

# Working Paper

## Innovation Activities of Industrial Enterprises in Market and Transition Economies

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WP-94-001  
January 1994



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## Foreword

The Economic Transition and Integration (ETI) Project at the International Institute for Applied Systems Analysis (IIASA) is continuing its subproject "Research and Development Management in Russia's Transition to a Market Economy". This subproject was originally started upon the request of the then Soviet State Committee for Science and Technology, and is still supported by the Russian Government. The major goal of this subproject is to advance understanding of R&D management and then to translate this understanding into practical advice to Russian policy-makers. The project is organized as a series of case studies and seminars, and is aimed at bringing together Russian policy makers and scholars and Western experts to exchange their views and research results in the field, and to promote further contacts and research collaboration among them.

Until now, five workshops on various aspects of R&D management have been held, and the first volume of papers presented at these meetings has been published (Serguei Glaziev and Christoph Schneider, (eds.), *Research and Development Management in the Transition to a Market Economy*, IIASA Collaborative Paper CP-93-1, March 1993). Preparations for the second volume are currently underway, and participants of the project have their studies in various stages of completion. This study by Drs. Elena Zhuravskaya and Marina Gracheva is nearly completed, and is circulated as an IIASA Working Paper to enable the authors to broadly discuss their results with other project participants.

Il'dar Karimov  
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## Abstract

The purpose of this paper is to make an overview of the recent economic tendency surveys as the source of information on enterprises' innovation activities in market and transition economies. The introductory section focusses on innovation theory as the basis of currently conducted innovation tests. The second and third sections are devoted to the analysis of changes in innovation activities of West and East German enterprises reflected in the results of regular surveys. The fourth section examines the original data obtained through innovation surveys recently started in Russia by the team of "The Russian Economic Barometer" information bulletin (International Center for Research into Economic Transformation). Section five concludes, identifying the main trends in innovation behavior of Russian industrial enterprises in comparison to their West and East German counterparts.

## 1 Introduction: The Theory and Practice of Innovation Surveys in Industry

The sphere of application of qualitative survey statistics in market-oriented economies is quite broad. During the last 3–4 decades, the so-called "business tendency surveys" were regularly conducted on a very wide scale, in more than 50 countries. Usually they range from several dozens to thousands of enterprises in different sectors of the economy and can be grouped into two large blocks. The first block includes the questions on current changes in the indicators of enterprises' performance (levels of output, prices, employment,

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\*Based on the results of innovation surveys of West and East German, and Russian industrial enterprises. The authors are grateful to the ETI Project for providing technical support.

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Table 1: Dynamics of Economic Tendency Surveys

Year	Number of Countries Covered by Surveys	Number of Economic Tendency Surveys		
		Total	Short-term	Long-term
1960	15	34	22	6
1970	25	99	46	39
1980	39	155	81	45
1990	47	215	116	65

Source: CIRET database. (CIRET Studies, 1992, p. 25) CIRET—Center for International Research on Economic Tendency Surveys—is an international organization uniting companies and institutions that conduct economic opinion surveys and tests all over the world.

inventories, order-books, capacity utilization, etc.). The second block covers indicators of a more long-term nature; in the first place concerning investment and innovation activities of enterprises.

The original impulse to the development of business tendency surveys (mainly from the first block) was given by the necessity to compensate the lack of official statistical information, especially in postwar West European countries. However, estimates and forecasts provided by company managers, remained a valuable additional and somewhat unique source of information even after comprehensive statistical services were developed in these countries. At the same time, the popularity of the second block surveys focusing on long-term indicators (including indicators of innovation activities) was increasingly growing.

The growth of interest towards innovation activities surveys was also determined by the renaissance of the theory of long waves (“Kondratieff cycles”), and the popularity of the idea that traditional statistical indicators of technological progress (such as labor productivity, capital/output and raw materials/output ratio) are not sufficient to reflect changes in the technological potential of nations. Many researchers saw, in the concept of innovation as a key component of technological progress, the opportunity to compensate for the inadequacy of traditional indicators of technological progress by empirical indicators of a principally new type. In fact, current innovation activities surveys (or innovation tests) are just practical applications of the modern theory of innovations.

Major principles of this theory were formulated back in the 1930s in the works of Josef Schumpeter. The theory was further developed in the 1970s and early 1980s by G. Mensch, C. Freeman, J. van Duijn, A. Kleinknecht, L. Soete, and others.

In short, the essence of the theory can be described as follows. The scope of innovation activities undergoes periodic changes and such changes are closely connected with the long-term fluctuations in business conditions as a whole. Hence, the irregularity of the flow of innovations determines the irregularity of technological process and economic growth and vice versa.

Irregularity of the innovation process is interpreted in two ways. Firstly, innovations are not evenly spread among different sectors and branches of the economy, but concentrate on particular points of “economic space”. Secondly, innovations do not appear regularly in time either, but always come in groups or clusters.

The theory distinguishes different types of innovations which are divided into technological and non-technological innovations. Technological innovations are further classified according to two main approaches. In the first approach, the economic effect of innovations is taken as a criterion of classification. Within this approach two schemes exist—the scheme suggested by Mensch and the scheme suggested by Freeman. Mensch distinguishes between basic (primary), improving (secondary) and pseudo-innovations (Mensch, 1979). Freeman suggested to identify product-innovations (i.e., innovations leading to the creation of completely new products) versus process-innovations (i.e., innovations improving technology of the production of existing goods) (Clark, et al., 1981). Thus, the “product-innovations–process-innovations” dichotomy corresponds to the “basic innovations–improving innovations” dichotomy suggested by Mensch.

In the second approach the sphere of innovations is regarded as the main classification criterion. Kleinknecht and Coombs distinguish between the following types: innovations in consumer goods industries; innovations in medicine; innovations in investment goods industries; innovations in industries producing intermediary goods which can be used in the production of both consumer and investment goods; innovations in research activities which can be used for production purposes; innovations in military (Coombs and Kleinknecht, 1986).

