Science and Public Policy, volume 29, number 5, October 2002, pages 367–383, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, England

Service sector innovation

Attempts to survey innovation in the Hungarian service sector

Annamária Inzelt

A survey of innovation in the service sector presents a great challenge even to the advanced economies and the Hungarian attempt is among the first to test internationally harmonised innovation surveys whilst focusing on the service sector as it functions in a transition economy. The primary conclusion of this feasibility study is that a subject-oriented survey can be used to examine the service sector in Hungary. Analyses of the survey findings drew our attention to several factors hampering innovation in the Hungarian service sector. Besides insufficient funding, a lack of trained professionals is an important factor. The system is weak in network-type cooperation. The role of foreign investors is controversial — do they truly connect Hungarian companies into international networks or not?

Annamária Inzelt is at IKU Innovation Research Centre, BUESPA, Budapest 5, Pf. 489, Hungary H-1828; E-mail: annamaria.inzelt@bkae.hu.

The first version of this paper was prepared for an OECD Conference to non-member countries on the Measurement of Innovation Activities held in Pretoria, South Africa on 28–29 March 2001. It was contracted by the OECD. The feasibility survey was contracted by Hungarian Technological Development Committee reference Tan 98-55-/0.

THE NATIONAL ECONOMIES of the world are divided by technology, as Jeffry Suchs (2000) describes in his new map of the world. The "technologically connected" population belongs to one of two groups: a smaller one, accounting for some of 15% of the earth's population but providing nearly all the world's technological innovations; and the larger part, which is able to adopt these technologies into production and consumption. His third group contains one-third of the world's population and is "technologically disconnected" — neither innovating at home, nor adopting foreign technologies.

The Central and Eastern European post-socialist countries (CEECs) definitely belong to the second group of technologically included regions, even if some areas inside those countries are almost technologically excluded. Innovation assistance from the Triad (EU (European Union), USA–Canada, Japan) means that there is remarkable potential in CEECs that have not integrated S&T to any extent in their economies, and where the use of new knowledge is far from satisfactory.

The innovative performance of this group of countries is different from the Triad. There are many factors and players influencing the crucial transformation of the system, which is needed for them to become emerging economies. Free markets and liberalisation are not enough: successful innovation at the micro-level requires supporting institutions, and it is a great challenge for policy-making to facilitate technological change for improving competitiveness and high value-added job creation.

Since the beginning of the transition period, the various players and factors within innovation systems have themselves been transforming (for

Dr Annamária Inzelt is Founding Director of IKU Innovation Research Centre (1991) and founding co-director of the Centre for Innovation Policy Research and Education for Central and Eastern Europe Budapest, Hungary (1999). She is a member of several international organisations and has organised some international conferences. She is author and editor of several books, chapters and articles and regularly participates in international research projects. Her main research interests are: systems of innovation; the role of internationalisation in technology upgrading and research and development; knowledge flow through mobility and migration; and brain circulation.

instance, enterprises are becoming commercial companies and, thereby, potential key players in innovation). As regards the environment of innovation, the basic elements of ventures, the seeds of venture capital and R&D co-operation have been present. However the institutional system of innovation still displays gaps and many skills relating to innovation are missing.

The formulation of innovation policy should be placed on a sound statistical footing, since effective innovation policy cannot be formulated in the absence of good information. More and more detailed information on innovation activities is needed to make any policy decision.

This paper deals with two main issues: the constructive adaptation of innovation survey methodology in Hungary and the main findings of a feasibility survey in the service sector. The first section describes the conceptual background for measuring innovation. The second details the methods and main findings of the feasibility innovation survey. It analyses first the aims of innovation, followed by the sources of information, the available human resources for realisation of innovation and also expenditure towards that realisation. It refers briefly to the importance of methods, which help in competitive advantage, co-operation and productivity. The paper then concentrates on the main findings relating to evolutionary and interactive processes among the players and among the different stages in the development of ideas into innovations. The final section draws some conclusions.

Conceptual background

This paper concentrates on the introduction of a tool to measure innovation in a post-socialist transition economy, Hungary. Innovation is extremely complex, a moving target, where many impacts of innovation are hardly measurable. One crucial element in these methods is innovation surveys. These have their advantages and disadvantages, as literature has discussed. (Arundel and Garrfels, 1997; Archibugi and Pianta, 1996; Arundel *et al*, 1998; OECD, 1996; Sirilli and Evangelista, 1998; Smith, 1998; Tomlinson, 1997).

Innovation surveys guided by the *Oslo Manual* (OECD–Eurostat, 1997) contribute to an analysis of the dynamics of technological change in the business sphere and enable policy-makers to find more effective ways to maximise the socio-economic and industrial development potential and to support competitiveness and productivity in transition economies. This accepted international standard furnishes a very sound background, even if many methodological problems and interpretations of innovation surveys have not yet been resolved. Core common indicators and definitions can help to avoid unnecessary differences in the measurement of disparate groups of countries. The OECD (Organisation for Economic Co-operation and Development) and Eurostat are key players in promoting the development and use of common definitions and statistical procedures inside and outside their member countries.

This national innovation surveys guidance is penetrating into CEECs. Working in tandem, the OECD and Eurostat involve CEECs in the harmonisation of innovation indicators, using the Community Innovation Survey (CIS) questionnaire guided by *Oslo Manual* standards.[1] This allows inter-country comparison, not only among the previously CMEA[2] member countries but also among post-socialist and advanced market economies. Internationally comparable indicators are extremely important, and, at the same time, indicators have to respond to locally, nationally and regionally relevant questions, even if they are not interesting for the broader community.

The process of developing a modern information system for innovation is a time-consuming task for any country. The so-called 'new economy' or 'knowledge-based economy' has changed the paradigm of innovation. This new paradigm is a challenge for innovation indicators. It urges the revision of the old methods, standards and classifications, and the development of new indicators and novel methods for measuring the innovation process. The transition economies must solve in parallel two different tasks of modernisation: adopting the traditional measurements of innovation and related areas; and being involved along with other countries in the development of modern innovation indicators.

This article deals with the first task, the constructive adaptation of innovation surveys for the service sector in a transition economy: this is a great challenge for all such economies.[3] Innovation surveys must be attempted to extend their use from mature OECD/EU countries to CEECs and other regions. Only through such exercises can the relevance of the existing standardisation of concepts and statistical methodologies be increased for other groups of countries and the need for further development brought to light.

The specificity of adaptation by CEECs is twofold. First, the transition period from command economy to a market economy is a very special environment for measuring typical market economy

phenomena such as innovation. The period of transition offers a different environment for any type of survey.

Second, the methodological framework and guidelines set out in the *Oslo Manual* (first published in 1989) is based on the experiences of the communities of academics and statisticians in advanced countries, and has been illustrated to different groups of users in these countries. Their joint exercises helped to take into account the diversity of innovation systems among countries carrying out such surveys and involved in international harmonisation procedures. These activities contributed to further development and refinement of innovation indicators (OECD–Eurostat, 1997) This accumulated knowledge has great value for newcomers to innovation surveys, shortening the development phase of innovation indicators.

In the mid-1990s, the CEE transition economies started to try to survey innovations in the manufacturing sector (parallel to revision work on R&D surveys), based on the concepts, definitions and classifications of the *Oslo Manual*. After ten years of transition there are some fruits of this learning process, although the level of implementation of OECD/Eurostat standards and the adaptation of CIS-1 or CIS-2 questionnaires in the national environments are different among CEECs.[4]

Innovations in the Hungarian service sector

The *Oslo Manual*'s internationally guided harmonised innovation survey in respect of the service sector is rarely available in CEECs. Surveying innovations in this sector is a great challenge for the advanced economies. The first large-scale statistical attempt was in the mid-1990s in many OECD/Eurostat economies (Evangelista and Sirilli, 1998; Gallouj and Weinstein, 1997; Sirilli and Evangelista, 1998).

The Hungarian attempt is among the very first to test the questionnaire of the second CIS (CIS-2) focusing on the service sector, which has only recently become involved in modernisation in CEECs. Whether the questionnaire will work in this sector of a less advanced, less internationalised, transition economy remains to be seen.. Constructive adaptation is not a simple translation of the questionnaire to the service sector. Rather it supports the development (incremental improvement) of questions that fit better into the character of transition economies to make the questionnaire meaningful and useful for them (Inzelt, 1995).

