

INNOVATION MANAGEMENT IN RUSSIAN UNIVERSITIES

(THEORY AND METHODOLOGY).

Nina Kazakova

Professor, department “Economics and Management in Construction”, Saratov State Technical University, Russia, 410054, Saratov, Politechnicheskaya Street, 77.

e-mail: nina@sstu.saratov.su , NinaKazakova@yandex.ru

Introduction

The beginning of the third millennium has confirmed the fact that science and technical progress have turned into a main source of economic growth. Permanent innovation activity has become a basis of modern economic progress. Technological, economic and social changes have been accelerating and obviously leading to emerging new type of economic development in advanced industrialized countries. Given new type is based on scientific and technological achievements that quickly materialized in new products and technologies and transform society life in whole. Of course, on this stage the role of new knowledge producers has been increasing. Universities are historically regarded as knowledge producers and distributors.

In western countries, since the beginning of the 19th century universities have been being not only educational but also research organizations in which big part of R&D is concentrated. In post-socialist countries the different system of science organization were performed which included university, academic and industrial sectors of science. However, nowadays when two latter sectors are in deep crisis the role of universities in retention of Russian scientific potential and production of new knowledge for industry is becoming especially essential.

Under current circumstances it is very important to take into account as Russian historical and contemporary specifics as rich experience of other countries and theoretical interpretation of this experience by western scholars.

Objective of this research is to analyze the transformation of Russian technical universities into innovation actors and their innovation management system at the period of knowledge-based economy (KBE) formation. This analysis is very important for Russian higher education when, on the one hand, world economy has been moving to KBE, on the other hand, the socio-economic crisis have had very strong impact on Russian higher education.

When the problems of higher education system have been actively discussed in Russian society the common idea is that the main reason of its transformation is deep socio-economic crisis in Russia. However, the basic premise of my work is that the transformation of Russian universities is determined, above all, by world-wide movement to KBE. In these circumstances, abovementioned process can be considered as a part of general process of changing universities' role in modern society, which is connected closely with changing knowledge role in post-industrialist economy.

1. Modern society and role of knowledge

The point about increasing role of science and university in modern society is argued by many authors, both scholars and policymakers. Nowadays it is not questionable that role of science and university has been changing last decades. However, before discussing this problem in details as a first step seems to be needed attempting to make clearer what is modern society as university's environment.

The transformation of university role in the modern society is determined by changing its environment, above all, by rising role and significance of knowledge, information and science. The

character of social development in industrialized countries on recent decades allows supposing about emerging new type of human history. One is named as “information society”, “post-industrial society”, “knowledge-based economy (society)”, “learning society” etc. Each of these definitions reflects some aspects of contemporary development but hitherto there is no common exhaustive definition what is modern society. As K.Smith points out “knowledge-based society” is at best a widely used metaphor, rather than a clear concept¹.

As a major point of this paper is role of university in innovations. It seems to organize this theme issue in terms of “knowledge-based society”. This approach allows demonstrating the transformation of university role in processes of knowledge generation, production, diffusion and utilization.

The common place is nowadays most developed countries are moving towards “knowledge-based society”, in which the role and significance of knowledge as an input and output in economic processes has fundamentally changed. There are seemed to be some basic views about the changed significance of knowledge²:

knowledge is quantitatively and in some sense qualitatively more important than before as an input, as factor of production like labour and capital;

there is a view that now codified knowledge is more significant as a component of economically-relevant knowledge bases. Knowledge is as a basis for the organization and conduct of economic activities;

finally, the knowledge-based society rests on ICT, which changes both physical and financial constraints in the collection and dissemination of information. The complex of ICT industries is rising fastest with the move to knowledge-based society.

The role of knowledge, especially scientific knowledge, in social development was analyzed by many scholars – for example, by J.Bernal, M.Castells, P.Drucker, Nonaka and Takeuchi and others. All scholars conclude that the role of science and knowledge in economy has been qualitatively changing from 18 century and this process has been continuing and accelerating. As P.Drucker pointed out, during pre-industrial era the knowledge was considered in terms of *thinking*. But from 18 century the knowledge became to be considered in terms of *activity*³. He connects this process not only with science and production development but with raising codification of the knowledge – the codification of implicit skills and practices in formalized technologies that allowed expanding their using in production. During 18-21 centuries, as Drucker described, the knowledge as instrument has been consistently applied to the process of production of goods, services and technologies (first and second industrial revolutions), to the process of labour (F.Taylor’s system and other management theories), and to the process of knowledge production (ICT using above all).

The evolution of knowledge role in historical retrospective is showed in table 1.

As a result of all above mentioned, OECD has spoken about modern economy as moving to knowledge-based economy which is directly based on the production, distribution and use of knowledge and information⁴.

¹ K.Smith. What is the “knowledge-based economy”? Knowledge-intensive industries and distributed knowledge bases. DRUID Summer Conference on The Learning Economy – Firms, Regions and Nation Specific Institutions. June 15-17 2000. P.3.

² Op.cit., p. 4.

³ Drucker, P. Post-Capitalist Society. N.-Y. 1995.

⁴ OECD, 1996.

Table 1. **Evolution of knowledge role in historical retrospective**

| <i>Period</i> | <i>Role of knowledge</i> | <i>Level and tools of codification of knowledge</i> |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Antiquity– XVIII century (pre-industrial era) | Knowledge as codified (science) and non-codified. Scientific knowledge as only thinking about human and nature. Non-codified knowledge as skills and competencies how to work (<i>techne</i>). | Transfer of codified knowledge was carried out by writing and book printing. Skills and competencies were non-documented; transfer of non-codified knowledge was carried out only by direct communications with its owners (learning-by-interacting, learning-by-doing, learning-in-production). |
| XVIII – beginning of XX c. (early stage of industrial society) | First and second industrial revolutions, applying the knowledge to production process. | Gradual transformation of non-codified knowledge into codified one through technical schools, textbooks, encyclopedias. Emergence of applied science, institutes, technical faculties in universities, engineer associations. |
| 1 st half of XX century (industrial society) | Management revolution, taylorism, applying the knowledge to labour process, increasing productivity as a result. | Continuing the previous trends, reorganization of specialized and technical education, that is more active transformation of non-codified knowledge into codified one. |
| 2 nd half of XX century (post-industrial society) | Applying the knowledge to process of knowledge production, diffusion and implementation. Development of ICT sectors and resource-saving technologies, changes in management paradigm as a result. | Development of electronic tools of codification, analyze and transfer of knowledge – computers, computer systems and languages, telecommunications, data bases. |

2. Changing role of university in modern society

Historically universities were created as custodians, mediators and generators of knowledge. From the very originating the main goal of university has been being the professional training of people on the base of accumulation, development and dissemination of knowledge and cultural values. This role of university is realized through their following functions:

- 1) *educational* function – training / retraining of highly-qualified specialists;
- 2) *research* function – generation of new knowledge and development of existing one. We suppose this function can be consisting of two sub-functions: cognitive research function as “knowledge for own sake” (basic research) and applied research function as knowledge for solving real problems of industry and society;
- 3) function of *dissemination of knowledge* within society. At present time the forms of this process have been changing so as knowledge has been transforming into important economic resource. Historically universities were performing disclosed dissemination of knowledge through teaching and exchange of research results (publications, conferences etc.). Now a lot of R&D results are having real market value and disseminating by commercialization (patenting, licensing etc.);
- 4) function of *preservation and transfer* of accumulated scientific knowledge and cultural legacy.

During the history of modern civilization the numbered functions of university has been changing and developing in accordance with society and science development and different types of universities have emerged in result. The evolution of university is shown on fig.1.

