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INDUSTRIAL STRATEGIES AND POLICIES FOR ECONOMIC GROWTH IN THE 1990'S

NAS — MTA Workshop
April 22—26 1991,
Budapest

Research Institute of Industrial Economics
of the Hungarian Academy of Sciences

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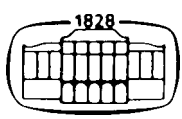

BUDAPEST

THE EDITOR'S PAGE

Ipargazdasági Szemle (Struktúrák-Szervezetek-Stratégiák), the quarterly review on industrial economics of the Research Institute of Industrial Economics of the Hungarian Academy of Sciences, is pleased to publish this first special issue in English, entirely devoted to a roundtable conference with the participation of distinguished experts from the U.S. and Hungary. The name of the quarterly means "Review of Industrial Economics - Structures, Organisations and Strategies" and typically focuses on issues of management, industrial policy, technological development and problems of industrial adaptation in general - all addressed at this conference. This special issue therefore reflects not only the theme of the conference but it also conveys a correct impression of the focus of our quarterly. We feel our research results are much more known in Hungary than abroad and it is incumbent on us to make them available to the international scientific community.

We greatly appreciate the help from our American partners and friends at the National Academy of Sciences in preparing this special issue. We hope the expanding network of international cooperation of our Institute will make it possible to publish further special issues in the near future. Hopefully these will report on conferences and/or international research projects as fruitful and rewarding as the current meeting was between the Hungarian Academy of Sciences and the National Academy of Sciences of the United States of America.

Ádám Török

Editor-in-Chief

PREFACE

This special issue of *Ipargazdasági Szemle* contains the papers presented at the workshop on "Industrial Strategies and Policies for Economic Growth in the 1990s," which was jointly sponsored by the Hungarian Academy of Sciences (MTA) and the National Academy of Sciences of the United States (NAS) and was held in Budapest, Hungary from April 22-26, 1991. The topic is one of great interest throughout the world, including industrial leaders and government officials searching for effective and wise choices in both Hungary and the United States.

Hungary is experiencing a tumultuous period of social and economic transition. New laws and policies are being formulated, affecting its economy over a wide range, including taxes, property rights, unemployment, banking, anti-trust policy, and foreign investment. Industrial managers are learning to deal with a host of new tasks and issues, such as developing strategies to compete in new markets and forging new relationships with research organizations, universities, and foreign firms.

U.S. managers and policy makers have been facing a different set of problems. Rapid scientific and technical developments are straining traditional methods of management. The globalization of markets is forcing U.S. companies to reexamine their products and processes to develop new competitive advantages, which often includes forming international strategic alliances. The success of industrial policies in Western Europe and Southeast Asia has stimulated an intensive public debate in the United States on the proper role of government in influencing industrial development. This workshop was based on the assumption that in spite of the vast and often fundamental differences between the two economies, Hungarian managers and officials could benefit from discussions with Americans on the successes and failures of U.S. experiences.

The workshop had five plenary sessions, each focusing on different aspects of government policies, industrial economics, and technological innovation and development. The first session set the context of the workshop, addressing recent global changes in industrial management and specific aspects of the U.S. and Hungarian economies. During session two, the American and Hungarian par-

ticipants shared ideas on the role of the government in supporting industry. Session three examined the issues of government fiscal policy, firm-level innovation, privatization, and employment. Options of financing industrial innovation was the focus of session four. The workshop concluded with the presentation of four case studies, allowing the participants to examine the issues of the previous sessions at a concrete, practical level. Appendix II lists the NAS and MTA delegations, while Appendix III list all who attended the workshop.

In addition to the workshop sessions, the American participants visited relevant government and industrial institutions in Budapest. These visits provided opportunities for the NAS delegation to gain insights into Hungarian industrial management and government industrial policies. For a complete list of site visits, please see Appendix I.

The ideas presented in this publication are those of the authors. The book does not represent the official views of any organization or agency.

The American and the Hungarian editors of this volume would like to express their appreciation to the staff of the MTA Research Institute of Industrial Economics and the NAS Office of Soviet and East European Affairs, particularly Stephen G. Deets and Angela Dredden, for their valuable contributions in organizing the workshop and assisting in the preparation of this publication.

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Perspective Changes of U.S. Industry, Including Increasing Development of Global Markets and International Business Alliances

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MEL HORWITCH
Theseus Institute

OVERVIEW

An issue that is increasingly challenging managers throughout the world is the growing need to develop a **Global Technology Strategy.** A top-level and strategic perspective are the most appropriate for dealing with this matter, because managing and directing a modern enterprise increasingly means viewing technology as a strategic variable.

Consequently, technological innovation--or more appropriately, **the accessing of innovative capabilities by an enterprise**--has become a matter of importance not only to scientists, engineers and other technical people, but also to a diverse array of general and functional managers. Indeed, technological innovation is no longer a specialization confined to particular units of a company. For example, in the modern corporation, innovation is now also the responsibility of people in marketing and finance. New forms of finance--such as internal venture capital and high-technology project finance--are being practiced by state-of-the-art corporations around the world in order to stimulate innovation. Technological innovation is also important in manufacturing and distribution. The accessing of innovative capabilities has also emerged as a critical general management task.

THE PATH TOWARD TECHNOLOGY STRATEGY

There has been an evolutionary path toward modern Technology Strategy. But this evolution is not linear or sequential. Ideas, concepts, and practices have been successively developed and tend to coexist, often laid on top of one another. The diverse and richly textured corporate practices in firms derive their heritage from various sources.

Until about the mid-1970s, strategy and technology never had much to say to one another. In U.S. corporate strategy and, to a lesser extent, in Europe (but significantly not in Japan), the field of strategy at first reflected mostly a "general management" tradition, which stressed such factors as sensitive and effective leadership, an emphasis on qualitative styles and goals, and an ability to run companies by viewing the enterprise as a whole. During the late 1960s and 1970s strategy entered a very rich and complex period known as a "Golden Age of Strategic Planning". All kinds of professional tools to help in enterprise planning were developed--including various portfolios and statistical-based techniques. Indeed, this was a "Golden Age" not just of strategic planning, but also of business schools (first in the United States and then in Europe) and strategic consulting firms (many of which are now global service organizations). It was, and remains, an age of professionalism. Strategic planning itself became a profession. Now, of course, planning and professionalism permeate modern business enterprises.

From the point of view of technology management, until very recently research and development (R&D) professionals never considered general management issues. Instead, the key issues in R&D involved such matters as improving the research task and managing small groups. There was a great deal of discussion on defining innovation and on delineating the process of innovation all the way from invention to development to production and diffusion into the marketplace. Attention was paid to technology's effect on organizational structure, the "product life cycle", and the sources of innovation, ranging from so-called "technology push" to "market pull".

One particularly critical aspect concerning accessing an enterprise's innovative capabilities was identified in the traditional management of technology literature--the enduring importance of **entrepreneurs and risk-takers.** Technological innovation clearly does not simply require a technical ability to achieve novel scientific or engineering developments, such as genetic engineering or redesigning semiconductor chips. The act of innovation also necessitates altering a certain culture, a way of life, a way of doing business, and a structure of an enterprise. Therefore, risk-takers and an environment encouraging risk-taking and exploration are often needed in order to create novel products, processes, and services and to produce new value. Innovative companies paradoxically often must be able to "destroy" in order to reconfigure themselves if they are going to be innovative--what the Austrian economist Joseph Schumpeter called "creative destruction".

The split between the world of strategy and the world of technology management is now over. One of the first ways strategy and technology began to interact was by incorporating professional managerial techniques into technology planning. The field of technology strategic planning is expanding with a growing number of consulting firms and professionals promoting various methods.

The attraction of technology strategic planning for firms is, in part, due to the real problem of selecting technology in the midst of technological diversity and a complex set of choices. All multi-technology companies (and almost all multi-business companies are now multi-technology companies) must choose among a diverse range of purely **technological options**--such as new materials, electronic hardware, and software. There is also the issue of what **kind of innovation process** firms emphasize: incremental innovation--i.e. slow gradual change, which is a very important part of innovation--or radical leaps that can redefine or create entire fields or industries? Examples of the latter type include the introduction of the first plain paper copier by Haloid (later Xerox) or, in the automobile industry, the Ford Taurus, the hugely successful car on which Ford spent billions of dollars developing in the early 1980s. This vehicle once again transformed Ford into an effective competitor in the U.S. automobile market. On the other hand, radical leaps have also resulted in failures, such as the RCA videodisc. There is also the issue of selecting the kind of technology to develop: product, process, or service?

Technology Strategy, therefore, requires varied choices from a diverse array of options. Planners argue that just as the traditional strategic portfolio was developed in the 1970s to assist strategic managers in allocating resources among diverse businesses, similar approaches can be applied in making technology resource-allocation decisions. Consulting firms around the world are developing and disseminating such methodologies, using such planning and analytical tools and schema as matrices, S-curves, benchmarking approaches, and statistical-oriented methods, surveys, and databases.

Still, the actual efficacy of strategic planning in stimulating and promoting real and continuous technological innovation deserves careful analysis. To be innovative is not necessarily to be systematic and rational. Perhaps there is a contradiction in planning rationally for the "creative destruction" caused by innovation. In other words, can systematic planning, which tends to flourish in an relatively orderly and stable environment, encourage radical risk-taking and change? Innovation often requires taking risks; it often necessitates tapping the skills of diverse kinds of people; it often means operating in very peculiar kinds of cultures; and it often entails going outside as well as inside for needed talent.

MODERN TECHNOLOGY STRATEGY

Therefore, a much broader conceptualization of Technology Strategy is required. One such perspective has **three dimensions.** The first dimension is termed **Competitive Strategy,** which conceptually has two extremes: competition and cooperation. Firms can compete against rivals and cooperate with them at the same time. A typical example is the relationships between General Motors and

Toyota. While General Motors and Toyota have a joint venture, the Nummi venture, to manufacture automobiles in Fremont, California, they also compete vigorously against each other.

Another dimension is termed **Domain.** Basically, this variable is concerned with where innovative activity takes place and where firms search for accessing innovative capabilities. Domain might be internal, such as corporate or divisional laboratories. The locale might also be external. Some firms place great emphasis on buying knowledge. Obviously, several companies today must make and buy innovative capabilities. Perhaps the stronger the firms are internally, the easier it is for them to make sound external choices as well. The issue of domain is a very critical matter in today's world, and, indeed, it is becoming even more significant and complex as globalization takes place.

The final dimension is **Structure.** In corporate strategy, the role of structure is generally accepted as key and controversial. Significant Technology-Strategy structures include corporate R&D and industrial R&D, which has been the traditional and most widespread approach for developing technology in large corporations. Corporate R&D emerged during the twentieth century as a venerable activity. Various labs, such as Bell Laboratories, the DuPont Labs, and the General Electric Labs, have developed important innovations over the years. However, some large corporations are also increasingly finding it necessary to replicate or mimic other kinds of innovative structures-- specifically those associated with flatter organizations and high-technology entrepreneurialism in small and medium-size companies. Finally, there are also networks of organizations of companies, made up of alliances, joint ventures, a variety of research agreements, contract research, and licensing agreements. Therefore, companies have to make complex structural choices. They tend to have some blend of structures and a certain amount of requisite variety in structures for Technology Strategy today.

We can begin to delineate most of the various key approaches for Technology Strategy that exist today. There are at least eight different categories. Two are internal and five are external. The internal ones are classical corporate R&D and novel kinds of internal structures, such as "internal venturing", entrepreneurial subsidiaries, independent business units, and decentralized small units. In a sense, this latter type of internal approach tries to instill within the large corporation much of the legendary "Silicon Valley model" of technology development. But is such an approach possible? Can large firms effectively operate like small firms? Or are large firms too hierarchical and bureaucratic with embedded strengths and weaknesses? There are some examples of large firms that seem to succeed in an entrepreneurial setting, such as 3M. However, such instances are few in number. Also, the success of such an operating style may be tied to certain cultures, such as in the United States, where individualism, labor, and capital mobility are valued.

There are also specific external approaches for Technology Strategy, such as contract research. Eli Lilly has a huge share in the traditional insulin market for treating diabetes, but Eli Lilly also wanted a genetically engineered insulin product. Even though Eli Lilly has a huge R&D lab facility outside Indianapolis, Indiana, it still went to Genentech, a well-known biotechnology company in California, to develop a DNA-based insulin product called Humulin. Firms can also make acquisitions of firms for primarily technology-acquisition purposes. For example, General Motors acquired Hughes Aircraft and EDS partially for their technical expertise. Hoffmann-La Roche acquired a majority stake in Genentech partially for the same reason. Firms also can become a licensee of another firm's in order to learn about technology. In Japan, Komatsu was a licensee of International Harvester during the 1960s and learned a great deal about technology in the heavy equipment industry. Firms can have joint ventures to develop technology, such as the Fanuc-GM joint venture, GMF, which is the largest robotics company in the United States.

Large firms can also have minority equity in small firms as part of their Technology Strategy. This is perhaps the most controversial vehicle for technology development. Monsanto has minority equity in a number of small biotechnology companies, such as Biogen. Japanese companies have minority equity in some U.S. and European companies. These arrangements function as so-called "strategic windows" on the technology and are not conventional business investments. But is this the way to learn about a new technology, by merely sitting on the Board of Directors and trying to understand how technology is being developed in a small company? A great deal of research is needed in order to understand whether this approach is actually an effective for large companies.

There are other approaches as well, including joining government-backed programs, such as MITI programs in Japan, Defense Department programs in the United States, or ESPRIT programs in Europe. Companies can also join multi-firm consortia, such as MCCor Sematech in the US, and they can link up with universities as a matter of strategy.

Research clearly shows that technology as a whole is now strategically more important than a decade ago and that approaches for accessing innovative capabilities are becoming more diverse. Data from both the public domain and from in-depth interviews of firms tends to confirm this (Figures 1 and 2). Corporate R&D is the largest Technology-Strategy option in terms of budget, but the same data indicates that the newer approaches--internal venturing and all the external approaches--have become important during the 1980s in terms of relative significance.

Therefore, there is a real question as to where in the firm the Technology-Strategy decisions should take place. Should the head of R&D be responsible for Technology Strategy? Or is it necessary for a wider group of decision makers to be deeply involved in Technology Strategy as firms reach outside as well as inside and as firms experiment and test various kinds of internal structures? The

answer is clearly that the incorporation of a wider group of people is critical. New kinds of managers and new kinds of functions are needed in order for this to be successful.

Figure 1.

Technology Development Activity of Selected 16 Firms 1978 and 1983 (Number of Publicly Reported Major Instances of Technology Strategy Activities)

Approach	1978	1983
1. Industrial R & D	—	1
2. Internal Venturing	0	4
3. Contracted Research	1	7
4. Acquisition of Firms	10	18
5. Licensee	5	9
6. Joint Venture	1	16
7. Equity Participation	0	8
8. Other (Market Another's Product)		
Totals	22	77

Source: Wall Street Journal Index. 1978 & 1983

Figure 2.

Directional Change in Relative Significance for the Eight Approaches for Ten Companies 1978-1984

Approach	Increase	Decrease
1. Industrial R & D	0	5
2. Internal Venturing	4	0
3. Contracted Research	2	0
4. Acquisition Firms	6	1
5. Licensee	4	1
6. Joint Venture	5	0
7. Equity Participation	3	1
8. Other (Market Another's Product)	3	0

Source: Personal Interviews

On a related point, technology planning and decision making at the strategic level is increasingly taking place throughout the organization. It is occurring at headquarters, group and division levels, business levels, labs, and elsewhere. For example, for at least one large corporation, the Director of Planning at its corporate laboratories does technology strategic planning for the whole company. Therefore, another critical aspect of Technology Strategy is making sure that relevant information throughout the enterprise and across the various businesses is disseminated in useful ways. In fact, the whole issue of technology transfer, which has always been an important concern in the management of technology, is even more complex and critical in today's world where technology transfer involves many different kinds of constituencies and many different kinds of people, organizations, and units within an enterprise. This situation presents a great challenge and opportunity for information technology.

A new industrial-structure pattern typifies much of modern Technology Strategy. The need for seemingly opposites to coexist--such as small and large, control and freedom, and professional and entrepreneurial--increasingly is required in a competitive environment where practicing modern Technology Strategy is a high priority.

In this regard, the structure of innovation-producing activities associated with large corporations around the world is becoming increasingly complex, exemplified by such companies as AT&T, NEC, Hoffmann-La Roche, and General Motors (Figures 3, 4, 5 and 6). Even AT&T, with perhaps the finest set of corporate laboratories in the world, Bell Laboratories, goes outside as well as inside for certain innovative capabilities. Similarly, the Swiss chemical-pharmaceutical company Hoffmann-La Roche has a variety of relationships around the world in the area of biotechnology, including its recent majority stake in Genentech. In Japan, NEC also has a very complex web of relationships around the world. In the U.S., General Motors exhibits a more extreme version of the same pattern. In addition to its special Saturn Project, GM has minority equity in vision systems and artificial intelligence companies and, as previously mentioned it acquired EDS and Hughes. It also has joint ventures, GM-Fanuc and the NUMMI joint venture with Toyota. Finally, GM has relationships with universities and other companies around the world.

Small and medium-size companies are also key participants in this dramatic emergence of modern Technology Strategy. Such firms often now exhibit an array of innovation-related relationships and alliances with large enterprises. The U.S. biotechnology company Cetus has had a web of relationships with large firms, including Kodak, WR Grace, Weyerhaeuser, and Nabisco (Figure 7).

Figure 3.

AT & T Joint Ventures and Equity Positions Analysis of Motivations

Form of Alliance	Market Expansion	Cooperative Development	Technology Acquisition
Joint Venture			
Goldstar Semiconductor (1980)	X		
Goldstar Fiber Optic (1984)	X		
AT & T Taiwan Telecom. (1984)	X		X
AT & T Philips Telecom. (1983)	X		
AT & T Microelectronica Espana (1984)	X		
AT & T Rioch (1985)	X		X
Lycom A/S (1986)		X	
Western Electric Saudi Arabia (1979)	X		
Japan ENS Corp. (1985)	X		
Covidea (1985)		X	
Equity Position			
Sun Microsystems (1958)		X	X
Olivetti (1983)	X	X	X
Mitek			X
Intermetrics	X		
Strategic Partnerships			
Western Digital	X		

Source: Moore, E.S.: "The Emerging Role of Strategic Alliances: AT & T in the Eighties" (Sloan School Mastar of Science in Management Thesis. May 1988.)

While large companies are trying to fragment and flatten in order to combat the problems of bureaucracy and excessive professionalization, small and medium-size companies, while maintaining an innovative and entrepreneurial style, are also trying to acquire both additional resources and a certain amount of professionalism by selectively joining forces with larger organizations. In fact, much of the entire Interleukin-2 biotechnology sector exhibits such a situation (Figure 8).

