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## THE INNOVATION MARKET IN BULGARIA<sup>1</sup>

Based on analysis of the results of the carried out observations in Bulgaria the article concludes that in the last years there is a process of continuing bending of the innovation market. The main reasons for this are connected with the delayed transformation of the innovation system of the country from administrative to market innovation demand and supply, with the changed in unfavorable direction international economic environment that is significant for the small and open economies as the Bulgarian.

As a suggestion for solving the problem about the innovations market formulated is the necessity of using the experience of the European Union, namely – wide discussion and adopting the national innovation strategy and policy that will coordinate the activities of the main partners in the economic life of the society – the enterprises, the state institutions, the financial and public sector.

JEL: O32; O33

Innovation is the main engine for economic development in the contemporary process of economic globalization. It has played crucial role for increasing enterprise competitiveness and sustainable development of the society. From this point of view the innovation market development problem has been of substantial importance for the prosperity of any economy.

Demand and supply of innovation are determined in a great extend by the national innovation system. With the collapse of the planned economies of the former Soviet Block, countries, which are in transition from an administratively-planned command economy to a market-orientated, one has to stimulate innovativeness during this period of transition. The problem is that a command economy is based upon “supply-push” policies where innovativeness is a function of what the administration perceives as needs of market; whereas the “demand-pull” of the market-orientated economy is perceived as resulting from the needs, incl. Research and Development (R&D), of the consumers, whether they are individuals or organisations. The main task of the national innovation policy during a transition period is to solve the problem of a driving force for innovation.

The current process of transformation of the national innovation system has gone without any strategy or policy for innovation. The collapse of the central planed system within the Eastern European and former Soviet countries unwound the linkages of the various systems of the society with alarming speed. The collapse of the linkages of the command innovation system is extremely negative for the national economy competitiveness. There were no immediately available

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<sup>1</sup> The article is elaborated in the frame of the Institute of Economics at the Bulgarian Academy of Sciences project. The main theses were discussed in SPRU at Sussex University, UMIST – Manchester, and WIIW – Vienna.

replacement mechanisms for distribution of their output from the existing markets to new ones. Much of the Bulgarian output, especially of R&D sector, was tied to the specific consumption patterns required by the CMEA (Council for Mutual Economic Assistance – economic organization of the former Central and Eastern European socialist countries) and was not easy to sale abroad, except on the failed CMEA market.

The impact of external factor influence – the collapse of CMEA, for small and opened economies like Bulgarian one, is very negative for innovation performance. The largest part of Bulgarian Science and Technology infrastructure has been strongly devalued and has become highly fragmented with the loss of the commanded “demand-pull” force of this market. In addition the loss of the commanded “demand-pull” force of the domestic market has speeded the process of devaluation and fragmentation, meeting no barriers like a defined and acting national innovation policy. Most of the novelties, invented in Bulgaria do not find any market and in this way they have not any economic impact – they are not innovations. The existing institutional structure for scientific, research and technological development is heavily devaluated and fragmented also because of destroyed linkages between national sources for innovative ideas and domestic enterprises, which are ultimate beneficiaries of a national S&T system. This is one of the reasons for inefficient integration of the national enterprises into the global production and market networks.

Negative innovation performance is typical not only for Bulgaria. The collapse of other CMEA market economies at the beginning of the 90s drastically decreased the demand for innovation ideas by enterprises, thus leaving Science & Technology capacities of domestic enterprises without market for their output. However the period of development without national innovation policy in Bulgaria has been longer than in some other countries in transition. This has defined the necessity to put the problem for development of stimulus for innovation to a broad and deep discussion and agreement by the main partners in the economic life of society – enterprises, state institutions, financial and nonprofit organizations.

This article has no ambition to offer solutions to all the problems in the area. The aim here is to put forward the problem for innovations and innovation market as a central problem for the Bulgarian economy under the condition of globalization. Analysis of the performance and potential for demand and supply for innovations in the country is carried out, based on the official data from the National Statistical Institute, from Ministries and from surveys on innovation behavior of enterprises. Special accent is put on demand and supply of information technologies, which are the engine of the process of economic globalization. Main areas for state activity for fostering innovation activity under conditions of market-oriented development of the economy are defined. This is done having in mind the experience of OECD and EC countries in formulating and providing innovation policy.

## **Demand for and Supply of Innovation – Macroeconomic Aspects**

The innovation market as any market, has two sides – demand and supply, which have macro- and microeconomic characteristics. For small and opened economies like the Bulgarian one, this market is strongly influenced by the development of international economic co-operation.

### *Demand for Innovations*

One of the main characteristics of the modern industrial economies at the end of the 20-th century is that their development depends in a greater extend on the potential demand, than on their supply capacity. During the last decade this trend is gaining speed. The processes in Bulgaria have opposite trend. They are consequences of the loss of the CMEA market and of slow intervention into new markets. In this way the external market is playing less important role as demand-pull for innovations factor. Consequently the internal market, especially internal demand, becomes the possible alternative for increasing innovation activity in the country.

But, the macroeconomic environment does not influence positively innovation demand and supply in the country, as results of the investigations, carried out at the Institute of Economics at the Bulgarian Academy of Sciences have shown.<sup>2</sup>

Internal demand is not a stimulus for innovation in Bulgarian enterprises too. This becomes obvious after macroeconomic analyses of the internal demand – those of consumers, of investors, and of the Government.

In spite of the plan for a fast privatisation of Bulgarian enterprises, the foreign direct investment is less than one billion USD, which is equal to the annual amount to be paid for the debt. It means that the internal final consumption is approximately equal to the produced GDP. This is a barrier to the increase of the real income and leads to stagnation of the final consumption, which is the main component (70-77 %) of GDP in recent years. It means that it is not realistic to expect an increase of the final internal consumption, which may form stimulus for demand thus leading to innovations. It is logical to expect a decrease of internal demand, because of the comparatively constant value of the debt (more than this – it is expected to increase the payments for 2001) and because of the finalisation of the privatisation programme, which is a financial source for innovation.

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<sup>2</sup> Macroeconomic aspect of development in Bulgaria is subject of a broad discussion among researchers in the area of economy. The main points of view are defined during the 50 years anniversary of the Institute of Economics at the Bulgarian Academy of Science conference on 8<sup>th</sup> of October, 1999 by the Active member of the Bulgarian Academy of Sciences, Prof., D.Sc. Ivan Angelov in his paper "Bulgarian Economy on the Threshold of Two Centuries", and by Prof., D.Sc. Garabed Minassian in his paper "Ten Years Transition – How Much More?". This article does not aim to characterize the different points of view, presented by different authors. It is based on non-contradictory results of investigations carried out as a starting point for innovation demands and supply analysis in our country.