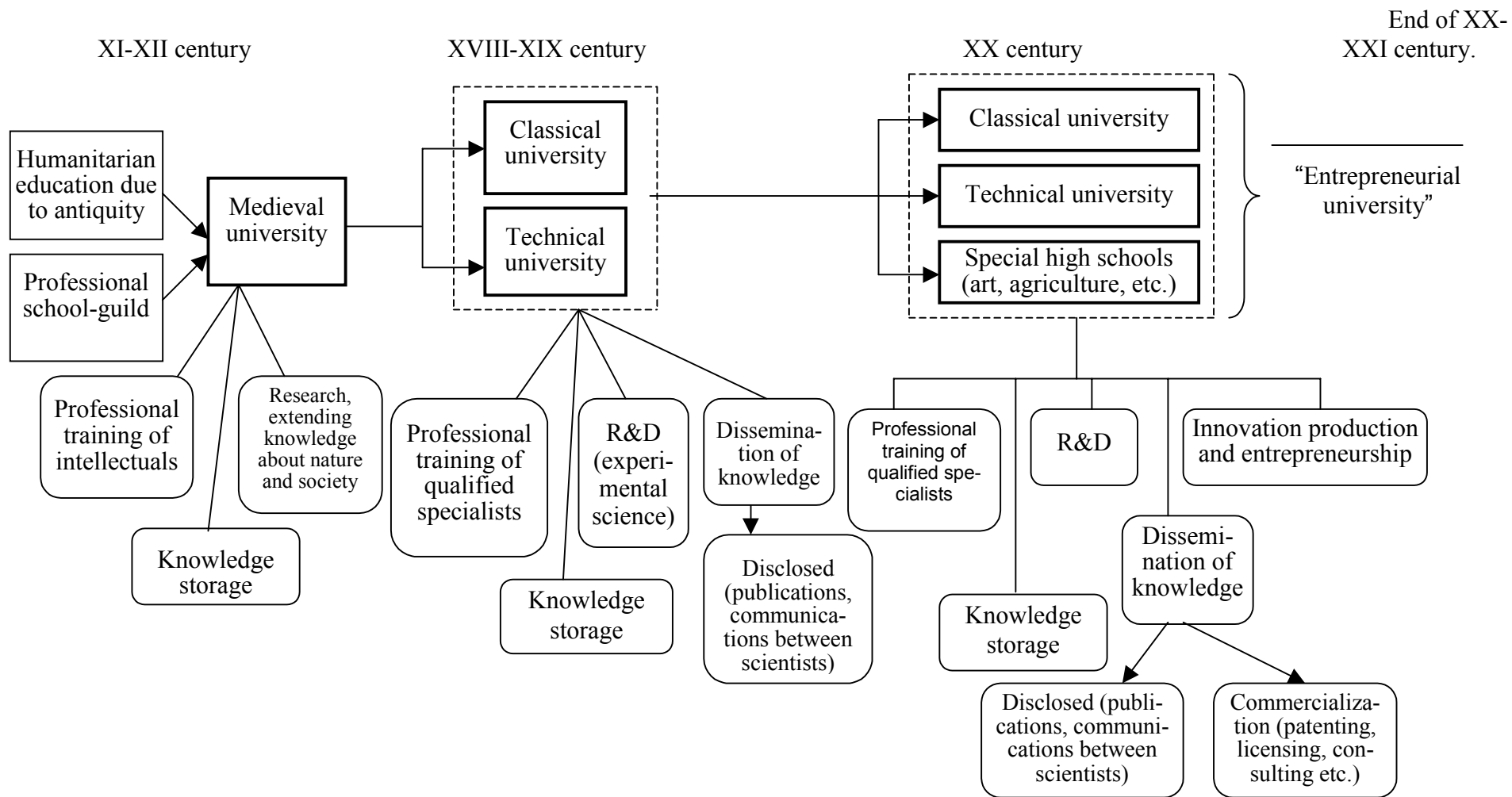


Figure.1. Evolution of types and functions of universities

The functions of university determine its position and role in the society and in the processes of knowledge production, diffusion and application. In these processes the role of university can be noticed as very important (Fig.2).

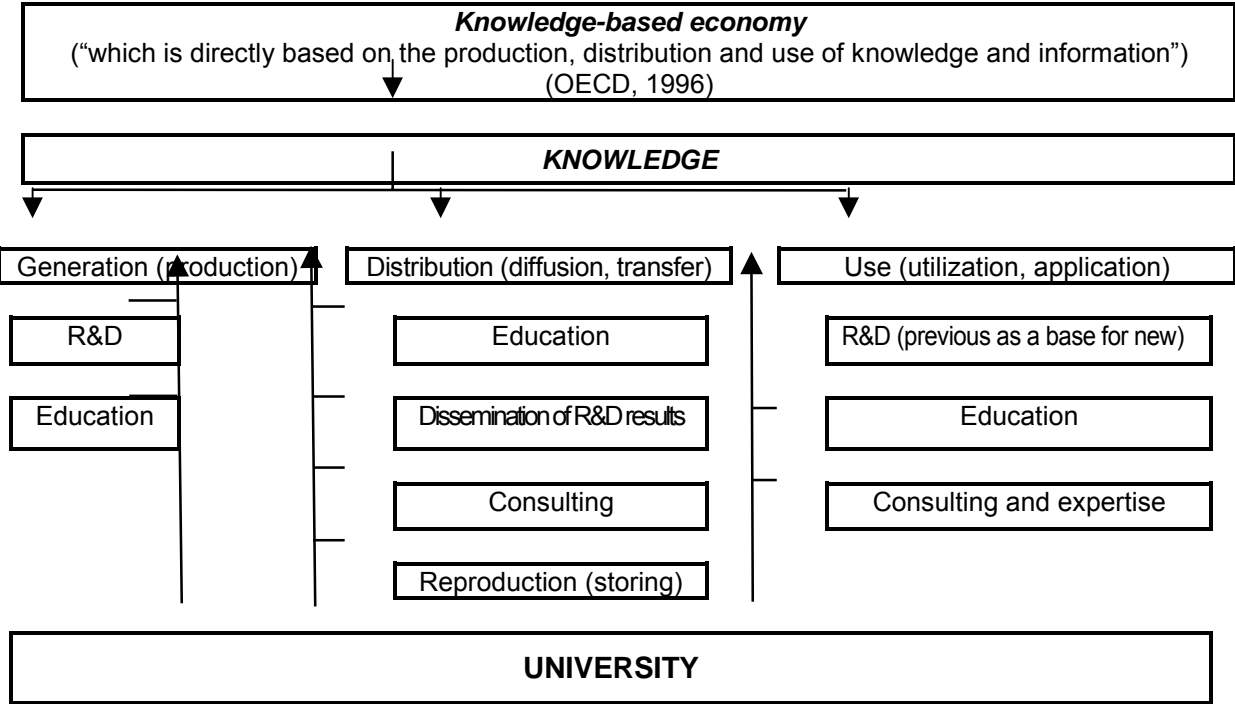


Figure 2. Position of University in modern society

Firstly, university is one of the major actors in the knowledge generation and production since a big part of R&D is concentrated in ones. This is shaped since the beginning of the 19th century when Wilhelm von Humboldt conceived the “unity of teaching and research” as the centerpiece of his new idea of a university. Here possible to note (as preliminary) if before universities were concentrated on fundamental research only, in XX century they carry out applied research and even constructing development very actively (especially technical universities). Nowadays the balance between teaching and research at universities is an actual question although it is outside of my focus here.

Further university plays one of the most important roles in diffusion of knowledge produced. Above all this is fulfilled through education, training of high-skilled specialists. This activity has becoming more and more important in knowledge-based society so as knowledge progress has been speeding up and accumulated knowledge are becoming obsolete faster than before. Then, universities distribute knowledge also through dissemination of R&D results. In accordance with different character of R&D processes and results – basic R&D and applied R&D – their dissemination is carried out with two main forms: disclosed one of fundamental R&D results – conferences, publications etc., - and closed, commercialized dissemination of applied R&D results by technological transfer, patenting, licensing etc. In some universities latter form of dissemination are becoming to prevail as a result of reinforcing university contribution to industry development.

University consulting activity also has own place in development of modern society’s knowledge base. However, the indisputable advantage of universities is their capacity to store and reproduce information accumulated for long decades. Libraries of big oldest universities are the real treasuries of human knowledge.

Finally, universities are using produced and accumulated knowledge very actively. Specific of this process is universities are both producers and consumers of knowledge including their own R&D results. Results of previous R&D are used as a base for new investigations. This occurs also within teaching process – university teachers being simultaneously as researches use their R&D results to improve their teaching courses. Carrying out consulting and expertise, scientists use existing knowledge to solve clients’ problems and transfer this knowledge to clients.

Thus, the role of universities as producers, distributors, custodians and users of knowledge and information is very important in knowledge-based economy in spite of activity of new actors on information and knowledge market. Universities have their own niche on this market.

University is complex complicated phenomena integrating many activities and existing within certain environment. Taking this into account, it is possible to recognize some factors which are influencing on university behavior and activity: a) basic character of knowledge production (here necessary to distinct the specific nature of knowledge production in academy and in industry); b) social-economic context; c) global context (these factors are represented on fig. 3.)

