rather a support-oriented program, which wasn't designed to make any theoretical studies of fundamental principles of RSO functioning, it gave very good practical results, but provided only restricted information about the needs and barriers for innovators.

Being aware of the high significance of **context factor** (in my study it is the transformations in the whole economic structure of society in Belarus during the whole length of suited phenomena, and the formation of national innovation system in particular), I am also highly interested in similar studies in other transitive countries. In Ukraine, an important study of large public research institutes has been conducted in 1993-1995 by CIPIN of the National Academy of Sciences (NAS) of Ukraine together with [Wissenschaftszentrum Berlin für Sozialforschung \(WZB\)](#) in Berlin (CIPIN, 1996).

Aim of this study was to determine the general trends and to track the specific features of socio-economic and scientific policy in academic research institutes of different profiles in conditions of radical transformation of society, to detect the grade of crisis in academic science, the reasons of it, and the ways and possibilities to come out of crisis. The study has become highly successful in tracking the real (and not proclaimed) changes undergoing in academic science of post-Soviet countries and critical state it had to experience. The reliability of the study has been ensured by many-level methodology, which has included expert enquiry and interviews to more than 800 respondents from 18 research institutes of NAS Ukraine, so this work is a highly valuable source of "historical" knowledge of the roots and preconditions of academic entrepreneurship. It will be particularly value-adding to compare the relationships revealed in Dobrov' institute study with relationships observed today, after the 13 years of these transformations' lifecycle. Nevertheless, one should bear in mind that the mentioned study has concentrated most on the troubles of academic science being in break-down, and merely went into the depth of research-based spin-off firms as a socio-economic phenomenon, as an institute in sense of set of norms. Worth mentioning, the parallel study has been carried out in Commonwealth of Independent States (CIS) by Russia and Belarus, but if one can find the references on the outcomes for Russia, for Belarus it is not the case – no results have been published.

In Belarus this research question has in general been left without specialized scholar attention. First, one should admit that the RSO phenomenon is very young in Belarus, with the first attempts dating back to the late 90's. Moreover, the whole process had to occur under conditions of the whole transformation of the social and economic system in the country, and challenged by lasting economic crisis. In these circumstances no large projects like EXIST (BMBF, 2002) have ever been financed in order to study the innovating academic entrepreneurship and the benefits of its being supported by state in particular. But then again, the very process of phenomena development in Belarus as a transitive country has been strikingly expressive, nevertheless, only few descriptions of the transformations undergoing in the scientific and technical sphere of Belarus have been made and published in form of 3-4 pages articles, dating back to 1993, whereas practically all of them concentrate on hazards escorting these transformations, such as "depredation/thievery of the national science". More general studies of transformations undergoing in Belarusian science and research have been made by several authors, perhaps the most bright of them have been done by Dr. Gennady Nesvetailov (1999), a founder of economy of science in Belarus.

The most close study which has been undertaken in Belarus in last years to study the small innovating firms has been conducted by Dr. Anton Slonimski, Institute for Economic Research

¹ EXSIF consortium, with a research base of about 50,000 researchers, consists of the [CEA](#) (French Atomic Research Centre), the [CERN](#) (European Organisation for Nuclear Research), the [CSIC-CNM](#) (Spanish National Microelectronic Centre), the [CNRS](#) (The French National Centre for Scientific Research), the [JRC](#) (the European Joint Research Centre), and [QinetiQ](#) (formerly part of the UK's Defence Evaluation and Research Agency, DERA).

of Ministry of Economy, under the framework of INTAS project jointly with Russia and Ukraine (INTAS,1999). The method of this project (face-to-face interviews) allowed closer insight into everyday practice of these firms, and important patterns of their functioning. Inter-systemic trace of development of NIS in transitive economies (Slonimski et.al., 2003) provides a good background for comparison, whether the transformation processes in academic sphere occur in dissonance, and where the diversities root from.

Though so little studies are available, in a number of separate institutions around the world, which are to organise the collaboration with RSOs, the official procedures and routines have been developed already. So, in Oxford university there have been worked out the standard forms for coordinating the relationships between spin-off firms and the university, which is parent to them (Isis, 2004).

3. Methodology of research

3.1. Theoretical rationale

For **theoretical evaluation** of my empirical data, a strict scientific approach is required. For the issue of such complexity as a new type of organisation in a wider set of innovation system certainly the **system analysis** is necessary. System analysis means application of system approach, which “aims to disclose the integrity of the object, the mechanisms which provide this cohesiveness, to find out various types of links of the complex object and consolidation of them into the theoretical wholeness” (Novikova, 1996), for analyses of particular applied problems. **System approach** will help to see the interconnections between occasions, functions of person and of organisations, to estimate the hierarchical interdependencies, to connect different disciplines, theoretical concepts, to see the general (relations) behind the specifics (facts), and to be able to integrate this general.