Figure 4.

NEC-New Linkages: Selected Examples (1980—1985)

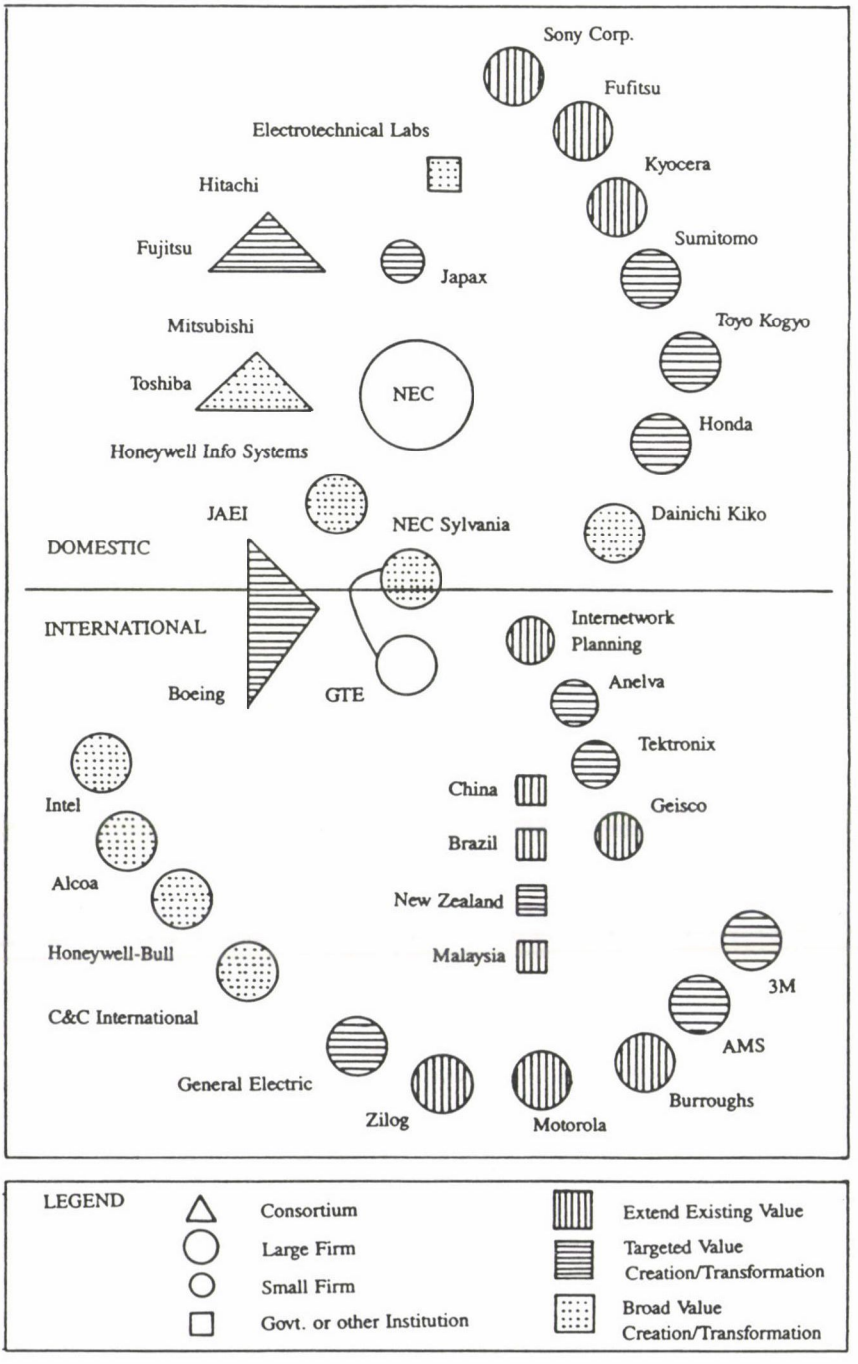


Figure 5.

Hoffman La-Roche: Selected Linkages with Biotechnology Focus

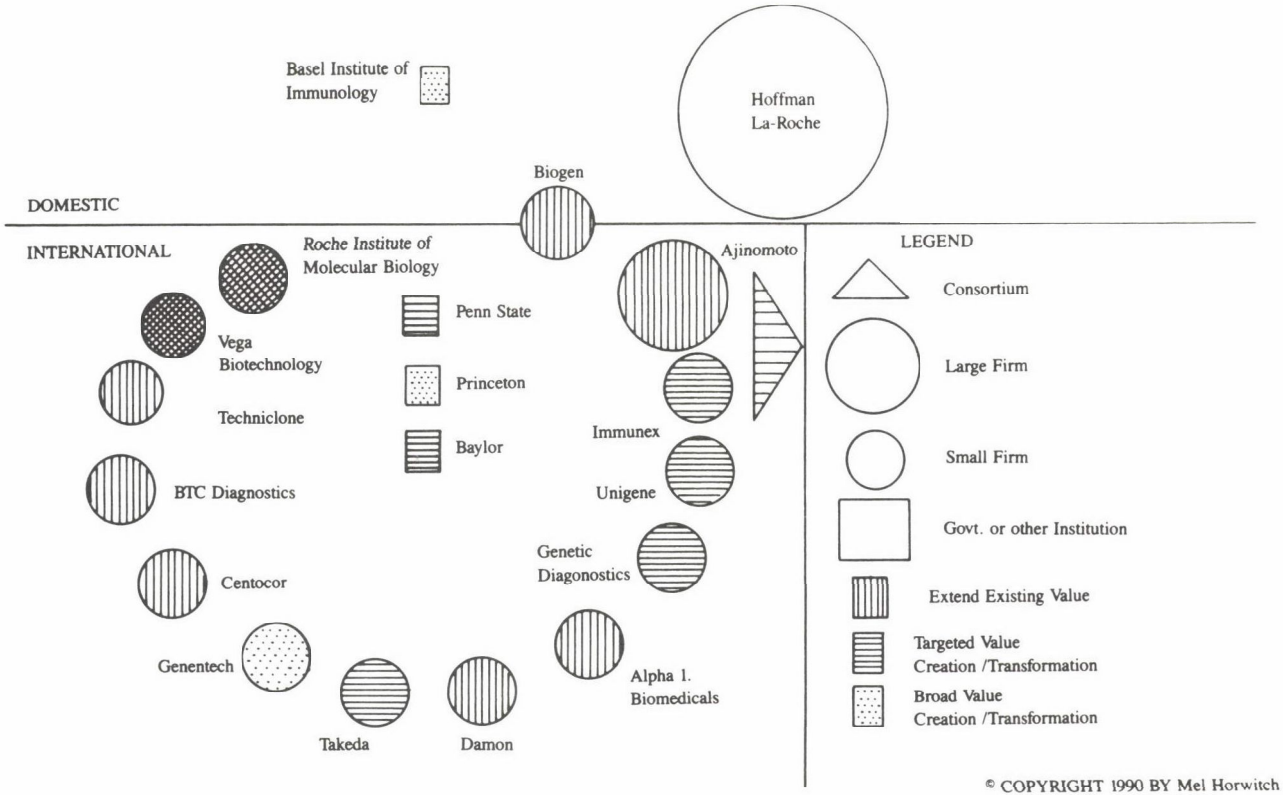


Figure 6.

General-Motors: Selected New Linkages with Technology Focus 1980—1985

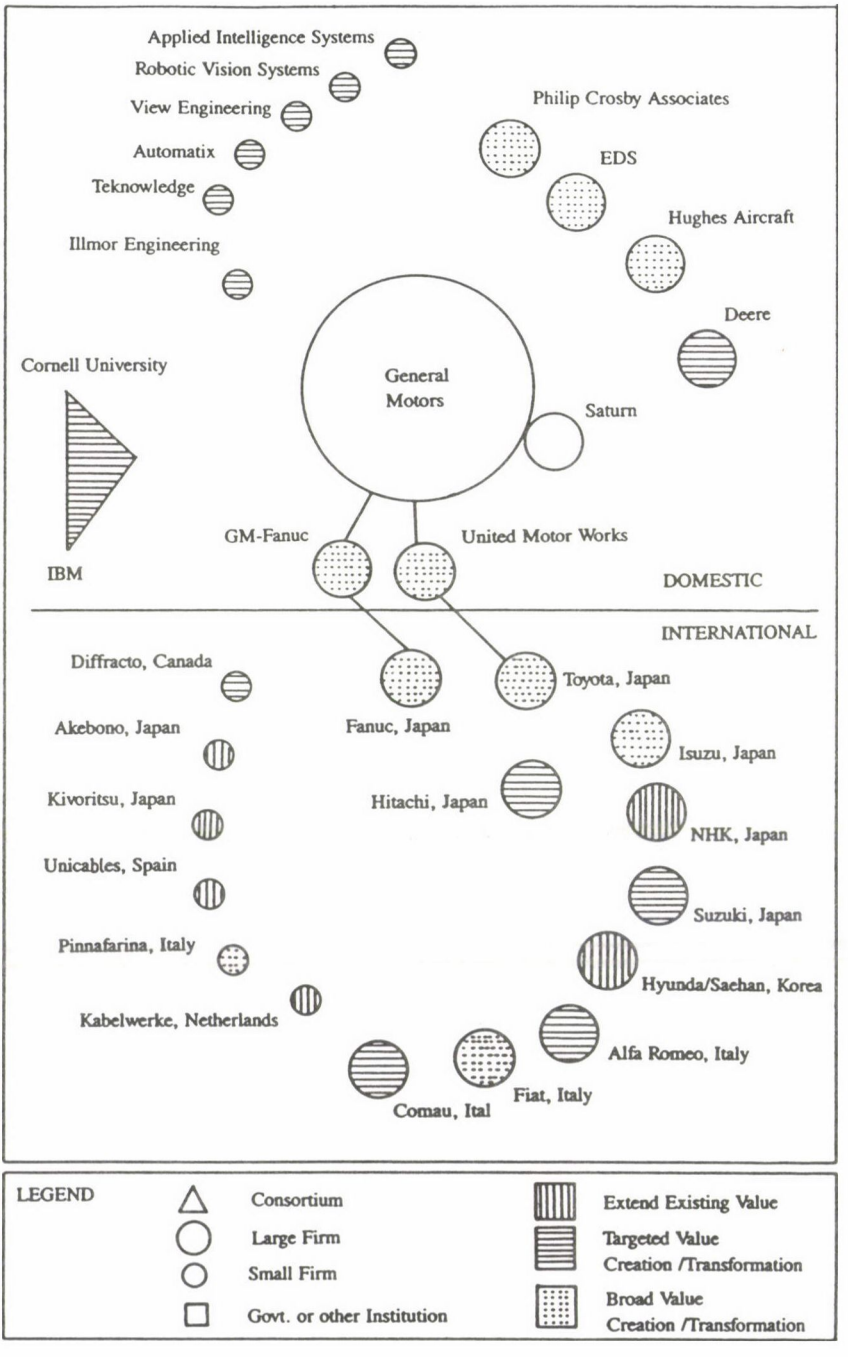


Figure 7.

Cetus' Joint Ventures and Major Contract R&D Agreement

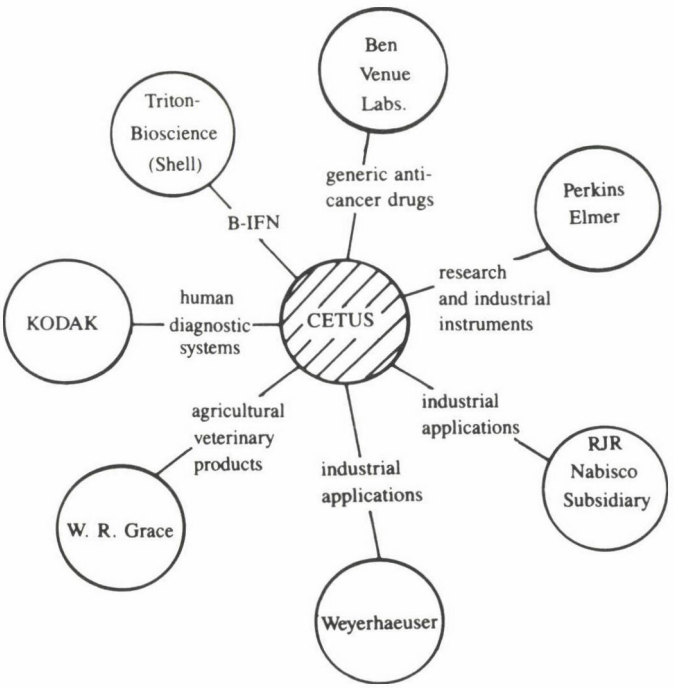
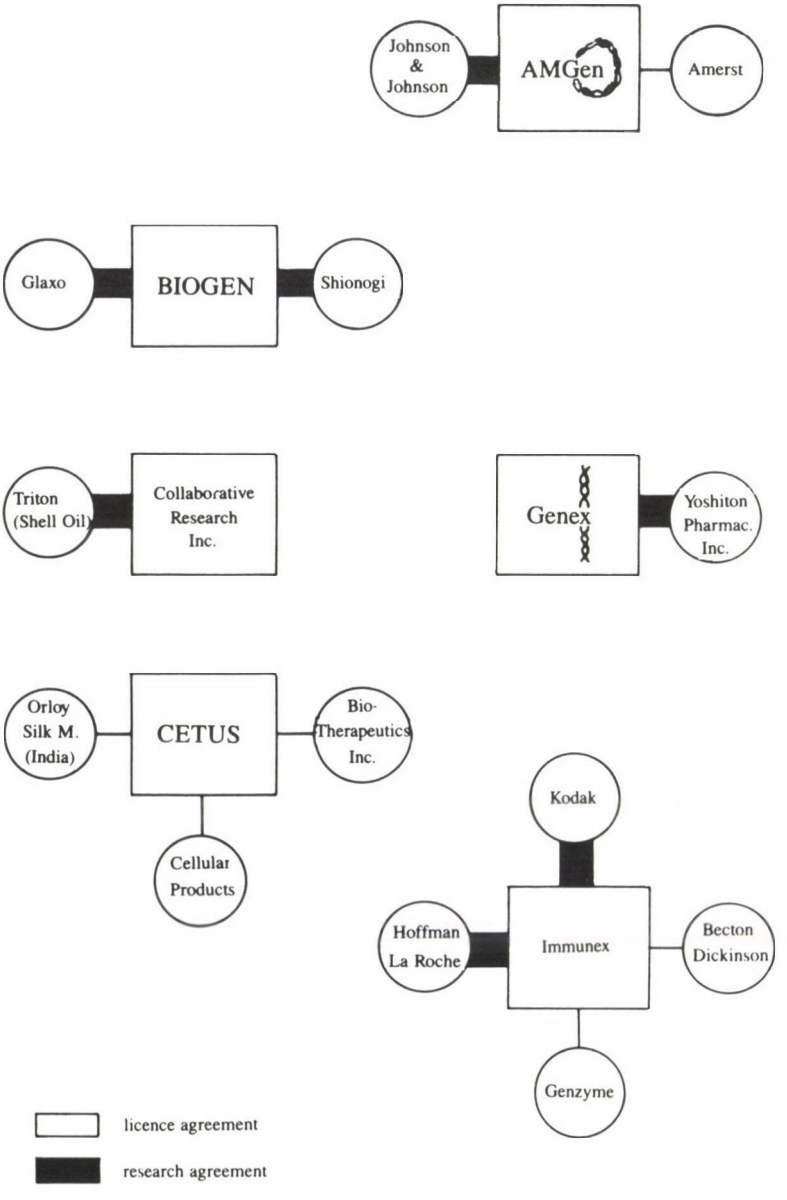


Figure 8.
Interleukon—2—Related Agreements



GLOBAL TECHNOLOGY STRATEGY

The most recent stage of evolution in Technology Strategy is **globalization.** The varied approaches for accessing innovative capabilities are now increasingly practiced on a worldwide basis, which makes the Technology-Strategy process even more complex and more difficult than before.

There are some fundamental reasons why globalization of Technology Strategy is taking place. First, the traditional strength of large corporations is not in speedy and continuous radical innovation, as large companies do not usually react quickly. GE invested millions of dollars in synthetic diamonds before that technology became a real product. Speed becomes more and more important as economies become increasingly advanced and value-intensive. Rapid innovation increasingly requires the linking up of different kinds of enterprises.

Another, almost paradoxical, reason for globalization is the fact that high technology demands softer skills. In high technology, people are key assets and brain power is critical. Talented individuals are extremely mobile and flexible, as they travel and work throughout the globe. Education in technology is also globally dispersed. In addition, there is also a worldwide recognition of the need for diverse skills and perspectives for accessing innovative capabilities effectively. Finally, the cost of R&D is rising. Firms, therefore, often join forces with other enterprises if only to share the economic and technological risks.

What might be termed **Global Technology Strategy** is manifested in diverse ways. Clearly it encompasses more than simply indicating a firm possesses R&D laboratories throughout the world. International R&D is not the same as Global Technology Strategy. Worldwide continuous searching for innovative capabilities requires a committed corporation-wide effort.

Global Technology Strategy embraces different models, different approaches, and different pathways to success. There is no single road to competitive technology-intensive achievement. One model--perhaps the prevalent approach--practiced by many companies can be termed **revitalized corporate R&D.** The emphasis here is explicitly on keeping or reinvigorating the R&D function, which includes the laboratories, teams of scientists and engineers, the process of technology transfer from R&D to the other operations, and coordination and cooperation between R&D and the others functions and businesses.

Another approach is **division-based** or **business-centered.** Under this model, the ongoing operating structure--usually based on groups, divisions and businesses--defines much of the key technology development activity. Innovation is frequently under the direction of such units. Motorola, to some extent, functions like this.

The use of diverse forms of **projects** is a very important tool for Global Technology Strategy. At least three types of projects can be identified. First, there is a kind of **bubbling-up and distributed-project** approach. A number of flowers

are permitted to bloom until one is obviously successful. Selection of projects to develop into commercial products or services is purposely delayed. Firms like 3M operate at times in this fashion. Another approach is to target a relatively few **salient projects** from the very beginning. Firms create a limited portfolio of key projects. From beginning to end large amounts of resources are allocated to them along with a great deal of high-level corporate sponsorship, encouragement, and attention. This method has also been quite effective at times. Canon developed the AE-1 Program Camera and the personal copier (which then evolved into the basis for a laser printer) in such a fashion. Similarly, JVC developed the VHS-C and VHS-Super videotape formats. Finally, there are what may be termed **Transformational Projects,** where some explicit activity is more or less purposefully established with the goal of changing the firm in a fundamental fashion in the direction of making the enterprise significantly more innovative. Examples of such a radical shift or possible revitalization are rare but might include the development of the Ford Taurus or the Fiat Uno. In both cases, an entire firm was transformed due, at least in part, to the success of a major product-development initiative.