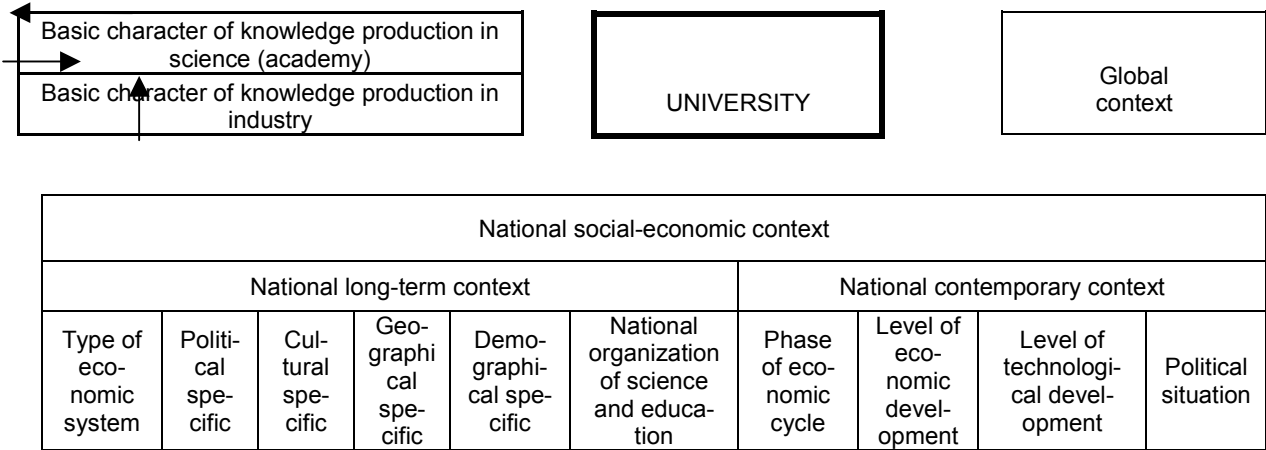


Figure 3. Factors influencing on university

Each of numbered factors has own specific. If to start from knowledge production, on certain stage of human development science and industrial production have become to be appeared as different types of human activity and distinctions between knowledge productions in these fields have become to be explicit (table 2). H.Schuetze has identified these distinctions as industry motivation and demand for university-industry collaboration (H.Schuetze, in: *Knowledge management in the learning society*, OECD, 2000). But it can be true just for market economy: history shows this specific exists under any type of economy (including command one) but it not always raise the demand for university-industry collaboration.

Table 2. Industry motivation and demand for university-industry collaboration

| Industry | Academy |
|---------------------------------------|--------------------------------|
| Realization of Economic Value | Creation of intellectual value |
| Industrial Applicability | Scientific Credibility |
| Consumer oriented | Mission oriented |
| Inductive or synthetic | Deductive or analytic |
| Problem-oriented (trans-disciplinary) | Disciplinary |
| Telesis (goal-orientation) | Serendipitous/curiosity driven |
| Commitment to schedules | No time constraints |
| Private good (proprietary) | Public good |
| Source: Schuetze (OECD, 2000) | |

Thus, demand for academy-industry collaboration due to different nature of these two systems. However, these systems are existing in concrete national and nowadays in global socio-economic context, which has a strong impact on their development and interactions.

National context has an especial importance for university innovation activity. Experience of big number of countries demonstrates undoubted dependence of innovation activity on national and even regional environment. But within national context there are forces related to given country during all its history (at least during long period) and also there are factors those act under certain circumstances within concrete time frames only.

This taxonomy is important especially for transitive economies so as transitive economy is special stage of development, controversial combination including old elements of former economic system, new elements of emerging new system and intermediate forms. In this situation the important task of policy-makers and all economic actors is to eliminate old vestiges, to stimulate new structures and to select all useful from transitive forms.

Thus, national context is as long-term and short-term (contemporary) one. The long-term context includes characteristics as following:

- Type of economic system – determines the stimuli and mechanisms of economic activity of industry and universities.
- Political specific (type of political system in whole) – especially important for Russia so as typical feature of Russian history is “politics above economy”. However, western researchers admit, “it is clear the economy is not independent on politics” (B.Vavakova and D.Wolfe, 1999).
- Cultural specific – very important for any country so as traditions, mentality, and behavior models determines an economic activity in a big extent⁵.
- Geographical specific – has an impact for countries having extreme climate, like Russia, African countries.
- Demographical specific – birth decreasing in western countries reduce demand for higher education.
- National organization of science and education – affects rules and structures of innovation activity.

All numbered factors have a strong impact on the university last decades when radical socio-economic and technological changes have been having place. In many countries these changes are as following:

- the growing role of knowledge and information in socio-economic development when knowledge has been becoming one of major factors of economic wealth and competitiveness;
- the changes on labour market due to previous factor: new knowledge-intensive technologies require new high-skilled workers that causes mass demand on professional higher education;
- increasing pressure on universities to meet societal needs more particularly the needs of industry and government;
- globalization of world economy.

The result of these changes is revising of universities’ goals and tasks and implementing new activities. Analyzing the situation in higher education demonstrates the main strands of university transformation:

- reforms in education system and education policy;

⁵ For example, as Max Weber’s works prove, classical western model of market economy was generated above all by protestant ethics.

- changing the strategy and organizing R&D;
- changing in universities' funding;
- radical shift in university-industry linkages;
- changing university internal environment, above all structures and management, as a result of abovementioned factors.

Summing up the consequences of numbered changes, it possible to conclude that:

- education system and education policy have been becoming more oriented to different teaching techniques and forms of education (continuous and long-life learning, retraining);
- R&D projects, including university R&D, have been being performing increasingly through multidisciplinary, multidimensional, inter-organizational and global structures and networks;
- recent years new channels of universities' funding have emerged, commercialization of R&D results have been being broadening;
- various forms of university-industry cooperation have been being developed very actively (R&D consortia, joint enterprises, contract R&D, technoparks, networks ...);
- structures and management of universities became more flexible and diversified.

Changes described above have led to that over past decades universities (especially technical ones) have become not only education and research centers but real innovation agents which produce new knowledge and convert it into new products, technologies, start-ups, networks, consulting services.

3. The theories of university role

Existing theories of knowledge-based economy point out their real position in one form or another. Relevant this theme issue theories of knowledge production can be classified conventionally into two main strands – those that argue there has been a shift in knowledge production to more university contribution to industry and social needs, and those that portray a necessity of changing “Mode 1” and “social contract” between academic researchers and state.

We look briefly these theories in respect of their main points to make clearer changing both in real university activity in modern life and in its theoretical interpretation. (These theories are represented schematically in table 3.)

Mode 1 involves new knowledge being produced primarily within individual disciplines, mainly in universities and other academic institutes. Its driven force is academic community, knowledge production is organized through separate disciplines within hierarchical stable academic structures where individual intellectual work is prevailing. The main stimulus of development is search of new knowledge that is knowledge for “its own sake” (B.Martin and H.Etzkowitz, 2000). Of course, commercialization of research results isn't supposed, publications of results are disclosed, priority of discovery is very important for researcher's reputation. There is little direct connection to societal needs and the results of research are transferred at the end of project to users. Under such conditions main instrument of achieving research work quality is internal consistency and peer review and this mode can be applicable in sphere of scientific knowledge production – at universities, basic research institutes and laboratories. The precondition of emergence of this model is parallel development of science and material production before industrial revolution. Although there are different opinions whether Mode 1 exists in real life or it is to some extent scientific abstract model (for example, H.Etzkowitz, 2000; K.Smith, 2000).

By contrast, Mode 2 (Gibbons et al. 1994) generally involved multidisciplinary or transdisciplinary research carried out in a growing variety of institutions (not just universities or academic research institutions) and with a blurring of the boundaries between the traditional sectors (industry, university etc.) Knowledge is increasingly being produced “in the context of application” - in other words, with societal needs having a direct influence from an early stage and with rela-

tively explicit social accountability for the funding that is received by researchers from government.

Table 3. Theories of university role

| | Mode 1 | Mode 2 | Triple Helix | Social contract |
|---------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <i>Actors</i> | Academy (university) | Academy and practitioners | University, industry, government | University, government |
| <i>Driving forces</i> | Academic community driven | Practice driven | Social needs | State needs |
| <i>Focus</i> | Disciplinary focus | Transdisciplinary | Interdisciplinary | Mostly disciplinary |
| <i>Organizational structures</i> | Hierarchical, stable knowledge structures | Heterarchical and transient structures | Flexible, transmitting structure, networks, feedback, recursive effects | Usually stable academic structures |
| <i>Instruments (methods) of achieving quality</i> | Quality through internal consistency and peer review | Appeal to temporary and heterogeneous set of practitioners in specific context | Quality through alliances between scientists, practitioners and officials | Quality through peer review and social assessment |
| <i>Work organization</i> | Individual research work | Team work, group creativity, actors' networks | Networks of actors involved | Individual/group research work |
| <i>Sphere of application (action)</i> | Science sector - universities, research institutes & laboratories | Applied research institutions, government laboratories, universities (especially technical) | Universities, public (official, government) bodies, R&D institutions, industry, business | Universities, R&D institutions, government programs |
| <i>Commercialization of results</i> | No, disclosed knowledge, priority of discovery | Closed knowledge, commercialization of results | Commercialization or public program funding | Depends on situation |
| <i>Preconditions of emergence</i> | Separate parallel development of science and industry | Emergence of knowledge-based industries | Increasing pressure of social needs (above all industry), growing demand on mass higher education, increasing competition within education services market. | State needs |
| <i>Stimuli of development</i> | New knowledge search | Demand from practice (needs of application) | Pressure of social needs, lack of university funding | Political needs |

Such type of knowledge can not be produced only within old stable hierarchical academic structures through individual research work. That's why these structures are replaced by heterarchical and transient ones with emphasis on team work, group creativity and networks of temporary sets of practitioners and researchers. So as R&D is demanded from practice their results are supposed to be commercialized that excluded openness of new knowledge.