Another important elements of the internal demand for obtaining long term fixed assets are gross investments. In 1996 they decrease with 13.5%, and in 1997 – with another 15% compared to the previous year. In 1998 and in the beginning of the 1999 the expected increase in foreign direct investment has not taken place, because of unstable international financial markets and because of the political situation in Yugoslavia. It is not possible to expect any significant foreign investment in 2000, because of several reasons. Among them are: problems with the export; limited liquidity of enterprises and stagnation of the credit supply; high level of debt of the enterprises, which is a barrier for getting new credits; unclear future for the most of the enterprises, which are waiting to be privatised, etc.

The recent level of taxes, interest rates, depreciation policy and roles for renting do not assist innovation behaviour too. In this environment it is logical to have stagnation of investment activity, or in other words, to expect an increase of internal investment demand as a stimulus for economic realisation of novelties in the country.

The above conditions determine the conclusion that stimulation of any innovation in the country would be based predominantly on external demand. However external demand is affected by some negative factors too.

The loss of the CMEA countries market has affected more negatively Bulgarian industry, especially innovation activities, than those of other countries. This is due to the fact, that in the frame of CMEA planned division of labour Bulgaria has been specialised in high-tech industries. The production of these industries was administratively directed to the broad market of CMEA countries, which were the main foreign economic partner. In 1980's the trade between Bulgaria and CMEA countries made up 60% of the GDP, and the main partner was the Soviet Union.

Now the main foreign markets for the Bulgarian production are those of the OECD countries, where 51.2% of the total export is realised. Central and Eastern European (CEE) countries are market for 33.1% of the national export. The main importers are OECD countries, whose share is 46.9%, followed by CEE countries, and others – with 10.5%. Russia has remained the main energy supplier and main economic partner, but with significantly less share than before.

The Bulgarian policy, directed towards political and economic integration with Europe, means a process of accelerated opening of the internal market to imports from the member countries. This will result in additional import, against which no adequate export competitive production would be present. Thus if a precise macroeconomic policy, able to avoid this negative effect, is neglected, the result of European integration will be negative for the economic development of Bulgaria. The negative trade balance with Russia, which is expected in the future, will not be a stimulus for improving the macroeconomic environment for innovation in Bulgaria.

In this situation, Bulgaria, which during the recent years has lost its traditional markets, must look for new foreign markets. This at the present moment it is not possible, because of the above mentioned macro economic reasons. There are no symptoms this tendency to change soon. The long delay of economic modernisation has reflected on the quality of the exported goods. The only

indicator for the increase of novelties demand is the increase of imported investment goods. But a deeper analysis has shown that they have not high significance for the compatibility of Bulgarian production, and especially, of the export. In addition, the recent tendencies of the exchange rate of the German Mark, to which the Bulgarian Lev is fixed by Law, has influenced the innovation activity in the country more negatively, then positively.

#### *Supply of Innovations*

The influence of macroeconomic factors on innovation supply is in unison with the negative tendencies for innovation demand, which, as it was mentioned – is the main engine for modern economy development. Less money is funded for science, research and development in the country than before. The state direct contribution has fallen to 0.18% of the GDP.<sup>3</sup> There is no clear policy for science, research and development priorities to be supported by the state. The formulated most important directions for developing information society, high tech, energy and other national strategies, which have been adopted by the Government in 1999, are too broadly defined and are not ranged from the point of view of state support.

Another factor, which influences innovation supply, is enterprise behaviour. Because of the low level of demand, innovations are not funded by enterprises. As a result the total expenditures for science, research and development in the consolidated budget are 0,43% of the GDP, which is below the critical level of 0,5% of GDP. A comparison with the European Union, where these expenditures are of about 2.8%, is not promising from the point of view of the future European integration success. This tendency is negative not only in view of the European orientation of the country, but also because it is characterised by decreasing internal forces of the national economic development, as well as of the Bulgarian society as a whole.

Another important approach to the innovation supply analyses is an institutional one: the number and structure of units for science, research and development activities in the country, the number of employed with these activities, and indices of the intellectual property in the country.<sup>4</sup>

The state of the institutions of the national innovation system is an important feature of the innovation supply potential. At the end of 1998 the total number of organisations, in which subject of activities is science, research and development is about 450, 68 of which are in the frame of the Bulgarian Academy of Sciences and 52 – in the former Academy of Agriculture. The state organisations are predominant. The main subjects of investigations in the state academies are in the area of nature, agricultural and social sciences. The investigations, carried out in universities, are directed mainly to technical and medical sciences. The non-

<sup>3</sup> This is comparable to the state subsidy for the Bulgarian Academy of Science.

<sup>4</sup> Some of the data, further presented, is kindly offered by the Ministry of Education and Science in November, 1999, other is a result of a project of the Institute of Economics at the Bulgarian Academy of Sciences, coordinated by "Technological Innovation Evaluations", which has passed its Scientific council in 1999.

governmental organisations are doing research mainly in the area of technical sciences (approximately 50%). The major part of research units of the enterprises, either are independent (they are about 30%), or do not carry out any research investigations, in spite of the fact that this is included in their subject of activity. The main reason for this situation is that there is no demand for these activities. Part of these units has oriented their activities towards production, trade, etc.

Another feature of the innovation supply potential is the number of persons employed in research and development (R&D) in the country. During the last years the level of this indicator has rapidly dropped down, and in 1998 it is 25,192. The R&D employed in the business sector are 1,951, in the government sector – 7,368, in higher-education sector – 16,542, in non-profit organisations – 26. The small number of R&D employed in the business sector is a very negative characteristic of the innovation supply potential of the country. It is a result of the process of the sharp decrease of the number of employed in branch research institutes and in enterprises. The same process is taking place in the Bulgarian Academy of Science, which in the national innovation system used to play a major role for science, research and development in the country. The decrease of the number of R&D employed there is higher, than in the Academy of Science in Hungary, Poland, Russia, Belarus, but less than in Slovakia, Czech republic and some Baltic republics.

Qualification structure of R&D employed in Bulgaria for the period 1996-1999 has followed the tendency of improving the scientific titles and degrees – a process of increasing the share of professors and assistant professors and of decreasing the share of research fellows. This tendency has been defined not by a faster development of R&D staff, but by an advance of the age of this staff and by low interest in scientific carrier by the young generation. In the same time, there are some positive tendencies in the area of Ph.D. education in the country. In 1996 the number of Ph.D. students is 2,075, which is the highest level after 1993. This figure would be explained not by an exit of the national innovation system from the crisis, but mainly because of the slow development of the reform in it. A deeper institutional analysis has shown that the dynamics of R&D employed structure in the state sector and in the universities has improved, compared to previous periods. In state industrial sector outgoing tide of young R&D employed is often because the well skilled and educated enterprising people are in doubt about the internal self-reproduction potential of this sector. On the other hand the inflow of part of this R&D staff into the private sector is an important potential resource for the development of a modern innovation system in the country.