The overall goals of innovation surveys are to provide indicators that connect with policy-relevant issues. The design of a survey is an ongoing interactive process and analysis is an important part of this. The key features — the preparation of a register, decisions about sampling methods and the design of the questionnaire and the statistical methodology of the Hungarian feasibility survey conducted in 1999 are described in Annex 1.

As one of the first attempts to look at levels of product and process innovation in the Hungarian service sector, this analysis illustrates what the data mean and how they could help in understanding the importance of such investigations

This is one of the first attempts to take a wide-ranging look at the actual levels of product and process innovation in the Hungarian service sector. The most significant function of this analysis is to illustrate what the data could mean and how they could help in understanding the importance of such investigations. The majority of the topics were investigated only in innovative firms. Non-innovative firms were asked to provide information on the main factors hampering innovation.

This survey can provide a picture of what is happening and can encourage periodic surveys of innovation. Policy-makers need to have reliable information on innovation, as well as on factors supporting or hindering the diffusion of new knowledge and of innovation in the service sector.

Essential message of the data

This section analyses the main findings. The interpretation of the data is an acid test of the significance of data collection. It makes it possible to evaluate how indicators can help to identify problems and improve our understanding of innovation processes. In the analysis of the summarised results of the feasibility survey I concentrate on several specific topics and not an evaluation according to the question groups in the survey. The survey allows us insight into innovation processes, although it cannot trace very many of their factors.

The feasibility survey concentrated mainly on the high technology-intensive service sector: information technology, telecommunications, research and development businesses, engineering, and banking and insurance. From the low technology-intensive service sector, trade was investigated.

Relating to our register the response rate was 11%. The number of organisations giving viable answers was 100, of which 54% were domestic companies, 15% were joint-ventures and 25% were foreign-owned companies. This sample size is adequate for a feasibility study. Readers have to keep in mind that the group of companies actually

Table 1. Number of innovative organisations by ownership (number of respondents)

Owners	Innovative	Non innovative	Total
Domestic 100%	39	15	54
Public	15	7	22
Private	24	8	32
Foreign ownership 100%	22	3	25
Public	19	3	22
Private	3	-	3
Mixed (foreign: 25–99%)	12	3	15
Public	8	2	10
Private	4	1	5
Mixed (below 25%)	–	–	–
Unknown owners	3	3	6
Total	76	24	100
Public	42	12	54
Private	31	9	40
Independent	37	19	56
Group member	37	5	42

investigated is small. The size of sample allows us to sketch a picture of innovation in the service sector and the nature of the results is incidental. This first attempt must be followed by a survey based on a representative sample to draw firm conclusions.

Three quarters of those answering were innovative businesses (Table 1). These are defined as those that have introduced new or improved products on the market or new or improved processes during the investigated period (*Oslo Manual*, 1997, paragraph 199). The minimum requirement for an innovative firm was that the innovation was new to the firm. In this sense the 'novelty' might have only a local meaning.

Many factors contribute to differences among the innovative and non-innovative firms. Some of the generally important influencing factors were included in the survey such as age, size, profit, type of sector, structure of ownership, and changes in the organisation of the company. Here we highlight the role of only two of them, since, during the analytical process it became clear that the small size of sample did not allow us to analyse more in any detail or to make far-reaching conclusions. Two of the potential influencing factors may be identified as playing an important role in firms' readiness to be involved in innovation and their innovative performance: their ownership structure and the type of sector.

The largest number of respondents was 23 in both trade and the banking and insurance sectors, so any allocation according to size can hardly display any meaningful characteristics. If we investigate the sample as a whole by size, we come up against the problem of multi-correlation. Differences in size structure and in profit are strongly related to sectors.

Another problem was that responses to quantitative questions such as sales and profit figures were incomplete or unreliable. If the economic indicators had been available, we would have had to face the influence of organisational changes on economic indicators.

Ownership

Of the 100-strong sample, 76 firms were innovative. One third of these 76 showed a change in ownership structure between 1996 and 1999, although there was no ownership change in the majority (21) of the non-innovative businesses.

The proportion of innovative firms was higher in businesses that were completely foreign-owned than in other groups. This group was followed by mixed (domestic and foreign-owned) firms. In the whole population there was no difference in the proportion of innovative firms by public or private ownership. In the case of domestic owners, the ratio of innovative firms was lower among public-owned firms.

Almost all partially or totally foreign-owned firms belonged to a group. One fifth of domestically owned firms were members of a group. The results do reinforce international experience that companies belonging to a group are more innovative than individual players (in the case of the non-innovative entities the figure is 12% if they belong to a group and 33% if they are independent).

Few examples given by respondents suggest that firms operating as part of an international group have implemented a technologically new product or process innovation that is new to the firm or to the Hungarian market but not new in international markets. Firms that operate as members of a group were in a better position to implement a technologically new product or process innovation in the period. "Joint development with another company" is widely found amongst the foreign-owned firms and does not vary from sector to sector of the economy. Our sample suggests that the modernisation of group members is based on passive innovation in two senses: the sector itself is a passive innovator and the main sources of innovation are outside the country.

This innovation survey has reinforced the experiences of other investigations, that foreign owners (either multinationals or a small group of companies in one or two countries) are supporting technology upgrading and incremental innovation through the transfer of technology and knowledge in Hungary.

During the transition period, changes in ownership were usually accompanied by organisational changes. A process such as a merger, acquisition, sale or closure of a factory may bring about innovation. It is possible that innovation goes some way to improving effectiveness, although there is, in fact, no real improvement, since other factors, such as a merger, reduce effectiveness in the same period. At two-thirds of the companies surveyed, there was no change in the size of the organisation and

Table 2. Number of organisations involved in innovation by economic sector (number of respondents)

Sector	Innovative	Non innovative	Total
Trade	17	6	23
Telecommunications	11	4	15
Banking, insurance	21	2	23
IT	11	3	14
R&D	13	3	16
Engineering service	3	6	9
Total	76	24	100

The order of importance of the aims of innovation is that characterising a market economy, so it can be seen as a sign of success for the transitional economy, in so far as it shows the arrival at a market economy way of thinking

subsequently none in the effectiveness of its operation: 24 established a new company or a new division and 16 of these were innovative. Most of those who were more effective as a result of a merger and also those who were less effective after a sale or a closure were innovative.

Sector

The specificity of sectors usually has an important influence on innovativeness. According to our sample selection it was mainly the technology-oriented service sector that comprised the population investigated. As Table 2 shows, the largest proportion of innovative firms was in the banking and insurance sector, followed by the R&D and information technology sectors. These technology-oriented service sectors were followed by telecommunications and a non-technology oriented sector — trade.

There were only three innovative firms in engineering services, although we have nine respondents in the sample. This ratio of innovative to non-innovative engineering firms highlights that many in this sector are involved in engineering knowledge-supported commerce and product/process services. Such small engineering businesses are typical products of transition. We will not analyse this sector in the following section because of the small number of innovative engineering firms. However their responses are included in the total figures.

By examining the innovative companies we can see that innovation in companies belonging to the IT, R&D and financial services sectors is founded largely on 'own development', whilst in telecommunications and trade it is largely a matter of developments by other companies.

Aims of innovation

There are various aims or objectives for innovation. In most sectors the main reasons are (based on a given list of reasons) 'maintaining' or 'increasing market share'. These closely linked reasons are followed by 'the penetration of a new market' and 'the expansion of services within an existing field of operation'. Improving the level of services was found to be among the most significant motivating factors in two sectors (trade, banking and insurance), which have direct contact with the consumer (Table 3).

This is the order of importance that characterises a market economy. In this respect it can be seen as a sign of success for the transitional economy, in so far as it shows the arrival at a market economy way of thinking.

It is worth paying attention to the telecommunication sector. The most important aim of innovation (based on developments by other companies) was to increase the market share two years before the liberalisation of this sector.