In its strongest form, Gibbons and his co-authors insist that

We are now seeing fundamental changes in the ways in which scientific, social and cultural knowledge is produced. ... This trend marks a distinct shift towards a new model of knowledge production, which is replacing or reforming established institutions, disciplines, practices and policies. (Gibbons et al. 1994).

However, as noted above, there is a doubt how much is Mode 2 really new. Another question is in the end of XX c the radical shift to Mode 2 has been realizing in many countries.

Perhaps, the newest and most arguable among scrutinized models of knowledge production is the Triple Helix model (H.Etzkowitz et al.). This model develops hypothesis of “third mission of university” which due to societal needs of knowledge-based society, at first, and lack public funding universities, at second (although in fact the latter is the former). This theory supposes the transformation of traditional university into “entrepreneurial university”. The university appears to be arriving at a common entrepreneurial format in the late 20th century. The entrepreneurial university encompasses a ‘third-mission’ of economic development in addition to research and teaching, though the precise shape this takes might vary such that different scenarios of academic development can be projected.

Some authors argue that this shift arises from both the internal development of the university and external influences on academic structures associated with the emergence of ‘knowledge-based’ innovation. Entrepreneurial activities are undertaken with the objective of improving regional or national economic performance as well as the university’s financial advantage and that of its faculty.

One model through which we can interpret these changes is that of the “triple-helix” (Etzkowitz and Leydesdorff, 1999). The triple helix model attempts to account for a new configuration of institutional forces emerging within innovation systems. As knowledge becomes an increasingly important part of innovation, the university as a knowledge-producing and disseminating institution plays a larger role in industrial innovation. In a knowledge-based economy, the university becomes a key element of the innovation system both as human capital provider and seedbed of new firms. Three institutional spheres (public, private and academic), that formerly operated at arms length in laissez faire societies, are increasingly interwoven with a spiral pattern of linkages emerging at various stages of the innovation and industrial policy-making processes.

There are four processes related to major changes in the production, exchange and use of knowledge, which the triple helix model has identified.

The *first* is internal transformation in each of the helices, such as the development of lateral ties among companies through strategic alliances or an assumption of an economic development mission by universities. Traditional academic tasks are redefined and expanded, according to the requirements of newly emerging functions.

Corollary of these processes is revision of existing tasks. Traditional functions and roles are re-interpreted and expanded in the light of new goals. For example, professors may identify opportunities for students to serve as interns in firms where their temporary apprentice role transcends the original educational intention.

As the university enlarges its role in innovation, controversies arise such as the propriety of the extension of the academic mission from dissemination to the capitalization of knowledge. Proponents and opponents of change debate these issues publicly and in governance structures within academia. Out of such controversies new rules and roles are defined and legitimated. Over time, the university reformulates its mission to incorporate the entrepreneurial paradigm.

The *second* is the influence of one institutional sphere upon another in bringing about transformation. For example government, in Sweden and the US, respectively, revising rules of intellectual property ownership to transfer rights from individuals or government to the universities.

The industrial and governmental spheres increasingly also develop similar intermediary capabilities. Thus, the imbalance between organizations and institutions that have such capabilities and those that lack them are redressed. A new equilibrium of overlapping institutional spheres is established in which collaborations and rules for interaction are more easily understood and negotiated.

Corollary is stabilization. Formats for collaborative arrangements are institutionalized in legal and customary formats, e.g., the US Co-operative Research and Development Agreement (CRADA). Such contracts take a flexible form of finalized projects or networks with a fixed time frame and external as well as organizational funding.

The *third* is the creation of a new overlay of trilateral linkages, networks, and organizations among the three helices, serving to institutionalize and reproduce interface as well as stimulate organizational creativity and regional cohesiveness. Groups such as the Knowledge Circle in Amsterdam, the New York Academy of Sciences and Joint Venture Silicon Valley encourage interaction among members of the three spheres, leading to new ideas and joint projects that might not otherwise have emerged from interaction within single spheres or from bilateral relations. The entrepreneurial university requires an enhanced capability for intelligence, monitoring and negotiation with other institutional spheres, especially industry and government.

Corollary is centralization/decentralization. Over time, as the entrepreneurial paradigm takes hold, interface capabilities spread throughout the university. Within academic departments and centers, faculty members and other technical personnel are assigned special responsibility to assess the commercial salience of research findings and encourage interaction with external partners. Centralized interface capabilities (e.g., technology transfer or university spin-off offices) play a leading role during the early stages of the introduction of an entrepreneurial paradigm into academia but their role declines as it becomes institutionalized.

A *fourth* process is the recursive effect of these inter-institutional networks representing academia, industry and government both on their originating spheres and the larger society.

Beyond establishing links with existing organizations, the university as entrepreneur also develops capabilities to assist the creation of new organizations. This may take various forms such as formation of firms based upon academic research, and leadership in forming regional organizations, bringing the various institutional spheres together for the common purpose of fostering innovation.

Corollary is trilateral organizations. The existence of capacities for interface in various organizations increases the likelihood of collaboration in creating new cross-organizational and cross-institutional entities such as centers including investigators from several universities or from universities, companies and government laboratories. Joint ventures among companies provide a related instance emanating from the industrial sphere.

The main idea of Etzkowitz et al. that Triple Helix theory states the university can play an enhanced role in technological innovations in increasingly knowledge-based societies. This thesis can be concurred so as, in Triple Helix interpretation of university-industry-government linkages, reinforcing relations rises reinforcing interdependence between actors including industry dependence on university R&D results. From only pragmatic viewpoint the strength of Triple Helix model is close universities' links with industry assist to universities to be more independent on government financing.

However, one of the weaknesses of the Triple Helix model is related to the fact that some basic researches have not direct industrial application in the short run. Also, these basic researches are off the frames of this model and not considered into account. This problem can be solved the better way with nether Mode 1 or so-called "social contract".

Social contract as a kind of model of knowledge production is most known as a famous Vannevar Bush's formulation in his report *Science, The Endless Frontier* (1945):

Government promises to fund the basic science that peer reviewers find most worthy of support, and scientists promise that the research will be performed well and honestly and will provide a steady stream of discoveries that can be translated into new products, medicines, or weapons.

This model of knowledge production supposes a kind of innovation process' linear model like Mode 1. It can to say in post-war period so-called "old social contract" have solved the main task to provide rapid scientific and technological progress of developed countries, above all USA. But nowadays this theory is in some extent not less disputable as Triple Helix (D.Guston and K.Keniston, 1994; B.Vavakova, 1998; J.Duderstadt, 1999; R.Florida, 1999; D.Guston, 2000;

R.Frodeman and C.Mitcham, 2000). The majority of discussants agree with idea that old social contract should be revised in accordance with changed socio-economic environment. The question is: how should it be done? Some of authors stand an idea to tie public research more closely to industrial needs and to decrease public funding. There are who believe reinforcing university-industry linkages will lead to restriction of R&D results' openness and availability of knowledge as public good that will have a negative impact on society. One way or another, but nowadays the question of new social contract is opened.

Previous theories' description explicitly performs two quite distinct approaches of the nature and purpose of the university. According to the first (Mode 1 and to some extent social contract) the purpose of the university is education and knowledge "for its own sake" with disclosed dissemination further. This approach is also known as "ivory tower" concept. Set against (Mode 2 and Triple Helix) is the instrumental or utilitarian ethos according to which the role of university is to create and disseminate useful knowledge and to train students with skills useful to society. These two approaches may be seen as attempting to reduce "a fundamental tension between the pursuit of eminence and the need for financial resources" (R.Florida, 2000) which is inherent for university activity in market environment.

4. The specifics of Russian universities

Russian higher education system is alike Western one but it has essential differences that affect entire process of universities functioning.