It is well recognized by scholars that the mechanism of innovation activities is based upon profit seeking incentives. However, the implementation of primary and secondary innovations have their own peculiarities. The mechanism of primary innovations is seen in different ways by different researchers. At least two approaches can be identified. Mensch and Kleinknecht suppose that most basic innovations are introduced during serious and lengthy depressions. Clark, Freeman and Soete share the opinion that more innovations are implemented during the period of long-term improvement of economic conditions. The contradiction between these two approaches can be initially explained by the different assessment of the planning horizon of firms.

The mechanism of secondary innovations is usually described in terms of the theory of innovation life cycles. According to this theory, each basic innovation results in the creation of a new branch of industry which consequently passes through all the stages of its life cycle—from the initial period of rapid growth, through the stage of maturity to gradual decline. This process goes on in two dimensions: vertically—from more fundamental to less fundamental innovations, i.e., product-innovations are gradually ousted by process-innovations (Duijn, 1983); and horizontally—from the limited diffusion of an innovation to complete saturation of the market (Mansfield, 1983).

The final element of the innovation theory is represented by the analysis of the relationship between the irregularity of innovation activities and long-term tendencies in

the evolution of economic conditions. The key category here is the notion of “innovation clusters”. An innovation cluster is defined as a group of basic innovations concentrated within a particular time period and at a particular point of economic space. This is not an accidental combination of individual technological novelties but a certain integral system of new products and technologies. Three types of mechanisms can lead to the formation of innovation clusters. Those are: the irregular emergence of basic scientific inventions (i.e., sporadic scientific revolutions); spasmodic changes in the quantity and quality of goods consumed by a society, and the irregularity of overall economic conditions (long-term improvement of the economic situation and the absence of scientific and technological barriers for the diffusion of innovations are required in a sufficiently large group of industries).

Uneven distribution of innovations is observed on two levels—sectoral and regional. From the sectoral point of view, a leading sector or a group of industries is determined. Such industries experience the stage of growth in the innovations life cycle and demonstrate the highest rates of economic growth. According to research by Zwan, the leading sector coincides with the production of investment goods to a great extent (Zwan, 1980). The regional aspect of a space cluster is represented by inter-country differences in the scope and level of innovation activities and competitiveness on the international market. On the whole, it should be noted that analytical transition from a single basic innovation to a cluster is not a formal procedure, in fact it is a transition to a new quality, i.e., to a category pertaining to the macroeconomic level.

And finally, practical recommendations are elaborated within the framework of modern innovation theory. According to the principles of the theory under consideration, the most reliable means of overcoming prolonged economic depressions is the massive introduction of basic innovations. However, the particular ways could be different—passive expectation of the “natural” end of a depression (Mensch); artificial encouragement of innovations (Freeman); or the implementation of institutional changes not so much with the aim to speed up overcoming the crisis, but rather to prevent the deepening of the crisis and ensure the possibility for the economy to use the encouraging effect of depressions in order to intensify innovation activities (Kleinknecht).

## **2 Surveys of Innovation Activities in Developed Market Economies, the Case of West Germany**

In developed market economies, surveys of innovation activities based on the principles of the theory described above, play an increasingly important role. Such surveys are designed to evaluate competitiveness of particular industries on the world market, to assess the effectiveness of state innovation policy, and to identify priority measures in this field. Innovation surveys, or innovation tests, are regularly conducted in Germany,

Italy, and Austria; and have recently begun in the USA, Switzerland, Sweden, Norway and Finland.

However, taking all of the criteria into account, such surveys are most fully developed in Germany (*Innovationsaktivitäten...*, 1991) which have been conducted on a yearly basis by the Munich IFO Institute since 1979. More than 1,500 companies in the manufacturing industry are regular participants. These surveys are financed by the Federal Ministry of Science and Technology. Innovation surveys are conducted in three different forms: as part of a business tendency test; as part of an investment test; and as a specialized innovation test.

An analysis of the results of innovation surveys enables the following:

- to determine the level of innovation activities in industry as a whole;
- to identify the most dynamic sectors of industry with respect to innovation activities;
- to examine the correlation between innovation activities and changes in production output;
- to analyze the extent of renovating a product range;
- to identify the relative importance of R&D for innovation activities in companies of different sizes;
- to reveal prevailing types of innovations (product-innovations or process-innovations) by sectors of the economy; and
- to identify the factors constraining innovation activities.

The surveys in Germany are based on the following definition of the term "innovation": a novelty or a substantial improvement in a product or a production process.

The questionnaires include questions on the introduction of innovations; the amount and structure of the expenditures on innovation activities; types and aims of innovations; the relationship between innovation and R&D activities; protection of innovations by patents; the extent of renovating production; incentives to innovations; and constraining factors.

An analysis of the results of innovation tests in West Germany shows that in 1979–1990 the innovation quota (share of innovating enterprises) in the manufacturing industry as a whole increased from 61.4% to 74.4%, the sector of investment goods being the most active and the sector of consumer goods the least active (see Table 2).

The expenditure on innovation activities increased during the same period by 1.7 times. The main innovating industries (chemical industry, automotive industry, electrotechnical industry and engineering) absorb 75% of the total amount of innovation expenditures in the German industry as a whole. R&D account for 45.1% of all the expenditures and in high-tech industries for almost 60%. Moreover, the larger the company, the higher its reliance on R&D in promoting innovations.

Table 2: Changes in the Share of Companies Introducing Innovations in the German Manufacturing Industry (%)

Sector of Industry	1979	1983	1987	1990
Consumer goods (I)	58.4	58.6	68.5	65.2
Investment goods (II)	64.0	74.9	78.0	77.8
Intermediate goods (III)	60.2	66.3	73.1	74.5
Manufacturing industry as a whole	61.4	68.4	74.4	74.4

The share of products during the first two phases of their life cycle (the phase of entering the market and the phase of growth) increased from 29% to 48%. The average duration of the “birth cycle” decreased from 2.4 to 2.3 years, and the average duration of the “market life cycle” of a product slightly increased from 3.9 to 4 years.