Table 3. Top ranking of aims stimulating innovation, 1996–1998

Aims	Ranking number					
	All respondents (*n*=75)	Telecommunications (*n*=11)	Banking, insurance (*n*=21)	IT (*n*=12)	R&D (*n*=13)	Trade (*n*=15)
Extend product range						
In main field	–	2–3	2–3	1	–	–
Other field	–	–	–	–	–	–
Improve level of services	1–3	–	1	–	–	1
Preserve/keep market share	1–3	–	–	2–3	1	2
Increase market share	1–3	1	2–3	–	–	3
Open up new markets	–	2–3	–	2–3	2–5	–
Marketing advantages	–	–	–	–	2–5	–
Fulfil regulations, standards	–	–	–	–	2–5	–
Obtain information	–		–	–	2–5	–

In the services sector, the realisation of aims as shown in Table 3 leads to either radical or incremental innovation in technology systems. The primary sources of information in the innovation process, and their uses, go some way towards predicting which one will be the more likely to result. Further understanding of the nature of information expected might be gained by looking at the size of resources that firms use to realise innovation.

Sources of information for innovation

Sources of information, which are available and put to use, are an important influencing factor on the innovative ability of companies and on the expected success of innovation. Table 4 shows the significance of information sources for innovation in detail for the various operational sectors.

This question was very popular among the respondents. According to the survey design the non-innovative firms did not have to respond to this question. All (76) innovative firms and five non-innovative ones evaluated the importance of sources (based on choosing from a given list of sources). The number of responses from the non-innovators is too small to draw any conclusions, but the decision of five non-innovative firms to respond to this question underlines the importance of focusing on 'potentially innovative firms'. It may be assumed that those non-innovative firms that are ready and able to evaluate the importance of different sources of innovations, have attempted to use them to introduce innovations.

The subsequent order varies from sector to sector. Among the companies surveyed, the most commonly used sources of information were, in order of importance: internal information; information from clients; and professional meetings and journals. If we separate out the categories 'not used' in the weighted average, computer-based information networks jumps to third place. The high ranking accorded to computer information systems amongst information sources is a sign of modernisation and of the presence of a computer-literate workforce in technology-oriented service sectors.

It might be useful to analyse the distribution of results by importance of sources, by size categories. Again, given the size of the sample, it does not make sense to go beyond the simple average of categories.

Reformulating the question

The feasibility character of this survey allowed us to investigate the same set of questions in different formulation or with a modified content. The importance of sources was investigated by their application in the innovation process (see Table 5). The question asked the significance of the information sources used in accordance with their form of application (for instance, adaptation, development, ideas, and realisation). The concept is taken from the literature (Arundel *et al*, 1998).

This modified, slightly more complicated form of question was included in the questionnaire addressed to only four sectors that are active innovators in general terms: telecommunications; IT; R&D; and engineering. This modification provided important additional information. The primary aim of Table 5 is to demonstrate that the formulation of the question

Table 4. importance of information sources for innovation by economic sector (weighted average of categories)

Rank	Information sources	Total	Trade	Telecommunications	Banking, insurance	R&D
1	In-house	2.5	2.3	2.0	2.6	2.2
	Entities within the corporate group					
8	Foreign	1.6	1.6	2.0	1.7	1.3
11	Domestic	1.5	1.8	1.0	1.5	1.3
	Market/commercial					
2	Clients or customers	2.3	2.1	2.5	2.3	2.6
6	Suppliers of equipment, materials, components or software	1.7	2.0	2.3	1.7	1.4
7	Domestic competitors	1.7	1.9	1.5	1.8	2.0
10	Foreign competitors	1.5	1.3	1.6	1.4	2.0
5	Consultants	2.0	1.7	1.5	1.4	1.0
	Generally available information					
12	Computer-based information networks	1.4	2.0	2.8	2.2	1.3
	Professional conferences, meetings,					
4	journals	2.0	1.7	2.0	2.0	2.0
3	Domestic	2.3	1.4	2.0	2.0	2.6
	Foreign					
9	Fairs, exhibitions	1.5	1.4	2.0	1.6	2.0

Notes: The weighted average of the following categories: 1= not used and slightly important, 2=moderately important, 3= very important
The weight was number of respondents: IT sector is missing because number of respondent firms was less than five for this question — their responses are included into total

Table 5. importance of information sources by field of application

Rank	Important sources	Adaptation	Development	Idea	Realisation
1	Sources within the enterprise	11	14	16	15
	Professional conferences, meetings, journals				
2	Foreign	7	9	16	9
3	Domestic	6	7	18	9
4	Fairs, exhibitions	7	7	16	7
5	Clients or customers	6	5	15	6
6	Computer based information networks	7	6	10	9
7	Other enterprises within the group	9	5	10	7
	Competitors				
8	Foreign	5	5	12	5
9	Domestic	6	3	9	5
10	Higher education	6	7	7	6
11	Suppliers of equipment, materials, components or software	4	4	3	8

Notes: Rank and number of firms with answer 'moderately important' and 'very important' to sources
The number of innovative firms in investigated sectors was 38: the table contains only those information sources that were selected at least by 20 firms for any application

in such a manner is, in fact, relevant. Given a little extra effort on the part of those replying, it becomes possible to gather significant extra information and analytical value.

The information sources used serve primarily as a source of inspiration, which obliges us to regard this operative link as a relatively loose one, albeit one capable of contributing to both incremental and radical innovation. The principal channels through which ideas are obtained are quite naturally professional conferences, meetings, journals, computer-based information networks, fairs, exhibitions, and in-house sources.

The interactive process between the various players is highly influenced by the different stages in the development of an idea into an innovation. Sources of information were for the most part regarded as important for the initial inception of ideas; their role in the actual realisation process followed this. Their significance is lower in the area of development and adaptation of innovation, and information emanating from other group members has an above-average significance rating where adaptation is concerned. At the same time, however, it fails to promote the emergence of technological systems, the driving forces of so-called 'millennial' competition, since the development of systems essentially requires an altogether more solid and intense link.

From Tables 4 and 5 we can see that neither a network form of co-operation nor a business–university link can be said to typify organisations. Institutions of higher education, research institutes, intellectual property rights (that is, the institutions that produce knowledge and those supplying information about codified knowledge) rarely rank among the 'moderately important' or 'very important' sources of innovation for technological innovation.

Several sources of innovation inspiration that are very important in many countries were not so important in the Hungarian service sector during the investigated period. For knowledge-based economies, the key to the whole process is the partnership between universities and the business sector. Businesses turn to universities in equal measure to promote adaptation, to gain inspiration for, and to aid the development and realisation of, innovation ideas. In this part of the world, in the CEECs, involvement in the realisation process does not signify a strong R&D relationship, but is, rather, an element in the basic survival strategy of universities, an example of the low-cost human resource factor being applied intensively in a subcontracting role.[5]

The first step in the partnership-building process is to screen the information. It is a relatively new demand in Hungary to use universities for information, for library services, or to make use of their software. The low ranking among sources of information awarded to universities, whether domestic or foreign, to research institutes whether they are government, non-profit or commercial ones, and to intellectual property rights means that companies are not employing them as direct sources. It is an important sign for policy if economic organisations are reluctant to develop direct links with knowledge-creating institutions and do not devote too much attention to information accumulated in intellectual property rights (IPRs).

It is worth investigating these attitudes further to determine the reasons. Among the causes might be the weakness of universities in providing up-to-date, relevant knowledge to the economy and also the lack of, or weak, capability of business to acquire and employ new knowledge from universities and IPRs. It is an important function of innovation surveys to bring to light such barriers to the innovation system, but the problem goes far beyond the scope of these surveys. Further investigation should suggest how a system could sweep away the burdening factors, whether the weaknesses of the business sector, or the failures of universities.

Knowledge and learning: human resources

Knowledge creation, dissemination and absorption are crucial to innovation, although it is difficult to display or quantify them by means of indicators. The feasibility, success, failure and economic effectiveness of innovation depend significantly on whether a firm has an adequate critical mass of human resources for the realisation of a project. The innovation capacity, which is available within companies, may be supplemented by knowledge, which is accessible within partner establishments or a co-operative network.

To create, and successfully sustain, innovation requires a variety of human resources — one of the most important factors of the firms' innovative behaviour. A crucial part of the investment in creating new knowledge is obtaining highly educated people and training and retraining the employees. The available quantitative information, such as number of higher-educated personnel, investment in training and retraining provides some data on how the innovation capacity of firms is changing.