Analytical task of my study will imply identification of **compounds** of RSOs, **structure** of them, **functions** of these elements, and their **integrity**, which provides the role of RSO in NIS. **Dynamics** of RSO development as a social and economic institute, as well as of its changing role, is tracked by *historical (genetic) analyses*. Consideration of RSO in NIS, thus, implies regarding them as a **system in system**, both of which change the characteristics of one another qualitatively. As far as namely this kind of relationship is studied into, analysis will address very much the systemic characteristics of national system of innovation, which is inherently open, probabilistic, complex, and partially regulated (organisational).

To disclose these aspects, evaluation of the phenomena from the viewpoint of principles appropriate for each side for development of organisation as a social system is desired. These theoretical principles are developed by Prof. Dr. Novikova in her monograph dedicated to economic studies system methodology (Novikova, 1996), and they provide an extremely interesting framework for our analysis of two systems: RSO and NIS.

Table. System approach: study of a system in a system (RSO in NIS)

<i>Structural organisation</i> aspect principles:	
1) consistency of elements	There are no useless elements
2) structural hierarchy	Shifts in authorities (movie), decision-making
3) coordination and subordination of production goals	Activity goals (realisation of their potential, profit, technological leadership, etc.)
<i>Functional organisation</i> aspect principles:	
1) coordination and subordination of functions	Technological management, marketing, networking, or even “PR” – not public relations but parent relations..
2) structural and functional lability (changeability, volatility, infirmity)	Flexibility of organisation, shifts in decision-makers structure, structure of organisation
3) neutralisation of dysfunctions (malfunctions)	Failures: institutional, market, governmental, system.. Sort of interference required, networking

<i>Progressive development of a system</i> aspect principles:	
1) progressive differentiation of functions (functional specialisation)	First – commercialisation, technology transfer, then – restructuring of economic structure, innovation culture, “situated knowledge” heritage
2) progressive iteration	Retrieval on the more advanced level
3) unification and standardisation	To what extent do this activity institutionalise and becomes a conventional practice
4) social expansion	To what extent it receives social recognition and status

Two main tracks for reasoning are followed in process of current research:

- context study
- participative empirical research.

3.2. Empirical background

Empirical basis of the project, which provides the major qualitative data about undergoing transformations in NIS, are the **case studies with “opportunistic data collection”** of the innovative technology-based enterprises originating from public research laboratories. It reflects the process of functions’ and authorities’ shifts in between the actors apropos knowledge and technology transfer. I accept the understanding of a case as a tool for academic research as of “empirical unit of research, which provides not quantitative, but qualitative insight into information”, and serves as a sort of translation – “for modifying the object of research in a way which makes it able to study it” (Ragin, Becker, 1992). Strengths and weaknesses of building theory from case studies, as well as an alternative methodology of doing this have been in detail studied by Eisenhardt (1989). Though further being criticized for too strict procedures demands for the case building, which make us forget of the rich context of each case by Dyer and Wilkins in 1991, this work has provided me a good framework of how to organise the steps and what reefs to take into account by case studies.

Pool of objects to study: ‘population’

Trying to *quantitatively estimate the pool of objects to study* (number of RSO generally in the economy) in Belarus, I have to admit that no exact statistics in Belarus is affordable. Some general view of what might be the quantity of enterprises acting in research- and knowledge-intensive sphere in Belarus in general might be gained from statistics about the **small innovative entrepreneurship**, which is still also rather restricted, but provides the more clear picture thanks to the high rigidity of definition.

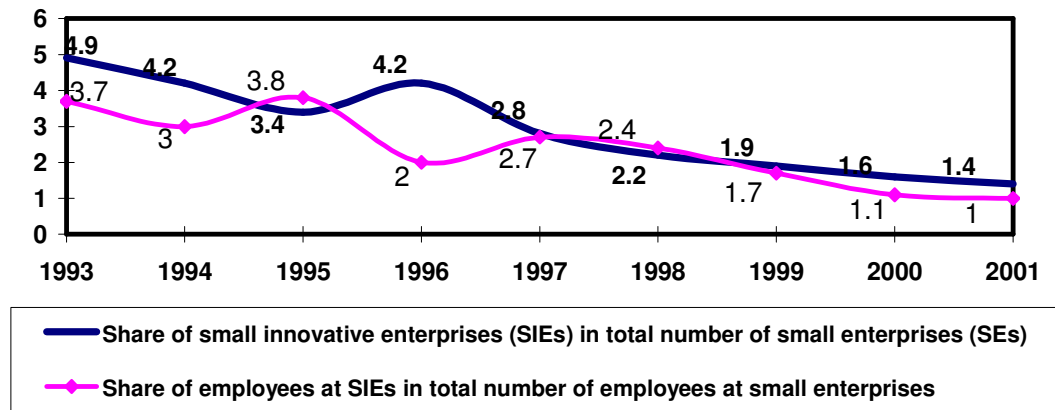


Figure1. Small innovative entrepreneurship in Belarus. Source: Ministry of Statistics of Belarus

Share of small innovative enterprises (with the size being defined as “small” according to a *per industry-ranged scale* appears to be very small, while official status of “innovative” strictly demands that organisation performs R&D. In general, there have been 348 enterprises (1.4% of small entrepreneurship) in Belarus in 2001, which have met the requirements of such definition. In terms of EXIST classification (see 2.1.) this category would correspond to quadrants II minus XI minus XIII. Attempts to quantify the division to **university-** and **LPRI-founded spin-offs** might imply even more difficulties. The Belarusian Interuniversity Center for Marketing of Scientific and Technological Developments (<http://www.icm.by>) unites in a single network the 21 universities from all over the Belarus, and runs a portal, where one can find the profiles of 601 ready-to-market developments of Belarusian universities – the objective basis for creation of minimum 601 university spin-offs around them.