Another kind of global model--termed the **orchestrator**--is to go outside and depend extensively on the **external acquisition of knowledge.** In this case, the firm acts primarily as the nerve center or brain for coordinating the largely external activities established to obtain innovative capabilities. In the "make or buy" tradeoff, such a firm often opts to buy knowledge-based assets. Olivetti has frequently operated along these lines.

Effective Global Technology Strategy also avoids over-emphasizing **asymmetries** (that is an over-dependence on apparent comparative advantages) and does not strictly differentiate on the basis of geographic or national differences. **Purposeful high-value redundancy** can be advantageous in a world where there is a growing globalization of high-value talent. In the end, human capital is the critical asset for effective technological innovation.

Political considerations in Global Technology Strategy also encourage a certain amount of selective duplication around the globe. One reason for major investment in R&D facilities in Europe, for example, is increasing political pressure for expanding high-value local content in products sold in that region, which includes demands for more R&D and advanced manufacturing.

It is also, therefore, quite important today to have very advanced global scanning of technology in an enterprise. The high-level scanner is a new and complex function in a company.

Still, determining the appropriate amount of such "purposeful redundancy" in Global Technology Strategy is a delicate matter. It must be weighed against a concurrent need to avoid obvious imbalances. Multiple centers of excellence are also required. Even as a firm becomes global, it should maintain that which makes it distinctive and great. Therefore, a subtle issue in Global Technology Strategy is to differentiate while becoming truly internation

THE GLOBAL TECHNOLOGY STRATEGY-INFORMATION SYSTEM CONNECTION

There is a growing opportunity in Global Technology Strategy for the incorporation of **sophisticated information systems.** Thus far there has been surprisingly little discussion on the relationship between Global Technology Strategy and information systems. One reason for the limited exploration of this connection is the great complexity of both areas. For example, Global Technology Strategy can be viewed as a progression of complex ''levels'' in terms of complexity for accessing innovative capabilities (Figure 9).

Figure 9.
The Progression of 'Levels' for Accessing Innovative Capabilities in Large Corporations

Level I: Direct Innovation within Firms - The Primary Objective of Local Work is the Development of New Technology **(Specialized Discrete)**

- Direct R and D Activity in Corporate Technology Centers and Laboratories by Individuals and Small Groups
- Identifiable Specialized Technology Development Activity

Level II: Multi-Member, Multidimensional Innovative Activities within Firms **(Distributed Discrete)**

- Formal Innovation Teams at the Business Level
- Formal Multifunctional/Multibusiness Projects or Programs as Stand-Alone Activities
- Formal Multifunctional Teams at Laboratories and Technology Centers

Level III: Formal Relationships with Institutions External to the Firm to Access Specific Innovative Capabilities **(External Targeted)**

- Joint Ventures
- Contract R and D
- Some Acquisitons
- Formal Technology Development with Suppliers
- Formal Technology Development with Customers

Level IV: The Promotion and Encouragement of a Selective Corporate Business Strategy Anchored on the Accessing of Targeted Innovative Capabilities **(Selective Set Internal)**

- — Building Up Innovation-Intensive Segments of a Corporate Portfolio
- — Increased Funding o R and D in Selected Technology Fields
- — Promoting a Specific Configuration of External Relationships

Level V: The Installation of a Broad-Based Continuous Commitment for Accessing Innovative Capabilities Throughout the Firm **(Broad-Based Firm-Wide)**

- — Top-Level Strategic Commitment Communicated Throughout Firm
- — An Embedded Culture Supporting Innovation
- — An Innovation-Intensive Human Resources Policy and Set of Practices
- — Systems and Producers for Monitoring and Assessing Innovative Activities

Level VI: The Installation of a Broad-Based Continuous Commitment for Accessing Capabilities Distributed Throughout a Network of Interorganization Relationships **(Broad-Based Network-Wide)**

- — Purposeful Education/Communication Programs for Inside/Outside Participants
- — Interorganization Rotation of People
- — Strategic Use of Consortia. Universities, etc.
- — Multiorganization Executive Dec. Effort

Similarly, there are varied ways information technology can be used for in firms for accessing innovative capabilities, including various off-the-shelf applications in: word processing, statistics, and spreadsheets; localized use of simulations and CAD within R&D; firm-wide electronic mail and VoiceMail; fax and Internet among researchers and colleagues anywhere; interactive simulations and CAD/CAM with suppliers, customers, and partners; teleconferencing, electronic firm-wide bulletin boards, interactive firm-wide electronic bulletin boards, and asynchronous conferencing; video conferencing for firm-wide R&D, new product development, seminars, training, and executive development; advanced "groupware"; and distributed "virtual" networks for teams, projects, programs, and joint ventures within or among organizations.

Conceivably, these two highly complex variables can mutually reinforce one another in assisting an enterprise in its search for greater and greater innovative capabilities.

Perhaps ultimately an innovation-oriented **"simultaneous information system"** can be created. Among its key attributes, such a system enhances innovation as well as "control" in a firm. On a global basis, it should also facilitate smooth and continuous access to diverse sources of data and knowledge inside and outside the firm, including quantitative data, head-hunter files, and direct links to selected sets of people. Another possible feature might be an ability to communicate with diverse kinds of groups. Also, such an information system must have a large capacity. It also should be flexible and should employ different kinds of media, including voice, visual, and data. The system should respond quickly and also be distributed. Therefore, the interface has to be easy and friendly. Finally, such a system must "learn" so that it can reconfigure itself and become even better in promoting high-value collaboration throughout different levels of the company.

There is clearly a mutually reinforcing relationship developing between Global Technology Strategy and information systems. Certainly, there are some obvious impacts, including closer links with other parts of the enterprise, enhanced speed and accuracy in decision making, broader types of communication, a growing need for new skills, and a build-up of the corporate "memory" in innovation. Moreover, in the longer term, as information technology itself becomes more ubiquitous, accessible, multifaceted, and flexible, perhaps at some point a significant **threshold** will be reached. Information technologies per se may actually accelerate the development of Global Technology Strategy toward Levels V and VI by offering easier pathways for disseminating diverse incentives for continuously accessing innovative capabilities.

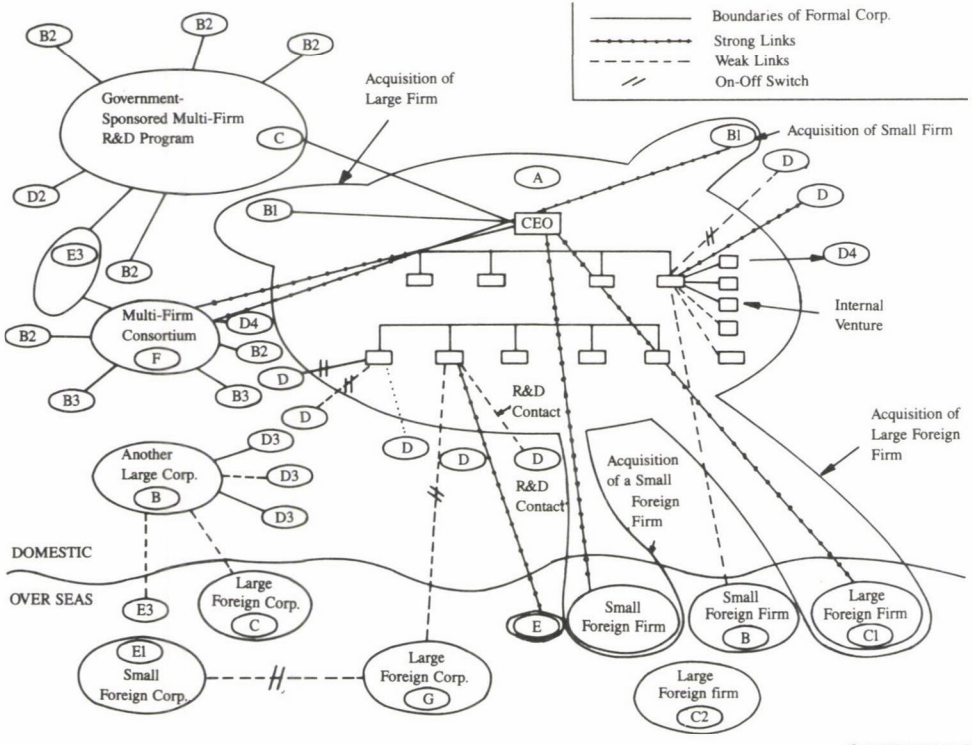
THE "SIMULTANEOUS CORPORATION"

Technology Strategy, like modern strategy generally, is more distributed and more complex than ever before. It is a part of a dynamic, changing network consisting of the R&D facilities, other units within an enterprise, separate firms, and other kinds of institutions. The relationships and linkages characterizing such a network can be stable or fragile and strong or weak. They are local, domestic, and global in scope. In effect, there are also countless on/off switches in this structural maze. The entire network often acts like some kind of organic structure that is continually evolving and changing (Figure 10). Such an entity also characterizes what is termed the **Simultaneous Corporation.**

High-level decision making in this enterprise reflects a quality termed **"Simultaneity,"** which encompasses the ability of a large company to exploit market power, economies of scale and scope, and vertical integration along with an ability to have high-tech entrepreneurialism and smaller kinds of units in order to have variety, creativity, and risk-taking. Today, alert technology-intensive companies are increasingly aiming toward such a complex blend.

Figure 10.

New Linkages for Technology Development



Such a system also requires a certain amount of professionalism and targeted systems and procedures. Technology decisions are systematically reviewed where appropriate. Skills, such as leadership and support from the top, are also required. Special interfunctional projects often stimulate innovation in such a situation. Task forces can manage and monitor the spider's web of relationships that are created. Culture is a key vehicle for management to bind diverse constituencies in an adaptive and flexible way. External training is desirable in order to expand managers' mindsets. Complex and sophisticated information systems might be used. But, thus far, though a key threshold may be in the wings, information technology is still an undeveloped opportunity in Global Technology Strategy.

There is a paradox required for practicing Global Technology Strategy effectively. On the one hand, technological innovation is the apparent focus. But depending on classical corporate R&D and a technocracy of experts is hazardous. Expertise and specialists are not enough in this new world. The earlier tradition in strategic management, known as ''general management'', which emphasizes people, leadership, and viewing the company as a kind of a living organic being, is just as important now. The general management tradition, therefore, albeit in a very different way, is being resuscitated.

This startling development is due to an exigency for a management apparatus based on the assumptions and strengths that underlie the emergence of the Simultaneous Corporation and Global Technology Strategy as major and distinguishing features of the modern competitive environment--the key driving force being an overpowering and growing strategic necessity for corporations to access innovative capabilities in diverse ways on a continuing and high-priority basis.

The Division of Labor Among Universities, Government and Industry in Supporting Innovation in the United States

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INTRODUCTION

In the United States, both universities and industrial organizations operate largely independent of the federal government. While both must obey federal laws (for example, regulations against racial discrimination in hiring and against certain kinds of environmental pollution), the federal government cannot prescribe or even guide any of their activities, including whether and how they should contribute to technological innovation. Rather, each institution contributes to the innovative process by pursuing its own distinct objectives: the university pursues new knowledge and trains the labor force, industry strives to be an effective innovator in order to survive and to compete with products and processes, and the federal government, through its many agencies and laboratories, does its own share of innovation, or provides funds and incentives for others to carry out the work.

Despite these different objectives, the term "division of labor" in the title is intended to imply that there is also a shared commitment in the relationships among the federal government, industry, and the universities in supporting and nurturing innovation. This "joint venture" reaches back to the early nineteenhundreds, but has never been as cooperative, intense, and diverse as it is today. This new initiative to cooperate can be attributed to a broadly held belief in the United States that for the United States to maintain or reestablish its competitive position in a number of technological markets worldwide, government, industry, and universities must reexamine past practices and policies and seek a more collaborative relationship that will encourage and support scientific discovery, technological development, and rapid commercialization in the national interest.

An early but important example of such cooperation evolved from the Land-Grant College Act of 1862. The Act granted approximately 100 square kilometers of federal land to every state for each of its two senators and several representatives in Congress. The land was to be sold and the proceeds used to maintain a

public college to teach "agriculture and the mechanic arts." Better farming methods had to be developed and, together with the mechanical arts (engineering), had to be taught to a growing rural population on the western frontier. Besides teaching, these colleges maintained experiment stations, undertook scientific research, and diffused their discoveries to farmers through agricultural extension programs. Eventually, private firms seeking to innovate in the areas of farm machinery, farm chemicals, animal nutrition, and seeds began to provide research grants to these state institutions. Close public-private cooperation over the years led to today's food production system where about 2% of the labor force feeds the entire country and part of the world relatively inexpensively on a constantly diminishing land area.

This effective pattern of agricultural cooperation illustrates the cultural context in which the present "division of labor" in the United States must be understood. The idea of the university as a service agency to society dates back to before the days of the land-grant colleges and has become ingrained in American higher education. Both state-supported and private universities think of themselves as serving the public either through their traditional roles in education and scholarly research or through some ad hoc mission required of them from time to time.

UNIVERSITY-INDUSTRY COOPERATION

Fifty years ago the scale and variety of academic R&D was extremely limited compared to today. Federal support for academic R&D soared from a few million dollars annually before World War II to about 9 billion by 1990. At the same time, the number and size of science and engineering departments increased significantly. Scientific discoveries and technological innovation entered a period of explosive growth and R&D became institutionalized. As most major universities became "research universities," a new emphasis on graduate training emerged. Undergraduate education remained important, but now had to compete for resources.

Accompanying this radical change, cooperative undertakings between university and industry increased both in numbers and in form. While industry had treated universities only as a source of manpower and the source of expert consultants, it now recognized them as a major source of high quality research. While professors remained dedicated to the high standards of excellence and integrity that scientific research required, they also became more aware of and sensitive to the imperatives of the marketplace. The developing communication and cooperation between the two institutions benefitted both.

While some scholars questioned the value of building research universities, it was broadly accepted that they had become essential contributors to the competitive strength of the United States in science and in high technology fields.

Universities also recognized that the close relationship with industry need not threaten academic freedom or organizational independence, but could in fact lead to synergies in the work of both. As a wide ranging relationship between the two institutions developed, industry became a welcome new source of R&D funds at a time when the federal government's share in relative terms was declining. Today many corporations make large research grants to universities, usually without any strings attached.

Some of the most rewarding relationships center on so-called liaison programs, which are now established at approximately forty universities and include almost three thousand corporations. The principal objectives of these programs are to enable industry to stay abreast of recent developments and directions in various areas of research; to establish communication and cooperation between faculty, staff, students and professionals in industry; and to foster long-term and in-depth relationships between universities and industry. For example, while few companies can afford to maintain extensive research facilities and staff for basic or exploratory research, many find it possible to sponsor such work at a university. Graduate students who work on such projects and subsequently take jobs in industry are among the most effective means of transferring knowledge from universities to industry.

The benefits of bringing together the perspectives, insights, and expertise of university and industrial investigators from many fields are also recognized by the federal government. Many federal funding sources encourage joint research proposals by academic and industrial researchers. On an increasing scale, the federal government provides funds for costly equipment and facilities for collaborative research. The National Science Foundation, for example, has had a major initiative establishing engineering research centers and industry research cooperative centers on university campuses. These centers have a formal but independent organization and a typical annual budget of 1 million or more. Here academic and industrial researchers can work together in interdisciplinary settings on problems for which the academic or industrial setting alone would not suffice.

COOPERATIVE R&D: INDUSTRIAL CONSORTIA

Most industrial firms must overcome two major impediments to innovation: steeply escalating costs of developing and producing the next generation of product after each level of scientific or technological breakthrough and a short supply of properly trained and skilled research personnel. This shortage is largely due to the competition for the limited number of Ph.D.s, as companies duplicate each other's research efforts. Some such duplication may be beneficial as alternative pathways are explored simultaneously, but on the whole this use of R&D

resources is not efficient from a national point of view, and large sums of R&D expenditures could be saved through shared research where appropriate.

Until recently, however, corporations were unable to resolve the problems of shared research because anti-trust laws prohibited cooperation between firms. Originally anti-trust laws were intended to curb the growth of monopolies and other improper restraints on competition in free markets. But now, laws intended to protect the public in a rapidly growing domestic market handicap American firms competing in an interdependent global economy. As a result, new laws passed during the past decade attempt to ease anti-trust barriers for some industries and encourage firms to form cooperative ventures in what has been defined as the pre- competitive R&D phase of product development. As a result an increasing number of industrial consortia are being formed to share the costs of the expensive initial research phase.

For example, the Microelectronics and Computer Technology Corporation (MCC) was among the first such consortia to be formed. MCC, an independent, for-profit R&D corporation, was launched with capital and research staffs from nineteen participating companies, including IBM, Digital Equipment Corporation, and Control Data. It now has its own research projects and full-time staff. Participating companies can sponsor one of MCC's projects, qualifying it for a license of the research results. Companies expect to recover 8 to 10 times their original investment.

Cooperation, however, is carefully restricted to the earliest phase of the innovation process. The development of the licensed research results into a commercially viable product must be done by the companies acting in competition. Cooperative R&D ventures, therefore, can complement, but not substitute for, in-house R&D.

As a rule the federal government does not financially support industrial research. The conclusions of a recent study are well understood: the U.S. government usually does poorly when it attempts to specify research products that would be useful in commercial markets. By contrast, when the government itself is the customer, as in military or space projects, and has a professional staff with the requisite competences, it operates successfully as a purchaser of R&D. It also does well in sponsoring research with broad "pre-competitive" objectives. For example, the U.S. government recently set a precedent by making an outright investment in Sematech, an R&D consortium established with the well-defined, but industry-wide, mission of developing state-of- the-art semiconductor manufacturing processes.

TECHNOLOGY TRANSFER FROM GOVERNMENT NATIONAL LABORATORIES

The government has long endeavored to transfer the results of its expensive and often esoteric research to industry for the benefit of the public. As early as 1962 the National Aeronautics and Space Administration (NASA) established a technology utilization office to publicize and transfer its discoveries and developments in space technology to the private sector. While NASA's dramatic developments in remote sensing and other satellite technologies had a major impact on the commercial sector, the transfer of more mundane technologies turned out to be considerably more difficult. In general, federal to private technology transfer has not worked well for two major reasons. First, companies considered it a bad risk to invest in product development and marketing research for an invention that would be, because of its public support, in the public domain--such inventions could not be protected by patents and thus would be available to all competitors. Second, to identify a problem to fit an available solution was at best a difficult and inefficient process.

Both of these hurdles are being lowered. In the 1980s Congress passed a series of laws to facilitate and encourage technology transfer from national laboratories to industry. The first such law, enacted in 1980, made technology transfer a specific mission of national laboratories and required them to establish a technology transfer office to deal with this task. Addressing the intellectual property issue, a 1984 law authorized many national laboratories to take title to their inventions and to make exclusive licensing arrangements with private sector companies. The law also mandated that the scientists whose inventions were being licensed receive at least 15% of the net income from these licenses.