Above all, higher education institutes similar European classical type had arisen in Russia much later than in Western Europe. First universities were established in Europe in XII-XIII centuries, in Russia – in XVIII-XIX centuries. Although before there were other types of high schools (for example, academies) in Russian cities.

Moreover, although governments and Church had a strong impact in European universities but they were originally autonomous and self-managed institutions. Besides external autonomy there is big internal autonomy of departments and chairs, participation of professors and teachers in decision-making process. In Russia universities have been state universities from the very originating; the government financed and regulated them. As a result, autonomy of Russian universities was and remains much lower, their environment is more regulated and bureaucratic, internal autonomy is much lower also: powers in decision-making mostly belong to university authorities. The specifics of Russian universities as compared with Western ones due to noticed factors, and that have a strong impact in Russian universities' activity in whole, including innovation activity.

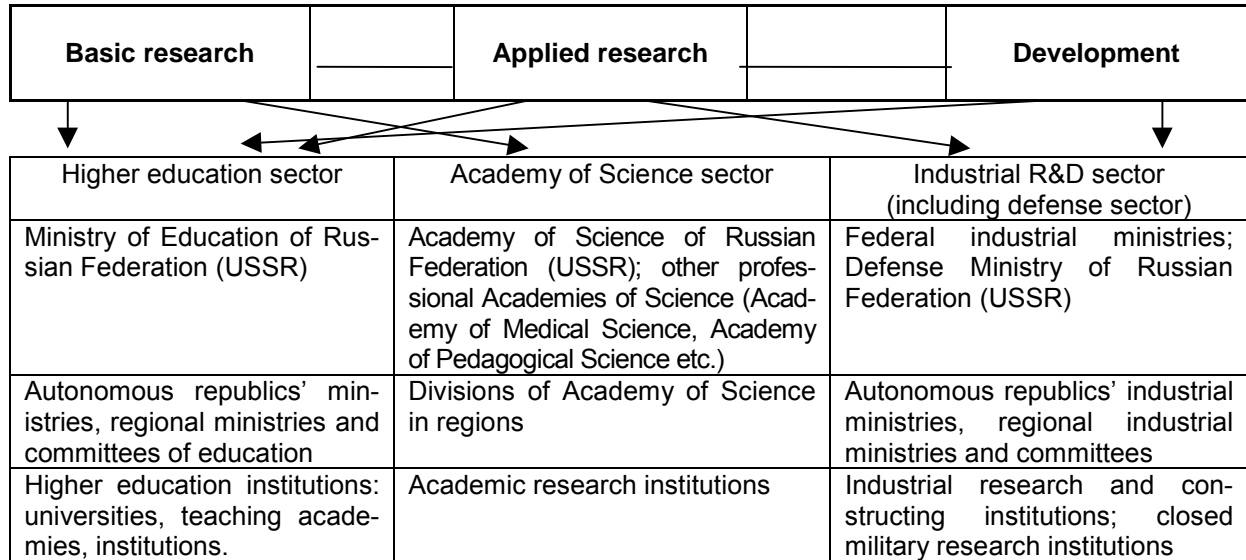
Autonomy of Russian universities had risen in the second half of 80th – first half of 90th. It was determined by radical changes in Russian social life. Universities had received bigger than before autonomy in the development of teaching plans and programs, teaching courses content and selection of textbooks. Right to elect Rector and to develop University autonomous by-law allows securing these principles of universities autonomy in some extent. However the reinforcement of state regulating university life have started since the middle of 90th – for example, of State educational standards and teaching plans, regulating university autonomy in education process were established. It has led to strengthening bureaucracy in Russian universities' life again.

Another specific feature of modern Russian universities and Russian R&D system is that Russian universities are mostly teaching organizations. This practice is due to Soviet period when the science was separated from education system. Since a big part of Russian R&D is concentrated in Russian Academy of Science institutions and in industrial R&D institutions. This situation is very harmful both for science and for education so as it disintegrates the integral process of knowledge reproduction.

For purpose of this paper, it's expediently to show here the system of science organization in Soviet Union and in modern Russian Federation (RF) (in fact, this system was changed a little) (see fig.4).

As seen on this scheme Russian science is divided across three sectors where Academy of Science concentrates basic research, industrial institutions, laboratories, experimental stations etc. carry out R&D for concrete industrial needs, and universities perform all kinds of R&D (but it depends on type of university).

Figure 4. Organization of R&D in Soviet Union and Russian Federation



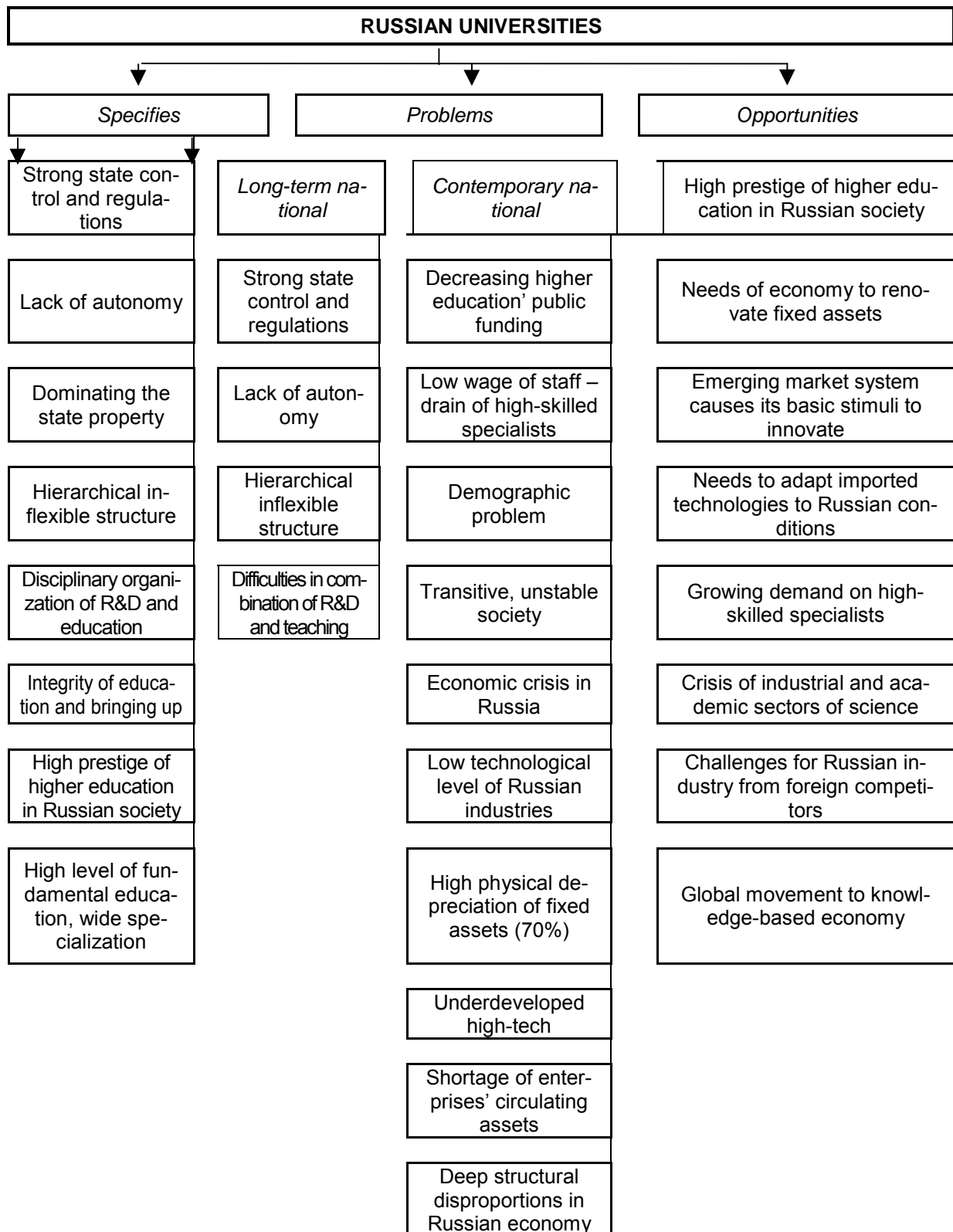
Besides noticed problems another negative factors have a strong impact in Russian universities activity. Some of them are common for higher education in the world, some of them due to transitive character of Russian economy.

By using approach, described above, for analysis of modern Russian situation and Russian university we can identify three main components – specific features of Russian universities *per se*, their problems and their opportunities. The interesting point is there are feedbacks and recursive ties across these components: some of specific features can be transforming into problems, some of them – into opportunities, some of problems can be harnessed as opportunities and so on. The three mentioned components are represented on fig. 5.