The comparative analysis of the quantitative changes of the number of R&D employed has shown, that during the last years Bulgaria has approached the EC average indicators and is leaving behind the other former socialist countries from Central Europe. Bulgaria has 10 R&D employed for 1,000 employed in the economy, and 7 researchers employed for 1,000 employed, when the average meanings for EC are respectively 9.4 and 4.6.

The number of publications as a result of scientific investigations in different branches has characterised the national potential for fundamental investigations in these branches. The specialisation of Bulgaria in fundamental science based on the number of publications is continuing to be in the so-called "hard sciences": chemistry, physics, and mathematics - like in the other former socialist countries. The fundamental scientific investigations in Bulgaria have had practical implementation on the first place, in biology and engineering, on the second place, in the science for Earth and Space, mathematics, and chemistry. Here we do not pay attention to the sciences, which have as a subject the national identity of development and aspects of national innovation culture, which will play more and more important role for the national prosperity.

The number of completed research projects, as well as their structure in the period 1996-1998 is the same as in previous periods. The total number of research projects is 4,709 in 1998 - 1,297 of them are in the area of fundamental investigations, 2,628 – of applied investigations, and 784 are experimental (demonstrative). The number of research projects in the state sector has the highest share in the total number of completed research projects – more than 50%.

A very important characteristic of the supply side of the innovation market in Bulgaria is the number of registered Bulgarian patents in the country and abroad during the last very difficult years. The most registered patents are in the area of pills and medicaments, pesticides, herbicides, and other heterocycle compound micro-organisms and ferments, medicine, veterinary science and hygiene, meetings and details of machines, main electric elements, techniques and electric cable connections, etc. These are areas, where it may be assumed Bulgaria has potential to develop innovation processes, incl. high-tech.

The analysis of macroeconomic aspects of innovation demand and supply is a base for concluding that the national level of innovation potential is continuing to decline. In the same time the transformation of the institutional structure of the national innovation system is going too slow and is not following the new market realities, offering effective mechanisms for connecting demand with supply of new ideas for innovations. The reduced internal demand of innovative ideas and the collapse of external demand have compelled the state to formulate and implement corresponding measures in order to compensate these unfavourable factors.

### **Demand and Supply of Innovations – Results from Surveys**

During the last decade of the 20-th century data from surveys are more and more used for the purposes of applied scientific investigations in the field of economics. However this kind of data is not sufficiently representative. Recently surveys have become of considerable importance for the identification of the new problems, which globalisation is setting, as well as for the definition of new political

decisions for their overcoming. This approach<sup>5</sup> would be applied in the analyses of demand and supply of innovations in the Bulgarian economy as well. Further, an analysis of the results of two surveys is provided – the first one is making an overview of the state of the art of innovation market in the country. The second one is a survey of the innovation market in the area of information technologies, which are the nucleus of ongoing global technology change.

#### *Barriers to Demand and Supply of Innovations in Enterprises*

The first survey, which has provided data for the demand and supply of innovations in Bulgaria, has been conducted in 1997. Its main object is identification of the main sources for ideas for innovations, as well as of factors, assisting and factors hampering innovations in the country. It follows the requirements of OECD Oslo manual for collecting and interpreting technological innovation data.<sup>6</sup> This survey covers 102 enterprises and 10 research organisations. The big variety of surveyed parameters has allowed drawing some conclusions about demand and supply of innovations in Bulgarian enterprises and research organisations.

The main conclusions for the innovation market in Bulgaria are as follows:

- A tendency towards a *declining the role of direct state intervention in innovation activities and increasing the role of market forces* is obvious. It means that now innovation activities in the Bulgarian enterprises are mostly depending on market forces, and not on state intervention.

- *The external demand compared to the internal one has higher influence* on the development of the market for innovative ideas. This conclusion is supported by the results of the survey, which show that the per cent of export oriented innovative enterprises is higher than those which are not export oriented. The increase of R&D expenditures in these enterprises is accompanied by increase of their export intensity.

- The internal demand for the period monitored is a source for increasing innovation activity in enterprises only in the construction sector.

- *The deteriorating financial situation* of Bulgarian enterprises during the transition period has rendered a negative influence on demand for novelties, as well as on supply of new products and services.

- A factor increasing the innovation activity is *the initiative of top-management*. This fact would be explained by the previous hi-tech industry specialisation of Bulgaria in the frame of CMEA, which gave valuable educational

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<sup>5</sup> Different economic approaches in investigation of globalization processes are discussed in: *Chobanova, R.* Economic Approaches for Investigation of Global Technological Change. - Economic Thought, 1997, N 5.

<sup>6</sup> The data from this first survey is analyzed in: *Димитров, А., Р. Чобанова и др.* Барииери пред иновациите. С., СИЕЛА, 1998; *Chobanova, R.* Barriers to Innovation in Bulgaria. – In: Technology Transfer: From Invention to Innovation. Eds. Inzelt, A., J. Hilton, KLUWER Academic Publishers, Asi series, 1999; *Chobanova, R.* Market for Innovation in Bulgaria (Analysis of results of the first innovation survey). – In: Transformation of Innovation Systems. Eds. Inzelt, A., L. Auriol, CEU (at the printers), etc.



standards in areas of specialisation, and national traditions to value of education. Most of the managers in the country are engineers, while in the United Kingdom, for example, they are economists. This fact has defined their role as generators of ideas for innovations, but in the same time, their insufficient economic qualification has obstructed the market realisation of their ideas.

- Disturbing is the fact, that the *marketing activities* are not recognised as stimulus for innovations in most of the surveyed enterprises and research organisations in the country. It means that the market-oriented thinking is not of big importance in the firms strategy formation process.

- The results of the survey show that there exists a necessity for establishment and development of corresponding to new realities *mechanisms for technology transfer*, and these will replace the inoperative ones. The process of increasing the numbers of R&D departments and offices at the enterprises during the last ten-year period has negative influence on the internal potential for innovative initiatives. This process has restricted the choice of new technologies to be implemented and new products and services to be supplied on the market.<sup>7</sup> In this connection the institutional restructuring of the innovation system is of big importance. The main direction of this restructuring must be establishment of innovation network for co-operation between organisations, enterprises and specialists, who are involved in the process of science, research and development, demonstration, marketing, process and sales of novelties.