As for spin-offs from **public research organisations**, this statistics seems to be even more sad. Worth mentioning, research in Belarus is conducted in specialized organisations with affiliation to either National Academy of Sciences, or various Ministries (Ministry of Industry, of Economy, Education, of Statistics, etc.), or again the large industrial enterprises (concerns – Belneftechim, Scientific and Production Concern of Powder Metallurgy, Belmashpribor, Belbiofarm, etc.). The only data is available about small innovative enterprises started on the basis of National Academy of Sciences - about 30 small innovative enterprises are organised with its participation (Rusecki, 2002). And the only published information available about them are their profiles with description of technologies at some of these enterprises.

Identification the borders of ‘population’ which belong to the objects of my research, alongside with the aims of the study by itself, predetermines the choice of methods of inquiry (questionnaires, interviews and expert studies). Theoretically it could be possible to conduct interviews with all of small innovative firms (with making the reservation of 40-60% response rate being common for democratic procedure of inquiry). But this is evidently a false assignment of mission when research problem is formulated as qualitative analyses, and not collecting of statistical evidence. For the purpose of working out a relationships-based concept, I decided to make an in-depth analyses of some reasonable number of **cases**. Not the last role for achieving the high quality of the case and data which is valid is the depth to which it will be possible to get integrated into the case, which implies another restriction on the number of cases. 10 cases have successfully constituted the core network of my close insight. For corroboration of them, additional interviews are executed, and other forms of participative research (as brokerage events organisation and participation) are exploited.

Pool of objects: sector to study

Number of frontier technologies created per branches of economy		Of them			Organisations creating frontier technologies
		New in a country	New abroad	Principally new	
[1] <i>Total</i>	407	371	28	8	150
[2] <i>Industry totally</i>	177	167	6	4	73
[3] Machinery and metal processing (MMP)	96	86	6	4	36
[4] metal processing	57	49	4	4	21
[5] Share of frontier technologies created in MMP in all frontier technologies created in industry, %	54	29.3	66.6	100	
[6] Share of frontier technologies created in MMP in all these in economy, %	23.6	13.2	14.2	50	
[7] <i>Public education</i>	44	34	8	2	15
[8] <i>Science and service of science</i>	186	170	14	2	62

Table 2. Branches where the frontier industrial technologies are created, 2002. Source: calculated on data of Committee on Science and Technologies, Council of Ministers of Belarus, 2003

I have decided to concentrate major attention on RSOs in *high-tech sector of machinery and metal-processing industry (MMP)* of Belarus, starting them in early 2001 (Gordienko et al., 2002), and tracing the fate of firms interviewed for the following 3 years. Decision for choosing the MMP sector was based on influence, which this industry plays in the economy (Table 1). Obviously, firms, the activity of which is based on frontier technologies, enjoy most fertile soil in machinery and metal processing. Significance of machinery and metal processing branch for economy is stressed by the fact that this branch contributes the largest share to the total industrial output in terms of production (Table 2).

Table 3. Share of selected industries in total industrial output in 2003 (per cent)

Electric power	Chemical and petrochemical	Machinery and metal processing	Logging, wood-working	Light industry	Food	Other
8.1	12.8	21.3	4.7	6.4	16.5	30.2

Source: on data of Ministry of Statistics of Belarus.

Pool of respondents

Most previous empirical studies (OECD, ADT) which have studied creation of enterprises from science addressed either the ‘science’ itself – universities, or research organisations from which the firms have branched-off, - or the structures supporting them (technology transfer centers, business incubators, etc.). As shown in EXIST (2000), having these organisations as the source of information about academic entrepreneurship is not satisfactory from both statistical, and the qualitative point of view. First, parent research organisations can only provide some information about the firms with which the contact and collaborating links have been supported, and not about the firms of earlier employed researchers who might have separated long ago and established a new pool of contacts for their activity, but not with “parents”. Similarly, and even more dramatic, this is the case for universities, who rarely maintain contacts with former graduates. Unjustifiable statistical error arising from support organisations inquiry is that far not all the new firms make use of their services.

Relevant to add, phenomena of academic entrepreneurship involves the technology-based firms of the second generation as well – which are not examined even in European countries but are a logical and important succession of the phenomena – and these are not necessarily even known to first-tier “nurturing” organisations. Finally, even when collaborating with spun-off enterprises, parent organisations do not possess the information of such depth and quality, which could allow for drawing rigorous and valid conclusions about internal processes of RSOs. No one can provide more deep and extended information about spin-offs as the spin-offs themselves. And, if a good deal of surveys have addressed intimately innovating firms (of any kind), for the case of spin-off enterprises from public research these firms have been directly interviewed only in a one study – of EXIST (BMBF, 2002).