Subsequent laws continued to refine the technology transfer process. Pilot centers were established where national labs and private firms could undertake joint research and development involving the free exchange of data but not money. Through cooperative research agreements the government now may even guarantee the confidentiality of research results and give exclusive rights to all intellectual property to participating firms. As experience builds, subsequent laws will further simplify rules and foster incentives for all parties in order to make technology transfer a smooth and rewarding process.

But even with the new legal framework in place, change is slow. This is partly due to the very different organizational cultures and objectives of public and private research organizations. Career scientists and engineers working in government laboratories are civil servants and more like academic researchers in that they think of their work in a long time-frame. They want to publish their research results at the earliest moment, not considering it worthwhile to delay publishing until the corporation has secured its patents. Many of them also consider it unworthy to pursue R&D with commercialization as the only object.

On the positive side, perhaps the most important lesson for increasing the likelihood of successful technology transfer has been that the earlier cooperation in the research process begins, the greater the chance for success. Both parties develop a shared understanding of the work as it proceeds and there are no communications barriers. Also, commercial applications often do not have the same stringent requirements as space or military applications. Meeting 25% of the federal technical specifications may be more than adequate for the corporate partner to start commercializing a new product for the civilian market. The final product that ultimately complies with full federal specifications may have obscured its market potential and may also be much too costly to make.

In sum, industrial consortia and technology transfer programs are beginning to show reasonable progress, but patience is still needed to work out the details. However, most people familiar with these relatively recent experiments are generally optimistic about their future.

MAINTAINING THE SKILLS OF THE TECHNICAL WORK FORCE

While successful innovation depends on all managerial functions in the firm, scientists and engineers are among the principal participants in the process. There were more than 4.6 million employed scientists and engineers in the United States in 1986, the number having approximately doubled every ten years since the mid-1960s. Of these, more than 1.2 million were engaged, at least part-time, in R&D (800,000 full-time equivalent). With research and development institutionalized worldwide, a growing pool of R&D professionals is increasing the rate of scientific discovery and technological change.

The implications of these developments are clear. Assuming an active professional life of 35-40 years and accepting recent findings that the half life of knowledge and skills in engineering disciplines is in the range of 2.5 - 7.5 years, one must conclude that technical obsolescence may threaten the livelihood of a majority of scientists and engineers, as well as the survival of companies and the competitive strengths of nations.

To deal with these challenges, a complex institutional network has gradually developed in the United States. It consists of universities, government, and industry as well as commercial training organizations, professional societies and other groups. Together, albeit with an untidy division of labor, they provide career-long opportunities for extending, up-dating, and improving the knowledge and skill of scientists and engineers. The means employed in this continuing education of the work force range from the traditional degree programs at leading universities and short courses tailored to the specific needs of a corporate staff to televised lectures via satellites to industrial locations nationwide.

While many agencies of the federal government make use of continuing education programs, the government itself does not provide leadership for maintaining and developing a high quality system. Rather, the federal government's support comes indirectly through the large sums of money it appropriates for R&D to mission- oriented agencies (such as NASA), which usually include funds for education and training. The demand and expenditures for continuing education has been steadily increasing since the 1950s. According to one estimate, in 1983 industry spent 30 billion on education and training while the federal government spent 10 billion.

Universities are preeminent in providing continuing education in a variety of ways. For the convenience of working scientists and engineers, they routinely schedule advanced degree programs in the late afternoon and evening. An increasing number of universities also televise classes live to specially equipped classrooms at industrial locations that have two-way voice communication. Best known is Stanford University's pioneering effort in televising its courses to Silicon Valley companies.

Revolutionizing segments of the continuing education system is the National Technological University, which offers Master's degree programs in engineering, management, and computer science. NTU contracts almost forty universities to beam a selection of their courses, day after day, via satellites to Fort Collins, Colorado, where NTU's transponder then retransmits these courses to over 160 corporations nationwide. NTU provides this service for a basic fee plus tuition. It also advises the company on the telecommunications equipment it needs, and it serves as the academic administrator on behalf of the participating universities. Without ever leaving his place of work, a graduate of NTU could have qualified for his degree by taking courses at the Universities of Arizona, Minnesota, and Maryland.

Industry, of course, is the principal consumer of continuing education. Corporations use a wide range of suppliers, program styles, and organization for their programs. Some large companies, such as IBM, publish elaborate catalogues listing hundreds of educational opportunities each year; others provide no support at all. Many special programs are organized by the companies themselves. Prominent among these are courses incorporating advanced research results and taught by their leading researchers. These courses can be as advanced as graduate courses at leading universities and have the added value of including the latest discoveries or innovation in the field. In fact a large science- and technology-intensive corporation, such as AT&T Bell Laboratories, may offer enough unique courses in a new field to qualify for a state license to offer an advanced degree. Companies, however, usually elect not to do so, as education is not what industry does best. Most companies depend on a competent, well-functioning system of external sources and avoid competing with universities in order not to weaken them.

INDUSTRIAL POLICY

It would appear from the above that the United States has a piecemeal and ad hoc way of making decisions affecting innovation and industrial policy issues. This has been and continues to be the case. There was an extensive public debate in the 1980s about whether the United States should adopt an "industrial policy" similar to those of Japan and Korea, i.e. adapting its governmental structure in order to distinguish among industrial sectors and corporations, supporting one and restraining another, in an effort to strengthen the innovative technological capability as well as the overall performance of the national economy. Proponents of such an industrial policy argued it would make the United States more competitive if, among other measures, the federal government, like the Japanese, selectively subsidized innovative high-tech growth industries, and through tax laws, tariffs and other measures helped either to modernize or to accelerate the collapse of mature industries with obsolete technologies and inefficient production processes. They further argued that the economy cannot depend on market forces alone to guide investment into desirable areas of technological innovation of national interest, for even venture capital may be averse to investing in R&D with high potential payoff if the risks of failure are too high.

While the United States does not have a coherent industrial policy, in the past it has indirectly promoted certain industrial sectors. Encouraging the development of railroads and airlines, subsidizing water for the West, establishing the space program, and passing environmental legislation have clearly affected selected industrial sectors in each instance. More recently the Department of Defense has aided the semiconductor industry through investments, research, and procurement contracts. The federal government has also prevented certain large companies, such as Lockheed and Chrysler, from going bankrupt when it would have resulted in a major loss to the technological resources of the country. Also, in times of crises, such as the depression in the 1930s and during World War II, federal bureaucracies did acquire rule-making and prosecutory powers which were equivalent, at least temporarily, to what we consider today to constitute an industrial policy.

Those opposed to formulating a comprehensive industrial policy argue that it could not be designed in a way to guarantee an overall improvement of the U.S. competitive position. They believe business decisions are best left to the corporations, where people are much closer to the details of the market in which they work. In other words, market mechanisms are preferable to the centralized imposition of rules based on objective rational analysis, technological studies, and professional judgement by a bureaucracy. This preference derives from a deep-seated preference of the American electorate for the Federal government to intervene as little as possible in the citizens' affairs more than from a negative evaluation of the analytical ability and general competence of the federal bureaucracy.

This preference extends not only to putting the market above government decisions, but also to preferring legislation to administrative policy-making.

Pressed for a more precise definition, one might say the federal government does have a de facto industrial policy considering the aggregate of separate pieces of legislation by Congress and the administrative decisions implemented by the various cabinet departments and regulatory agencies at different times in response to different objectives or exigencies. What this aggregate of policies lacks in coherence and consistency it gains in differentiation and diversity. In many ways this diversity is its strength.

Barriers to Privatization in Hungary

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All political parties in the new Hungarian Parliament have declared their support for a new economic order based on the dominance of private ownership. The Hungarian government has also proclaimed its willingness to reduce the share of the state sector. Accordingly, the governments economic program states: "One of the central elements of our economic policy is the permanent and vigorous development of private ownership and of private initiative, the permanent protection and development of the private sector and... to diminish the weight of the oversized administration."[1]

Does this mean that if the government possessed sophisticated techniques for privatization, the dominance of the private sector could be achieved in Hungary in a relatively short period of time? Indeed, this is the essence of the present political debate about privatization, as the opposition blames the government for using inefficient methods for privatization and for the delay in presenting workable privatization programs.

There is no doubt that political forces and the present government play a decisive role in the development of the Hungarian private sector. Yet the speed of privatization (measured in the yearly change of the private sector's share in the overall economy) is also influenced by non-institutionalized social forces.

This paper will cover some of these social forces, namely the barriers to privatization: physical, financial, ideological, and educational. There are feedbacks and trade-offs between these factors, of course, but we do not yet have enough empirical and analytical results to present them. Several examples from Western Europe show that these barriers even have a remarkable impact in the

[1] A Nemzeti Megújhodás Programja, (Program of the National Renewal) Budapest, Sept, 1990. pp. 13.

privatization processes in market economies. Compared to the West, Eastern Europe must pay much more attention to these barriers and brakes, because the investment activity and institutional framework followed from the rules of the centrally planned economy.

PHYSICAL BARRIERS

In Hungary, setting up new private firms is hampered by a shortage of machinery, equipment, raw materials, and services. For example, buying the small tractors, animal feeding technologies, and transport equipment needed for household plots and small farms is very difficult. This situation is identical in several other industrial branches, such as construction trade.

Another important impediment to privatization is the uselessness under the new political circumstances of many fixed assets owned by legal and illegal private entrepreneurs. The brilliant technical solutions and forced innovations.[2] produced by the actors of the second economy are often not competitive in a market economy. Excellent machinery and equipment created and produced by the workers and engineers of illegal firms were highly efficient and profitable in the socialist economy. If foreign entrepreneurs replace inefficient state-owned firms as the market competitors, the advantages of the relatively higher efficiency of the second economy may diminish quickly.

The infrastructure of these businesses is susceptible to similar tendencies. Many in the second economy are successful because they illegally use the (albeit unsophisticated) infrastructure of the state-owned firms where they are employed. They conduct business on their telephones, use their electricity, water and gas, take part in extensive training courses organized by these firms, and use their libraries and information networks. The new small business class has no telephone lines and must make a significant investment for the extension of gas and electricity lines. Due to high prices, they also cannot engage in information networks. Indeed, the miserable infrastructure will hamper new Hungarian entrepreneurs for decades.

The public recognizes these physical barriers to privatization. However, most state-owned assets can and will be sold easily and without any additional investment. In such instances, the new owner can quickly make a large profit. This form of privatization is also very advantageous for the employees of these firms, because in a majority of cases they may convert their local knowledge into capital.[3]

[2] Laki, Mihály: Kényszerített innováció. (Forced innovations) Szociológia 1984-85/ No. 1-2. pp. 45-53.

[3] Neumann, László: Small Business Off-Shoots from Large Manufacturers - A Privatization Option. Acta Oeconomica Vol,42. No.1-2. pp. 23-41 (1990).

These considerations, though, are only valid in some cases, as some state-owned fixed assets are unmarketable. There are two sub-groups in this category. The first and the smallest is the propaganda and prestige projects of the communist regime, which were useless and irrational even in a centrally-planned economy. In the second group, there are fixed assets following the logic of the centrally-planned economy: machinery and equipment able to consistently produce output on a large scale for a long time is either impossible or very costly to adapt into new product lines because of their inflexible technology and rigid organization. For example what will happen to the large, centralized clothing factories which can only produce a large quantity of outmoded clothes?

There are also activities in which the costs of privatization to the state exceed its benefits.[4] In some cases the expected income of the buyer will not cover the investment costs of transformation and, therefore, he or she will not buy the assets offered by the privatization agency. In this case, as well as the cases when these negative incomes will accumulate, a large part of these assets will remain in the hands of the state. This will also be true in cases when specialized and profit-oriented agencies or companies are responsible for privatization. (In these cases the share of unsalable assets is expected to be much smaller than the bureaucrat's.)

No one knows how big the share of these unsalable "bubbles" of state property will be. In the recent privatization measures, one could distinguish between those parts of the firm that the buyer really wanted and those parts that were obtained merely because they were linked to the desirable pieces. Buyers will make this kind of selection in the future as well. A possible consequence is that the share of unsalable assets will increase and, therefore, the speed of the privatization process will decrease.

FINANCIAL BARRIERS

The second frequently discussed barrier to privatization is the lack of capital. Estimates reveal that the population's savings represents only 10-20% of the value of Hungarian state property. This ratio illustrates the seriousness of the monetary barriers to rapid privatization. However, to accurately define real demand, we have to measure the stock of property owned by the population as well. We must consider the property of households not only as a source of investment, but perhaps as an attractive goal of investment as well.

A large percentage of a Hungarian household's property consists of real estate (i.e., houses, second residencies, land). Their property also may consist of significant gold and hard currency reserves, and considerable forint savings. Hun-

[4] Except the case of capital with negative price.

garian and foreign investors buy and sell these goods in addition to state bonds, stocks, and fixed assets offered for privatization. These markets are already large and the number of transactions is growing constantly. One reason for this is the negative savings rate. Although holding hard currency is a very profitable, low risk investment because of the growing difference between the Hungarian and West European inflation rates, buying real estate is also advantageous and of limited risk, since the rise in real estate prices is higher than the rate of inflation. In this market situation, Hungarians and foreigners will buy state property or will start new businesses only if the expected profit is higher than in real estate or hard currency markets. Therefore, liquid money and the population's savings will not automatically be invested into the state-owned fixed-assets or securities now floated by government, state-owned firms, and banks. If the rates of profit differ significantly, we can not exclude the possibility that part of the preferential loans for buying state property will go into the money and/or real estate markets.

Another advantage of these markets is that transactions are based on well-established and accepted rules. As few people know the rules of the stock and bond market, many people will buy hard currency or real estate even though the profit share is lower than purchasing state-owned assets. Even in the advanced capitalist countries few individuals are especially knowledgeable about investment activity, but there is a broad network of investment banks and brokerage agencies to serve people's investment needs. In Hungary the number of these banks and agencies has grown very rapidly, but their actual market share is marginal. Lacking expertise and hardware, the number of them will increase only gradually. So, the speed of privatization will also be regulated by the velocity of banking knowledge.

IDEOLOGICAL BARRIERS

Although the communist propaganda of the last four decades was totally inefficient in some respect, it was successful in linking itself to other traditions. The communist ideas of personal enrichment and acceptable degrees of social inequality are deeply related to influential Hungarian ideologies, including ones that are conservative, right-wing, and middle-of-the-road. The relative popularity of these anti-capitalistic ideologies demonstrates that several social groups are not attracted to the aims and conditions of the market economy. We know from empirical research that only a minority of the Hungarian population is oriented to success and upward mobility. Not only do traditions slow down the diffusion of the entrepreneurial spirit, but new political forces and personalities that declare anti-entrepreneurial sentiments and reservations do as well. A significant prejudice remains against the "middleman businesses" and other non-productive activities. In other cases the anti-capitalistic sentiment is combined with a

nationalist character. The representatives of these ideas do not argue directly against business activity, but they focus on the dangers of the growing influence of foreign capital.

Although it would be misleading to underestimate the influence of political propaganda, an expanding entrepreneurial spirit has been more effectively undermined by the negative effects of those already active Hungarian private ventures (small legal and illegal businesses). As János Kornai wrote:

> "I am fully aware of how common it is to find private entrepreneurs who greedily want to make money hand over first, even by cheating their costumers or by defrauding the state. Instead of striving firmly and soberly to establish their business for the years or decades to come, they consider it their priority to make the largest profit on the shortest possible terms. This kind of entrepreneur forgoes productive investment and settles instead for conspicuous, prodigal consumerism. Such entrepreneurs also tend to be impolite toward their costumers, and adopt a 'Take it or leave it' attitude akin to the high-hat behavior created by the shortage economy in the state sector. Together, these abuses turn public opinion against the private sector."[5]

In short, the present behavior of several small firms is not a positive model.

EDUCATIONAL BARRIERS

The behavior characterized by Kornai is indeed a consequence of the superior market position of the seller, but the lack of entrepreneurial skill and knowledge has also played an important role in its diffusion. Some entrepreneurial skills can be acquired in schools, while others are attainable only through practical experience. Decades of socialism have not been favorable for the latter.

Institutionalized teaching of market skills did not exist in the communist era. Instead, public education spread knowledge applicable only to centrally-planned economies: a huge number of plan-statisticians, purchasing agents, and, of course, apparatchiks were trained during this period.

In some cases, the structure of the curricula was harmful from the point of view of entrepreneurship. In secondary schools and in vocational training, there was no instruction in business fields. It was impossible to learn marketing in technical universities and high schools, and marketing courses were not even formally adopted at the Budapest University of Economies until the late 1960s.

[5] Kornai, János: The Road to a Free Economy. Shifting from a Socialist System: The Example of Hungary. W.W. Norton and Company New York London, 1991. pp. 55.

The practical experience or learning-by-doing cases can be considered a shrinking process. This process started with the Holocaust, continued with the deportation of the Germans after the Second World War, and had a new impetus in 1956. It was impossible to learn entrepreneurial skills because of the lack of experienced indigenous entrepreneurs. The transmission of familiar traditions was often interrupted and it was impossible to collect entrepreneurial knowledge from abroad.

The lack of understanding markets and entrepreneurial skills will limit the speed of privatization for a long time. The appearance of foreign investors and joint ventures on the Hungarian market, the spread of courses on entrepreneurial skills, and the pressure of market competition will permanently increase the entrepreneurial knowledge of the Hungarian population--but not suddenly.

INTERESTS AND COUNTERINTERESTS

Experts waiting for rapid progress toward a market economy in Hungary regard the second economy as an effective illustration of the population's entrepreneurial skills. They argue that in a business-friendly economic environment, actors in the second economy will quickly start up a large number of small businesses. Is it really obvious that the experience people received in the second economy will translate into entrepreneurial knowledge? If the answer is yes, are they interested in such a transformation?

The second economy consists of economic activities and organizations with different aims from the first economy. These activities are common in one respect: they oppose the promised utopias of the communists, who tried to arrange people into big organizations with no market contact. Just as entrepreneurs in market economies, people involved in second economy activities enter markets, sell and buy goods and services, and compare costs and benefits. This similarity supports the argument of those who see the development of the second economy as a result of the increase of the economic autonomy[6] and the reemergence of civil society, which was part of the silent revolution against the communist regime[7] in the last two decades in Hungary. Emphasizing a destructive character of the second economy, these experts also point out three characteristics of the actors of the East European second economy. First, unlike Western businessmen, they do not expand their business activity and minimize

[6] Juhász, Pál: Társadalmi csoportok együttműködése az első, a második és a harmadik ökonómiában. (Cooperation of different social groups in the first second and third economy) Fogyasztói Szolgáltatások 1981. No.4.

[7] Kemény, István: The Unregistered Economy in Hungary, Soviet Studies, 1982. No.3.

investment activity. For example, they do not substitute labor with capital even if the return of capital is higher than of labor.