- Of big concern is that *co-operation between enterprises and research institutes* (recently presented mainly by the Bulgarian Academy of Sciences) and universities is not recognised by enterprises as a factor assisting innovations, in spite of the fact that the specialists from the research institutes have an opposite opinion. The latest puts an accent to the necessity to intensify R&D activities in the public sector in order to provide assistance to Bulgarian enterprises to compete on the international market. Special attention must be paid to the establishment of adequate to the market environment infrastructure, aimed to connect research and demonstration sector with those of small and medium enterprises.

- *Attraction of foreign investors*, who are to be consumers of the output of the scientific investigations and demonstrations, carried out in the country, is traced out as one of the main activities to increase demand for innovations. The low salaries of the highly qualified R&D personnel, as well as the traditional respect to education and professional specialisation, are still attractive prerequisites for foreign investors in this area.

- Reconstruction of the innovation system, directed to increase demand for novelties produced in the country. This defines the *international programmes big importance* for innovations and co-operation. Protection and development of

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<sup>7</sup> Similar processes and their evaluations are done in Germany as well. See *Chobanova, R., P. Ileva, R. Bakardjieva, T. Dimitrov*. Financial Environment and Technology Change. – In: Economic Investigations, 1998, Book N 1.

conditions for reproduction and improving of Bulgarian innovation potential needs an adequate institutional infrastructure and formation of national innovation strategy and policy to define priorities and helps co-operation between Bulgarian, European and other programmes.

To achieve this objective it is expedient to apply European experience in innovation strategy and policy formation, which is connected with a vast public discussions among the main economic actors in society – enterprises, state institutions, financial and non-profit sectors.

#### *Demand and Supply for Innovations in the Bulgarian Information Technologies Sector*

Information technologies are the main engine of the third global technology change and for the transition to information society and this defines their significance for investigating the innovation processes. The development of the market in this sector is a premise for social prosperity. That is why further basic results of an implemented inquiry into supplying and demanding of information technologies as well as few technology transfer mechanisms in forty-two enterprises, which supply of or demand for information technology products services in Bulgaria are presented.<sup>8</sup>

The second survey, which is a source for data for innovation market development in Bulgaria, is aimed to investigate demand and supply of the newest information technologies. It was provided at the end of 1999.

Most of the surveyed enterprises, suppliers of information technology products and services in Bulgaria, are specialised in hardware supply, integrated services and software (see Fig.1).

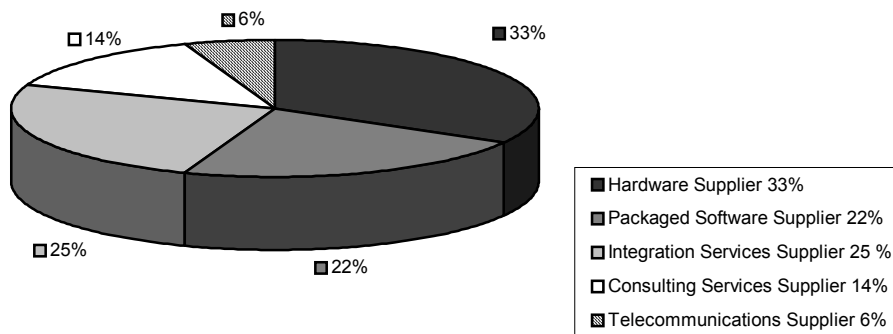


Figure 1. Specialisation of the surveyed firms - suppliers of information technology products and services

<sup>8</sup> Presented data is collected by a team of European project INCO COPERNICUS CP977047 "Centers for Technology Transfer – Moscow – Sofia" Prof. G. Jeleu, Assoc. Prof. R. Chobanova, Assoc. Prof. S. Maleshkov, Ass. Y. Minkova. The applied methodology follows OECD Oslo requirements for collecting and interpreting technological innovation data.

The survey has shown that the number of the companies supplying consulting and telecommunications services is still comparatively small. That is a niche for development of supply of novelties within universities and research centres of the country.

The surveyed users of information technology products and services belong to different branches. The highest is the share of companies from the Manufacturing - Textiles (18%), Publishing, Printing and Recorded Media (15%), Chemicals (11%) (see Fig. 2).

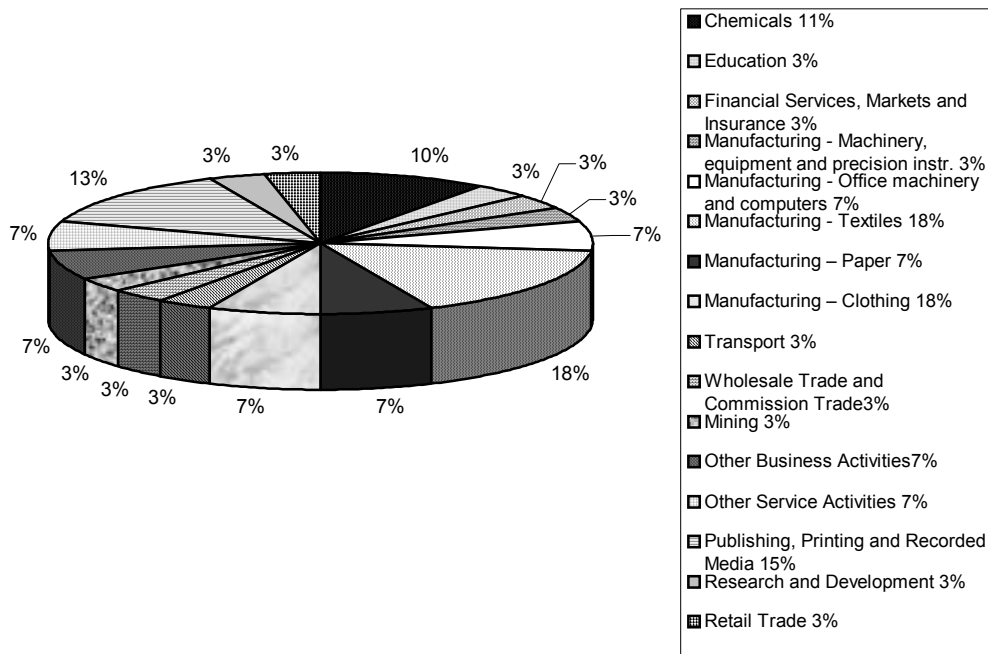


Figure 2. Distribution of surveyed enterprises – users of information technology products and services, by branches

An important feature of the market for information technologies of the country is that both, users and suppliers are predominantly small enterprises with a number of employees between 1 and 9 (see Fig.3). This number is characteristic for users of information technologies in all developed countries.