Research and development capacity is an important, but by no means exclusive, factor of such overall capability. This is particularly so in the services sector, where the majority effort is directed towards application rather than to creation of new R&D developments, even in the most technology-intensive service areas. However, as is well known from the literature, even a successful application requires specific internal R&D abilities. The capacity of companies to innovate depends partly on their ability to adopt knowledge from other companies and institutions and, thereafter, to rework and apply this knowledge in new ways, in a new environment. (David and Foray, 1994) We will, therefore, deal first with the question of in-house R&D human resources.

It may be assumed that the in-house R&D function represents the true receptive capability of companies. The aim of in-house R&D activity may be to obtain new results, but it may also be to support the study of externally generated results in order to promote innovation. R&D activity is usually continuous in the first instance and occasional in the second.

Table 6 shows the number of those engaged in R&D and their proportion of total staff by sector and also allowing for less-than-full-time R&D activity.

R&D represents only a small proportion of total company staff, save for those two branches of the economy (R&D and IT) that consistently, and by their very nature, produce R&D results. This shows that in most cases R&D activity predominantly aids the application process, and more rarely produces new technology.

The proportion of those engaged in R&D remains below 0.5% in trade and in telecommunications, and stays below 2% in the financial sector. The below 2% figure in respect of engineering services is also worth consideration. IT firms and R&D establishments have a value around 25%. In the case of the latter, this shows that research is only one area of the R&D business operation. We may be able to make significant deductions from this, but the phenomenon is worth further specific investigation.

Table 6. Number of firms and proportion of those engaged in R&D

Sector	% of R&D personnel to total	Size groups by number of R&D personnel in FTE			
		1–5	6–10	11–20	Above 20
Trade	0.2	2	2	–	–
Tele-communications	0.4	2	1	–	1
Banking, insurance	1.9	6	4	5	4
IT	23.3	3	2	1	3
R&D	25.6	4	1	3	4
Total		17	10	11	12

As we investigate R&D activity, it is worth focusing on its frequency. Different knowledge needs arise if people are involved continuously or occasionally in such activities. The majority of the 71 companies responding to this question are engaged in R&D activity. Continuous R&D activity helped in the introduction of innovation in 42 cases, and occasional R&D in ten cases (Table 7).

There are several barriers to companies using new knowledge and technology, including a lack of internal capability to use it. A technologically successful innovation can fail even after a successful introduction if the appropriate professionals (workers, engineers and managers) are not available.

The following steps are taken to avoid failure stemming from the lack of appropriate human resources: expenditure for training and retraining of workers; hiring personnel; employing those who have the necessary professional knowledge to implement a new assignment; and raising the level of education by changing the remuneration structure.[6] From all of the more significant influencing factors, 'innovation acceptance' is able to show how much of its innovation expenditure a company devotes, in comparison with other types of expenditure, to education linked to technological innovation and to the training of its employees.

Table 7. Frequency of R&D activity, 1996–1998 (number of respondents)

Sector	Continuously	Occasionally	Total
Trade	5	–	5
Telecommunications	3	2	5
Banking, insurance	13	7	20
IT	8	–	8
R&D	11	1	12
Total	40	10	50

Examining the various types of expenditure directed towards the introduction of innovation and ranking them according to expenditure ratios (see Table 8), it can be seen that training costs are moderate, ranked 4. The telecommunications and trade sectors in which innovation is a matter of developments by other companies, devoted the largest proportion of their innovation-related expenditure to training.

The significance of training as either helping or hindering innovation is reinforced by one further fact. Following 'insufficient funds', the lack of trained professionals' features as the next factor to slow down or postpone the introduction of innovation within those service areas that are tend to increase their use of the results of technical development.

Non-R&D expenditure, such as the purchase of equipment and software connected with technological innovation, the training of personnel, education and market introduction costs, can be more important than the R&D expenditure itself

Main routes of innovation

The costs of innovation and the breakdown of costs (R&D, acquisition of patents and licences, product design and so on) in a particular instance depend largely on the strategy of the firms involved. A firm might be innovative even if it does not invest in resources in R&D as such. However, it is not possible to avoid spending on introduction, adaptation, market analyses.

Data on innovation expenditure provides information on a variety of activities addressed by the innovation process. This data spotlights internal and external sources of innovation (Table 8).

Among expenditure linked to innovation activity, non-R&D expenditure, such as the purchase of equipment and software connected with technological innovation, the training of personnel, education and the market introduction costs of innovation, can be more important than the R&D expenditure itself. Companies frequently employed such methods to acquire knowledge.

In the sample as a whole (and ranked according to the number of those responding), the cost of purchasing such equipment proved to be the most significant, followed by the cost of buying software likewise linked to technological innovation. The smallest proportion was spending on R&D activity, the market introduction of innovation and purchasing R&D results. This ranking is empirical evidence that the investigated firms are passive rather than active innovators in the Hungarian service sector. (Passive means innovation exclusively or mainly achieved by importing technology incorporated in new machinery and equipment.)

A common factor of innovation expenditure is R&D. However, internal and external R&D rank towards the lower end of expenditure. The service sector is generally more important as a user of R&D than as a producer. Of 76 innovative firms, 26 do not claim even occasional R&D activities. These appear in relatively large numbers in trade and telecommunications (12 out of 17 and 6 out of 11, respectively). Based on the figures for R&D expenditure and the proportion of those engaged in R&D, it seems likely that the areas surveyed do not produce many patents or products that come under copyright protection.

Expenditure on supporting the market introduction of technological innovation also lagged behind. Telecommunications differed somewhat from this general trend, in that market introduction and education linked to technological innovation come out on top (Table 8). This response corresponds to the objective of innovations. The telecommunication

Table 8. Ranking of innovative activities by resources allocated, 1998

Resources devoted to innovation	Total rank	Rank by sectors				
		Trade	Telecommunication	Banking, insurance	IT	R&D
Acquisition of machinery and equipment linked to technological innovation	1	1	5	1–2	2–3	1–2
Acquisition of software and other external technology linked to technological innovation	2	2–3	3–4	1–2	1	3
Preparations to introduce new, or significantly improved, services or methods; to produce or deliver them	3	4	3–4	3	4–5	4–5
Training directly linked to technological innovation	4	2–3	1–2	5	4–5	4–5
Internal R&D	5	6–7	6	6	2–3	1–2
Market introduction of technological innovation	6	6–7	1–2	7	6–7	6
External R&D	7	5	7	4	6–7	7

industry declared that its most important aim is to increase market share.

A deeper analysis of the structure of innovation expenditure and its correlation with sector specificity, size of firms and ownership structure is hampered by a low rate of quantitative responses. Whilst all innovative firms responded whether or not they devoted funds to a list of resources, only three-quarters of them estimated the expenditure on such resources. The reliability of these estimates was doubtful in several cases.[7]

Importance of competitive advantage

The likelihood of a company investing in R&D depends on its ability to recoup the cost of its investment and to find suitable technological opportunities (Cohen, 1995). At first glance, questions referring to the importance of using various methods to protect a competitive advantage seem a quite natural part of an innovation survey. There is no discussion among the experts about the relevancy of this question, but during the first phase of testing the questionnaire it became clear that the question is meaningless for respondents in several service sectors. Such a result also gives food for thought regarding the reasons for missing, or very limited, innovation capabilities but such speculation would lead us far from our survey analysis. Our solution was to include this question only in the questionnaire to IT, telecommunications, R&D, and engineering services.

Looking at methods to protect a competitive advantage in the sectors surveyed, rapid market entry, business confidentiality, frequent technological development, and technological complexity preceded in importance that of protection through the patenting process. The latter did not rank among the most significant methods of maintaining competitive advantage even in the technology-intensive service areas.

Products protected by some kind of IPR were created in 19 firms between 1996 and 1998. Considering the nature of these services, it may be reasonable to assume that trademark registration with the consequent legal protection is often undertaken. The answers give us no information in this respect.

The number of respondents is too small to make a clear statement on the reasons why IPRs are at the bottom end of the ranking lists either as sources of information for innovations or to protect the innovative advantages in the sample. The coincidence of low ranking as both source and a form of protection would repay our attention in further investigation.

If I were simply to speculate on reasons, the legal framework can be discounted since the Hungarian IPR system is fully harmonised with the European. The reason might be sector specific, or it might be the low enforcement rate of patent protection for innovators in a small, developing economy. The hindering factors of innovation (Table 10) may support the latter alternative. However, rather than further guesses, we need substantially more detailed information to evaluate these facts.