At the same time, for the objectives of receiving reliant qualitative information, which would also reflect some confronting views on spin-off process and role, communicating with “external world” organisations in research is an undeniable merit of it. The need is obvious to create a reliable *framework for verification, validation and analyses of qualitative data* gained during *face-to-face interviews*. I suggest, the only way for constructing the theoretical concept which would benefit from objective, many-sided evaluation of interconnections about RSOs in NIS, is to communicate with possibly different actors. In my set of **opportunistic views collection** are the representatives of

- different layers of parent organisations (director of the institute, heads of laboratories, ordinary researchers, bookkeepers);
- different layers of research-based spin-offs (managers, technical managers, bookkeepers, researchers),

– organisations rendering innovation support.

Above that, it was very cautionary:

– to hear the assessment of spin-offs' success from their "*sisters*" and "*sworn brothers*"

– to compare the 'spin-off-ers' (competences, mode of behavior, self-rating) as a social strata in different countries (during brokerage events on innovation),

– to observe the process of communicating between different-nations researcher-entrepreneurs

– and the process of linking them by international "bridge" organisations

Now I have worked out and am going to proceed the empirical inquiry by addressing

– the *clients of RSOs* (customers of their knowledge-intensive products and services);

– and the *second generation spin-offs*.

"Sisters" is a term applied by NUTEK to typify the new firms and implies "one or at least two spin-offs originating from the same mother organisation in the same year, with the mother organisation surviving" (Svanfeldt, 2001). Disclaimer: this term originates from corporate business, nevertheless I consider it to be very helpful to identify relationships for RSOs. Above, one should distinguish the "splits with no surviving mother" - firms split up with no parts qualifying as spin-offs or cleavages, and "cleavages" - firms divided in 2 or 3 parts that would all qualify individually as survivors. For the purposes of defining spin-offs in the similar technology area originating from differing parent organizations, I have found the term "sworn brothers" to be appropriate. Involvement of these sources of information, to my best knowledge, has never been applied in such studies before, and I consider that it is particularly this method of opportunistic sources involvement, which allows me to create a reliable framework for verification, validation and analyses of data.

Tools for interviews and participative research. Questionnaire

As the background of formal interviews, the more or less formalised data collection tools have been employed - Questionnaire and Guidelines to Interviews, which rather serve the function to prepare the researcher by helping to structure the dialogue. In them, RSO characteristics and different domains of relationships are classified. Production of a questionnaire is a responsible task, which in large projects requires being reviewed by experts in relevant fields to evaluate them on structure and understandability. Because my research is directed on achieving the qualitative, and not statistical quantitative data, on one hand, and requires the many-sided and many-level analyses of the phenomena, on the other, I decided to integrate the questionnaires already checked by experts from different knowledge areas for producing my questionnaire:

- a. SMEs and economic development in a transitive country (INTAS, 1999)
- b. Introduction of Product/Service on Market by high-tech firms (Gemünden et.al., 2003)
- c. Success-Oriented Management of Innovation projects (Gemünden et.al., 2003)
- d. Team-based Start-ups (Müller, 2000)
- e. Networking competence and Technological Networks (Ritter, 1998)

Inclusion to Guidelines of various aspects of technology-based firms organisation, as addressed in these studies, has enabled me to cover in my study the issues, which have principally not been paid attention to previously. Structuring the questionnaire occurred upon the major constructs, the building blocks of research. Basing on the deeper knowledge of them, and of the relationships between them (or the absence of any relationships or role for the issues central to our research), the fundamental knowledge supported by empirical evidences is to be gained. The questions having been set to managers have mostly been open-ended. Nevertheless, they were structured to address the definite domains of interest, as disclosed further in 4.1.

As the instruments of gaining the objective data in course of participative research have hitherto served the following activities and events I took part in especially for studying the relevant to RSO in NIS issues:

- Brokerage events.
- participated in the international conferences, devoted to innovation activity
- have spoken personally for hours with experts from England, Germany, Finland - recognised scientists in innovations
- have spoken to experts in patents and IPR regulation in between the research organisation and spin-off firms
- have worked out the proposal to EU in part of innovative technology-based SMEs support
- hold negotiations myself for establishing contacts between RSOs in Belarus and other countries
- listened to the presentations of researchers-entrepreneurs of their technologies
- attended the sittings of scientific council of a mother research institute dedicated to technology transfer issues
- was present by the experimental works of researchers- entrepreneurs
- attended the sessions of the Club of scientists of the National Academy of Sciences, where the questions of S&T activity organisation, relations between institutes, and innovation culture have been discussed by the most prominent scientists
- have attended the lectures of guest professors experts in innovation activity and small innovative entrepreneurship organisation
- visited with excursion the center for technology transfer and business-incubators
- was an interpreter at business negotiations – two officially organised, one – “underground”
- participated as a representative from German side in business visit of industrials to Belarus for establishing contacts and technology exchange
- visited with an excursion the closed for public concerns (enterprises) – the largest Belarusian software developing firm and spin-off from it
- visited with excursion the largest metallurgy factory in Germany, and the enterprises along the whole technology chain of metal production.