The Innovation Market in Bulgaria

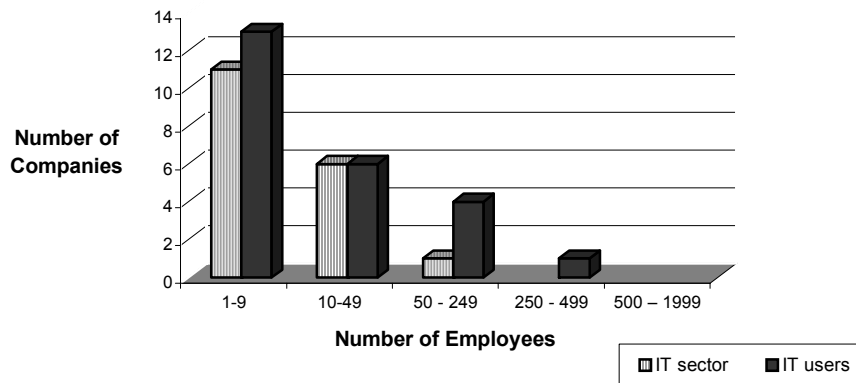


Figure 3. Number of employed in the observed enterprises – users and suppliers of information technology products and services

The survey has used EC standards and the smallest turnover monitored is defined as less than 7 MEuro, because this business is one of the most profitable ones. Among the surveyed firms the highest is the number of the companies with turnover less than 7MEuro (see Fig.4). It shows that there is still not enough demand for information technology products and services as it is in the developed countries, or that there are still not sufficient skills in the management of enterprises in this specific fast developing sector.

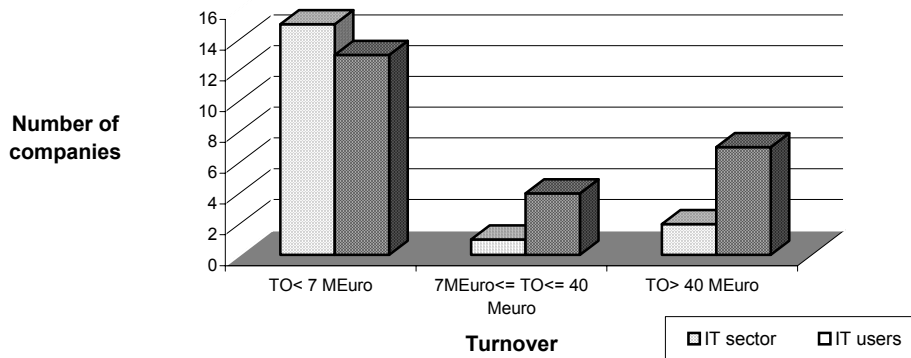


Fig.4. Distribution of the surveyed enterprises – users and suppliers of information technology products and services by volume of turnover

According to their geographical location of the market for realisation of newly produced information technology products and services, the survey shows that

enterprises concentrate their efforts predominantly to the national market. To a small degree they are aimed to local and international market (see Fig.5).

This orientation in practice is a stimulus for development of the national market for hi-tech products and services, as well as for the establishment of modern information infrastructure, which is a premise for increasing the competitiveness of Bulgarian business of all sectors. On other side, the results show that Bulgarian suppliers of information technology products and services are still not ready to conquer new external markets. It is a fact of concern, which explains why young Bulgarians are recognised abroad as talents in information technologies and do not prefer to stay in the country. One of the decisions might be to include in the education programme, management of business in the area of information technology development and applications.

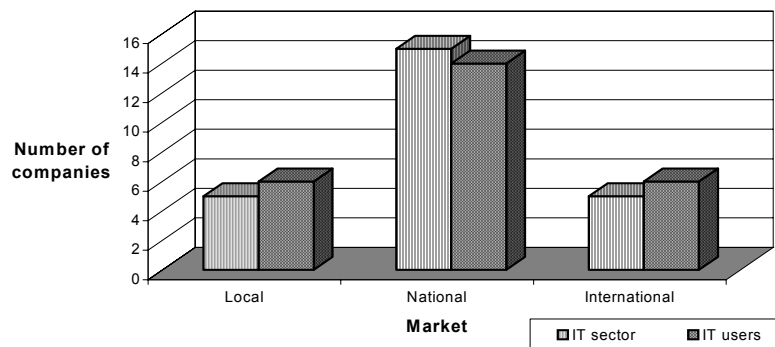


Figure 5. Markets, the surveyed enterprises are aimed to

The potential for development of innovation market in the sector of information technologies is characterised by the level of application of the latest novelties in enterprises. The survey data are about the use of the newest applications of information technologies, which are classified by the following criteria:

- Software applications;
- Software systems;
- Types of software;
- Tools for communication.

Monitored software applications are: Legacy systems; DBMS & application generators; Internet and e-commerce; CASE-tools; Telecommunications; Consumer appliances; Security devices; Modelling and simulation.

The application of software systems is studied by a question whether enterprises use them.

The types of software applied in the monitored enterprises are: DBMS applications, legacy systems, client – server applications, internet and electronic commerce applications, modelling and simulations and others.

The monitored tools for software development used by the surveyed enterprises are: 3<sup>rd</sup> generation programming languages, application generators, CASE tools.

Among the observed companies – users of software applications (see Fig.6), the largest share has development of consumer appliances, then databases, Internet and electronic commerce, legacy systems.

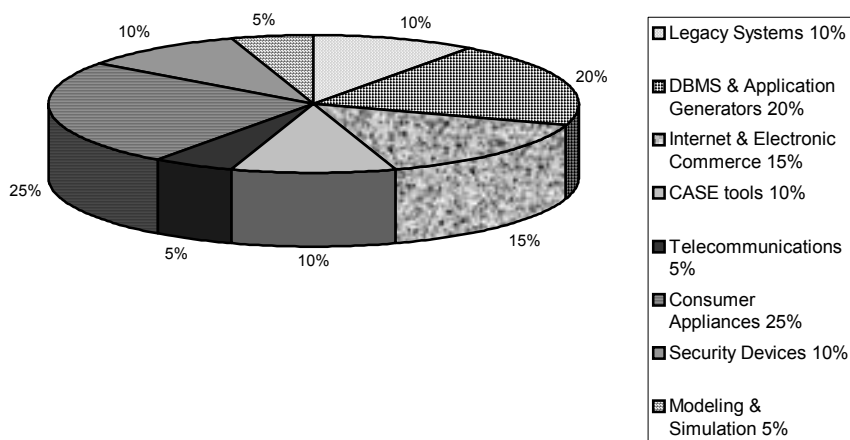


Fig.6. Share of the observed enterprises –users of software applications

The companies – users of software systems are 62% of the monitored firms. This shows that information technologies are comparatively widely used in the every day work of the enterprises and this creates conditions for demand and supply of new products and technologies (see Fig. 7).