Some of noticed problems are common for entire European civilization, for example, decreasing higher education' public funding and demographic problems. Another ones are special only for Russia or have essential specific according to Russian context. So, economic crisis in Russia has large distinctions if compare with economic crisis in developed market economies. If latter stimulates fixed capital renovation and, consequently, increasing innovation activity, in post-socialist economy economic crisis is combined with system transformation crisis when old stimuli to innovate are already eliminated but new ones are not generated yet. Because of this reason innovation activity is very low what deepens and prolongs economic crisis. Not only moral but also physical depreciation of fixed capital has been arising. But at some moment it raises urgent necessity to renovate fixed assets and to innovate more than before.

Renovation of production basis can be fulfilled as with own new technologies as with imported one. Both of these ways produces the motivation for industry to collaborate with universities and the opportunities for universities to do it: in first case there is necessity to create new technologies, in second case – to adopt technologies imported. Also deep crisis (above all financial) in industrial and academic Russian science make universities as main actors of R&D performance. The question is how have Russian universities been solving their problems and using their opportunities and what university-industry relations have been raised here?

Figure 5. Specific features of Russian universities, their problems and opportunities



5. Innovative university (IU) as a way of Russian technical universities' transformation

The necessity of Russian universities transformation has been determined by both national specifics and, above all, world-wide trends. In early 2000th RF Ministry of Education was adopted Concept of reforming education system. In this Concept the main forms of high education institutes transformation are pointed out.

These forms are as following:

- university educational districts,
- innovative universities,
- university complexes combining integrated teaching systems with practical training.

Existing universities and academies should be reorganized in accordance with their resource and teaching characteristics.

In this work the *innovative university (IU)* is proposed as most effective line of development for technical universities so as they have relevant technical facilities (as research laboratories as engineering and production structures) and developed partner relations with local enterprises.

The main task of IU is a transformation of knowledge into marketable innovation products on the base of combining teaching, R&D and innovation production. It means that within IU professors and teachers are in the same time as researchers and as innovation entrepreneurs who use their R&D results to produce new science-based goods and to teach high-qualified specialists. Students are as interns in R&D labs and innovation firms what gives them possibilities for learning-by-doing together with traditional learning in auditoriums.

To solve given task, IU should be a complex diversified structure. It should include not only traditional faculties, departments and laboratories but small innovation firms, project groups, short-term teaching programs etc. The specific feature of Russian universities is that small innovation firms, technoparks and other innovation units are often not independent but included into university structure as its elements. This is determined by mixture of factors including property rights, tax policy etc. Thus, outputs of innovative university are three innovative products – highly qualified experts, new ideas, and new innovation products. According this, innovative university consists of three closely interacting subsystems – educational, research and innovation-production subsystems.

6. Intellectual capital in innovative university management

We investigate modern university and IU as big complex system performing different activities and using different kinds of resources especially intellectual resources. To increase the efficiency of university activity, there is a need to have common basis to manage all intellectual resources in whole. The problem is to integrate all intellectual assets into united system in which all elements strengthen mutually each other and positive synergetic effect emerges.

These issues made it possible to apply a concept of intellectual capital (IC) to Russian innovative university management. Nowadays intellectual capital is being seen as an instrument of increasing organization competitiveness in modern economy.

On the basis of analyzing relevant research, conceptual frameworks of intellectual capital management in IU were detailed. It should be noted, IC management approaches existing in modern literature are developed to use them within commercial organizations.

The approaches of T.Stewart and A.Brooking are taken as a principle of hypothesis regarding to identification of IU intellectual capital. These approaches have being modified in accordance with IU specifics.

IU can be identified as:

- ◆ state institution;
- ◆ non-commercial organization;
- ◆ organization producing different types of innovative products;
- ◆ organization using mostly intellectual resources, different kinds of knowledge and information (as explicit as implicit knowledge);
- ◆ its outputs are as non-animated (new knowledge, innovation goods and services) as animated (high-qualified specialists).

All of these IU features should be taken into account to develop effective IC management system.

Intellectual capital of IU is identified as divided into four components: human capital, structural capital, intellectual property and external relations capital. The specific of each component in each subsystem is recognized taking into account university environment in modern Russia.

For example, it's necessary to keep in mind the strong state regulation of Russian education system and in particular universities. Russian universities have hard hierarchic structures and strong rules and standards, both internal as external. Because of this reason, so-called "regulative" capital has being detached as a part of structural capital. Regulative structural capital includes external and internal ones. External regulative capital includes government official documents and standards as well as internal one includes rules and norms established by Rector and University Council within university.

In our opinion, it is possible to show an intellectual property as separate component of IU intellectual capital so as important activity within IU is a creation and utilization of intellectual property (textbooks, patented technologies, R&D results etc.)

The customer (client) capital has been being recognized as an important element of IC in commercial organizations so as their benefits are depended on customer preferences above all. IU is state non-commercial organization. Not only relations with clients but very wide range of interactions – with government, society, other education institutions and with enterprises as partners in innovation projects - are very important for IU successful activity. By this reason *all* of external relations of IU can be recognized as a component of IC named "external relations capital". These relations can be classified according to agents of interactions (relations with federal ministries, regional authorities, other education institutions ...) as well as according to forms of interactions (strategic partnership, short-term contracts, etc.). Detailed analysis of IU external relations allows finding the ways of their improvement.

The detailed classification of IU intellectual capital is shown on fig.6.

On the basis of IU intellectual capital identification the model of intellectual capital circulation within innovative university is developed. All of four components of IU intellectual capital are being involved into this circulation: human capital (HK) as IU staff performing teaching, research and innovation activities; structural capital (SK) as organizational structures, knowledge bases, university culture, etc; intellectual property (IP) as patented technologies and objects of copyright used in IU activity; external relations capital (ERC) as relations with suppliers, consumers, labour market and government.

All of numbered components in their combination are forming IU intellectual capital which is being involved in production (P) of three innovative outputs of IU – specialists, new knowledge and science-based products. It is necessary to note, the starting point here is investing money (M) for acquisition of all elements of intellectual capital. After the production, products created are realized and earned revenue (M') is spent on intellectual capital increase (IC').