Among the factors constraining innovations West German firms most frequently indicate the insufficient profitability of innovations (68.9% of the respondents), mainly because of the unclear prospects of demand. In second place is the lack of qualified personnel in the sphere of R&D (34.9% of the respondents). Other constraining factors are very seldom mentioned.

On the whole, based on the innovation surveys results, the following conclusion can be made. In the 1980s the German industry intensified its innovation activities in order to adequately meet the challenge of the USA and Japan. Taking into account all of the indicators, one can observe both an intensification of innovation activities and an improvement of the quality of innovations. It can be assumed, with a high degree of confidence, that the German industry will have strong innovation potential throughout the 1990s which will provide the necessary preconditions for further economic growth.

### 3 Peculiarities of Innovation Tests Results in East Germany

Taking into consideration the vital importance of innovation activities for the restructuring and modernization of the economy, the Munich IFO-Institute started to conduct innovation surveys in East Germany practically immediately after the reunification of the country. Since December 1990 such surveys have been conducted on a regular basis, twice a year (as a specialized innovation test and as part of a general business tendency survey). Results of 1990–1991 surveys are already published (*Innovationsaktivitäten...*, 1992) and represent an extremely interesting source of information on the economy in transition.

In 1991, East German companies demonstrated a very substantial growth in innovation activities. In 1990 only 36% of the respondents reported the introduction of product-innovations and 22% of process-innovations. A year later, these indicators amounted to 59% and 46% correspondingly. Progress is quite obvious, although the innovation quotas

Table 3: Structure of the Turnover of East German Companies by Innovation Life Cycle Phases (%)

Share of Goods in the Phases of an Innovation Life Cycle		1990	1991
I	entering the market	12	21
II	growth	11	20
III	stagnation	47	41
IV	decline	30	18

are still lower than in West Germany. In 1991 the West German companies reported a 68% quota in product-innovations and a 64%-quota in process-innovations.

Two main reasons for the relatively rapid growth of innovation activities in East Germany can be identified. Firstly, 1991 was a year of rapid ousting of the most inefficient enterprises; secondly, the new economic environment imposed a very strict market discipline on East German companies and forced them to introduce innovations in order to survive.

With respect to product-innovations, innovation quotas differ considerably over sectors of the economy. In first place is the sector of consumer goods excluding food stuffs (65%), second is investment goods (63%), third is intermediate goods (52%), and in last place, industries producing food stuffs (41%). In process-innovations the differentiation is less pronounced, but the sector of consumer goods excluding food stuffs is leading again (50%), then food stuffs (47%), followed by intermediate goods (47%), and lastly, investment goods (43%) sectors.

The differentiation of innovation activities by size of companies (number of employees) in East Germany is completely different from that in West Germany. In West Germany, the extent of innovation activities correlates directly to the size of the enterprises. The highest innovation quota in product-innovations is demonstrated by large-scale enterprises, with over 1,000 employees. The contrary is the case in East Germany, where medium-size enterprises with between 50 and 999 employees are the most active (62% innovation quota). Large companies are considerably less active (53%). The innovation quota of small companies is the lowest at 48%.

The surveys showed that the structure of turnover of East German companies has undergone favorable changes. The share of goods being in the first two: the most important stages increased by 1.8 times within a year. At the same time, the 21% share of goods being in the phase of entering the market means that a considerable part of the total turnover of East German companies is represented by goods not yet yielding profits and requiring high expenditure on their production and marketing. The goods in the growth and stagnation phases yielding the highest returns account for 60% of the total turnover, whereas in West Germany the corresponding indicator equals 80%.

Among the aims of product-innovations the East German companies assign top priority to introducing modifications to already produced goods (70% of the respondents), whereas

Table 4: Aims of Process-Innovations (% of answers)

	East Germany	West Germany
Increase in the flexibility of production	79	77
Reduction in labor costs	71	75
Reduction in raw material costs	48*	38
Reduction in energy costs		30
Improvement in working conditions	40	50
Reduction in industrial pollution	36	48

\* Lines 3 and 4 are combined.

Table 5: Factors Constraining Innovation in the Manufacturing Industry in East Germany

Factors	% of Answers
Lack of finance	70
Insufficient profitability of innovations:	
<i>due to unclear market prospects</i>	70
<i>due to high expenditure on innovation</i>	16
Lack of adequate equipment	28
Necessity to reduce expenditure on R&D	18
Unwillingness to cooperate:	
<i>by suppliers and customers</i>	16
<i>by firms of the same industry</i>	14
Lack of information on existing know-how	10
Lack of qualified personnel in R&D	3

West German firms initially opt for an expansion of an existing product range (83% of the respondents). The aims of product-innovations with respect to market policies are almost the same for the companies of both parts of the country, i.e., preserving the existing market share clearly prevails over gaining access to new markets abroad (70% and 56% of East German companies and 68% and 52% of West German companies).

The picture of the aims of process-innovations is given in the Table 4.

Contrary to the aims of product-innovations, the aims of process-innovations are clearly different in the Eastern and Western companies. The reduction in raw materials and energy costs is considered to be much more important in the Eastern part of the country, whereas the orientation towards a reduction in labor costs and industrial pollution is stronger in the West.

The distribution of answers to the question on factors constraining innovation is of special interest for the analysts of transition economies. The rating of such factors is given in the Table 5.

The results of the survey show that the lack of finance and insufficient profitability of innovations resulting from unclear market prospects are the most serious constraining

factors for East German companies—approximately 70% of the answers, whereas in the West the respective figures are 25% and 30%. At the same time, managers of East German companies have no difficulties in finding qualified personnel in R&D, whereas their Western counterparts consider it to be the second most serious constraining factor—35% of the answers. (First place is firmly occupied by the insufficient profitability of innovations resulting from the excessively long pay-back period).