3.3. Context study

Of a limited scientific value would it be to study the situation with Spin-Offs in a transitive economy purely, without reviewing the experience of other countries, where this process is on the approximately similar or, better, a more mature stage of development. So, to my mind, there is a strong necessity for regular surveys and defining of burning concerns of Spin-Offs, for the better policy-making, and it could become an important step in contemporary innovation science for a Transitive Economy: to compare the process of Spin-Offs development with what has taken place in the European Union. Nevertheless, because of high diversity of systems to organise innovation activity in each country (different educational, political systems, structure of economy, geographical position, and mentality), benchmarking in building the NIS should be approached with precaution. Analyses of international practices in NSI-related policy needs hence always to take into account the specifics of contextual framework these practices are introduced into. Discussions with Prof. Gerd Schienstock, Tampora university, have strongly influenced my favour of the method of *discursive comparison* to employ, which aims to not mechanistically benchmark the universal ‘best practice’, but to identify functional equivalents – find out which practice suits for the functions being performed best. Under context I understand the state of economy, industrial, education, research sector and relations between them, including social and cultural conditions, which predetermine the significant features of subject (RSOs) in comparison to other countries, other environments. *As a matter of fact, the subject I study by itself could only emerge due to the context, in result of transformations undergoing in these spheres.*

4. Path of research and outcomes

4.1. Design of the work

When started, no theory has been underlying the research (which “provides the ideal framework for case study research” (Eisenhardt, 1989)). Though for gaining the knowledge of each plain research activities of various kinds occur to be most beneficial, the paths of research activities and logics of research do not concur. In factual research the stages (of activities) and plains (of research) overlap, (based on sources of information available), and ordinary is the situation, when some incremental addition of knowledge of some stage makes to put additional research questions - and these of the twofold character: as “how did the changes in institutional frame reflect on everyday organisation of researchers’ activity, or, conversely, what was it in the (economic, political, social, institutional) environment, that caused them to change their strategy). Nevertheless, the logical narration requires being presented in a coherent sequence of steps in approaching the case:

- studying the environment of where the case we study is to emerge (Pobol, 2004),
- then deepen the sight first till the level of observing the phenomena of RSO birth (Pobol, forthcoming),
- come closer and deeper into the essence of RSO themselves and observe their internal functioning,
- and then extend our understanding of them as a part of a general system by analysing the way they are integrated into the general framework (resource and product flows).

Being so organised, research is to bring us to a deep understanding of the *essence, aim, content* and *forms of appearance/existance* (classifying) of RSO phenomena. Thus, the path of research runs as follows.

First, theoretical and methodological background of research is studied into, with defining the terms, methodology, and profound discourse into theories and previous empirical studies. Further, financial and organisational provision of RSO activity is analysed: framework conditions of scientific and technological sphere in Belarus. From microlevel perspective the organisation of RSO activity, insight into practices and processes is done, considering the problems and barriers, as well as incentives, moving forces, and factors of success. By proceeding the analyses with relationships between the institutions and networks, it becomes possible to estimate the functions this novel for a post-Soviet economy type of innovation activity organisation plays in forming the NSI. Last, the relevant policy implications are discussed into, with special attention paid to cluster and industrial policy, entrepreneurship and education policy, network policy and institutional policy as framework-building one. Realising the complexity and dynamical character of the phenomena studied, suggestions to further research are expected to be made, based on conclusions from my research.

4.2. Intermediate results and corollaries

One of cases to illustrate the intermediate results could be that in identification of reasons for RSO-decision, which helps to make an insight into the correlation of interests, responsible for structuring of the getting formed NIS. This has required putting questions like: who has been an initiator of organisational and economic changes at the parent research institute, initiator of transformations at state laboratories and establishment of Spin-Off firms. Have these transformations been caused by the general strategy of the institute’s management (and the motivations of them are especially important), or rather they have been dictated by state, or evoked by initiative of the scientific workers. Who proved to be most consistent and logical in pursuing their intentions, and following whose goals it did prove to be most effective? To what extent did the success of changes depend on who has been the initiator?