Partnership and network connections

Based on our picture of the sources of information for innovation we have already referred to the importance of collaborative partnerships (clients, suppliers, competitors, professional meetings and conferences) and to the weaknesses of network-type co-operation (higher education and research institutes). This is underlined by the fact that expenditure on bought-in R&D is, proportionately, the smallest item of R&D expenditure directed towards the realisation of innovation (ranked 7 in Table 8).

At the same time, we have stated that belonging to a business group has influenced innovation favourably, representing a bond to a group with a limiting set of conditions.[8] Of the 42 businesses belonging to a group of firms, 37 were innovative (Table 1). Four fifths (29) of these took part in some form of co-operation on innovation within the group (Table 9).

Of 76 innovative firms, 43 had established some kind of link or partnership to promote innovation. These can be categorised according to the partners' field of operation and geographical location (Table 9).

The order of importance relating to co-operation partners naturally differs from that of the same companies acting as information sources. Clients are the

Table 9. Number of partnerships in innovation activities by type and location, 1996–1998

Rank	Type of partner	Total number of partnerships	Location of partner					
			National	EU	CEE	USA	Japan	Other
1	Clients or customers	145	132	7	2	4	–	3
2	Government or private, non–profit research institutes	47	12	30	1	4	–	–
3	Higher education	44	18	16	3	5	2	–
4	Other enterprises within the group	29	9	12	–	7	1	–
5	Suppliers	28	14	8	1	4	–	1
6	Consultants	21	17	3	1	–	–	–
7	Competitors	20	10	6	2	–	–	2

most important co-operation partners. They are followed by research institutes and institutions of higher education, which have far fewer links, and then, with fewer still, by organisations within the same group of companies, and finally by suppliers. Consulting firms and competitors feature least of all as partners. This implies that co-operation between competitors in the precompetitive stage is rarely present in that segment of the services sector surveyed.

If we take a look at partnerships based on their geographical location, we find that domestic co-operation predominates — obviously so in the case of clients and consultants. The predominance of foreign connections is noticeable in partnerships with research institutes and with other members of a group, and, to a lesser extent, with partner universities. In partnerships with competitors and suppliers, domestic and foreign ties are present in equal proportions.

More than one-third of the participation in innovation co-operation has been with foreign partners.[9] This is a relatively good performance if we take into account that Hungarian participation in innovation co-operation has, in general, been established in the last decade. The transition period opened up the economy for such co-operation, but building it up is a very slow process; it is based more on mutual knowledge and confidence than on economic/innovative capabilities.

Still, however, a lack of possibility for co-operation is among the factors hampering innovation (Table 10). The majority of foreign links are with EU member states although co-operation with US organisations must not be overlooked. The fairly modest level of innovation co-operation with the Central and Eastern European region in the service sector is not surprising. Such co-operation hardly existed in COMECON because of the low importance accorded to services. Nevertheless, innovation co-operation in the services sectors with the Central and Eastern European region does exist. A part of this has been preserved from the COMECON era and reorganised to fit current needs.

It is worth mentioning that the EU partnerships are largely with research institutes and that this figure is, in fact, double that of partnerships with domestic institutes. They are followed by partnerships with EU institutions of higher education, which only just lags behind that of existing ties to domestic universities. The reasons for this are varied: it may be that the foreign owner favours established research relationships or it may be that the research portfolio of the domestic university differs from the needs of the organisation. It may also be that the marketing of research activity and the effectiveness of partnership management are simply lacking on the part of domestic research institutes and institutions of higher education.

Success of innovation

Whether a company is innovative or not is influenced not only by its strategic decisions, but also by an environment, which either helps or hinders innovation. Three-quarters of those replying were successful in seeing their innovation through to realisation, whilst the remaining quarter failed to complete the process satisfactorily. Changes in the innovative performance of companies can be traced back to many factors. Successful realisation, incidental failure, or the absences of innovation are just single elements in effectiveness. The improvement of economic effectiveness as a result innovation is not easy to measure.

When measuring innovation, we generally cannot eliminate those factors that increase or reduce effectiveness, but that have no connection with innovation activity.

It is worth noting that, of those willing to undergo self-evaluation; it was the wholly foreign-owned companies that most frequently evaluated their innovation activity as unsuccessful. It would require further investigation to determine whether this is

Table 10. Effects of factors hindering innovation, 1996–1998

Hampering factors	Slowed down	Seriously delayed	Abandoned	Not even started
Lack of appropriate financial resources	18	15	3	10
Innovation costs too high	9	17	3	8
Excessive perceived economic risk	5	12	4	9
Innovation potential too low	10	6	4	6
Lack of technology possibilities	9	5	2	5
Lack of qualified personnel	13	5	–	2
Difficulty in controlling innovation costs	5	6	2	2
Organisational inflexibility	10	2	–	2
Lack of co-operation possibilities	7	3	2	1
Decreasing demand	4	2	3	3
Fulfilling regulations, meeting standards	6	–	3	2

Notes: One respondent may face more than one hampering factor
The total result is the total of all answers for a particular factor
Hindering factors that featured in fewer than ten cases are not in the table — they were: lack of innovation management; lack of market information; lack of customer feedback regarding a new service and competition

a sign of tension between domestic and foreign management or whether it is greater innovation activity and increased risk-taking, which actually lead to more failures. Unsuccessful or incomplete developments were noted in all areas except telecommunications.

Innovation can be hindered or slowed down by many factors. The economic effectiveness of a more-or-less successful innovation can be seriously damaged if the introduction of a new product or procedure has to be slowed down or delayed for a long period of time. Innovation that is planned but has not been started or has been cancelled following a formal decision can have a beneficial effect, for instance, by eliminating or reducing losses. A prolonged absence of innovation, however, generally does not improve a company's success.

A review of the innovation survey gives some indications as to why innovation activities and their results are so very limited. A range of 15 possible key impediments can be contained under two major factors, with a range of miscellaneous issues completing the picture. Table 10 shows what firms thought were the central factors constraining innovative activity. A small proportion of respondents recalled cancelled innovation projects (30); more referred to innovation that was not commenced (59). These were in turn followed by references to innovation that was delayed for a longer period (80) and innovation that had been commenced but had had its actual implementation schedule slowed down (114).

The most significant factors leading to a slow-down or delay are a lack of funds, excessive costs of innovation and the low innovation potential of the company. This is in accord with our findings regarding innovation expenditure. The other hindering factors differ according to their end-results: either a slow-down or a delay. Those resulting in a slow-down include internal organisational resistance and the lack of trained personnel and technological possibilities. The reasons for a delay include great economic risks and innovation costs, which are difficult to control.

The reasons given are primarily financial when innovation is simply not started at all: the lack of funds, excessive economic risk and high innovation costs. These reasons are well known and are among the hindering factors reported in numerous countries. However, policy-makers must understand that, even if a company has enough financial sources, it may remain non-innovative. Supplying lots of funds for research does not automatically increase the intensity of innovation activities.

That is why the reasons relating to the financing of innovations carry a more significant message for economic policy-makers: that is, based on the experience of those responsible for the slowing-down of innovation projects, the innovation potential of firms is low and appropriate professionals are lacking. We may consider whether the lack of professionals can be offset by external contracts. Is the weakness of network relationships a consequence of the lack of the specific intellectual potential necessary for innovative co-operation, or is the shortage itself a consequence of the weak relationships and the low potential as brought about by the neglect of available external knowledge?

Factors promoting innovation include tax benefits and government measures that, directly or indirectly, help in its realisation. Public funds contributing to financing innovation in Hungary are limited and incentive measures also continue to be thin on the ground, although they do exist.[10] It should be pointed out that less than one-fifth of businesses received state aid to promote the realisation of their technological innovation; companies employing more than 50 staff had a greater proportion than those employing fewer.

Conclusions

Indicator activities are not performed for their own sake, but so that the results can be used in a variety of decision-making processes. The empirical evidence of the feasibility study confirmed that the innovation survey could provide much useful information for innovation policy-making, although it was not able to delineate many of the relationships involved in the processes.

These results of the feasibility study show that the effort put into the Hungarian innovation survey was not in vain. The primary conclusion to be drawn from an analysis of the micro-sample is that a subject-oriented survey can be applied to examine the service sector in Hungary.