Such factors as “necessity to reduce expenditure on R&D” and “lack of adequate equipment” prove to be specifically “Eastern”. After the reunification of the country, East German companies were practically immediately exposed to international competition and were forced to start the struggle for survival. In such a situation, problems of markets and costs came to the forefront. As specialized surveys conducted in East Germany show, in order to reduce costs the management resorts to the dismissal of personnel employed in the so-called “non-productive” divisions of companies, and in the first place in R&D. Although effective in the short-term perspective, such a measure can be highly damaging to the process of future innovations in East Germany.

On the whole, the following intermediate conclusions can be drawn. In 1991 innovation activities in East Germany were noticeably intensified, both in product-innovations and process-innovations. In parallel, the structure of the companies’ turnover improved considerably: the share of goods in the phases of entering the market and growth increased and the share of goods in the phases of stagnation and decline decreased. Both trends were, to a great extent, determined by the rapid ousting of companies with an obsolete product range. However, surviving companies currently find themselves in a rather difficult position—high expenditure on production of new goods does not yet yield substantial and stable returns.

Not unexpectedly for a transition economy, the lack of finance and unclear market prospects prove to be the main factors constraining innovations in East Germany. However, the results of other business tendency surveys in East Germany show that the companies in the manufacturing industry give rather optimistic estimates of their medium-term market prospects (71% of the respondents suppose that their markets will expand and only 6% expect them to shrink). One of the explanations for this phenomenon could be the fact that those enterprises that had successfully survived the reunification found themselves in an already well established market economy with a stable financial system and a sophisticated market infrastructure.

At the same time, specialized surveys conducted in the “new Eastern lands” showed that in this region the innovation activities are still considerably lagging behind those in the Western part of the country by practically all of the surveyed parameters, and the reduction in R&D expenditure of the firms is one of the most disturbing signs. In this connection (and taking into consideration the results of innovation tests), the Federal Ministry of Science and Technology has developed special programs encouraging the development of various aspects of innovation activities, such as, for instance, programs for training and expanding personnel in industrial R&D, contract financing of R&D, develop-

ment of critical technologies, and the promotion of technoparks and consultancy centers on innovations under the Chambers of Commerce and Industry.

## **4 Behavior of Russian Industrial Enterprises in the Mirror of Innovation Surveys**

In the Russian Federation regular surveys of industrial enterprises' innovation activities were started in 1992 by the editorial board of "The Russian Economic Barometer" information bulletin. These surveys were requested by the Ministry of Science and Technology Policy of the Russian Federation.

The analysis in this section is based on the results of the first two surveys conducted in October 1992 and March 1993. The first survey covered 109 enterprises, and the second covered 137 enterprises from practically all of the regions in Russia.

### **4.1 General Results**

Taking into consideration the fact that such surveys are, in effect, an innovation for the managers of Russian enterprises, only three basic questions on innovation activities were included in the questionnaire of the first survey (other points dealt with various parameters of business conditions for further comparisons of enterprises).

1. Were the innovations introduced at your enterprise during the last three years? This question enables the calculation of average innovation quotas of different groups of Russian enterprises.
2. If there were innovations at your enterprise, what type prevailed? (Respondents were offered three variants of answers: introduction of new technologies; introduction of new products; both equally). This question was asked in order to identify the relative shares of product- and process-innovations.
3. What factors constrained innovations during the last year? Respondents were asked to indicate no more than three factors:
  - (a) lack of financial resources;
  - (b) lack of adequate R&D;
  - (c) inadequate qualifications of personnel;
  - (d) managers being uninterested in innovations;
  - (e) inability to ensure necessary supplies;
  - (f) overall instability of the situation at an enterprise; and
  - (g) other factors.

Table 6: The Share of Enterprises-Innovators in the Total Number of Polled Enterprises (innovation quota), %

	1990-1992		1992	1993 (forecast)
	I Survey	II Survey		
Industry as a whole	53.2	55.5	44.5	48.9
Manufacturing industry	55.8	56.3	45.2	49.2
Sector I (consumer goods)	47.2	51.1	44.7	44.7
Sector II (investment goods)	73.3	69.4	47.2	61.1
Sector III (intermediate goods)	48.3	51.2	44.2	44.2

Questionnaires of the second survey were more complicated and included seven questions:

1. Were innovations introduced at your enterprises during last three years? (This basic question was asked for the second time).
2. Were innovations introduced at your enterprise during the last year (1992)?
3. Are innovations planned to be introduced at your enterprise during the next year? (Questions 2 and 3 were asked in order to obtain more information on short-term changes in innovation activities).
4. If innovations were introduced, what type prevailed: the introduction of new technologies or the introduction of new products? (This question was asked for the second time and was accompanied with necessary explanations as the answers from the first survey were rather indistinct.)
5. What were the aims of the innovations introduced at your enterprise during last three years?
6. What share of the output at the end of 1992 was linked with the innovations introduced during the last three years?
7. Over what period of time has the main part of your output been produced without serious alterations? (Questions 6 and 7 were asked in order to obtain information on the efficiency of innovation activities expressed in such indicators as share of products entering the market and the average life cycle of the product on the market.)

The aggregate results of the answers to the first question of the October 1992 survey and the first three questions of the March 1993 survey on the dynamics of innovation activities are presented in Table 6.

The reduction of innovation activity in Russian enterprises in 1992 is quite obvious. (Slightly better indicators obtained within the second survey for the period of the last

Table 7: Types of Innovations in Russian Industry

	Share of Enterprises having Introduced Innovations in 1990–1992 %	
	Mainly Product-innovations	Mainly Process-innovations
Industry as a whole	53.9	46.1
Manufacturing	57.8	42.2
Sector I	50.0	50.0
Sector II	77.3	22.7
Sector III	45.0	55.0

three months are most probably the result of the enlargement of the sample and certain changes in its structure.) And what is most disturbing, the polled enterprises did not forecast any considerable expansion of their innovation activities in the nearest future. The only exception is represented by the enterprises of Sector II—they intended to raise their innovation quotas by 2/3 (from 47.2% in 1992 to 61.1% in 1993). An attempt to explain the reasons for such optimism will be made later by comparing the characteristics of two groups of enterprises, innovators and non-innovators. Here, it should also be noted that innovation activities in Russian enterprises differ substantially by sectors of industry at large. Thus, the innovation activity of the enterprises in the manufacturing industry is much higher (55.8%) than that of enterprises in the fuel and energy complex (35.7%) (according to the results of the October 1992 survey).