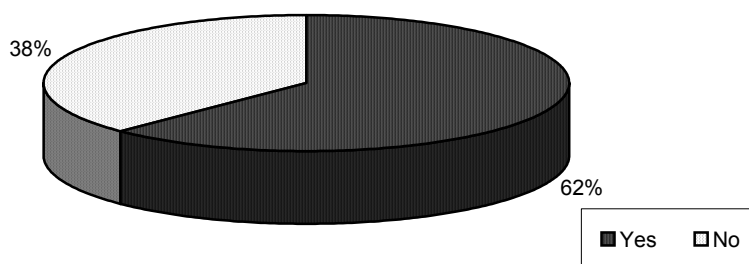


Figure 7. Distribution of the observed enterprises according to whether they are users of software systems

According to the type of software most of the surveyed enterprises in Bulgaria use DBMS applications, other applications (CAD, GIS, pre-press applications), some enterprises use client-server applications, legacy systems, application for electronic commerce, modelling and simulation (see Fig. 8). These results describe directions, in which demand will develop in the country. To satisfy the needs for using software applications such as client-server, legacy systems, applications for electronic commerce, modelling and simulation, technology transfer centres, which belong to universities and specialised research units at the Bulgarian Academy of Sciences can help.

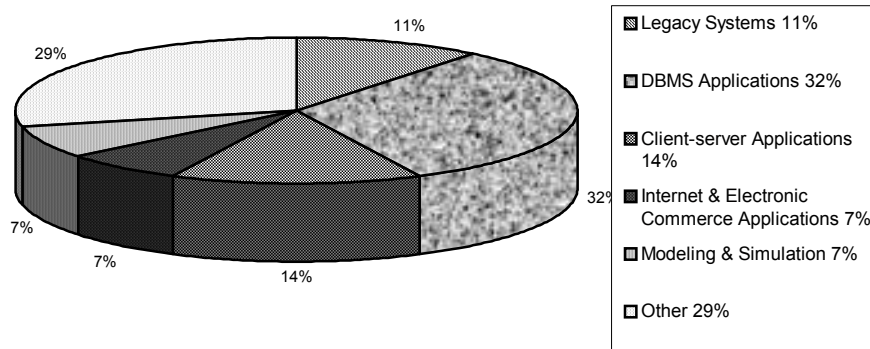


Figure 8. Distribution of the surveyed enterprises – users of information technology by type of software

Comparatively good for the level of demand for information technology is the fact, that twenty five percents of the enterprises, although not being in the IT branch, are involved in the development of software for internal purposes or involved in development of products of their own organisation. Predominantly they use programming languages, and rarely - application generators and CASE tools (see Fig.9).

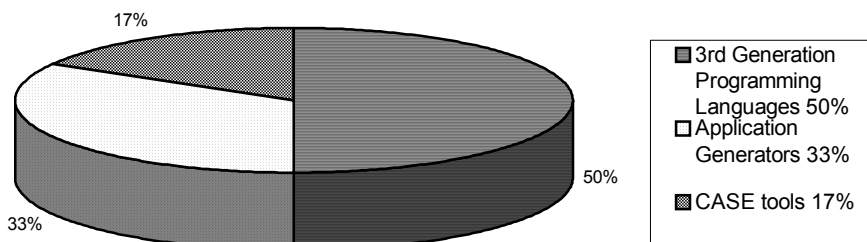


Figure 9. Distribution of the observed enterprises according to the tools used for software development

An important indicator for the effectiveness of the market mechanisms for information technology diffusion is the way the demand and supply activities take place – what kind of means of communication the observed enterprises are using on a daily basis, internally, with their clients, partners, etc. (see Fig. 10).

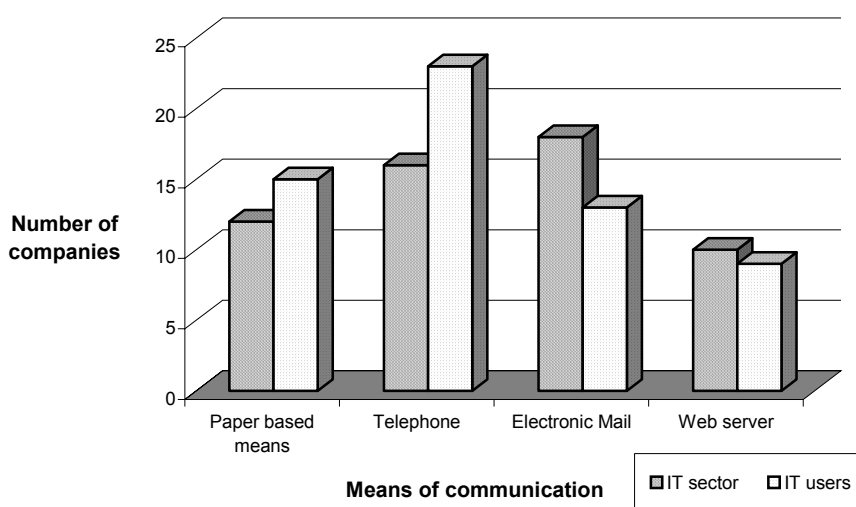


Figure 10. Distribution of the observed firms – users and suppliers of information technologies by types of applied means of communication

Except the standard means like paper and telephone, obviously the use of contemporary means of communication like electronic mail and Web server is widely spread. Of course enterprises, which are not users or suppliers of products and services of information technology naturally use more often paper and telephone rather than electronic means of communication. In the same time, the fact that raises hopes is that they use e-mail and web server approximately as often as enterprises - suppliers of information technologies. The indicated levels are not satisfactory from the point of view of achieving competitive power in the globalised economy. Development of demand in this area may be supported by corresponding education in schools, colleagues and universities.

A very important aspect of monitoring the innovation market for information technologies is the direction in which the demand for innovative ideas is oriented. The observed institutional structures, which enterprises prefer to have as partners for those kind of purposes, are research centres (mainly institutes of the Bulgarian Academy of Sciences), private enterprises, technology vendors and universities (see Fig. 11).