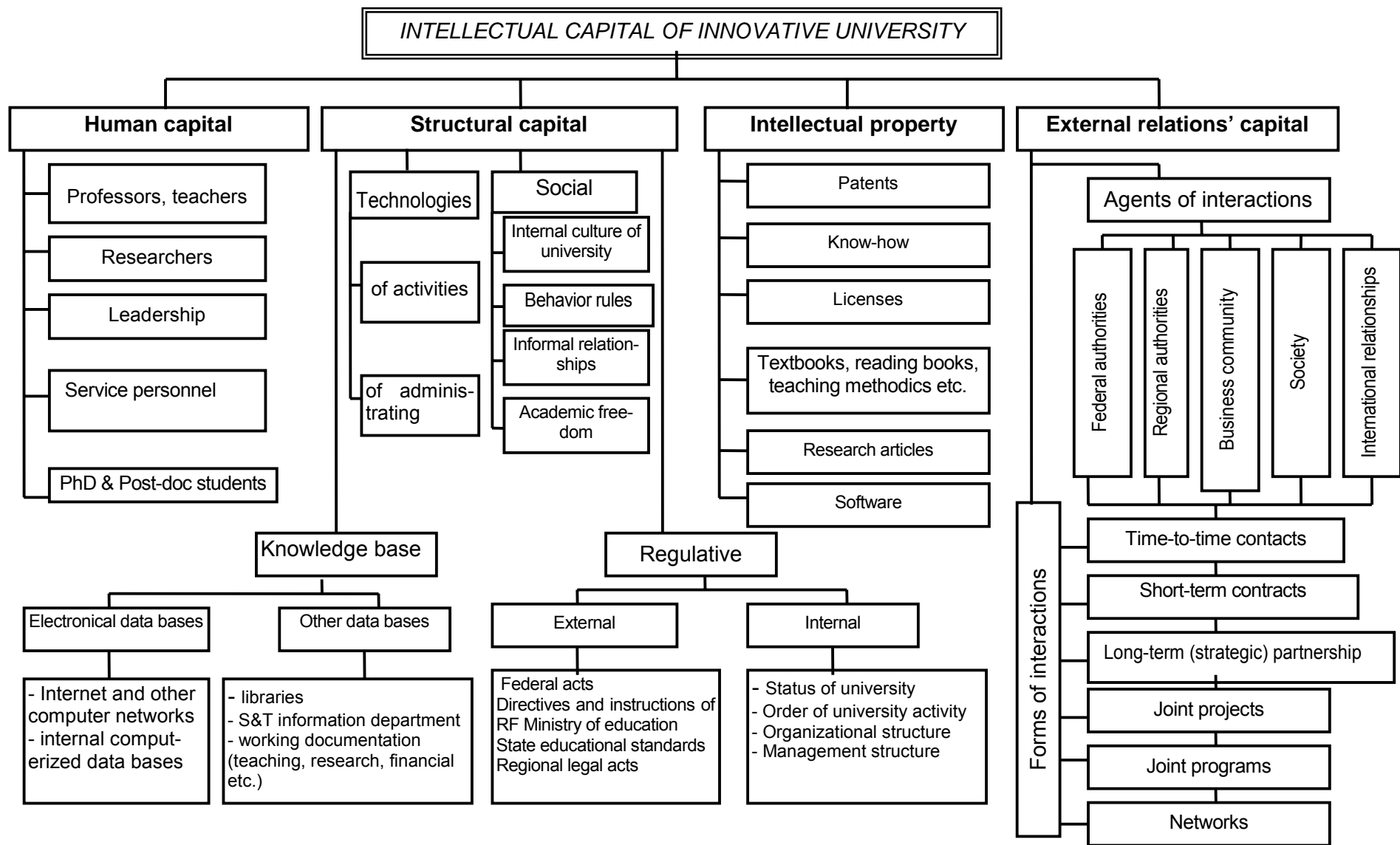


Figure 6. Structure of intellectual capital of innovative university

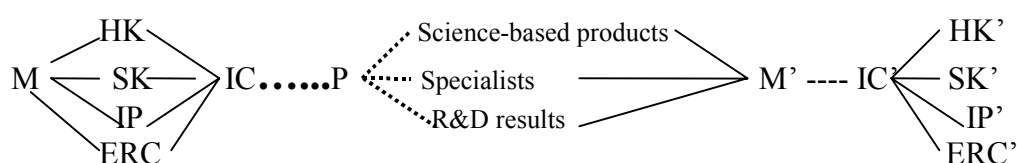
Human capital increase (HK') is a growth of knowledge of IU staff during labour process (learning-by-doing) and hiring of new personnel with new knowledge and skills.

Structural capital increase (SK') means an improvement of existing structures, creation of new ones (for example, new innovation firms), development of university culture, development of knowledge bases etc.

Intellectual property increase (IP') includes new publications, patenting and licensing new R&D results as well as new teaching materials.

External relations capital increase (ERC') is a result of attraction of new clients and partners, loyalty of old clients, sharing knowledge between IU and its partners, etc.

Then increased intellectual capital is being again involved into production of knowledge-based outputs and its circulation process is beginning again.



The main tasks of intellectual capital management in Russian innovative universities can be defined on the basis of our interpretation of intellectual capital substance. These tasks are as following: an optimization of intellectual capital structure; a continuity of intellectual capital circulation; maximization of outputs with optimal inputs of intellectual capital; increasing value of intellectual capital for organization and society. There is some experience of Russian and Western universities in the solution of these tasks what is described in author's monograph [Казакова Н.В. Университеты и экономика, основанная на знаниях. Саратов: Сарат. гос. техн. ун-т, 2002.].

7. Innovative university in regional innovation system

Innovative university can be considered as an innovation micro-system, which is an element of big innovation systems – regional, national, international ones. IU plays an important role in regional innovation system as in itself as through interactions with other elements. In developed and stable economy (organized system) its role appears through output of abovementioned three innovation products. In conditions of economic transformation and formation of regional innovation system IU obtains important additional function to insert an organization and stability into low-organized system.

In transition period national and regional economy can be defined as low-organized system. Increasing its organization can be achieved through reinforcement of “stability islands in chaos ocean” - some organized stable elements inside system. Innovative university can be considered as such “stability island”, organized element in low-organized space within region. At first, among all sectors of Russian science only higher education could to save better its research and innovation capability which can be enough base of rising innovation activity within the region and within the country in whole.

At second, it is supported by Russian Ministry of Education policy of reforming higher education system. As it was said before, one of ways of this policy is transformation of some Russian universities into innovative universities. Through abovementioned innovation products IU can affect all aspects of region life – real production through new knowledge-intensive goods and tech-

nologies, information sphere within region, management of production, life style, culture and mentality through high-qualified experts.

At third, university as IU concentrates all phases of innovation process within its framework including innovation infrastructure and workers’ training, that allows to be independent (to some extent) on environment in supply of resources and to reduce transaction costs.

As a result, innovative university activity gives a possibility to form the real agents of regional economy who are able to create and to apply innovations. Thus, innovative university is really able to become *system-creating element* of regional innovation system.

In author’s monograph [Казакова Н.В. Университеты и экономика, основанная на знаниях. Саратов: Сарат. гос. техн. ун-т, 2002.] IU interaction with other elements of regional innovation system is analyzed. These elements are divided into two groups of institutional agents – federal and regional authorities and private agents (firms, banks, industrial enterprises). This interaction can be performed as structural and functional one. The forms of structural and functional interactions and their developments are shown (fig.7). We can describe the formation of innovation system in Saratov region and role of regional higher school in this process particularly such forms as technoparks, regional R&D and technological programs, regional government departments coordinating innovation activity in the region.

Innovative programs and projects, corresponding to the priorities of the development of the region, districts, and some enterprises and industries are developed in Saratov region. Universities, being suppliers of intellectual products and qualified personnel play an important part in their realization. As an example of an effective regional innovative program, in the realization of which Saratov State Technical University takes part is Governor Program “Energy Saving in Saratov Region for 1998-2005” (fig.8).

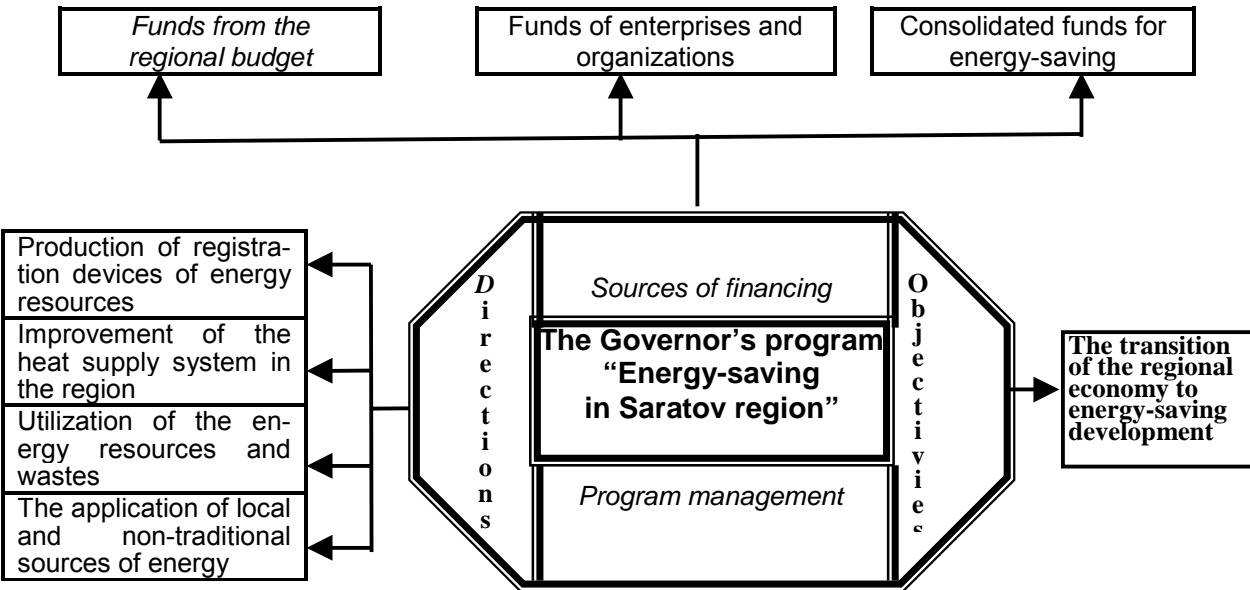


Figure 8. Governor’s program “Energy-saving in Saratov region”

Earlier consolidated non-budget funds of energy supplying organizations were the first sources of financing the program. Now the program has shown to be effective and it is financed from the regional budget. In 2002, 20 million roubles were given from regional budget together with 80 million roubles of outside funds. In 2003, 30 million roubles will be given from regional budget and 120 million roubles of outside funds.