The innovation survey has highlighted some of the key policy questions that have to be answered. Even if the feasibility survey is followed by a full-scale survey, the latter will only serve to bring these problems into even sharper relief. As was emphasised earlier, the measurement of innovation activity requires a range of approaches. We need substantially more detailed information on appropriate conditions to be able to make any policy recommendations.

The analysis of the factors that hamper innovation may help to prepare a better innovation policy for the future.

Summing up the main conclusions of the survey:

- The main objectives of innovation are the improvement of product quality, service level and maintaining and increasing market share.
- The sources of information rated highly by the greatest number of innovators are those closest to the firm: clients and customers, and internal sources. A breakthrough has occurred among the sources of information. The computer-based information systems were ranked highly in prestige — a sign of modernisation and of the presence of

a computer-literate work-force in the Hungarian service sector. Traditional external sources — professional conferences, meetings, and journals — are judged to be more significant. Suppliers, competitors and other entities within the corporate group are just behind them.

In practice, firms turn to universities in equal measure to promote adaptation, to gain inspiration for, and to aid the development and realisation of, innovative ideas. In this part of the world, participation in the realisation process is not so much a sign of a strong R&D relationship, but, rather, an element in the basic survival strategy of universities, an example of the low-cost human resource factor being applied intensively in a subcontracting role. The role of foreign universities as partners is rather different, in that those companies that outsource research define specific tasks for them.

- There are several barriers that may prevent companies from using new knowledge and technology. These include a lack of internal capability to use it. A technologically successful innovation can fail, even after a successful introduction, if the appropriate professionals, that is, workers, engineers, managers, are not available.
- The incidence of co-operation in innovation is spreading among companies active in the Hungarian economy, although these co-operations are as yet rather weak. The Hungarians belong to an outer networking circle. These relatively loose partnerships can support both incremental and radical innovation, but they are not able to promote participation in technology systems, which are on the leading edge of competition at the turn of the millennium. A precondition of participation in the latter category of innovation is a strong partnership displaying a deep commitment to co-operation.
- Financial factors, including lack of appropriate sources of finance, are evaluated as the most significant impediments to innovation. Another major complex of factors hampering innovation relates to company-specific issues, such as inadequate innovation potential, lack of technology possibilities, and lack of qualified personnel. In most cases, R&D activity predominantly aids application and so results more rarely in the appearance of new technology. Based on the figures for R&D expenditure and the proportion of personnel engaged in R&D, it seems likely that the sectors surveyed do not produce many patents and products subject to copyright protection. It can be assumed that in-house R&D activity demonstrates the receptive capacity of companies.
- Belonging to a business group had a favourable influence on innovation. Many up-to-date items of information were available to group members. They could overcome several factors inhibiting innovations (such as a lack of financial resources and weaknesses in innovation management) more easily than others. The network-based forms of co-operation showed weaknesses either within the group or among the various independent companies. The links between companies and universities are still in their early infancy.

Methodological lessons

The adaptation process of the traditional metrics of innovation brought to light several methodological questions. Changes implemented during the adaptation of the questionnaire have stood the test of feasibility acceptance. A handful of modifications have relevance and value not only to local or transitional economies, but also provide results valid for international methodological experiments.

- Respondents were able correctly to identify the definitions employed in the questionnaire. However, a simplified questionnaire was workable in several investigated groups. Tailor-made wording was important for different sectors. The design of a survey takes much longer if we try to develop harmonised questionnaires adjusted to individual sectors. Such adjustments can result in more easily understood questions for respondents thus improving the quality of responses. Meaningful questions can improve significantly the chances of obtaining the required information.
- The sources of information can provide us with much knowledge, not only on the present innovation activities, but also allow us an insight into future tendencies. So the content and formulation of this question is very important. The feasibility survey suggests that we investigate the sources of information by their application in innovation processes. The question explored the significance of the information sources used in accordance with their form of application (for instance, adaptation, development, ideas, and realisation). This test within the (generally) active innovator sector and this modification of the question was not only practicable but provided important additional information. Such a broadening of the question did not increase the tasks of the respondents, and, given a little extra effort on the part of those replying, it became possible to gather significant extra information and analytical value.
- At first glance, questions referring to the importance of using various methods to protect a competitive advantage seem a quite natural part of an innovation survey. There is no discussion among experts about the relevance of this question, but during the first phase of testing the questionnaire it became clear that the question is meaningless for respondents in several service sectors. Such a result also gives us food for thought on the reasons for missing or very limited innovation capabilities, but such speculation leads us far away from our survey analysis. Our solution was

to include this question only in the questionnaire to IT, telecommunications, R&D, engineering services.
- The investigation of the specificity of service sectors stressed the known limitations of innovation surveys guided by the *Oslo Manual*. This regime of indicators can provide very little information on innovation in the form of adaptation and innovation as diffusion, and on the content of co-operation and networking. Because of the limitations of survey-based indicators we need to conduct more focused case studies for both the subject and object approaches, and also semi-structured interviews to understand the complexity of innovation activities of specific sectors and problems.
- Another important methodological lesson of the feasibility study relates to the problem of the response rate. It seems that non-innovative firms are quite reluctant to respond to such questionnaires. We have identified one typical group of non-responders: some of the foreign-owned companies belonging to foreign chains. It should also be the task of the decision-makers to seek ways to reduce this unresponsive attitude.
- Our interactive mode of surveying innovation highlighted some topics for further investigation. Some of them can support a revision of the existing questionnaire whilst others may help in the development of modern innovation indicators.
- To create, and successfully sustain, innovation requires a variety of human resources, which is one of the most important factors of firms' innovative behaviour. Crucial parts of the investment in creating new knowledge are to obtain highly educated people and to train and retrain employees. The available quantitative information (the number of higher-educated personnel and the investment in training and retraining them) are important indicators but they are only one half of the solution to extracting information on knowledge acquisition through human resources.

To sum up the conclusions: under transitional conditions, initial stratagems may lead in many different directions. Government policy has to find ways to create an environment friendly towards innovation and towards entrepreneurs and to build a system of guidelines to help locate the best solution for the whole economy.

Business enterprises must create a demand for R&D results, and be capable of utilising them. They need to possess an intellectual base that can promote inventions and innovations introduced in other countries. International experiences suggest that the market cannot by itself solve this problem. It must be supported by general economic policy, as well as by science, technology and innovation policies. The present research can help to lay the foundation for these policies.

Nowadays information technology is revolutionising the mode of any surveys, and this process will strongly affect the methods of surveying innovation. It is very common international experience that the length of questionnaire is in inverse ratio to the response rate. Traditional questionnaire technology (the printed questionnaire) hampers the asking for more details. Information technology is revolutionising our survey mode. It may increase the number of closed-ended questions without increasing the length of the questionnaire (responses may be based on simple choices from a given list).

Annex 1. Profile of Hungarian feasibility survey on innovation in the service sector

Preparation of register

It was necessary to find a suitable register for selecting companies. For this sampling it was much easier for us to find virtually up-to-date listings of Hungarian companies than in previous years of the transition. Rapid changes in the institutes and businesses where data should be collected are still making it difficult to find up-to-date comprehensive lists, so we had to employ several lists.

The basic source was the Hungarian Central Statistical Office (CSO) Enterprise Register (1999/2). Additional sources were:

- the Hungarian Almanac of Financial Organisations and Exchange (1997/98);
- the list produced by The Association of Internet Providers;
- and the list of Hungarian Software Companies compiled by the Hungarian Investment Development Agency (ITD) Hungary Ltd.

Different sources served as the basis for the preparation of the register.

Sampling method and response rate

The main target of the survey was to test basic feasibility — whether the range of the companies to be surveyed was or was not representative within any selected sector. In statistical terms we cannot speak of a 'representative sample'; 'sample' here means the group of companies actually examined. Our aim was to test the questionnaire not only in different branches of the service sector but also in different types of organisation.

The statistical population selected from the lists comprised firms with more than ten employees in trade, telecommunications, banking and insurance, R&D and information technology (except databank services). From engineering services, firms with more than 50 employees were selected. The sample covers 100 firms.

The organisations selected from the sources differ by size, ownership structure and region; for example, multinationals, joint-ventures, domestically owned SMEs (small and medium-sized enterprises) operating in developed and depressed regions, in large cities and small towns.