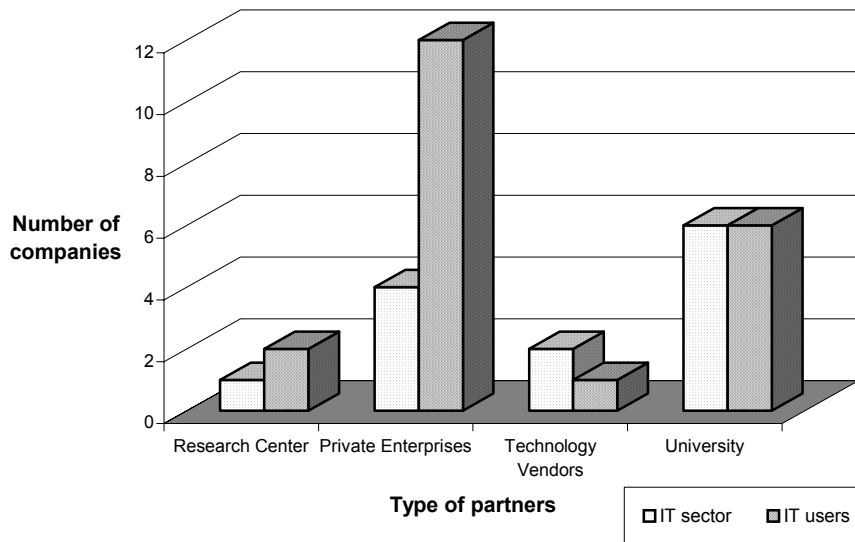


Figure 11. Distribution of observed enterprises – users and suppliers of information technologies, according to the used type of co-operation for exchange of knowledge

The results show that companies – users of information technology products and services, prefer collaboration mainly with private enterprises aiming at exchanging knowledge or transferring technology. This is a negative characteristic for the university and research centres role as technology transfer centres at the present moment. The enterprises that supply information technologies prefer first of all the collaboration with universities and research institutes and after that with private enterprises. That confirms the fact that there is a potential for collaboration in order to transfer knowledge in universities and research centres and that these centres must activate their efforts in this direction.

Used mechanisms for demand and supply of information technologies by enterprises are important characteristics of this significant for the economy sector of the national market. The facts, extracted by the survey are that companies - suppliers of information technologies use joint research projects more often than general collaboration contracts and exchange of personnel. The companies - consumers of information technologies use general collaboration contracts more often than exchange of personnel and joint research projects (see Fig. 12).

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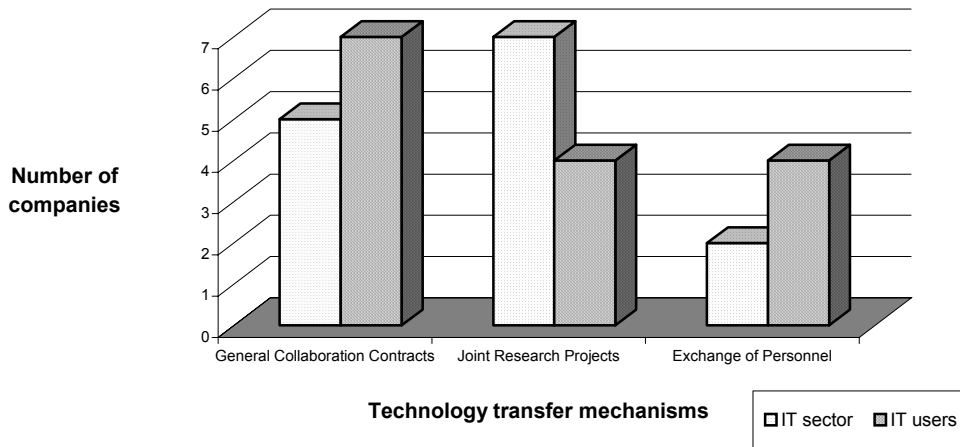


Figure 12. Distribution of the observed enterprises according to mechanisms used for technology transfer

Enterprises, which are suppliers of information technologies, prefer different sources of ideas for innovations, compared to enterprises - users. The most used mechanisms are attendance of conferences, seminars, and reading of brochures. Less used is technology brokerage (see Fig. 13). This fact can be explained by the stages of the innovation process – new ideas are firstly presented on scientific conferences and seminars, then they are published in brochures and after some time are ready to be a subject of technology brokerage.

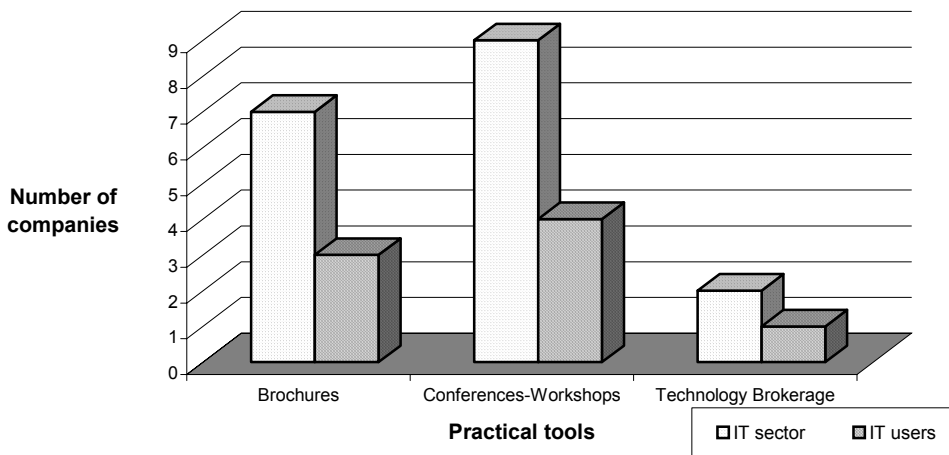


Figure 13. Distribution of the observed enterprises by sources of innovation ideas they use

A very important aspect of the potential of Bulgarian enterprises for demand and supply of novelties is whether they have a corresponding institutional structure for those activities. In 27.8% of the enterprises-suppliers of information technologies there is an employee, who is in charge of demand and supply of new technologies, while in the enterprises-users of information technologies this percent is 20.8 (see Fig. 14).