A second characteristic of players in the second economy is that they operate within the state sector. As previously mentioned, this grants them attractive benefits. They pay no taxes and social security on the income resulting from their activities and part of their indirect costs is paid by state-owned firms. Another advantage of this integration is that their use of the informal "system of mutual help" within the big organizations means they can obtain inputs cheaper and easier than on the market.

The third characteristic of Eastern Europe's second economy artisans is that they do not compete on the market. As sellers they behave like monopolists. They collect orders and select among the buyers, and they are not cost-sensitive.

The actor of the second economy who is not interested in expanding business activity, integrated into the state sector and able to avoid market competition also has a conservative character. He or she will change his or her business philosophy or strategy only if the alternative is much more profitable. In other words, he or she will become competitive and expand as an autonomous Western-type entrepreneur only if this decision results in higher income, more social security, and prestige.

Under the conditions of the transitional period a significant number of these "conservative" actors will not be interested in starting a new, western-type business. On the contrary, many of them are interested in maintaining their bargaining power market share and influencing that obtained earlier in the second economy. Ironically, this means that important forces in the silent denationalization in centrally-planned economies will hamper privatization processes in the post-communist societies.

CONCLUSIONS

This list of obstacles shows that the speed of privatization is determined by a number of non-institutional factors. In sum, political planners are wrong if they estimate that only the techniques underpinning privatization determine the speed of the process. An effective privatization program is not only a package of regulations, incentives, and preferences: it must also describe how we can overcome the impediments and bottlenecks of privatization.

Reflections Concerning the Recent Past and the Future of Hungarian Foreign Trade

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Writing a paper on Hungarian foreign trade relations used to be a simple task for any economist. Though Hungary experienced some shocks and basic changes in many areas of cooperation with the East Bloc countries, the general frameworks and patterns remained relatively clear and stable. In this world of almost Newtonian foreign trade mechanics, even the major disturbances seemed easy to forecast. The major partners and the commodity patterns of our external trade reflected an apparently eternal structure. Being eternal, however, did not necessarily mean being good and profitable. All East Europeans learned how to live with the problems of shortages, poor quality, delayed delivery, and delayed or almost forgotten payment obligations. They were also accustomed to trade without a strict measuring rod of real prices or calculable profitability. Hungarians can be proud that their economists recognized these problems earlier than the economists of other CMEA countries, but recognition has never been enough to change something. In the maze of political power plays, economic rationality could hardly be a motivating factor for all of Hungary's partners. Of course in this respect, Hungarian companies were not very different from those in other East European countries.

The political landslide of 1989-90 swept away all of the traditional political and economic structures in this part of the world. As a result, the newly democratic East European countries are striving to integrate themselves into the family of developed nations. They have realized that without fully accepting the ideas of the market economy, there is little chance of reaching this aim. Although the abstract idea of a market economy is clear and readily available in any textbook, the market economies in the real world are surprisingly different. We must realize that in the market economies, there are divergent patterns of governmental philosophies, social traditions, institutional solutions, and legal frameworks; this

is easy to recognize by comparing the USA, Japan, Germany and Sweden. Hungarians must now decide whether to pursue one of these models or to create a new one. Because this decision has not yet been made, governmental measures, the parliamentary legislation, and foreign relations are full of contradictions. All of these things make the analysis of foreign trade a challenging process, full of surprises and unpredictable events.

IMPACT OF POLITICAL CHANGES IN EASTERN EUROPE ON TRADE

The recent changes in Eastern Europe have had a major influence on Hungarian foreign trade in many ways. As the region's economic crisis resulted in shrinking market demand and the declining reliability of supplies, a major drop in both export and import performances became inevitable. In addition, Hungary had been accumulating trade surpluses against the Soviet Union and other countries of the region. Because of the lack of clear methods for settling liabilities, the government was forced to intervene. It froze exports to the Soviet Union, narrowing the scope of viable solutions for most companies. Companies either had to find an escape route through the Western markets or to decrease, and perhaps eventually shut down, any further production. Surprisingly enough, Hungarian companies proved to be more flexible and successful than expected. The shift from Eastern to Western markets is reflected in Table 1.

Last year when ruble payments still existed, total imports grew 4.1%, as non-ruble imports (i.e. hard currency) increased by 19.5% and ruble imports dropped by 20.7%. Total imports increased at a significantly slower rate than most Hungarian economists had expected, especially considering the broad trade liberalization. Ruble trade has ceased to exist and all importing and exporting is now conducted in hard currency. Comparing 1990 trade with different groups of countries, we find that Hungary's imports from CMEA countries declined by 11.7% (slower than the ruble import), imports from EEC countries increased by 11.4%, and imports of EFTA countries rose by 15.9%. Not only have these trends continued in the first three months of this year, but they seem to be getting stronger.

Exports have also shown several signs of favorable reorientation. Last year ruble exports dropped by 26.4% and hard currency exports increased by 25.1%. Total exports rose by 5.7%. Looking at exports to Western Europe, it is easy to realize that the growing importance of EEC (+37.1%) and EFTA (+19.1%) regions could compensate for the decrease in CMEA (-19.3%) exports. These tendencies have also been gaining further strength in this year's first quarter.

In general we can state: the Hungarian economy has been showing surprising flexibility in reorienting its export and import trade. These trends are in accord with the general economic policy and help fulfill the balance of payment targets. The country's high indebtedness and the relatively high debt service ratio make

Table 1

External trade by groups of foreign exchange and groups of countries (current prices)

Year, month	Rouble accounts	Non-Rouble accounts	Total	CMEA	Of which EEC	Of which EFTA
			Imports (Billion Forints)			
1987	207.8	236.2	444.0	216.1	111.3	49.4
1988	199.7	261.2	460.9	205.0	118.7	57.1
1989	200.8	322.7	523.5	207.4	151.8	72.2
1990	159.3	385.6	544.9	185.2	169.1	83.6
1991						
J—M	—	—	110.4	23.1	48.3	22.7
			Corresponding period of previous year=100.0			
1990	79.3	119.5	104.1	89.3	111.4	115.9
1991						
J—M	—	—	108.5	78.4	129.0	156.8
			Exports (Billion Forints)			
1987	211.5	221.1	432.6	227.9	87.1	36.4
1988	204.9	287.4	492.3	227.6	111.1	48.5
1989	215.9	355.4	571.3	238.9	141.8	60.8
1990	158.9	444.7	603.6	192.7	194.5	72.4
1991						
J—M	—	—	152.5	25.8	71.4	27.0
			Corresponding period of previous year=100.0			
1990	73.6	125.1	105.7	80.7	137.1	119.1
1991						
J—M	—	—	134.3	82.4	163.6	187.4

Source: Statisztikai havi közlemények. Bp. 1991. KSH.

the balance of payments and, consequently, the foreign trade balance a central issue. Last year there was a current balance of payment surplus of 130 million. In order to appreciate this performance it should be mentioned that the 1989 balance of payment deficit was 1.4 billion and that before 1990 the last year with positive

the revenues from tourism exceeded the 1.4 billion interest burden of Hungary's convertible debts. At the same time, 2.5 billion in new borrowing was needed to meet capital claims. Gross convertible debt reached 21 billion in 1990 and the net indebtedness of the country totaled 16 billion. In spite of having the highest per capita debt in Eastern Europe, Hungary has been able to manage its debt.

If we were naive positivists, based on the external trade indicators of the last five quarters we could easily forecast a very promising and shiny future for the Hungarian economy. The only question is whether or not these predictions would have a solid basis. The second part of this paper will concentrate on some of the problematic features of Hungary's external trade that make accurate forecasting nearly impossible.

COLLAPSE OF THE CMEA

First, CMEA and its system of payments no longer exist. As a result, there will be bottlenecks in exporting to East European countries because of their hard currency liquidity problems. The related problem of the near collapse of Hungarian-Soviet trade may prove to be a ticking time bomb. In the first quarter of 1991, Soviet exports to Eastern Europe added up to 2 billion while imports from these countries barely reached 0.5 billion. This shows that the Soviets are trying to keep their balance of payments manageable by accumulating more and more hard currency from Eastern Europe. This behavior might serve as an indirect way of tapping Western aid to Eastern Europe. At the same time, these small countries are forced to export on credit in order to avoid a major recession and rocketing unemployment. Though the statistical data and the highly optimistic statements on our foreign trade administration speak of a very quick and successful shift from Soviet markets, the situation is far from rosy.

The bulk of Hungary's problems emerging from the collapse of the CMEA, especially with regard to Soviet trade, have not really been solved. What Hungary has been experiencing is no more than the first layer of serious trouble. There are several signs of this; three of them are:

- In the second half of 1990, Hungary reached a more than 1 billion ruble surplus in Soviet trade. This surplus does not help solve Hungary's trade problems, but it is simply an irrational way of granting very risky credits. As a result this practice must stop in 1991.
- The real effects of Hungary's declining exports were cloaked behind the accumulating stocks of Hungarian companies. Although some experts estimate these goods are worth hundreds of millions of dollars, they are hardly marketable anywhere except in the Soviet Union. This practice cannot continue very long. Moreover, Hungary must not forget that the favorable switch

from Soviet to Western markets was done by the rare competitive companies. The behavior of the best companies does not provide any guarantee for the behavior of the others.

- Many Hungarian companies are bankrupt and have stopped paying their debts to other enterprises. This form of involuntary credit is called "queuing". Nobody really knows what proportion of claims are enforceable and how many are irrecoverable. The present practice of non- payment simply spreads the problem of bankrupted companies over the whole economy. Sooner or later this misleading practice should end.

OTHER EXTERNAL FACTORS INFLUENCING HUNGARY'S TRADE

The second problem in Hungarian foreign trade is that during the last five quarters, its performance was supported by some unusual occurrences. For example, Hungary gained some special allowances from EEC countries because of the reunification of Germany. As economic rationality regains its supremacy over political decisions, this special treatment will surely disappear and bring back the old problems of protectionism. The relatively low oil prices in the first quarter of 1991 represent another unexpected factor, as does the strengthening of the U.S. dollar, which helped ease the debt burden by more than 500 million. In long run we cannot count on such fortuitous incidents.

The unified EC market in 1992 will pose a third difficulty for Hungary. Though the Hungarian government hopes to have some partnership agreement with the EEC, this agreement will be only an important framework. It will not provide Hungary with special advantages, but merely removes some disadvantages. It will not change Hungary's standards, quality requirements, or technical level. No provision will allow poor quality, poorly marketed, and technically lagging goods to succeed in the Western markets. It will not be the old CMEA market where governmental agreements used to ensure that sooner or later products would be bought. In many respects the situation is very similar to Hungary's free trade agreement with EFTA. In a highly competitive environment, Hungary must remember important trade agreements are not enough, and it is not even enough to have a good product. Without marketing skills and financial coverage to make Hungary use them, success will be unattainable.

FUTURE DOMESTIC FACTORS INFLUENCING FOREIGN TRADE

A fourth problem is the uncertainties in Hungary's foreign trade policy. Several signs prove this statement. For one, Hungary's financial administration and the trade administration seem to be in conflict over the future role of government in foreign trade. The former is determined to remove the subsidies, supports, and different forms of governmental intervention, while the latter largely wants to keep them. There are also signs of hesitation in the creation of new company forms in the foreign trade sector. The almost complete trade liberalization and the removal of legal obstacles has made foreign trade activities very attractive and profitable, causing the number of newly founded companies and entrepreneurs in this sector to mushroom. In two years their number has increased from several hundred to more than 15,000. Most are privately owned, and many operate with different international partners. They are successful, active, and very promising, but usually rather small. The fact that the big foreign trade companies have not even made the first steps in the direction of privatization seems to bring a major conceptual conflict within the government to the surface.

Finally, some question marks exist concerning the future orientation of Hungary. Foreign trade is tied to foreign political commitments. To find the way into European integration is one of those rare principles on which most Hungarians agree. But there are different views concerning the methods. Shall Hungary go alone or shall it form blocs with other countries in order to represent a larger political commitment? I do not think the economic rationality supports any special bloc-forming aspirations. I do not see what kind of major economic advantage would come from a Polish - Czechoslovakian - Hungarian joint effort. For Hungary it may be very dangerous to be part of a bloc. The Polish and the Czechoslovakian problems are very different from Hungary's. Unlike Poland, Hungary has been paying her debts regularly, and Hungary is further ahead in creating a market economy than Czechoslovakia. Unless Hungary clarifies the differences with all potential partners, Hungary may risk losing all advantages.

On the other hand, the idea of the so called Pentagonale (the regional accord with Italy, Czechoslovakia, Yugoslavia and Italy) seems to be much more promising. The partnership with Austria and Italy may bring Hungary technology, marketing and management skills, and the possibility of cooperation on third markets.

The introductory part of this paper tried to make clear that there are no Archimedean points in the evaluation of the recent past, present, and future of Hungarian foreign trade. All of these statements may have been wiped out by the time this text is published. Anyway, this subjective snapshot reflects only one of the many possible interpretations of the present situation, a point which should be considered during the discussion.

DISCUSSION

During the ensuing discussion, Dr. Zeller made the following points:

- Convertibility of the forint is important, as it would remove some of the remaining obstacles in foreign trade. However, because Hungary has limited hard-currency reserves, instituting convertibility now would not have the desired effects.
- Although Hungarian technology lags behind the West, human development is also behind. An adjacent problem is the low capital absorption capacity of the economy which is partly due to the fact that changed all of Hungary's pluses to minuses and vice-versa. Hungarians have grown up in a very different culture than that of the Western countries.
- Where Hungary does have comparative advantages for export, there are no sufficient markets. Agricultural products is a good example. After the Hungarian government eliminates agricultural subsidies, Dutch milk will be cheaper on the domestic market.
- Privatizing Foreign Trade Organizations (FTOs) sounds rational in the long-term, especially as their patterns of management and innovation are not ones that should survive in a market economy. However, the government has a rational reason for maintaining some state control. Basically the government wants to prevent Hungarian goods from competing against each other on foreign markets. Another Hungarian argued that this was absurd, especially since the FTOs also still dominate imports. Instead, it is the anti- privatization sentiment of the Ministry of International Economics that is preventing the privatization of the FTOs.

State Sector Initiatives for Improved Global Economic Competitiveness and Enhanced Quality of Life

L. DONALD SHIELDS
California Council on Science and Technology

Technology innovation is widely considered one of the essential driving forces behind economic and productivity growth. U.S. economists have agreed it accounts for two-thirds to four-fifths of the United States' productivity growth since the 1930s.

Over the past 10 years, U.S. state governments increasingly have taken leadership roles in facilitating the technology innovation cycle: the process which leads from technology discovery to technology diffusion into commercial products, processes, and services. This technology innovation cycle is not a linear process. There are important interactions and feedback opportunities that lead to even more and improved innovations. To function effectively, this process must be dynamic with strong communication linkages among the work force and the organizations involved.

In the United States, the principal contributors to the technology innovation cycle are science and technology based industries, public and private universities, and national laboratories. The differences in the mission and culture of these institutional sectors impede the speed and efficiency of interaction and communication between them. With an increasingly knowledge-based and rapid information flow global economy, state governments recognize that future competitiveness depends on more effective linkages between these three entities. Acting on the principle that the governing body closest to the organizations involved typically is the most effective broker in achieving cooperative relationships, state governments have become proactive in trying to facilitate these linkages.

Also, most small and medium size science and technology oriented industries have little continuing research capability beyond their initial developmental activity. In a global economy, these organizations' continuing technical and business health and vitality depend upon the regular upgrading of their products,

processes and services based on current state-of-the-art technical information and best business practices.

Increasingly in the United States, individual states are serving as catalysts for technology innovations that are related to facilitating and maintaining economic competitive advantage for the states' businesses and industries. In this regard, a number of states support the following initiatives:

- Collaborative basic and applied research activities between industries and universities
- Technology transfer initiatives from universities to industries that encourage further industry applied research and development activities
- Small business financial capital and business management assistance, including sponsorship of technology incubators that often include in the same location:
  - — Low-priced start-up space - Access to shared technical resources
  - — Access to shared business facilities
  - — Business management education and counseling
  - — Introductions to financial capital resources
- Technology diffusion or technology deployment programs providing off-the-shelf technologies to assist small- and medium-size businesses and their work forces in a continuing quest to be competitive in productivity, quality, cost, flexibility, and timeliness for their customers.

Essentially all 50 U.S. states now have at least one program designed to stimulate technology related economic development, with over 250 such programs nationwide.

CALIFORNIA PROFILE

Before presenting two case-studies of California technology innovation programs, some comparative data will help place the state's many activities in perspective. For 1990: California's population was 29.8 million (12.0% of the U.S.); its gross state product (GSP) was 730 billion (13.2% of the U.S. GNP); and, research and development expenditures in the state totalled 30.1 billion (20.1% of all U.S. R&D expenditures). Over the years California has been a leader in science and technology innovations. Its strong public and private universities have been important resources for developing internationally prominent industries including aerospace, microelectronics, computers, communications, biotechnology, high value-added services, and agriculture. Like the other states, California recognizes that for it and its residents to continue to prosper in an increasingly competitive global economy, it must continue to facilitate technology discovery, development, and deployment.

CALIFORNIA COMPETITIVE TECHNOLOGY PROGRAM (COMPTECH)

The California Competitive Technology (Comptech) Program was created in 1989 as a technology innovation initiative. Its mission is to facilitate the more rapid transfer of knowledge from research institutions to the private sector through an industry/ state matching grant program. In the long-term, Comptech aims to create and maintain quality private sector jobs within California and to advance the state's competitive strength in the world marketplace. Its motto is "In California, the goal is not just to invent the future, but also to manufacture it and sell it!" To date the Comptech program has combined 16 million from the state with 16 million of private sector funds to support 80 diverse projects involving faculty from 17 universities, 4 California-based national laboratories, 11 non-profit organizations, and 94 California industries. An example of a Comptech collaborative project is revolutionary rice.

REVOLUTIONARY RICE

Even though rice is one of the most important international agricultural commodities, its production methods have not changed significantly over 70 centuries in terms of its large water requirements. Furthermore, traditional rice growth also is susceptible to pests and vulnerable to weeds, which in recent times has required substantial herbicide and pesticide use. As a result, agro-chemicals present in water run-off from traditional rice fields contaminate rivers, endangering fish and fish reproduction.

A project entitled, "Agro-chemical-Free Rice Production" is a joint-venture between an agro-business organization (PureHarvest, Inc.), a public university (faculty and students at the University of California, Davis), and the state of California (Comptech program). This Comptech collaborative project includes:

- The development of new agro-technical methods, use of tested varieties of rice seedlings, and, ultimately, genetically engineered rice seedlings to grow rice in ways that challenge traditional methods used for rice production
- The integration of rice physiology, breeding, genetics, and biotechnology with a new process for growing rice
- A process for growing rice that includes initially planting rice seedlings below 2 inches of earth with no water flooding

In this project, a special weeding technology is used, and the germination process continues using 25% less water than traditional methods without herbicides or pesticides. To date tests on rice seeds (100,000-150,000 varieties exist) for seedling vigor are complete; productivity of approximately 7,000 lbs per acre is now comparable to rice grown by traditional methods. Automatic weeding and

systems control features are being refined, and gene splicing experiments to produce higher levels of seedling vigor have begun.