In comparing the results of the Russian and West German innovation tests (see Table 2) the following picture emerges: the sector of investment goods in Russia only slightly lags behind (by 5–8 percentage points), whereas the innovation activities in the sectors of consumer and intermediate goods can be characterized as extremely sluggish (Russian enterprises lag behind by 14–18 and 23–26 percentage points correspondingly). On the whole, the manufacturing sector in Russia lags behind quite considerably, by 18–19 percentage points.

As was already indicated, in East Germany the market reforms resulted in increasing innovation activities in industry from the very beginning. The situation in particular sectors of manufacturing industries is also different. In East Germany the influence of the reforms was most pronounced in Sector I (production of consumer goods), whereas in Russia the centre of innovation activities continues to remain in Sector II (production of investment goods).

The distribution of answers to the question on the prevailing type of innovations is presented in Table 7. (Data of the March 1993 survey).

On the whole product-innovations prevail over process-innovations. However, the picture in different sectors is not the same. The priority of product-innovations is vividly pronounced only in Sector II, whereas there is a balance between the two types in Sector I, and in Sector III process-innovations prevail.

Table 8: Aims of Innovations in the Russian Manufacturing Industry

	Share of Respondents, %			
	Manufacturing Industry	Sector I	Sector II	Sector III
1. Production of completely new goods	69	54	84	68
2. Improvement of goods already produced	38	50	24	11
3. Utilization of new raw materials	17	21	8	23
4. Reduction in labor costs	31	25	28	41
5. Reduction in raw material costs	25	13	36	27
6. Reduction in energy costs	10	4	12	14
7. Other aims	11	13	12	9

It is interesting that in West Germany sectoral differences by the share of product-innovations are practically the same: the highest level of this indicator is observed in Sector II, the lowest level in Sector III, and Sector I occupies the intermediate position.

The hierarchy of aims serves as one of the most significant parameters of innovation activities. Thus, in the second survey question 5 was offered to the respondents in order to determine the main lines of their innovations. The distribution of answers is shown (in %) in Table 8 (the respondents were asked to indicate all of the aims they considered important).

Among the aims relating to product-innovations (items 1–3) production of completely new goods appears to be the most important for the manufacturing industry as a whole, in second place is the improvement of goods produced, and in third place the utilization of new components. The hierarchy of the aims in Sectors I and II is almost the same (the only difference being that in Sector II the production of completely new goods more strongly prevails over the improvement of the goods produced than in Sector I). Sector III differs in respect that the utilization of new raw materials proved to be relatively more important than the improvement of the goods already produced.

In Germany, on the contrary, (both in the West and the East) priority is given to the improvement of goods produced rather than to the production of completely new goods (the utilization of new raw materials is in third place). At first sight, the preference given by Russian industrial enterprises to the production of completely new goods must witness higher “quality” of product-innovations, i.e., the fact that the Russian industry is oriented towards primary (basic) innovations to a greater extent than in Germany.

In the authors’ opinion, however, this impression is delusive. The true situation can be understood with the help of data on the share of products entering the market in the total turnover of enterprises—in Russia this indicator is twice as low than in East Germany (10% and 21% correspondingly), as well as the data on “average life cycle of the product on the market”—in Russia it is on average three times longer than in West Germany (13 and 4 years correspondingly). Hence, “the production of completely new goods” as an

Table 9: Efficiency of Innovation Activities of Russian Industrial Enterprises

	Share of Output Linked with Innovations %	Time Period in which the Output is Produced without Alterations years
Manufacturing industry	10.3	12.8
Sector I	8.4	11.9
Sector II	12.2	10.2
Sector III	10.9	16.2

aim of innovations has an entirely different meaning for Russian enterprises and German companies. The former consider the products to be “completely new” which are already outdated for the latter.

Among the aims relating to process-innovations (items 4–6) in the manufacturing industry as a whole the reduction in labor costs appears to be the most significant one, in second place is the reduction in raw materials costs, and in third place the reduction in energy costs. The hierarchy of the aims is the same in Sectors I and III, whereas in Sector II priority is given to the reduction in raw material costs. It should also be noted that the difference in the weights assigned by Russian enterprises to the given aims is closer to similar indicators of East German companies than to those in West Germany. Thus, the rating of the most significant aim (reduction in labor costs) at Russian enterprises is 1.2 times higher than the rating of the second significant aim, at East German companies it is 1.5 times higher and at West German companies 2 times higher.

The last two questions (6 and 7) of the second survey were asked in order to estimate the efficiency of innovation activities, i.e., the extent of renovating the output. The question on the share of products entering the market in the total turnover of enterprises was formulated as “What share of the output at the end of 1992 was linked with the innovations introduced during the last three years?” The question on the average life cycle of the product on the market was formulated as “Over what period of time the main part of your output been produced without serious alterations?” The results are presented in Table 9.

The best indicators of innovation efficiency are demonstrated by the enterprises of Sector II (the share of products entering the market is the highest and the product life cycle on the market is the shortest). Enterprises of the other two sectors show controversial results—the first indicator is better in Sector III, whereas the second indicator is better in Sector I. This could be explained by the fact that the indicator of the share of products entering the market reflects the results of recent innovations (i.e., innovations of the 1990s) and the indicator of the average life cycle of the product on the market is linked with past innovations (i.e., innovations of the 1980s).