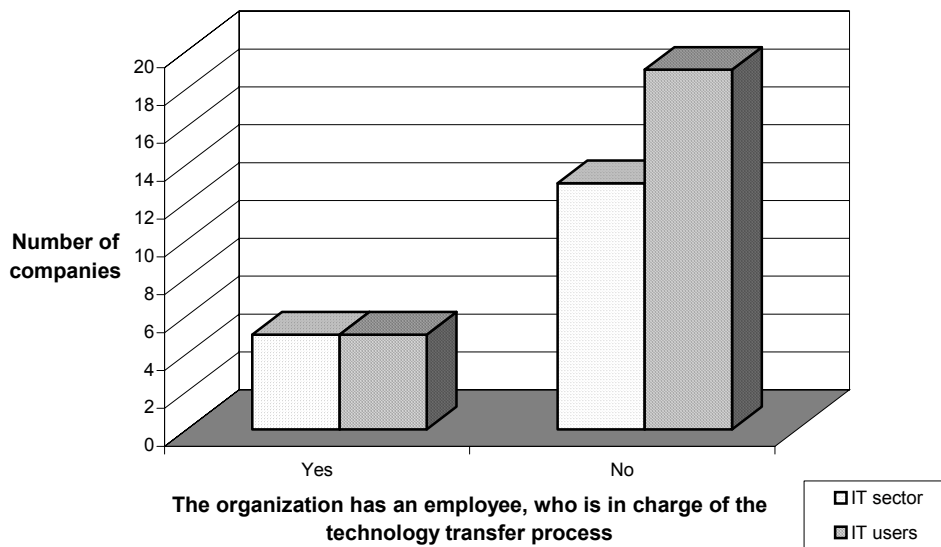


Fig.14. Number of observed firms, which have an employee, who is in charge of demand and supply of new technologies

These results of the survey show that most of the enterprises-suppliers and users of information technologies do not realise the need of an office or a single employee to be in charge of the technology transfer process. This is an important element of the modern firm's structure. A policy decision to solve this problem is to include management of innovation in the education programmes for students, as well as for continuing education of specialists, who are to develop a national market for new information technologies.

The conclusions of analyses, carried out on the basis of the survey of innovation market for information technologies results would be summarised as follows:

1. There is demand and supply of information technologies in the Bulgarian enterprises, which is an important factor for national competitive economic development. In the same time the alarming fact must be taken into account, that the market for the newest applications of information technologies is not well developed, and that Bulgarian enterprises still do not have potential to fight for new

foreign markets. New markets are needed to replace the former CMEA relationship and their role for development of a small and opened economy like the Bulgarian one.

2. The mechanisms for demand and supply of information technologies under the circumstances of the contemporary economy are not well known to the basic actors in this process (in our case – the interviewed enterprises) and especially to the enterprises - users of the information technology products and services.

3. The overcoming of these negative positions, from the point of view of the competitive requirements in the globalised economy, has defined directions in which the universities and academic scientific activities in co-operation with enterprises to be developed.

### **Areas for State Influence on Increasing Innovation Activity in the Country**

The market oriented development of the Bulgarian economy and the accompanying global technology change, based on the revolution of information and communication technology, have risen the problem of a qualitative restructuring of the national innovation system. Its solution is elaboration of an overall view on the development of demand as stimulus for high innovation activity.

During the recent years the Bulgarian Government has attempted to formulate and offer a national strategy, which stimulates innovations in conditions of a market development of the economy, but up to now it have been not been implemented successfully. There is certain optimism, risen by the *National Strategy for High-Tech Development in Bulgaria* and the *Strategy for Information Society Development* passed by the Government at the end of 1999. They put forward the problem of the main dilemma in front of the country, which consists in the following:

“Whether to be a generator for new ideas, products and services, and effectively to introduce results of high technologies in the process, or to stay just as a consumer of end hi-tech products, imported and paid with non-environment friendly, high material and labour intensive production.”<sup>9</sup>

The experience of OECD countries has shown that the state influence on speeding innovations in condition of a market economy is directed towards improving the general conditions like: to create a perfect scientific and engineer (technological) base, to establish necessary conditions for technology transfer, to increase the influence of factors, assisting firm’s behaviour to generate and adopt novelties.<sup>10</sup>

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<sup>9</sup> National Strategy for High-Technology Development in Bulgaria. S., December, 1999.

<sup>10</sup> See *Chobanova, R.* In: Evaluation of Technological Innovations. Project of the Institute of Economics at the Bulgarian Academy of Sciences, 1999.

According to the facts, extracted from the surveys, commented above, and the elaborated analyses, based on statistical data and OECD practice, the state influence towards *improving the general conditions* for accelerating innovation process is to be directed to:

- improving legal framework – intellectual and industrial property rights, patent and license legislation, normative base for high-tech parks establishment;
- fiscal environment – taxes, depreciation policy for high-tech firms;
- foreign trade policy – duties for necessary modern equipment and technologies, creation of conditions for access to international markets as well as to high-tech free zones;
- improvement of the system for basic education for the entire population, which defines minimum educational standards and quality of the working force, as well as receptivity of the internal consumer market to high-tech products;
- development of the transport and telecommunication infrastructure;
- support to the development of financial institutions, offering access to varied and flexible forms of financing, incl. venture capital;
- improvement of the industrial structure and competitive environment;
- development of corporate culture and managerial skills of specialists in the area of high technologies.

Other direction to a positive state influence to innovation process is the *renovation of the scientific and technological base* in the country. Scientific knowledge and engineer skills are of primary importance for innovations of products and methods of production. The main elements of national scientific and engineer base, which is to be a focus for state innovation policy include:

- specialised system for technical education;
- university system;
- system of support for basic (fundamental) investigations;
- significant for society R&D – funding programmes mainly in the area of health care, protection of the environment and defence;
- strategic R&D - funding programs and institutions, aimed at “before competitive” R&D, or technologies of specific class;
- support for innovations through funding programmes and institutions in areas, where enterprises will not have any profit, or they will get it hard if they carry out the corresponding R&D by themselves.

The survey has shown that state influence of the innovation process must be directed to the *transfer factors* as well. The state innovation policy would pay special attention to improving:

- formal and informal contacts between firms, incl. small firms network, relationships between consumers and suppliers; between firms and regulation

agencies and research institutions, as well as stimulus in the frames of clusters, which may produce information flows, supporting innovations, or to help firms to have an access to them;

- availability of leading experts, keeping through different means keys for technological development (incl. new technologies and codified knowledge in patents and specialised publications) and developing personal network of contacts, which define information flows inside firms and in society;
- international relations as a key component of networks, through which channels for information flows are created;
- degree of mobility of experts in the area of technologies, which is directly connected with the speed of new technologies diffusion;
- easy access to public R&D;
- supporting spin-off companies from existing or public R&D institutions, which usually includes transfer of experienced individuals and very often leads to the commercialisation of new technological decisions;
- ethics, public values, confidence and sociability are factors, which influence the widening of networks, contacts and other channels for communication;
- codified knowledge in patents, trade marks, technologies, know-how;
- broad access (incl. high schools) to world sources for specialised information like press, scientific publications, conference proceedings, data bases with technical and scientific information.

Very important from the point of view of high-technologies development are the *dynamic factors, defining absorption and generation abilities of firms*. It includes a variety of human, social and cultural factors, which are of big importance for effective operation of these channels. The state may influence these factors indirectly, establishing an entire favourable environment, improving educational system, etc.