Six service sectors were covered. Sectoral classification was

(*continued*)

Annex 1 (*continued*)

based on ISIC Rev 3. Not all subsectors were targeted. By the Hungarian version of ISIC Rev 3 the sectors and their subsectors are:

- Trade: 5010, 5030, 5050, 5130, 5143, 5146, 5161, 5162, 5164, 5211,5212, 5231, 5232, 5245, 5261
- Telecommunications: 6420
- Banking, insurance: 6500, 6700
- Information technology: 7210, 7220, (7240, 7260)
- R&D businesses: 7310, 7420
- Engineering service

Data have been collected by face-to-face interviews and a mail questionnaire prepared on the basis of the standards and definitions of the OECD *Oslo Manual* (CIS-2). It was decided to run a pretest of the innovation survey in 1998. We visited some firms and asked members of top management to fill in a draft questionnaire. The pretesting period was followed by a pilot survey.

Designing the questionnaires

The design of the questionnaire was a crucial part of the feasibility study and was again based on CIS–2 recommend-ations. The first Hungarian draft was a simple translation and then the questionnaire was modified step-by step with regard to both the content of the questions and the layout of the whole questionnaire. Generally speaking, the following issues were raised: the type of innovations introduced (service, process/ delivery); innovation expenditure; factors influencing the aims of innovations; sources of information; co-operations; factors hampering innovation. The modifications have not affected international comparability.

The pretest was done by face-to-face interviews in each selected sector. Every researcher had to fill out the pilot questionnaire and prepare a written report on his/her experiences with the interviews. After the preliminary questionnaires filled in by the firms had been examined and collated, the first round of interviews was evaluated as not adequate to start the postal part of the feasibility survey. More development was need. We realised that the people interviewed were not able to understand the concept of the questionnaire. The questions were not meaningful for them.

Facing this problem, we consulted several Hungarian experts in the retail trade and in banking, and asked advice from several foreign experts (members of the NESTI group) who had successfully carried out innovation surveys in the service sector. Following this, we both simplified (significantly) the original questionnaire and added a few items. The modified wording and good examples of innovation made it easier for respondents to understand the questions.

Then we selected several other companies to continue pretesting with our revised questionnaire. We devoted much time to finding the most suitable respondent at the company. The second round of pretesting was successful. However, it was very clear that we could not employ the same selection process to identify the most suitable person at the firms for the postal survey.

Thirteen firms filled in the questionnaire and seven others gave valuable, detailed comments on its design. After pretesting we still entertained some doubt as to whether the questionnaire was workable in Hungary. This was why we proceeded further on a sector-by-sector basis, and so the survey period was divided into two phases: March 1999 and August–September 1999.

First, we concentrated on the banking and insurance sector, since this seemed to be the most capable of responding to a postal survey. In this sector, the survey was successful, since we had a good response rate and the responses were relevant. Here we combined the twin methods of interview and postal survey.[11] The resulting stronger relationship with respondents helped us to identify the strengths and weaknesses of the questionnaire and to improve it further.

Following this, we utilised the postal survey in other technology-intensive service sector areas and then we moved on towards traditional, less technology-intensive sectors. (Shopping centres refused to give any information.) This careful development was important for us to obtain meaningful responses from those who would not refuse to answer a voluntary survey provided they thought it might be useful for them.

Follow-up telephone calls helped to obtain information from missing organisations and to clarify the reasons for non-response in several cases. Enormous methodological experience was built up through the completed questionnaires, the 24-hour hotline and follow-up phone calls.

The feasibility character of the survey included:

- Different versions of the same question. One question was asked in two ways in different sectors: the importance of innovation sources for innovation. Option 1 asked in general terms whilst option 2 asked the significance of the information sources used in relation to their form of application: adaptation, development, ideas, and realisation.
- Different lengths of questionnaire. According to many experts the complexity of the questionnaire and the willingness to respond are in inverse ratio to each other. In two sectors (trade, and banking and insurance) we did not ask the question relating to 'methods protecting competitive advantage', since, during the pretest, they had seemed irrelevant to these sectors. It may be assumed that it was the positive influence of the responses that caused us to omit this block.
- Attempting to approach several non-respondents by telephone interviews. This was a very clear positive influence, and we omitted the question on expenditure devoted to innovation and co-operation for innovation. The telephone interviews took 30–40 minutes and everyone who did not refuse at the very outset proved ready to respond.
- Extending a few questions.
- Formulating definitions in a more easily understandable way. First they were broadened by numerous examples tailor-made for individual sectors. These were useful in making distinctions between innovative and non-innovative companies by illustrating innovations by sector-specific instances. The questionnaires contained several different examples according to sector. By way of illustration, typical examples were: building teleworking networks; introducing novelty multimedia training and retraining systems; building an advanced telephone exchange for digital transfer; introducing smart-cards; introducing a bar-code system. In the financial sector, one specific was a one-stop banking service; in the trade sector the specific was the 'just-in-time' system, an IT-controlled warehouse, electronic business and franchises. In the IT sector, specific examples were extra-net for services, and introducing or developing advanced web-servers.
- Extracting very useful information from the responses of non-innovative firms. The non-innovative firms have to answer many fewer questions than innovative ones. According to the experiences of the feasibility survey, it is worth asking non-innovative firms to evaluate the sources of innovation. The question is meaningful for at least a proportion of the non-innovative firms as 'potentially innovative firms'. It may be assumed that such questions are appropriate to this extremely important group of firms.

Layout

The layout of the questionnaire can also help to improve the willingness of potential respondents. In this case the respondent-friendly design meant that the explanatory notes were very short and usually put there only when respondents asked.

(*continued*)

Annex 1 (*continued*)

Table A1. Lifelines of Hungarian innovation feasibility survey (service sector)

Methodology	Characteristics
Kind of survey	Feasibility survey
Survey unit	Enterprise (balance sheet reporting unit) Innovative and non-innovative firms
Classification	ISIC Rev 3 (four-digit level)
Obligatory/voluntary survey	Voluntary
Size of survey (number of responses)	100
Cut-off-point	10+ employees in most sectors except databank service (5+) and engineering services (50+)
Questionnaire	Modified CIS-2
Combined with other survey	No
Reference period	1996 to 1999
Survey method and implementation	Postal survey/phone calls for those missing the deadline
Response rate	11%

Note: Data collected and analysed by IKU, commissioned by OMFB

Acknowledgements

The author thanks all those who shared their experiences and gave advice during the process of designing and carrying out this survey – specifically: István Alföldy (Nemuann Society), Imre Béhm (Ministry of Economic Affairs, Dept. of Commerce), Gábor Kepecs (Insurance Supervisory Authority), Katalin Miskolczi (Ministry of Economic Affairs), Judit Polgárdy (State Financial and Capital Market Supervisory Authority), László Üveges (ÁFEOSZ), György Vámos (National Commerce Bond); Mikael Åkerblom (Statistics Finland), Laudline Auriol (OECD), Fred Gault (Canadian Statistical Office), Keith Smith (STEP, Norway), Genevieve Muzart (OECD), Bill Pattinson (Australian Statistical Office), Sheridan Roberts (Australian Statistical Office).

The author is grateful to all of those professionals who dedicated time and effort to the interviews and questionnaires. The first version of this paper was discussed at different meetings and the author thanks for valuable comments: Danielle Archibugi (CNR, Italy), Gustavo Lugones (Argentina), Dominique Guellece (OECD), Ruy Quadros Carvalho and Andre Tosi Furtado (UNICAMP, Brazil) and Roberto Sbragia (University of Sao Paolo), Andrew Wychoff (OECD), and anonymous referees.

Notes

1. The so-called Community Innovation Survey (CIS) questionnaire is revised for each survey period. The different versions of the questionnaire are named: CIS-1 (1990–1992), CIS-2 (1994–1996) CIS-3 (1998–2000).
2. CMEA means Council for Mutual Economic Aid also known as COMECON. It used to be an international economic organisation established to encourage trade and friendly relations among nine communist countries including the Soviet Union.
3. In this process the international community has been playing an important role that may shorten the adaptation–development phase. Foreign governments and international organisations have been supporting such knowledge transfer through different channels. The first milestone of knowledge transfer was the OECD Vienna/Bratislava Conference in 1991. It was followed by a series of international training seminars (OECD) for Central and Eastern European experts (in 1993 Paris, 1996 Budapest). The OECD has involved transition economies in several activities (workshops, conferences, on-the-job training). It supported the translation and dissemination of the *Frascati Manual* (OECD, 1993) as the theoretical framework containing the definition of this process.