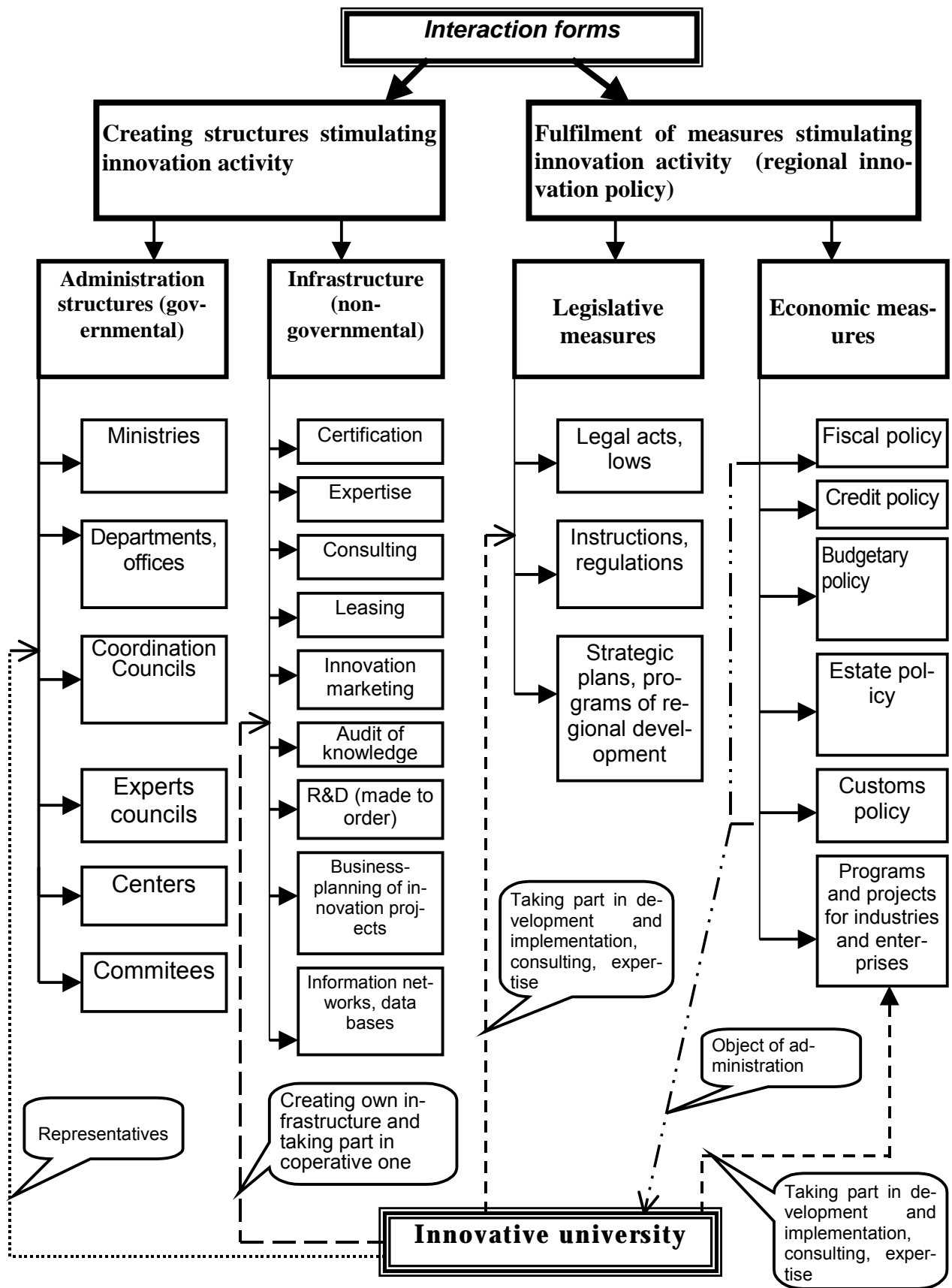


Figure 7. Interactions between innovative university and regional authorities

The development of innovative activity demands the formation and improvement of adequate infrastructure. In Russia, this process is carried out by the creation of science parks at universities. “Volga-Technics” at the Saratov State Technical University (SSTU) is science park comprised of about 20 innovation firms, producing and commercializing new products and rendering more than 30 services in the certification and protection of intellectual property for industrial enterprises. In 2002, SSTU science park “Volga-Technics” has performed R&D at a cost of more than 50 million roubles.

At the same time an innovation infrastructure of the science park is developing. This system provides patenting, expertise, marketing, advertising, information, personnel services for the innovation firms.

Our next step is to create Innovational–Technological Centers (ITC). The aim is to coordinate all structures and innovation processes in the region. These units are organized jointly by one or more enterprises and research and educational organizations. Their aim is to implement innovation projects and programs. The development of these structures involves industry enterprises, especially during the first steps of the innovation process. The cooperation between universities and enterprises not only ensures the effective promotion of new R&D results, but also staff training.

In recent years, based on the cooperation of the Saratov State Technical University with industrial enterprises, some Innovational–Technological Centers (ITC) were introduced, which shows a great efficiency in developing new products and technologies. The ITC of “Saratov Aircraft Plant” Corporation with Saratov State Technical University (1999) and the ITC “Contact” of state research and production enterprise with Saratov State Technical University are both examples of university and industrial enterprises cooperation.

An excellent example of the most complete and effective form of such integration is the educational, research and innovation complex “The Precise Machine-building Institute” which was created in 1999 based on the “Saratov bearing plant” (fig.9). The separate research and educational subdivision of this plant provides the research for high technologies in the precise machine building, projecting, creating and application of new technologies, certification of the machine-building products. It also provides personnel training and retraining in new precise machine-building technologies.

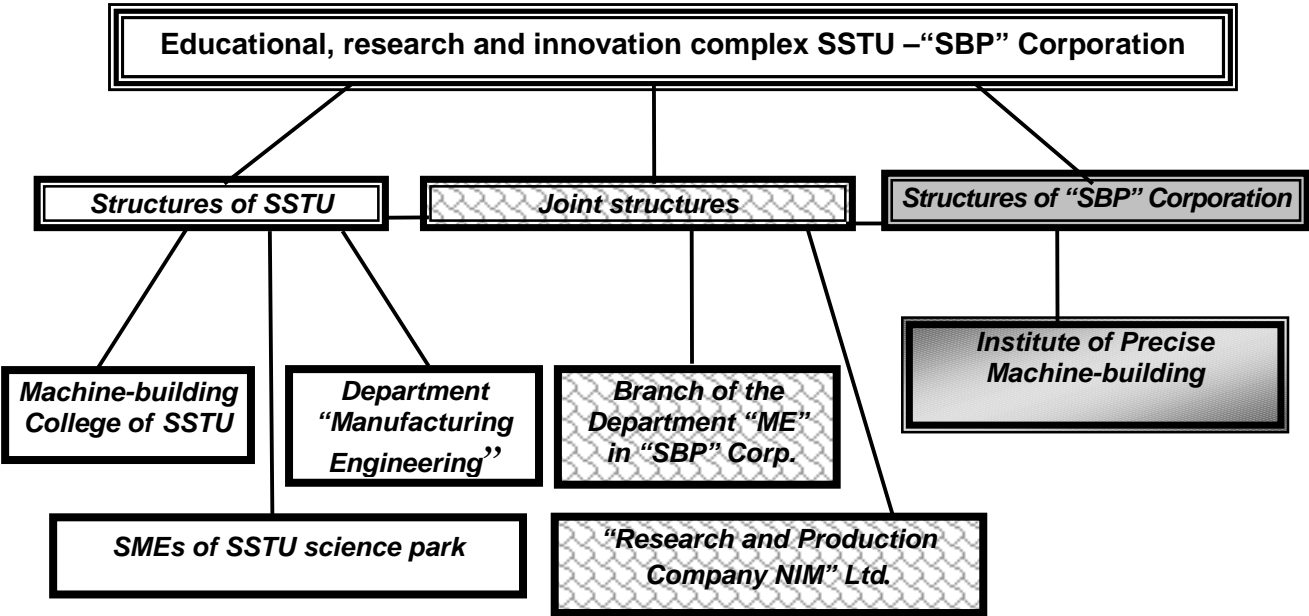


Figure 9. Educational, research and innovation complex SSTU – “SBP” Corporation

Thus, the university impact on social-economic development of Saratov region is as following:

- ◆ training high-skilled personnel (all levels);
- ◆ R&D for industry needs;
- ◆ serial production of innovation products;
- ◆ start-ups;
- ◆ consulting services;
- ◆ expertise and certification of goods;
- ◆ development and expertise of regional programs and legal acts.

Judging by our experience, we can say that Russia has begun the transition to an innovation way of development. Now we see a new role for the universities in this process. Universities in a region must be the main innovation base and the main strategic resource.

In conclusion, patterns of Russian economic life are the acknowledgement the universities is really able to become system-creating element of innovation system. These university activities should be very useful for the transition to innovative development.

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