In Europe, two different types of Spin-Off processes are clearly distinguished according to their motivation (Corporate and Research-based Spin-Offs, EU, 2001). While the exploitation of individual knowledge or of a product prevails in an entrepreneurial Spin-Off, strategic restructuring and the provision of cash flow are the main aims of a restructuring-driven Spin-Off. I suppose, that this distinction represents two preconditions of spinning-off: the 'rejection' (tearing away) of new organisational forms from inside, and the external 'call' from the whole system for a new form of innovation activity' organisation, which could meet the emerging requirements. Taking into account the comparative strength of the factors of these two natures, *a posteriori* it will be possible to identify the different key success factors. What distinguishes the Belarusian Spin-Offs, is that their establishment could only become possible due to both reasons' coincidence:

- First, research institutes need some new mechanisms for continuing R&D activities in the economy when being underfinanced (deriving from this is the need for restructuring their activity and the way of managing the research and cooperation).
- Second, the need of advancing the whole structure of the transitive economy, which strives to be knowledge-based, requires that new technologies and science-intensive innovations are introduced in the economy, though there exist only very limited financial ability of the industry to pay for these innovations.

It's my strong opinion that it is the 'socioeconomic event' of Spin-Offs' formation (however surprisingly might it sound), helping to meet these challenges successfully. **Success factors of them**, nevertheless, differ from those characterising the European firms, and constitute the general scheme of organising the innovation process at the Spin-Offs, which at the first approach might be described as follows. Research institutes become the parents for the small-sized firms which can flexibly change their product profile in reaction on market needs, on the one side, and which produce science-intensive innovations with the much lower overhead expenses, hence, prices, than by LPRI, on the other side.

As for the individual decisions about spinning-off (decisions of particular actors to 'follow' the needs and calls of institutions and economic sectors), these need to be described by the whole set of *personal motivations* of decision-makers - from a normal wish of material well-being (a need to find a new sphere of application for their skills and knowledge, where they would be remunerated), ambitions of preserving the managing power (usually the founders of Spin-Offs are the former managers or informal leaders of the state laboratories), up to wish of employing their knowledge and research potential and scientific curiosity (which are very high appreciated among the Spin-Off' researchers). Some supportive and confrontation motivations of the interest groups of parent institutions' management, and relevant politicians', are also studied.

Empirical results about financial and organisational provision of RSO in Belarus are reported in Pobol (forthcoming). Currently, the further study into *contradictions of interests* in RSO's further development and innovation activity organisation in transitive economies is done, which aims at identifying the *failures and lock-ins*, hampering the dynamic process of NIS formation in these countries.

Further intermediate corollaries

"Discursive" comparative analysis of academic spin-off firms with these in European countries is currently carried out in order to understand the ways in which RSO contribute to transformations in the S&T sphere. The following hypotheses of RSO's role in a national system of innovation, which open perspectives for further research, have been the intermediate outcome of my investigations:

- *RSO's shaping of technological profile of NIS;*
- *sub-organising the networks in science and industry;*
- *innovation culture shifts.*

i. RSO's role as shaping of technological profile of NIS

This hypothesis has roots in the concept of „circles on the water“, which is especially important for the transitive economies with very high deterioration rate and outdated level of technologies at most domestic industrial and especially so at agricultural enterprises. As corroborated by my case studies, RSO can break down the *technological lock-ins* in the economy, and cause the *path dependency* in a positive sense by cumulative integration of new technologies and reconstruction of old capacities in neighbouring industries.

RSO in former Soviet Union origin from state laboratories or university departments, which have been the not-one-another-copying elements of one strongly coordinated system of R&D (thus science-intensive innovations), and, obviously, the managers of laboratories have been the only or among the few know-how carriers (have developed technologies by themselves). This has provided the practically oligopolistic position of RSOs in their technological areas. Hence, RSOs, in distinction from other SMEs, have the strong ability to influence on how the technological infrastructure and relations between the industries or between different stages of production process will be shaped (raw materials – customers – R&D collaborators – employment structure – even relations with controlling bodies). As antithesis, this oligopolistic position is very much restricted by shrunk demand, causing RSOs to develop markets instead of exploiting them. Thus, negative externalities get eliminated.

ii. Networking and technological collaboration

This hypothesis is about the **knowledge of contacts**: linking science and industry occurs through joining the two networks of contacts: in scientific community, and in industry. It is the knowledge of who knows the people who know where the technological decision can be developed/would find an application. As noticed, the great deal of RSO's success comes from that the top managers of them just possess the knowledge of who could be a potential client, supplier, and scientific consultant in their area. The well-established earlier contacts with colleagues on scientific activity, with customers and direct users of R&D results of Research-Based Spin-Off firms serve not only for attracting of the best experts for fulfilling the jobs, but also for finding the best organisational and financial schemes of collaboration with other researchers and with customers. Because personal contacts (and personnel mobility) is the channel to transfer the tacit knowledge, RSOs are not just performing the lacking R&D, but involving the actors and organisations from both spheres into continuous R&D process by sharing efforts. This all helps them to suborganise the networks around themselves – it is this way that they also bring the industrials closer to and deeper in research. Simultaneously, this makes them a „local“ phenomena. They are most successive acting at the „acquaintances“ market, especially at the beginning. The informal social relationships, which naturally are restricted to a limited geographic area with a special intensity, constitute the so-called „*internal representation*“, which can develop into a social network, in frames of which the specific innovation culture is cultivated.