In the 1980s (and especially in the first half of that decade) the industries producing consumer goods (Sector I) were in a relatively good position. During that period a lot

Table 10: Characteristics of Innovation Activities of Enterprises Grouped by Number of Employees

Number of Employees	Innovation Quota %		Time Period over which the Goods are Produced without Changes years
	1990-1992	1993 (forecast)	
1-149	48.0	44.0	12.4
150-299	74.1	74.1	14.3
300-499	40.0	55.0	17.8
500-999	57.1	39.3	12.0
Over 1000	63.6	36.4	9.1
Manufacturing industry	56.3	45.2	12.8

of imported equipment purchased in exchange for oil revenues was installed (especially in the enterprises of light industries). This made it possible to considerably renovate the product range in the consumer sector. Contrarily, at the end of the 1980s and in the beginning of 1990s, it was the consumer sector which suffered most from the reduction in state financing. This is reflected in the lowest share of products entering the market in 1992. As Table 1 shows there are no grounds to believe that in the nearest future Sector I will seriously intensify its innovation activities. If the existing situation persists in 1994-1995, the average life cycle of Sector I products will sharply increase.

Interesting results are yielded by the analysis of innovation activities of the enterprises of different sizes (see Table 10). (Based on data of the March 1993 survey).

As Table 10 shows in 1990-1992 higher innovation activities are demonstrated by the enterprises of two groups—large-scale enterprises (with more than 1,000 employees) and relatively small-scale enterprises (with 150-300 employees). Large-scale enterprises simultaneously have the shortest life cycle of the product on the market which means that they are traditional innovators. At the same time, enterprises of this group expected the most considerable reduction in innovation quota in 1993 (from 63.6% to 36.4%).

In the second group (relatively small-scale enterprises) the product life cycle on the market is much longer, which means that the increase in their innovation activities has taken place rather recently. The forecast made by this group for 1993 indicates that they are expecting to preserve their high innovation activities. (It should be noted that the sectoral structure of the group in question is practically similar to that of the manufacturing industry as a whole—the ratio between three sectors in the group under consideration is 35:30:35 and in the manufacturing industry it is 37:29:34.)

An increase in innovation activities is also expected by the group of medium-scale enterprises (with 300-500 employees), and their products life cycle on the market is also longer than average in the manufacturing sector. Thus, it is highly probable that in the nearest future the centre of innovation activities will shift from traditional innovators (large-scale enterprises) towards small- and medium-scale enterprises. The changes in

their behavior might be explained, on the one hand, by the more urgent need to introduce innovations because the large share of their output is obsolete and, on the other hand, by the higher flexibility of smaller enterprises in the situation of market reforms.

In this respect the situation in Russia is obviously similar to that of East Germany, where the highest innovation quota is typical for medium-scale enterprises (in contradiction to West Germany where the highest innovation activities are demonstrated by large-scale enterprises).

Finally, according to the data of the October 1992 survey, among the factors constraining innovations the first place is firmly occupied by the lack of financial resources (66% of the respondents mentioned this as one of the three main reasons), in second place is the overall instability of the situation (40% of the respondents), and in third place the inadequate qualifications of personnel (24% of the respondents). The situation over particular sectors is different. Enterprises of the consumer goods sector assign even more importance to “the lack of finance” factor than is done over the sample as a whole (78% against 66%); enterprises of investment goods sector assign more weight to the overall instability of the situation (57%), and the enterprises of the intermediate goods sector indicated a different third factor, i.e., insufficient readiness (unwillingness) of management—31%.

## **4.2 Comparative Portraits of Innovators versus Non-Innovators**

In order to produce a more detailed picture of Russian innovating enterprises by comparing them with those that do not introduce innovations, the whole sample (according to the answers to Question 1 of the March 1993 survey) was divided into two groups—innovators (I) and non-innovators (NI). The aggregate comparative characteristics are presented in Table 11.

First of all, the data presented shows that the characteristics of innovating enterprises in the manufacturing industry as a whole and in the sectors under consideration are practically the same (with only occasional exceptions). The main observations include the following:

- the enterprises which introduced innovations in 1990–1992 are likely to remain basic innovators in the future as well—the forecasted innovation quota for 1993 was on average three times higher in the I group than in the NI group;
- higher innovation activities are reflected in distinctly pronounced results—the goods produced by the enterprises of the I group are more “modern” (their average product life cycle on the market is almost three years shorter than in non-innovating enterprises);
- innovations are relatively more frequently introduced by non-state enterprises (the share of non-state enterprises in the I group is on average 1.5 times higher than in the NI group), the only exception is represented by Sector I;

Table 11: Main Characteristics of Innovating and Non-innovating Enterprises

	Innovators (I) 1990–1992	Non-innovators (NI) 1990–1992
Innovation quota in 1993 (% , forecast):		
Manufacturing industry	70.0	23.6
Sector I	66.7	21.7
Sector II	72.0	36.4
Sector III	71.4	19.0
Time period during which the output is produced without alterations, years:		
Manufacturing industry	11.7	14.4
Sector I	11.2	12.6
Sector II	10.0	10.6
Sector III	14.3	18.2
Share of output linked with the innovations of 1990–1992, %:		
Manufacturing industry	19.2	...
Sector I	17.2	...
Sector II	19.1	...
Sector III	21.4	...
Share of non-state enterprises, %:		
Manufacturing industry	37.0	25.0
Sector I	42.0	48.0
Sector II	36.0	9.0
Sector III	32.0	10.0
Average number of employed:		
Manufacturing industry	1041	539
Sector I	375	596
Sector II	1044	711
Sector III	1765	384

- innovation activities remain to be the “privilege” of large-scale enterprises (the average number of employees in the enterprises of the I group is almost two times larger than in the enterprises of the NI group). The exception here is related to Sector I, where innovators are, on the contrary, represented by relatively small-scale enterprises—2/3 of innovating enterprises in Sector I producing consumer goods have less than 500 employees. And that is exactly why relatively small enterprises have a considerably large innovation quota in the manufacturing industry as a whole (see Table 10).