This highly promising and synergistic project between a small, entrepreneurial agro-business firm and university research faculty and students is funded by Pure-Harvest Inc. (118,000) and the State of California (199,000 - Comptech grant).

MANUFACTURING QUALITY ENHANCEMENT AND WORK FORCE DEVELOPMENT

In a rapidly changing global economy, product lines, manufacturing processes, and personnel services and responsibilities often change within organizations. New technology developments frequently are factors in these changes and they often require work force retraining. In the United States, the states are assuming cooperative responsibility with business and industry to provide such opportunities for work force development. In California, the State Department of Commerce, the California Community Colleges, and the State Employment Training Panel are cooperating with California business organizations to provide these opportunities. An example of this cooperative program is the California Aerospace Supplier Improvement Program (CalSIP).

CALSIP

The quality of a major manufacturing company's (hereafter referred to as a prime contractor) products is directly related to the quality of the components which make up its products. In the United States, a significant percentage of such components are provided by smaller companies (hereafter referred to as suppliers). Large aerospace companies and their suppliers represent an important example of this relationship, with suppliers providing approximately 50% of end-product components.

Thirty percent of California manufacturing is aerospace or aerospace related. The state has the largest number of major aerospace companies in the United States. Ten of these organizations have joined forces with nine suppliers, labor representatives, the state's 107 member community college system, the State Employment Training Panel, and the State Department of Commerce to develop CalSIP. This program provides training in total quality management (TQM) philosophy, principles, and procedures. The training covers four topics: TQM philosophy, statistical process control, just-in-time inventory systems, and team work and communications skills

The program includes four, eight-hour seminars designed for supplier owners and top managers which provide an overview of TQM and other skills. An on-site

program--expected to average 120 hours of instruction including on-the-job training--is customized to meet each suppliers individual needs.

The state of California covers much of the training cost, with some cost-sharing by the participating supplier firms. The training instructors are certified to present the curriculum by meeting standards adopted by representatives of the CalSIP Advisory Panel (prime contractors, supplier representatives and labor representatives).

The stimulus for developing and implementing the CalSIP program is the issue of economic survival for the organizations involved. In this regard, the following factors are important:

- With the end of the Cold War, decreases in federal defense spending are anticipated
- Increasing international competition for space and commercial aerospace markets is expected
- Prime contractors are reducing their supplier base
- In this environment, total quality management and the use of related tools such as statistical process control are keys to survival for aerospace suppliers

It is anticipated that suppliers who participate in the CalSIP program can expect:

- Reductions in costs through less rework, shorter process time, and improved processes
- Better product quality by controlling the process and by doing more than just meeting particular specifications
- Increased business from prime contractors - suppliers higher quality products mean lower costs to prime contractors
- Greater competitiveness in entering new markets

California has committed 7 million to this program for its first six months of operation. In January 1991, 6,000 initial notices about the CalSIP program were sent to aerospace supplier companies. There have been 650 inquiries and to date over 100 companies are involved in the first workshops and on-site training activities. Many more participant companies are anticipated as this program continues.

CONCLUSION

The two California case studies discussed above are representative of a large and increasing number of U.S. state initiatives directed to facilitate the use of technology discovery, technology development, and technology deployment to enhance a state's global economic competitiveness and, consequently, to advance the stan-

dard of living and quality of life of its citizens. Most of these efforts involve an active and energetic collaboration of business and industry, educational institutions, labor organizations, government leaders, and government agencies in establishing meaningful linkages among themselves. The most successful of these ventures are those strongly driven by the needs of business and industry.

DISCUSSION

Most of the questions probed for more detail about the genesis and development of the California Council on Science and Technology. Dr. Shields explained that the impetus for the council came out of the business community, which was concerned that the state's R&D resources needed to be better used. After the state took these concerns to the universities, it became clear that the state had a role to play in promoting links between educational institutions and private firms.

Responding to a comment that basic research scientists demand absolute freedom to choose topics, Dr. Shields noted that too often the problem is that basic researchers in universities are not aware of the needs of industry. The California Council brings these two groups together to exchange information and discuss problems, after which university researchers still have the choice on whether to get involved in the problems of industry.

The California Council is most successful in advising the state government on policies which affect science and technology (such as regulatory and tax policies), in initiating collaborative projects between public and private institutions, and in sustaining these projects through monitoring and careful oversight. Role of Government in Promoting Technical Innovations.

Role of the Government in Promoting Technical Innovations

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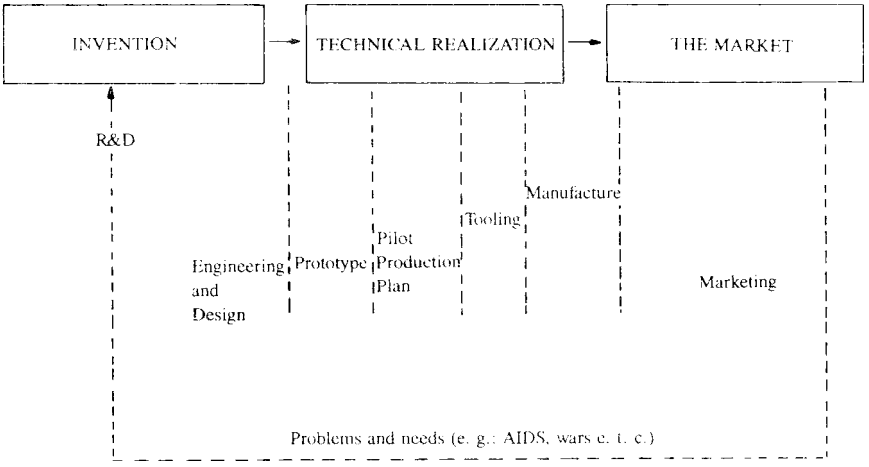
FERENC NÁDASDI AND ISTVÁN DÁNYI
Ministry of Industry and Trade

INTRODUCTION

Innovation[1] has become the most important factor in social and economic development during the past decades. It is important to remember that the process of industrial innovation (illustrated in Chart 1) is not a one-way street, but a cons-

Chart 1.

The process of industrial innovation



[1] Innovation is a broader concept than technical innovation. Considering the subject of this presentation, we are going to deal with technical (industrial) innovation, which has the following OECD definition: "Innovation is defined as comprising those technological, industrial, commercial or other steps which lead to the successful marketing of new manufactured products and/or to the commercial use of technically new processes or equipment. "Policies for the Stimulation of Industrial Innovation," Analytical Report, Vol. II, O.E.C.D., Paris, 1978.

tant interdependence of innovations and markets. However, the final goal is always to introduce a new product onto the market. This can occur either by society demanding ever newer products or by society replacing its former needs with newer means. Transistors and computer chips are good examples of an innovation gaining a much wider currency than originally planned.

As most states and governments have recognized the importance of technical innovation, they give eminent support to scientific research and technical development, and regard their control as one of their priorities. In these countries the intentions and even investments are quite high, but the results vary greatly. While the OECD countries are very successful in the field of industrial innovations, countries with similar levels of commitment are not. Hungary is one of the poor students and change is clearly necessary. Whether Hungary comes out of its present predicament depends on how quickly and exactly the problems can be diagnosed and whether an effective remedy can be found.

INDUSTRIAL INNOVATION IN HUNGARY

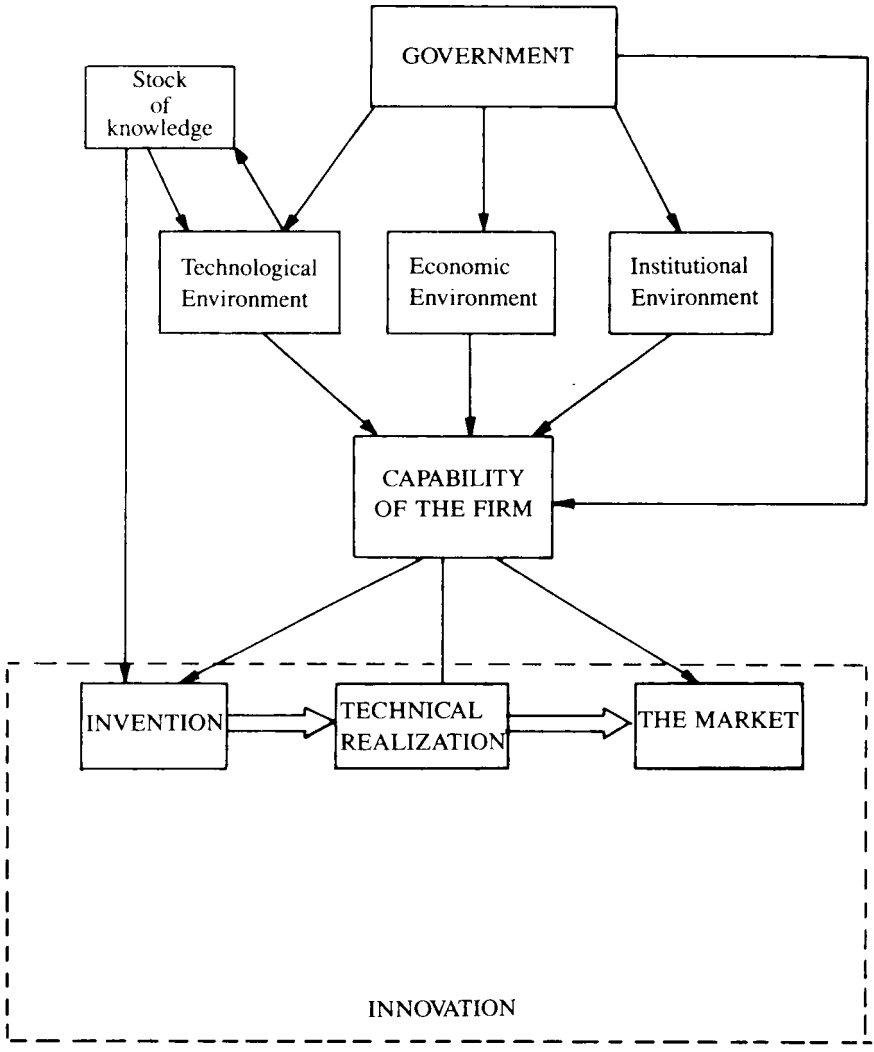
What was the gravest error of the former Hungarian regime in industrial innovation? Its biggest mistake was denying the necessity of private property; consequently, fundamentally limiting property's forms of existence. It also underestimated the role of the individual and put heavy constraints on his interests. These errors must be grasped clearly. This also explains why the transition to a market economy is so sluggish in the former socialist countries.[2] Now Hungary must perform well in an area that used to be forbidden.

Chart 2 shows the interdependence of industrial innovation, the government, and the business environment. On this basis, Hungary's situation can be characterized relatively well. The starting point of technical innovation is scientific discoveries that can be used to manufacture new, competitive products. In countries that manage technical innovation efficiently, the most important players in the field are universities and colleges, whose task is to generate and transmit knowledge. The most important duty of governments is to maintain proper financial support for the universities and to encourage their participation in the international division of labor, while at the same time ensuring their autonomy.[3]

[2] In the planned economy even those who had money could not engage in business. He could have bought a nice house, line up for a car, and go to the West in every three years. Capital was a dead thing, and shortage characterized the system in all areas. This also meant that instead of the economy there was a wasteful system of distribution.

[3] It is characteristic of Hungary's woes that an overwhelming majority of students entering universities and colleges do not speak a foreign language (English, German or French). Presently, there is a shortage of about 3,000 English teachers in Hungary's elementary and high schools and learning any foreign language abroad is an infinitely distant dream for most.

Chart 2.
Factors Influencing Innovations



With regard to the situation of universities and colleges and higher education in general, Hungary's educational shortcomings are significant. This backwardness is an impediment to charting a more dynamic road. The most important shortcomings and problems in Hungary are the following:

- While only 9.6% of the 18-22 years old in Hungary attend institutions of higher learning, the corresponding number in Western Europe is 17-22%.
- Quotas are determined bureaucratically, and the rigid methods of entrance examinations make sure that many gifted students will never get accepted or their enrollment will be delayed.
- The very low pay for university educators deter many gifted professionals from starting a university teaching career, and, for this reason, low quality instructors usually cannot be replaced.
- The former regime separated research from the universities, so the conditions for research at universities are inferior to those at industrial research institutes or institutes associated with the Hungarian Academy of Sciences (MTA).
- Universities, beside offering graduate and post-graduate training, can only confer doctoral degrees, while the candidate of science (Phd) and the doctor of science degrees can only be awarded by the MTA.

The problems and shortcomings listed above indicate that a fundamental change must occur in the way Hungarian universities and collages are run. Some reforms have begun at the graduate level, but it will be a long time before undergraduate and high school education are restructured.

Finally, the other producers of new scientific results are the industrial research institutes and the MTA institutes. The former strategic and paternalistic behavior of the state created a system in which research was isolated from production. This too must be changed.

IMPORTANT INDICATORS OF SCIENTIFIC RESEARCH AND TECHNICAL DEVELOPMENT

By analyzing the information of the past twenty years on the growth of research positions, the number of research projects, and financial support for research, the previous statements can be further refined.

In 1970 there were 1,071 institute research positions in Hungary. In 1989 this figure had increased by only 30%, while during the same period research expenditures nearly quadrupled. Unfortunately, the latest available information indicates that a brain-drain of gifted researchers towards the United States and Western Europe has already started, pushing the number of researchers back down to the 1970 levels. The number of researchers employed by universities grew 175% over the last 20 years, a much higher rate than at research institutes. Again it must be stressed that there is a still a need for substantially raising the quality of university instruction.

In Hungary there is an excessive number of research projects. With almost a one-to-one ratio between researchers and projects, it is nearly impossible to

achieve significant results. Important new scientific breakthroughs are produced not by individual researchers, but by teamwork. Also, little has been done to couple Hungarian research with international work. Only 8% of Hungarian research activities are carried out with international cooperation.

Table 1.
Major data on research and development activities

Indicators	1970	1980	1987	1988[a]	1989[a]	%
number of research and development units	1071	1442	1310	1323	1312	100.0
of which: research and development units	131	124	69	69	69	5.3
academic research	737	1078	925	944	933	71.7
company R&D	203	240	238	235	235	17.5
other research						
staff, in thousand	64.4	85.4	75.4	72.5	68.2	100.0
employed at: research development inst.	28.8	35.7	19.7	19.2	18.2	26.7
academic research	12.8	22.2	22.2	22.5	22.4	32.8
company R&D	22.8	27.5	28.7	26.2	23.3	34.2
other research			4.8	4.6	4.4	6.3
scientific researcher. innovators. in thousand	23.2	38.7	36.5	35.3	33.8	
assistants, in thousand	29.2	30.8	25.2	23.8	21.6	
current expenditures, thousand forints	5,828.8	15,982.6	26,173.6	24,823.9	26,202.9	86.4
investments, million forints	1,663.1	3,046.9	4,734.4	5,131.3	4,031.1	13.3
expenditures, sum total, million Fts	7,491.9	19,029.5	30,908.0	29,955.2	30,955.2	100
research subjects, developmental tasks underway	25,410	30,647	31,787	30,005	28,493	100
of which: within the framework if international cooperation	1,15	2,602	2,790	2,751	2,310	8.1

[a] Since 1988 less activities than before belong to the category of scientific research and experimental development. For this reason, total expenditures cannot be compared to expenditures in previous years.

Source: Statistical Yearbook, 1989. Központi Statisztikai Hivatal, Budapest

These problems are made worse by the scarce financial resources available for research purposes. As seen in Table 2, 2- 2.7% of the Hungary's GDP has been allocated to basic and applied research, as well as to experimental development. Technical research and innovation received only FT 19,619 million, the equivalent of 280 million. In developed countries, developing a single product costs over 1 billion. Chart 3 illustrates the present system of financial support for R&D.

Table 2.
Use of reduced expenditures[x]

billion forints

financial sources, use	1985	1986	1987	1988[a]	1989[a]	%
basic research	2.6	2.6	3.3	3.5	4.4	
applied research	7.2	7.3	8.3	9.5	9.5	
scientific research	9.9	10.0	11.7	13.1	14.33	42.3
experimental developments	14.5	17.8	20.8	19.6	19.55	57.7
total expenditures on R&D	24.4	27.8	32.5	32.8	33.8	100
of which: from state budget	4.5	4.7	5.2	5.4	6.8	20.1
expenditures expressed in the % of GDP	2.4	2.6	2.7	2.3	2.0	2.0

[x] Together with sums used in places other than research and development units: without expenditures on activities (services, production, etc.) in connection with research, experimental development.

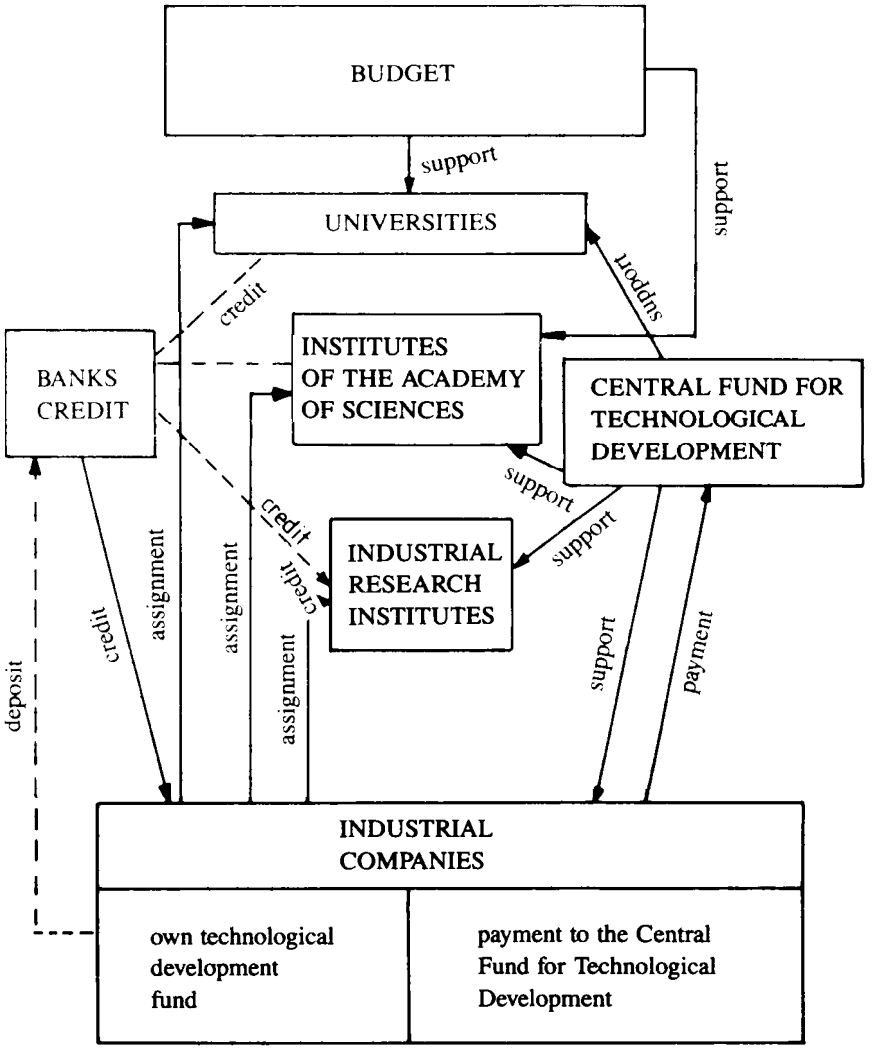
[a] See note[a] in Table 1.