iii. Advancing innovation culture

The **third hypothesis** is about *organisational lock-ins* – or about how to teach customers to innovate, and the management of state industrial enterprises to learn. The role of institutional culture of Spin-Off entrepreneurs gains the particular importance in a transitive economy in connection with *specifics of knowledge required* in their activity. Generally in Europe, because corporate-based spin-offs are much more mature as a phenomena than research-based firms, (being estimated for around 13% of new firm formation), and have accumulated an advanced practice of organising the innovation process, their experiences are considered to be a relevant source of market experience for the managers of research-based spin-offs, who, as genuine 'inborn' scientists, often lack knowledge and experience in

commercial affairs. In Belarus, corporate-based spin-offs are trade-oriented rather than research-leaned, and not much 'older' and experienced in innovation than firms being spun-off from research institutes (the legal opportunities for emergence of private enterprises in general as a phenomena in the economy of Belarus arose only few years earlier than for entrepreneurial activity in science sphere). *Bringing up of the private innovating initiative culture thus occurs in way of 'learning-by-doing' in all the transitive economies.*

In all RSO firms, the top management is the main creative and driving force. They develop due to their „scientist-inherent“ curiosity, not the least creative genie, and ‚parent‘ attitude to their innovations: wish to bring their child up, following its fate; to incremental improvements and up-building for sophisticated requirements of the flexible and changing market. Developing the results of fundamental research for the applied needs of industry, Spin-off entrepreneurs make R&D activity their everyday 'routine' – innovating is their corporate culture. As RSOs' managers and most workers origin from scientific circles, their consciousness and institutional culture are scientifically inventive and flexible. RSOs mediate the newest scientific knowledge directly from laboratory to industrials, thus bring up 'scientifically educated' corporate industrial culture, and build their further activity on the *knowledge-grounded feed-back from customers.*

4.3. Outlook for further research

Certainly, the need for more statistical surveys is obvious. Working out of whole national toolbox for raising statistical data and tracing situation with innovations is certainly a task coming out of the framework of a doctoral work, and objectively estimated possibilities of the single researcher; but it doesn't deprive us of right to underline, that very slight advancements have taken place in this domain since country has gained its independence.

But also interesting are the qualitative studies, even these of interdisciplinary character. Some reflections on these issues, which are planned to be reviewed deeper, are as follows. On the one side, origin from scientific circles of innovative firms' managers and most workers will contribute to the continued, successive process of knowledge creation and dissemination in the economy with a transforming institutional framework of technological development, while being underpinned by the scientific consciousness and institutional culture. On the other side, institutional changes in innovation activity organisation, changed roles and functions cause the challenge to innovators' traditional beliefs and attitudes. I wonder, and it is of a scientific and political importance to find it out, what they are, in order to look deeper into the national innovation culture, its specifics, and possibly lacking capacities.

References

- Alic, J. (1992). *Beyond spin-off*. Harvard Business School Press.
- BMBF (2002). *Spin-off Gründungen aus der öffentlichen Forschung in Deutschland*. Zentrum für Europäisirtschaftsforschungen (ZEW), Bundesministerium für Bildung und Forschung (BMBF), Bonn.
- CIPIN (1996). *Development of Science and Technological Potential In Ukraine and Abroad*. Collected volume of analytical materials. Issue 2 (10). Center for Research of Scientific and Technological Potential and History of Science after G.M. Dobrov, National Academy of Sciences of Ukraine. Kyiv.
- Corporate and Research-based Spin-Offs: Drivers for Knowledge-Based Innovation and Entrepreneurship* (2001). Proceedings of the Expert Workshop held in Brussels, 18 January. European Commission.
- Der Kompass für Innovationen (2003). In: *EXIST-news. Existenzgründungen aus Hochschulen*. Bundesministerium für Bildung und Forschung (BMBF), Juni-August (02).
- Development of Science in Belarus in 2001* (2002). (Analytical report). Eds.: Rusecki A.M. and Miasnikovitsch M.V. Committee for Science and Technology. Minsk, BellISA.
- Development of Science in Belarus in 2002* (2003). (Analytical report). Ivanov, V.F.,Artiuhin, M.I., Grigianets, R.B., Jenin, S.V., Karelina, V.A., Korshunov, A.I., Kostjukovitch, N.I., Meerovskaja, E.D., Slonimski, A.A., Hartonik, I.A. Committee for Science and Technology. Minsk, BellISA.
- Dyer, G., Wilkins, A. (1991). Better Stories, Not Better Constructs, To Generate Better Theory: A Rejoinder to Eisenhardt. In: *Academy of Management Review*, no. 16 (3), 613-619.
- Eisenhardt, K. (1989). Building Theory From Case Studies. In: *Academy of Management Review*, no. 14 (4), 532-550.
- Gemünden, H.-G., Salomo, S., Weise, J., Talke, K., Trommsdorff, V. (2003). *Erfolgorientierte Steuerung von Innovationsprojekten*. *InnovationsKompass*. TU Berlin.
- Gordienko, A. I., Pobol, A.I., Pobol, I.L. (2002). "Spin-off Firms Around the Academic Institute as a Form of Innovation Networks Development in Belarus". In: *Actual Issues of Innovation Activity Development*. VII International Scientific and Practical Conf., Alushta, Ukraine, 16-21 Sept., pp.185-192.
- Lundvall, B.-Å., Johnson, B., Andersen, S.E., Dalum, B. (2002). National Systems of Production, Innovation and Competence Building. In: *Research Policy*. Vol. 31, Elsevier Science.
- Müller, Th. (2000). *Erfolgsfaktoren teambasierter Unternehmensgründungen*. Fragebogen IBU. Karlsruhe.
- National innovation system of Russia and major directions of its development. (2003). Normative document. In: *Innovatica*, 24 November. Available at: <http://kicbi.karelia.ru/innovation/info.phtml?from=0&id=33>
- Nelson, R.R. and Nelson, K. (2002). Technology, Institutions, and Innovation Systems. In: *Research Policy*. Vol.31, Elsevier Science.
- Neshitov, Yur. (1999). Spin-off – a process of new firms creation. In: *International innovation activity*. № 9-10.
- Nesvetailov, G. (1999). Survival of Science and Technology in Belarus. In: *Reconstruction or Destruction? Science and Technology at Stake in Transition Economies*. Claes Brundenuis, Bo Göransson, Prasada Reddy. Universities Press (India).
- Niosi, J. (2002). National Systems of Innovation Are x-Efficient (And x-Effective). In: *Research Policy*. Vol. 31, Elsevier Science.
- Novikova, I.V. (1996). *System Methodology in Economic Research*. Minsk, "Economic Technologies"
- Pobol, A.I. (2004). Development of Scientific and Technological System in Belarus. In: *Supporting the Development of R&D and the Innovation Potential of Post-Socialist Countries*. Ed.: Walter L.Filho. IOS Press.