Table 12: Comparative General Position of Innovating and Non-innovating Enterprises

	I Group	NI Group
Ratio between enterprises that benefitted and lost as a result of the 1992 reforms:		
Manufacturing industry	1:8	1:4
Sector I	1:5	1:4
Sector II	1:17	1:6
Sector III	1:5	1:3
Share of enterprises where output/input prices ratio worsened over the last 6 months, %:		
Manufacturing industry	54	40
Sector I	46	43
Sector II	64	36
Sector III	50	38

From the point of view of the factors constraining innovations the I and NI groups also demonstrate certain differences (results of the October 1992 survey). If two of the most important constraining factors are identical in both groups (the lack of financial resources and overall instability of the situation), the third factor differs completely. In the group of innovators it is the inability to obtain the necessary supplies and in the group of non-innovators it is the insufficient readiness (or unwillingness) of management, which could mean that results of innovation activities in a transition economy depend to a greater extent than in a well-established market, upon the flexibility of the management acting in the extremely unfavorable situation of lack of finance and overall economic instability.

In order to conduct further comparisons of innovators and non-innovators the results of other regular surveys of "The Russian Economic Barometer" were used.

First of all, let us examine the general position of enterprises of both groups in the second half of 1992. The following estimates of respondents provide the necessary data aggregated in Table 12.

The data of Table 12 quite obviously shows that the market reforms (and price liberalization in the first place) produced more unfavorable impact on innovating enterprises. And enterprises of Sector II were the ones that suffered most.

Such basic performance indicators as the volume of output and the level of employment proved to be practically the same in the I and NI groups. However, the capacity utilization rate, stocks of finished goods and order-book levels demonstrate certain differences (see Table 13).

The indicators presented above in the I group are worse (with rare exceptions) than in the NI group, which means primarily that innovating enterprises were more seriously affected by the current industrial depression than non-innovators. However, the difference between the two groups by the indicators of capacity utilization and order-book levels (3-7

Table 13: Selected Performance Indicators of Innovating and Non-innovating Enterprises

	I Group	NI Group
Capacity utilization rate, %:		
Manufacturing industry	73.9	78.2
Sector I	81.7	80.9
Sector II	69.8	73.6
Sector III	70.0	77.6
Level of finished goods stocks as against the "normal" one, %:		
Manufacturing industry	79.9	87.9
Sector I	62.5	82.2
Sector II	85.4	100.5
Sector III	91.6	86.6
Order-book level as against the "normal" one, %:		
Manufacturing sector	81.3	84.0
Sector I	80.8	84.8
Sector II	81.2	88.6
Sector III	81.8	80.7

and 4–8 percentage points correspondingly) is considerably less than the level of finished goods stocks (8–20 percentage points). This could mean that the relatively lower level of finished goods stocks in the I group is determined not only by the sharper decline in production but also by the fact that demand for the goods produced by innovators is relatively higher than for the goods of non-innovators.

The financial position of innovators versus non-innovators will now be examined (see Table 14), bearing in mind that in the transition economy the lack of financial resources proves to be the most important factor constraining the introduction of innovations. As was already mentioned, this factor was indicated by 68% of all the respondents participating in the first innovation test. Almost the same rating (70%) was assigned to this factor by the companies in East Germany.

Data presented in Table 14 clearly shows that the financial situation of the innovators (at least its perception) is noticeably better than that of the non-innovators. The former less frequently assess their financial position as unfavorable and the threat of bankruptcy as real. However, attention should be paid to the exceptional situation of the innovators in Sector II—the first indicator is the same as in the corresponding sector of the NI group and the second indicator is even worse.

The more stable financial position of innovators cannot be explained by the favorable ratio of their input and output prices. On the contrary, as was shown earlier in Table 12, the relative prices proved to be unfavorable for innovating enterprises, hence the question arises of how, under such conditions, the innovators still manage to maintain

Table 14: Estimates of Financial Position by Innovating and Non-innovating Enterprises

	I Group	NI Group
Share of enterprises estimating their financial position as unfavorable, %		
Manufacturing industry	50	55
Sector I	33	43
Sector II	64	64
Sector III	52	62
Share of enterprises not excluding the possibility of their bankruptcy in the next 1-2 years, %:		
Manufacturing industry	13	20
Sector I	4	22
Sector II	16	9
Sector III	18	24

Table 15: Degree of Market Monopolization in Innovating and Non-innovating Groups of Enterprises

	I Group	NI Group
Share of enterprises considering their markets highly monopolized, %:		
Manufacturing industry	34	24
Sector I	30	26
Sector II	44	45
Sector III	27	10
Including the enterprises recognizing themselves as monopolies, %:		
Manufacturing sector	13	9
Sector I	17	9
Sector II	12	18
Sector III	8	5

their relatively good financial position which is the necessary prerequisite of continued innovation activities.

In the authors' opinion, two explanations of the phenomenon can be offered. First, the results of the survey show (Table 15) that innovators act in relatively more monopolized industrial branches than the non-innovators.

However, it should be admitted that the "monopolization" factor plays its role only for the innovators of Sectors I and III, whereas the innovators of Sector II are again in the "unfavorable" position by this indicator.

Table 16: Share of Enterprises Considering Themselves Completely Free in Price Setting (%)

	I Group	NI Group
Manufacturing industry	37	29
Sector I	21	17
Sector II	52	36
Sector III	36	38

Table 17: Aims of Innovations in Innovating and Non-innovating Enterprises

	Manufacturing Industry, %	
	I Group	NI Group
Find new markets and change product range	67	56
Force the buyers to repay debts	56	58
Repay own debts to suppliers and banks	27	44
Find new suppliers	31	29
Conduct privatization	18	18
Change the enterprise management	13	16
Expand production capacities	13	9
Reduce the number of employees	4	4
Other measures	8	4

Second, the better financial position of the innovating enterprises can be explained by the fact that they enjoy more freedom in setting prices for their products (Table 16).