Source: Statistical Yearbook, 1989. Központi Statisztikai Hivatal, Budapest

The lack of financial resources has also limited the availability of information systems. In developed countries, researchers at any time can sit at their computers and access business or professional information. However, in Hungary the possibility of using computer data banks is very small as the number of Hungarian data stations is below 70.

Chart 3.

Financing scientific research and technological development



THE NEW ROLE OF THE GOVERNMENT IN SUPPORTING TECHNICAL INNOVATION

As a rule in developed countries, the framework of financing technical innovation and coordination is set by the legislature. So, in addition to information gathering, analyzing, and decision making, the government is also an important factor in the efficiency of technical innovation.

Hungary is confronted with a unique situation. Although Hungary is attempting to create a market economy, the processes still reflect the economic logic of the old model. Immediately following the changes in Hungary's political system in 1989, the government should have created a comprehensive legal framework for the market economy. Although a number of laws have been promulgated, the following legislation needs to be passed in the near future:

- Act on Innovation
- Act on Higher Education
- Act on Scientific Research
- Bankruptcy Act
- Act on Investments

The overall economic strategy of the Hungarian government is contained in the action program entitled "The program for economic transition and development in Hungary."[4] The relations between the goals and means of the economic action program is illustrated by Chart 4.

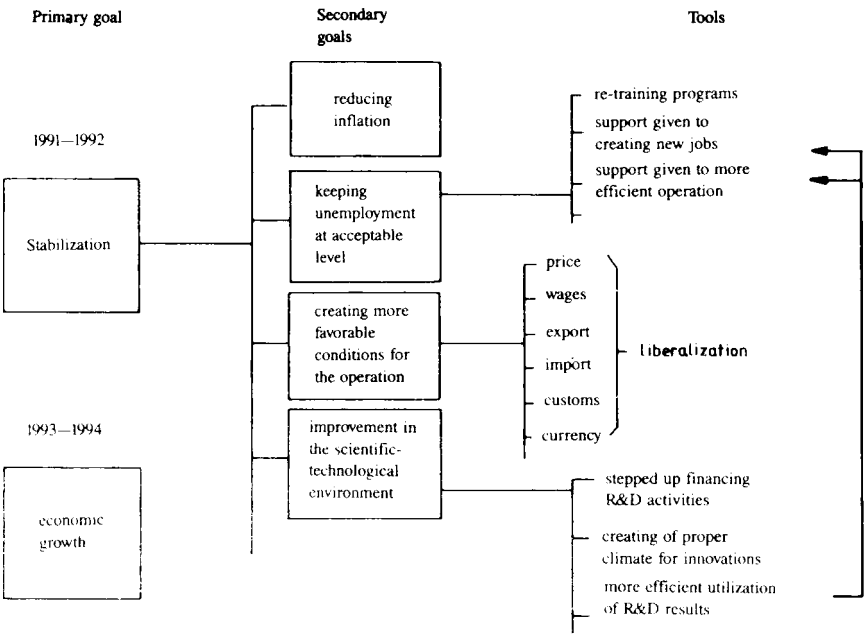
Parallel with the new economic laws, establishing a national technology policy must be a priority. State organs, scientific workshops, and entrepreneurial interest groups are presently participating in formulating this policy. The government's goal is for innovation to spur economic development, and vice versa. In other words, the government hopes that when it increases its financial support for innovation, the resulting economic benefits will allow it to further increase its support for innovation.

The government plans to develop a new institutional and financing system that would effectively support innovation. In short, the old system of translating innovations into practice has already ceased, while a new system has not yet begun working.

[4] The Ministry for Industry and Trade laid down its own ideas, as part of the overall program, in its program concept.

Chart 4.

The relations on the goals and means system of the economic action program (detail)



IMPORTANT INFRASTRUCTURAL FACTORS OF INNOVATION

In developing an infrastructure for innovation, the government plays a predominant role. Important infrastructural factors for promoting innovation are value engineering, industrial design, and the creation and operation of technical information systems.

Value analysis/value engineering (a recognized approach to design reliable products at the lowest cost) is the best known method of improving industrial efficiency. Hungary began using value engineering 25 years ago, but its industry-wide application has not yet been carried out. In order to lend moral and financial support to spread value engineering in Hungary and to help establish a training system, the National Board for Technology Development conducted two competitions during the 1970s related to the use of value engineering, while the Ministry of Finance in conjunction with other branch ministries conducted four competitions.

According to analyses, each forint invested in value engineering yielded an additional FT 5, largely because of better organization of the intellectual activities.

Value engineering makes it possible to improve quality and to reduce expenditures by 10-30%. This not only increases the competitive position of Hungary's products, but can also help reduce the rate of inflation. According to previous calculations, Hungarian manufacturers used 20% more material and energy than their counterparts in industrially developed countries. As Hungarian products require 30-40% more inputs, they are at a disadvantage on international markets.

Industrial design is supported by governments in economically developed countries because this activity also improves product quality and competitiveness. Hungary has a number of programs to support industrial design. For fifteen years Hungary has had the Industrial Design Prize, which is awarded by the Minister of Industry during both the spring and the fall Budapest International Trade Fair. Industrial design policy is coordinated by the Council for Industrial Design and Ergonomics, whose members come from ministries, professional organizations, and educational institutes. The László Moholy-Nagy scholarship also supports innovative industrial designs. Thanks to it, many gifted designers have been working for three years on new concepts that have great potential for many industrial areas.

The efficient allocation of means can only be realized through the possession of proper information. In the case of some research and developmental programs, the Ministry supported with its own resources the gathering of technical, scientific and economic information and its dissemination. Company people confirmed that the R&D and design activities were quicker and more efficient than earlier, which ultimately made possible a quicker marketing of new products.

SUMMARY

Hungary's tasks are enormous, and its possibilities and knowledge are very modest. Hungary has started off on the road leading to a social market economy, but the steps are hindered by the burdens of the past. The social and economic conditions are becoming more and more favorable both for our present and our future partners, and Hungary looks forward to the United States providing it with valuable experience and modern means.

Monetary Policy and the Banking System in Hungary in the 1990s

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REZSŐ NYERS Jr.
National Bank of Hungary

Over the past few decades, the Western countries have increasingly turned to monetary and fiscal policies to manage their economies. As a developed banking system is necessary for these tools to be effective, it is not surprising that as Hungary's centralized economy has been dismantled, the banking system and the role of monetary and fiscal policy have grown in importance.

BANKING REFORM OF 1987

Until 1987, Hungary had a single-tiered banking system. The National Bank of Hungary (NBH or Central Bank) was responsible for central banking, foreign exchange and commercial banking, as well as clearing turnover transactions. In this single-tiered system, central banking activities were subordinate to the government, whose primary monetary policy was to satisfy the central plans' estimated financing needs of the government and business sector. Simply put, the aims of the monetary policy were no more than reflections of the aims determined by the central plan.

With the 1987 banking reform, the banking system again became two-tiered. The major part of commercial banking functions were transferred from the NBH to three new commercial banks, for which the government contributed the majority of initial capital. Now 36 commercial banks and specialized financial institutions exist, in addition to 260 savings cooperatives. This reform has created the institutional framework for a more effective and vigorous monetary policy. Soon the Central Bank Act will be submitted to Parliament and will further define the basic tasks of the Central Bank.

FORM AND FUNCTION OF THE COMMERCIAL BANKS

The 1987 banking law states that Hungarian banks may only operate in the form of joint stock companies. Shares in banks may be purchased by both private individuals and legal entities. In most of the banks, the majority of share capital is owned by enterprises and private individuals; state ownership exceeds 50% of the share capital in only a few banks, and this will be reduced to less than 50% within a few years. Shares also may be bought by foreigners. Currently there are 13 commercial banks with foreign participation, and foreign institutions even hold the majority shares in some of them (Charts 1-2-3).

The commercial banks in Hungary are now universal banks; in other words, there is no sectorial restriction on their operation. They are also universal in that they make no distinction between the household and the business sector; private individuals may place deposits and take out loans in the same manner as entrepreneurs and business persons. Regarding interest rates, between 1987 and 1990 the central bank prescribed a ceiling on interest rates for deposits by private individuals, but this ceiling was abolished at the beginning of 1991.

Two other important commercial bank functions center around foreign trade and securities transactions. As there has been a unified exchange rate since 1980, it is natural that the commercial banks are gradually taking over convertible foreign currency transactions. Export-import financing is also being carried out by the commercial banks. Based on the 1990 Act on Securities, they may also deal in securities. However, following a three-year period of transition, banks will no longer be able to conduct direct security transactions.

FUNCTIONS OF THE NATIONAL BANK OF HUNGARY

A consensus has already emerged in professional circles and between the political forces on the basic functions of the Central Bank. The NBH will be granted a great degree of autonomy, similar to that enjoyed by the U.S. Federal Reserve and the German Bundesbank. Accordingly, the responsibilities of the NBH will be reduced to classical central banking functions.

One function will be to supply refinancing credits to banks. The importance of these credits is being gradually reduced as the volume and proportion of short-term refinancing credits is decreasing rapidly. The re-discounting of bills and open market transactions are becoming the main forms of short-term refinancing. Currently the Central Bank's refinancing credits make up about 20% of the banking systems liabilities. The proportion of central bank refinancing is relatively high at the larger commercial banks and in long-term lending. As a consequence, during the banking reform of 1987, the large banks took over company investment and other long-term credits from the NBH.

Chart 1.
Balance sheets
by size groups of Hungarian banks

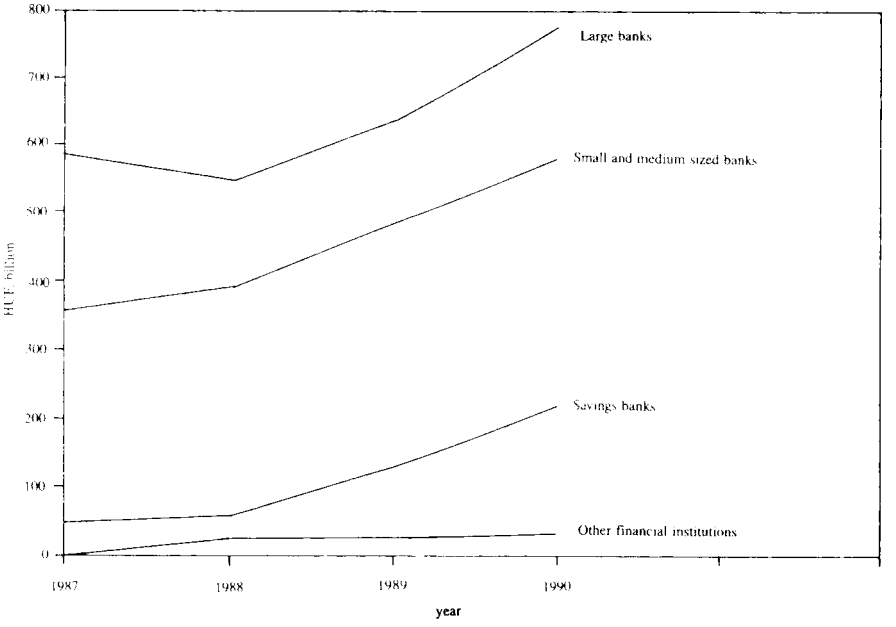


Chart 2.
Equity e capital

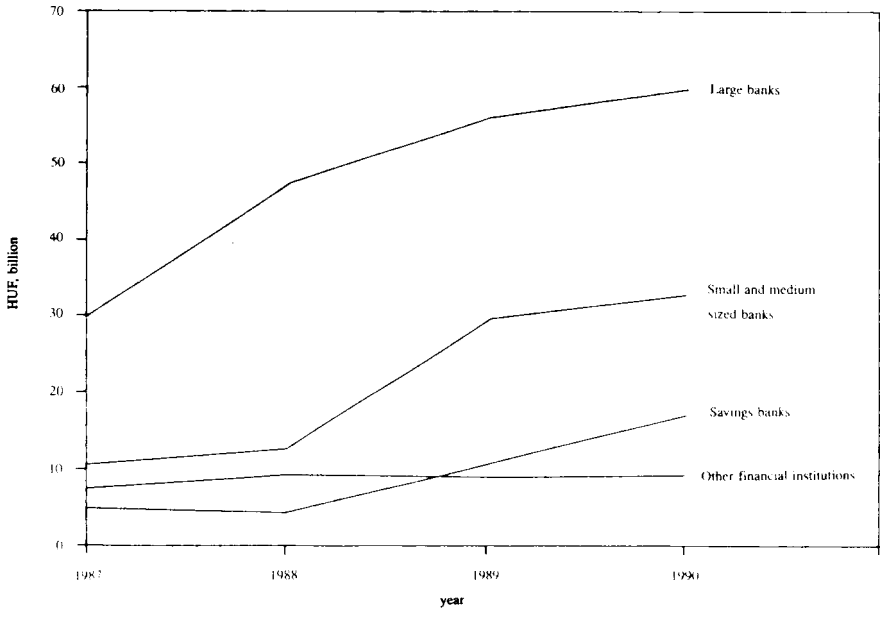
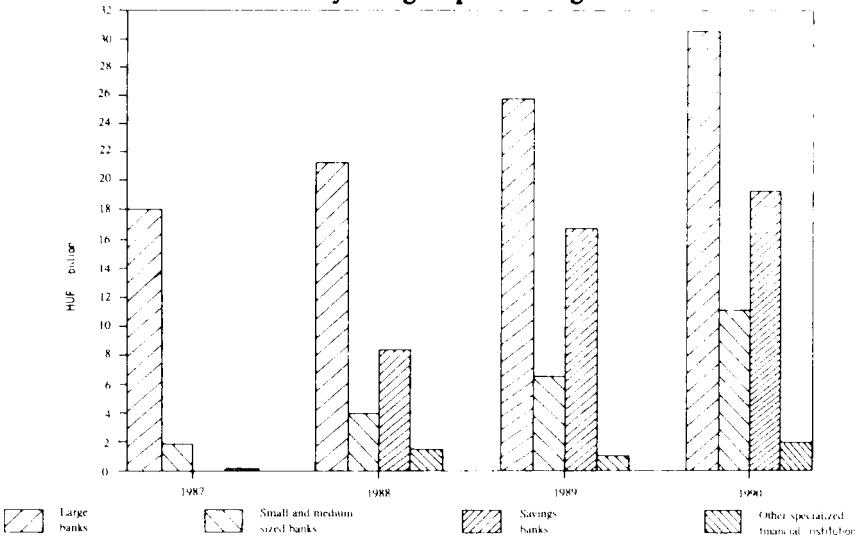


Chart 3.

Total revenues by size groups of Hungarian banks



In the short term, the bank's liquidity regulations and open market transactions are gaining in significance. NBH systematically organizes treasury bill auctions and the sale of central bank issued deposit certificates, and it issues an increasing share of the short-term refinancing credit allocation to the banks through inter-bank auctions.

The Central Bank also influences the economy by the level of deposit and interest rates. The central bank deposit rate policy effects the liquidity of the banks and their profitability. At the moment a deposit rate of 15% is applicable to short-term and long- term forint and foreign exchange deposits. The Central Bank interest rate policy is directed towards developing a market rate that encourages savings. In 1990, for every FT 100 of income, the population saved FT 5-6, significantly behind the savings Western Europe. The Central Bank also supports exports, privatization, and the development of small enterprises with refinancing credits at favorable interest rates (Chart 4). On the other hand, short-term financing, which plays a great role in a bank's liquidity and in open market transactions, follows the interest levels of the market.

Finally, with its new autonomy in monetary policy, the Central Bank's tight regulations will also restrict the financing of the state budget. The new restrictions of central bank financing of the budget can be seen in the indices referring to the involvement of central bank sources in the budget and the banking sector (Chart 5). One of the great lessons of recent years is that when the central bank is subordinate to the short-term views of the government and automatically finances large government budget deficits, it is incapable of implementing anti-inflation efforts or of achieving equilibrium in the current balance of payments.