   Many countries started the adaptation process by means of a translation and dissemination of the OECD *Frascati Manual*. The *Frascati Manual* has been published in several CEECs, and its availability in national languages closed the gap between existing and employed knowledge. In the late 1990s, Eurostat involved transition economies (also called the newly associated countries) in the indicator development process. However, penetration by newly acquired knowledge is not a very rapid process.. For example, the *Frascati Manual* was published in Hungarian in 1996 and the first citations outside Central Statistical Office and academic circles were seen in 1999.
4. Data and analytical reports see in: Auriol and Radosevic, 1998; Bazhal 2002; Csobanova, 2002; EC-Eurostat, 2000; Inzelt, 1991; 1993; 1996; Inzelt *et al*, 2000; Radosevic, 2002; Sandu, 2002. Radosevic (2002) compared the first round of CEECs innovation surveys in manufacturing sectors (available until 1998). His comparison highlights the methodological differences and shortcomings of comparability. He went into the detail of the difficulties in interpretation of different national surveys and made analytical comparisons. It is worth repeating such work when the next round of surveys is available.
5. IKU's (Innovation Research Centre) recent analysis of the administrative database (developed by the Ministry of Education) has shown university–industry relationships have been developing in Hungary. However, the low income per project to finance the university by business illustrates the weak collaborative character. Universities are partners for short-term, market-oriented research, testing, and for clinical trials. Very few joint research activities can be seen (more details in Inzelt, 2002).
6. Another IKU study (Inzelt *et al*, 2000) presents a picture of changes in the work-force and the growing demand for knowledge-intensive human resources in the services sector. According to this study on domestic mobility of higher-educated personnel, both new graduates and those who obtained their degree a decade or two earlier tend to seek employment in the knowledge- and technology-intensive services sector. The main attractions are higher salaries and opportunities for workers to utilise their professional knowledge.
7. However, the feasibility study did not produce proper responses to analyse the positive side of the issue: three-quarters of respondents were ready to make estimates, even if some of them estimated badly. This positive aspect must be emphasised since several experts suggested omitting the quantitative question for developing countries and for transition economies. (Neither the Brazil innovation survey, contracted by FAPESP nor the Hungarian pilot innovation survey conducted by CSO asked for such estimates.) The willingness of so many respondents to make estimates is not a bad argument in favour of including questions on expenditure according to innovation sources.
8. As other sources, such as the IKU-prepared case studies show, relationships within groups of companies can be very

varied. In one group there is a partnership where the available scientific and technological know ledge is shared and used commonly and R&D tasks are distributed. In another group it is harder to get information within companies than from outside on innovation.

9. The importance of these co-operations may be evaluated if we can obtain information on the character and content of co-operation (networking, alliances, assemblers and first/second/third tier suppliers) and the frequency of activities. This investigation goes beyond our innovation survey.
10. The large-scale changes in the period surveyed were brought about by the introduction of tax benefits linked to the direct R&D expenditure of companies (benefit which could not be applied to contracted out R&D activity).
11. Post-graduate students were the interviewers who performed an excellent job: Szilvia Lukács, Noémi Gál, Péter Cserna.

References

Archibugi, Danielle, and Mario Pianta (1996), "Innovation surveys and patents as technology indicators: the state of the art, in OECD", *Innovation, Patents and Technological Strategies*, pages 17–50.

Arundel, A, and R Garffels (editors)(1997), *Innovation Measurement and Policies* (European Commission, EIMS publication 50, Luxembourg).

Arundel, Anthony, Keith Smith, Pari Patel and Giorgio Sirilli (1998), "The future of innovation measurement in Europe", IDEA paper, 3, STEP Group, Oslo, Norway.

Auriol, Laudline, and Slavo Radosevic (1998), "Measuring S&T activities in the post-socialist countries of CEE: conceptual and methodological issues in linking past with present", *Scientometrics*, 42(3), pages 273–297.

Bazhal, Yuriy M (2002), "Contemporary issues of innovation activities in Ukraine economy", in Inzelt and Auriol (2002), pages 65–82.

Cohen, W (1995), "Empirical studies of innovative activity", in Paul Stoneman (editor), *Handbook of the Economics of Innovation and Technological Change* (Basil Blackwell, Oxford).

Csobanova, Rositsa (2002), "Market for innovation in Bulgaria", in Inzelt and Auriol (2002), pages 43–64.

David, Paul A, and Dominique Foray (1994), "National profiles in the systems of science and technology learning: a framework for interpreting available quantitative measures", Report for OECD.

EC-Eurostat (2000), *R&D and Innovation Statistics in Candidate Countries and Russian Federation, Data 1996–97* (European Communities, Luxembourg).

Evangelista, Rinaldo, and Giorgio Sirilli (1998), "Innovation in the service sector: results from the Italian statistical survey", *Technological Forecasting and Social Change. An International Journal*, 58(3), pages 251–269.

Gallouj, F, and O Weinstein (1997), "Innovation in services", *Research Policy*, 26, pages 521–536.

Inzelt, Annamária (1991), "Certains problemes de la recherche-développement et de l'innovation", *Revue d'Etudes Comparatives Est-Ouest*, 22(1), pages 21–36.

Inzelt, Annamária (1993), "The objective, the method and the process of the 1993 Innovation Survey in Hungary", CCET/DSTI/EAS/M(94)12/ANN (OECD, Paris) pages 24–34.

Inzelt, Annamária (1995), "For a better understanding of the innovation process in Hungary", SPRU, STEEP Discussion Paper no 22, University of Sussex.

Inzelt, Annamária (1996), "The Hungarian Pilot Innovation Survey", in *Science and Technology Statistics in the Partners in Transition Countries and the Russian Federation* OECD/GD (96)56 (OECD, Paris).

Inzelt, A (2002), "Restructuring and financing R&D: new partnerships", in A Varga and L Szerb (editors), *Innovation, Entrepreneurship and Regional Economic Development: International Experiences and Hungarian Challenges* (University of Pécs Press, Pécs, Hungary).

Inzelt, A, and Auriol (editors) (2002), *Innovation in Promising Economies* (Aula Publishers, Hungary).

Inzelt, Annamária, and Robert Becsky, Peter Cserna, Noemi Gal, Ilona Hoffer, Szilvia Lukacs, Gabor Tofalvi, Janos Vago (2000), "Surveying innovation in service sector, feasibility study" report for OM/OMFB (in Hungarian).

OECD, Organisation for Economic Co-operation and Development (1993), *Proposed Standard Practice for Surveys of Research and Experimental Design; Frascati Manual* (OECD, Paris).

OECD, Organisation for Economic Co-operation and Development (1996), "Service industries in the *Oslo Manual*. Definitions and coverage and associated issues", Services working Group, Discussion Paper (OECD, Paris).

OECD-EUROSTAT (1997), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data* (*Oslo Manual*) (OECD, Paris).

Quadros, Ruy, André Furtado, Roberto Bernardes and Eliane Franco (2002), "Patterns of Technological Innovation in Brazilian Industry: the Case of the State of São Paulo", in Inzelt and Auriol (2002), pages 147–164.

Radosevic, Slavo (2002), "Understanding patterns of innovative activities in countries of Central and Eastern Europe: a comparison with EU innovation survey", in Inzelt and Auriol (2002), pages 1–27.

Sandu, Steliana (2002), "Innovativeness of Romanian manufacturing firms" in Inzelt and Auriol (2002), pages 29–42.

Sirilli, Giorgio, and Rinaldo Evangelista (1998), "Technological innovation in services and manufacturing: results from Italian surveys", *Research Policy*, 27, pages 881–899.

Smith, Keith (1998), "Summary and results from a recent indicators research project: IDEA: Indicators and Data for European Analysis", room document for OECD Seminar New science and Technology Indicators for the Knowledge-Based Economy. Development Issues, Canberra, Australia, 28–29 November.

Suchs, Jeffry (2000) "A new map of the world", *The Economist*, 24 June, pages 99–101.

Tomlinson, Mark (1997), "The contribution of services to manufacturing industry. Beyond the deindustrialisation debate", CRIC Discussion Paper no 5, The University of Manchester.