However, here, on the contrary, innovators of Sector I do not differ much from the non-innovators, in Sector III the position of innovators is even slightly worse, whereas the difference between the innovators and non-innovators in Sector II is quite substantial. It looks like this very factor, i.e., the much greater freedom in price setting, compensates for the less “advantageous” position of innovators with respect to the monopolistic structure of their branches.

And finally, two interesting details could be added to the comparative portraits of innovators and non-innovators. The questionnaires of “The Russian Economic Barometer” business tendency surveys contain a set of questions on desirable measures and prospects for overcoming the present economic recession. Managers of innovating and non-innovating enterprises are not at all unanimous in their estimates in this sphere.

Table 17 contains the aggregated results of answers to the question on measures that should be undertaken by enterprises in order to adjust themselves as quickly as possible to the new economic environment.

The divergence between innovators and non-innovators is clearly concentrated in two points. As could have been expected, enterprises of the I group assign much more

Table 18: Estimated Time Period after which the Current Recession Ends and Economic Growth Starts (years)

	I Group	NI Group
Manufacturing industry	5.6	6.7
Sector I	5.2	6.2
Sector II	4.9	5.3
Sector III	7.0	8.1

importance to the measure being directly related to the innovation process, i.e., search for new markets and change in product range. The percentage of innovators having indicated this measure is so high (67% against 56% by non-innovators) that it occupied first place in the innovating group having overtaken the “enforcement of debts repayment” measure which has the highest rating over the sample as a whole.

NI enterprises, in their turn, assign much more importance than innovators to the repayment of their own debts in order to adjust themselves to new market conditions. 44% of non-innovators indicated this measure, whereas the respective share in the I group was 1.5 times lower, only 27%. This is not surprising at all in the context of a much worse financial position of non-innovators versus innovators.

Table 18 contains the aggregated results of answers to the question on the time prospects of overcoming the current economic crisis.

The data presented in Table 18 indicate that innovators in the manufacturing industry as a whole, as well as in all three sectors of it are steadily more optimistic than non-innovators. However, it should be noted that greater divergence is demonstrated by innovating and non-innovating enterprises producing consumer (Sector I) and intermediate goods (Sector III), whereas the estimates of both groups in the investment goods sector are quite close, which could indicate the relatively worse prospects of this sector at large.

## 5 Conclusions

On the whole, the results obtained through the first innovation tests in the Russian industry enables the conclusion that in the sphere of innovation activities no substantial promarket changes took place in the behavior and mentality of the enterprises’ managers. And in this, they differ radically from their counterparts in the industry of East Germany where a sharp shift took place in the intensification of innovation activities within the first year of the transition to a market economy. Although the East German companies are still lagging behind their West German counterparts by practically all of the surveyed parameters of innovation activities.

Certain positive changes in the innovation activities of the Russian enterprises did take place, some of the trends observed are similar to those discerned in East Germany. However, such positive trends are not yet prevailing in the Russian industry. And what is most

disturbing, the innovation activities although being, to a certain extent, reflected in the rates of output renovation, practically have not yet had any impact on the improvement of the enterprises' performance indicators.

It could also be stated that judging by the results of the first innovation surveys in Russia those enterprises that introduce innovations are, on the whole, more "optimistic" and more oriented towards the market type economy. And this is very important as the innovations form the basis of future economic development. In the authors' opinion, however, the survey results simultaneously show that in too many cases the innovations are introduced so to say "under their own momentum", or by enterprises that can afford financing such a "luxury" under high inflation. Quite often these are enterprises enjoying a monopolistic or nearly monopolistic position in their industrial branch. The most dangerous, in this respect, is the sharp curtailment of innovation activities in the sector producing investment goods, which has until now been the main centre of innovations in the Russian manufacturing industry.

The problem of encouraging innovation activities in the Russian industry is closely related to more general problems of stimulating investment activities of enterprises and long-term financing under high inflation and overall instability. The latter are, in turn, connected with the problems of macroeconomic financial stabilization and the imposition of hard budget constraints during the period of transition to a market economy. Undoubtedly, the solution of more general problems will allow the shaping of effective incentives for the growth of innovation activities in the Russian industry. And the relative success of such a specific transition economy as East Germany provides proof of this statement.

At the same time, Russian enterprises are not unique in the necessity to overcome the contradiction between developing the basis for future economic growth (by means of innovations) and the high risks implied by such activities. As IFO surveys show, the problem of insufficient short-term profitability of innovations exists in West Germany as well. Under the current transitional economic crisis in Russia it is even more important to implement the specific policies encouraging innovation activities. The conduct of panel surveys on innovation activities and regular analysis of their results may prove to be the invaluable source of timely information for the development and improvement of such policies.

## Bibliography

CIRET Studies (1992) Munich, p. 25.

Clark, J., Freeman, C., and Soete, L. (1981) Long Waves, Inventions and Innovations. *Futures*, Guildford, Vol. 13, No. 4, p. 308-322.

Coombs, R. and Kleinknecht, A. (1986) New Evidence on the Shift Toward Process Innovations During the Long-Wave Upswing. In: **Design, Innovation and Long Cycles in Economic Development**. New York, p. 78-103.

- Duijn, J. van (1983) *The Long Wave in Economic Life*. London.
- Innovationsaktivitäten auf Hohem Niveau Stabilisiert. (1991) IFO Schnelldienst, Munich, No. 21, p. 3–9.
- Innovationsaktivitäten in den Neuen Bundesländern. (1992) IFO Schnelldienst, Munich, No. 15, p. 3–9.
- Mansfield, E. (1983) Long Waves and Technological Innovation. *American Economic Review*, Vol. 73, No. 2, p. 141–145.
- Mensch, G. (1979) *Stalemate in Technology*. Cambridge, Mass.
- Zwan, A. van der (1980) On the Assessment of the Kondratieff Cycle and Related Issues. In: **Prospects of Economic Growth**, Amsterdam, p. 183–222.