- Pobol, A.I. Financial and Organisational Provision of Innovation Activity at Research-Based Spin-off Firms in a Transitive Economy of Belarus. In: *R&D Priorities in Innovation Policy and Financing in Former Socialist countries*. Ed.: Walter L.Filho. IOS Press. Forthcoming.
- Poisk-NN* (2000). Monthly regional attachment to newspaper of the scientific society „POISK“. Department of education and science at Administration of Nizhegorodskaja district, State educational establishment “The Nizhegorodski scientific and Information Center”. № 8. 18 May
- Radosevic, S. and Gristock, J. (2003). *Achieving Growth in a Wider Europe: Understanding the Emergence of Industrial Networks*. Summary of the ESRC project “The emerging industrial architecture of the wider Europe”. Seville-Sussex-London: UCL, ESRC, SEI, SPRU.
- Ragin Ch. C., Becker, H. S. (1992). *What is a case? Exploring the Foundations of Social Inquiry*. Cambridge University Press.
- Ritter, Th. (1998). *Netzwerkkompetenz und Technologiennetze*. Interviewleitfaden. Institut für angewandte Betriebswirtschaftslehre und Unternehmensführung. Universität Karlsruhe (TH).
- Science of the Republic of Belarus 2001* (2002). Statistics collection. V.N. Tamashevich (Ed.). Committee on Science and Technologies and Department of Statistics and Analyses, Minsk.
- Slonimski, A.A., Meerovskaja, O.A., Pobol, A.I. (2003). Formation of National Innovation System of Belarus and Prospects of Integration Into the World Scientific and Technological Framework. In: *Formation of Inter-State Innovation Systems*. Eds.: Dynkin A.A. and Ivanova N.I. Moscow: IMEMO RAN.
- Smallbone D., Welter F., Egorov I., Slonimski A. (2002). *Innovations, Small and Medium Enterprises and Economic Development in Ukraine and Belarus: A Position Paper*. / Ed.: Rheinisch-Westfaelisches Institut fuer Wirtschaftsforschung. – Essen: RWI.
- SMEs and economic development in Ukraine and Belarus*. (1999). INTAS Project 99-00943.
- Svanfeldt, Ch., Ullstroem, J. (2001). Firm Demography: Mapping Firm Dynamics by Human Resources Data. In: *Innovation and Enterprise Creation: Statistics and Indicators. Proceedings of the conference held at Sophia Antipolis, 23 and 24 November 2000*. Contract No: INNO-146. Edited by Technopolis: Ben Thuriaux, Erik Arnold, Célia Couchot. Directorate-General for Enterprise. EUR 17038. Luxembourg: Office for Official Publications of the European Communities.
- Technopolis: *Innovation and enterprise creation: Statistics and indicators*. (2001). Proceedings of the conference held at Sophia Antipolis, 23 and 24 November 2000, Contract No: INNO-146. Eds.: Ben Thuriaux, Erik Arnold, Célia Couchot. Technopolis. European Commission.
- BEGiN. Brandenburger ExistenzGründer im Netzwerk. <http://www.begin-brandenburg.de>
- <http://olegevs.narod.ru/gloss/2.htm>
- <http://www.icm.by>
- Isis Innovation Limited Ewert House, <http://www.isis-innovation.com>

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