Chart 4.
Credits to entrepreneurs
(flow figures)

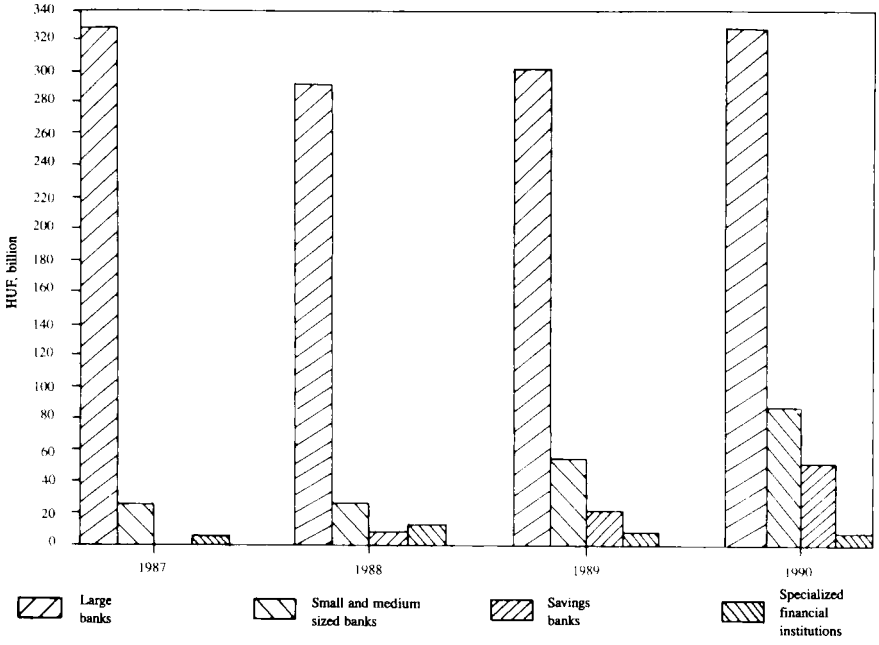
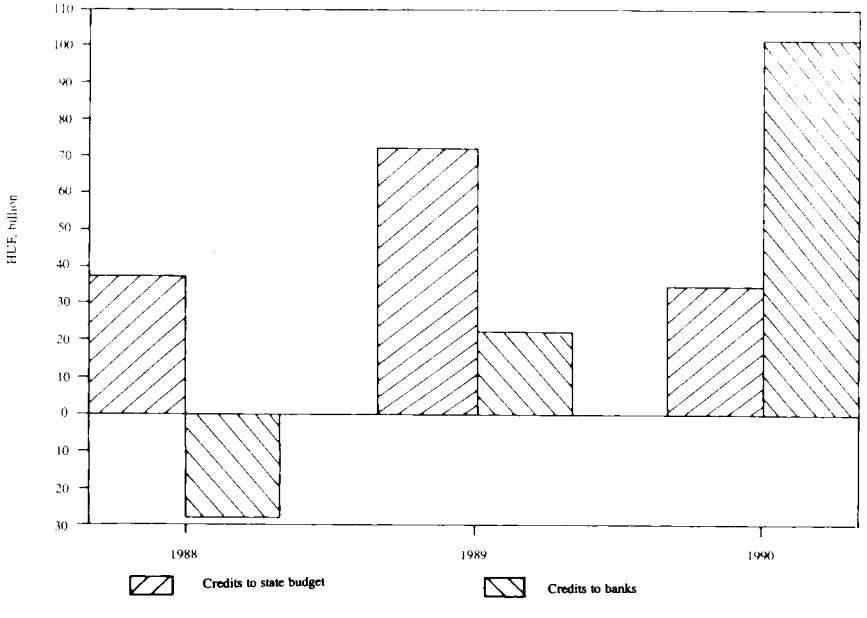


Chart 5.
Changes in the stock of NBH refinancing credits



OBJECTIVES OF HUNGRY'S FISCAL AND MONETARY POLICIES

Since the two-tiered banking system was introduced, the NBH has enjoyed increasing independence in forming and executing monetary policy. The broad objectives of Hungary's current monetary policy are similar to those of countries with developed financial systems. One goal is to balance the current balance of payments. This is an especially significant task in Hungary, because at the end of 1990 the country's gross debt in convertible currencies stood at more than 21 billion and the debt service ratio (debt service in relation to annual convertible exports) exceeded 50%. Also among the objectives of the monetary policy is, naturally, the stability of the national currency, which includes controlling inflation. Finally, the monetary policy must assist the balanced growth and development of the economy.

The National Bank has now identified a number of medium-term aspects of its monetary policies. The first is pursuing a tight monetary policy, i.e. limiting the growth of the money supply to a rate lower that the growth of the nominal Gross Domestic Product, in the interest of improving the current balance of payments (Chart 6). Secondly, the bank seeks to stabilize the demand for money by setting the interest rates so that they cover liabilities and encourage savings (Chart 7-8).

Chart 6.
GDP, Broad Money
(current prices)

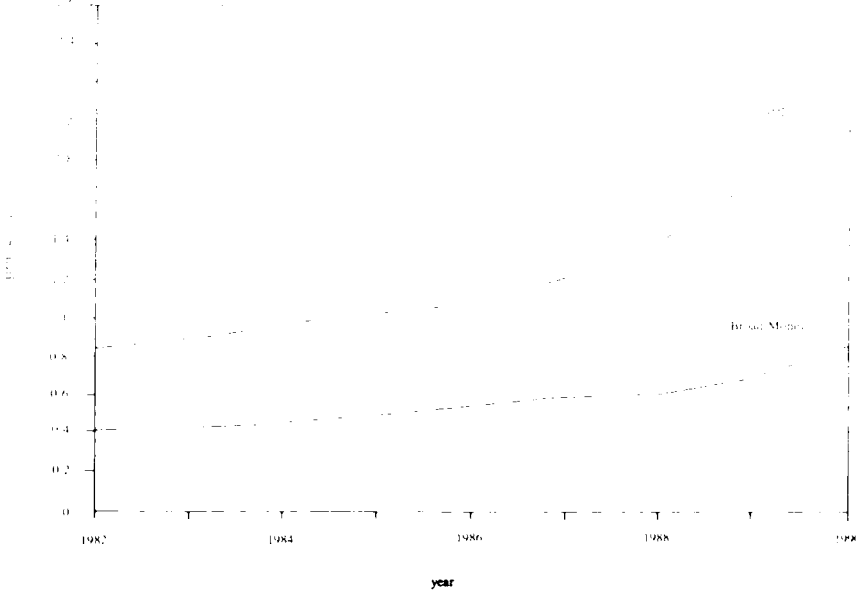
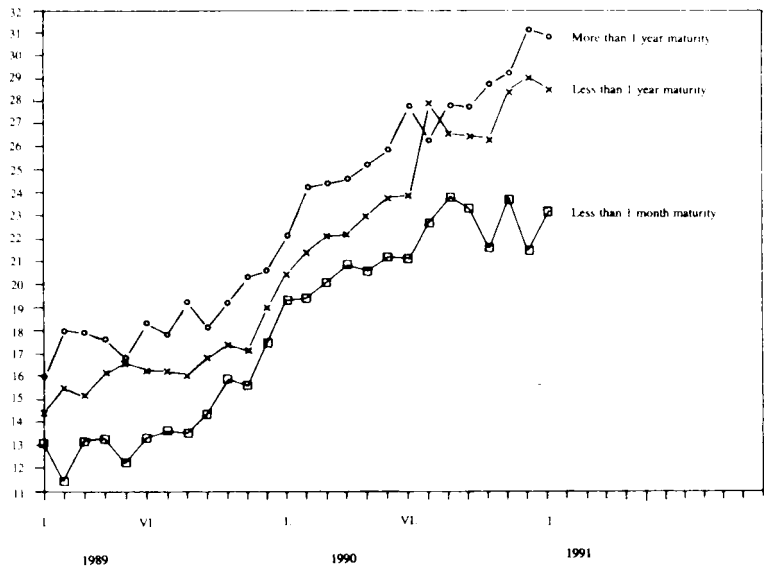
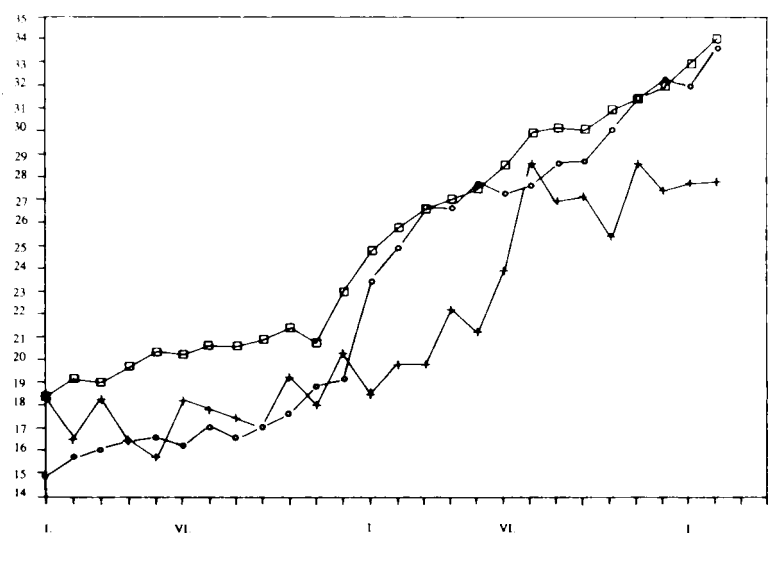


Chart 7.
Market rates 1.
Interest rates of deposits



Maturity: O=more than 1 year; x=less than 1 year; □=less than 1 month

Chart 8.
Market rates 2.
Interest rates of credits



□=less than 1 year +=More than 1 year O=Disc. bills

In December 1990, the interest rate for deposits was 31% and the rate for credit was 34%, up from 17% and 19% respectively in January 1990; inflation for this year is expected to be 34-38%. Finally, the NBH will try to set an exchange rate for the forint which is stable and also ensures the profitability of export. Nominal exchange rate fluctuations and devaluations should aim only to balance the difference in the domestic inflation rate and the inflation rates in foreign markets, because continuous devaluations do not support long-term export growth, but merely provide temporary improvement in the balance of payments. Devaluations also effect domestic inflation immediately and directly (Chart 9-10).

It is apparent that the central bank's monetary policies are primarily directed at regulating the net domestic credit supply (net domestic assets). The modification of the monetary policy can be noted in the rate of growth of nominal GDP, the rate of growth of the broad money and the changes in the velocity of turnover of money (Chart 6-11-12). From the data, the fluctuations in the velocity of turnover of money in recent years are already evident, especially the significant increase in the velocity in 1989. It should be noted that in the 1989 increase of velocity of money, a great role was played by economic policy decisions falling outside monetary policy, primarily foreign exchange purchase by the public and the explosive expansion of tourism.

Chart 9.

Direct foreign trade fco border, 1989

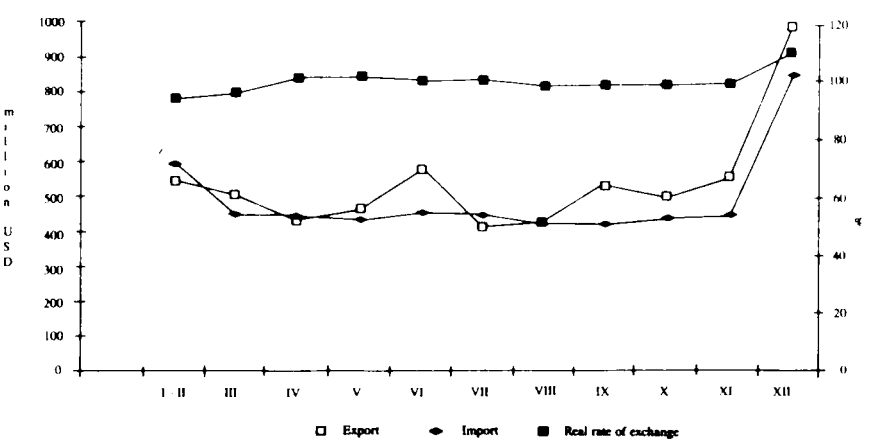


Chart 10.
Direct foreign trade fco border, 1990

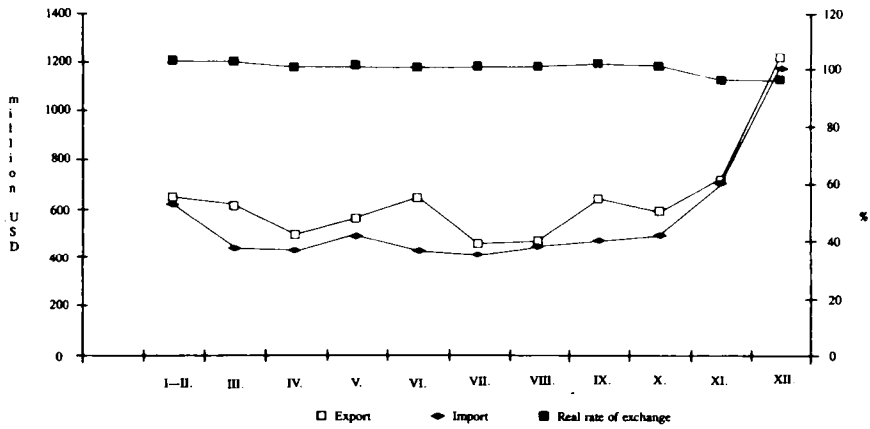


Chart 12.
Velocity of money, semi-annual figures (current prices)

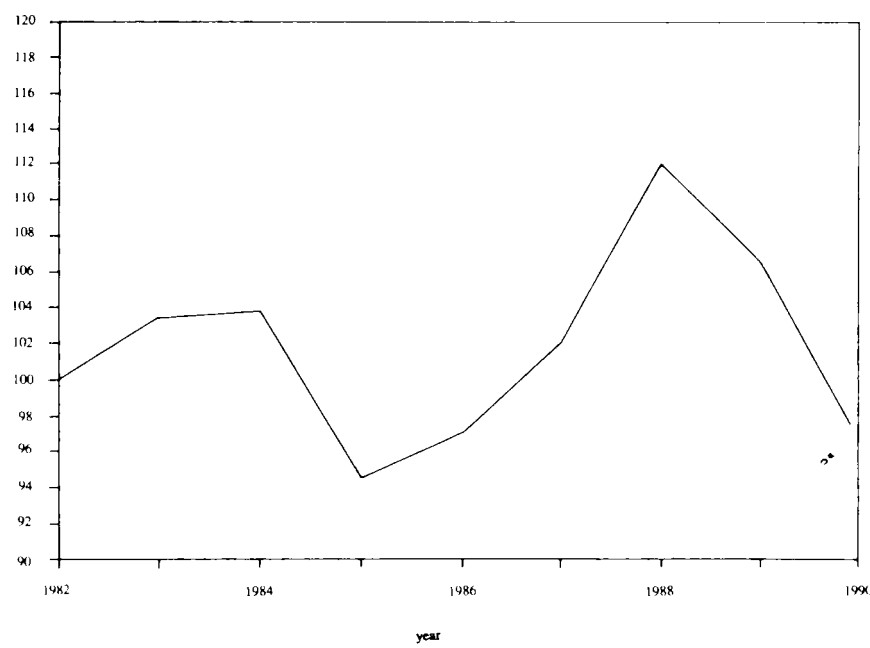
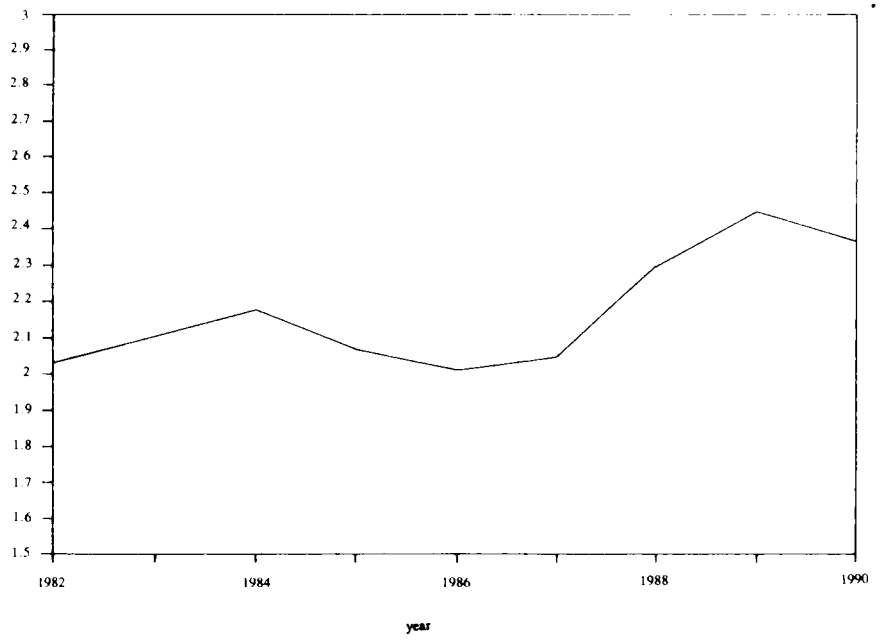


Chart 11.

GDP valume, annual growth rate
(Previous year=100%)



FUTURE DEVELOPMENT OF THE BANKING SYSTEM

With the passage of the Act on Financial Institutions, which may take place in 1991, the banking system will receive a concrete and modern legal framework. The current draft of this bill, which is based on international practices, would regulate the activities of the banks and the system of establishment of banks; set bank security regulations in harmony with the requirements of the Basel Accord and the recommendations of the Bank of International Settlements and the World Bank; regulate the classification of the banks' assets according to risk; create the necessary reserves to insure banks; and set the minimum risk-weighted capital - asset ratio at 8%.

Another problem to be addressed is the ownership profile of banks. Some banks are still largely owned by the state, and this needs to be changed. Under clearly defined conditions, foreign capital should be allowed into the Hungarian banking system. Allowing foreign capital would help draw the banking system closer to the international financial world, and the foreigners could also help modernize the operation of the banks, improve professional and technical standards, and, last but not least, increase the capital of the banks.

With or without foreign involvement, the Hungarian banking system needs significant improvements in technical standard. This includes extending branch networks, modernizing clearing turnover operations, broadening the range of banking services, and increasing the standard of service.

Currently the Hungarian banking system is also overly concentrated. The four largest commercial banks hold more than 80% of the current accounts of enterprises and represent more than 80% of the loans and deposits of the business sphere. Clearly such a concentration is extremely unhealthy and must be reduced in the near future.

Finally, the foreign exchange transactions will be further decentralized in the coming years. Combined with the integration of Hungarian banks into the international financial networks, this is indispensable to achieving a high degree of forint convertibility within a few years.

Role of U.S. Government in Supporting Industrial Competitiveness

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NAS PANEL DISCUSSION

In the United States, the role of the federal government in the private sector is very controversial. As mentioned in Dr. Schillinger's presentation, Americans traditionally have preferred the federal government to intervene as little as possible in the personal and business affairs of the citizens. However, in light of the successful national industrial policies in Europe and Asia, which have resulted in increased globalization of markets and growing competitiveness, a broad range of voices have begun calling for the U.S. government to devise an industrial policy.

To highlight the different views between those who favor a federal industrial policy and those who oppose it, as well as the variances within each of these groups, there was a panel discussion on the topic "The Role of the U.S. Government in Supporting Industrial Competitiveness." The panel consisted of Dr. L. Donald Shields (California Council on Science and Technology), Dr. Karen Fortin (University of Florida), and Dr. Lowell Steele. After each made some brief remarks, the topic was opened to the floor. This is a summary of the remarks and discussion.

The discussion was opened by Dr. Shields, who provided some comparative statistics on the U.S and Hungarian economies. Currently the U.S. Gross National Product is 5.5 trillion and the federal debt is 3.5 trillion. Hungary, on the other hand, has a Gross State Product of 24.4 billion and a debt of 20 billion. So both countries have high debt ratios and both are in a recession. To give one more comparison, both the U.S. and Hungary spend 2.7% of gross product on research and development (R&D).

A U.S. TECHNOLOGY POLICY

The U.S. government has become increasingly aware of the link between R&D and economic growth and, consequently, has been examining related issues, such as science education at all levels and the role of the government in promoting R&D. In March 1990 the U.S. President George Bush announced that the federal government would work with industry in the "pre-competitive" phase of R&D (the pre-competitive phase is basic research prior to the development of prototypes). Six months later, Dr. Allan Bromley, Assistant to the President for Science and Technology, issued a paper on U.S. Technology Policy. The document was significant in and of itself, as the United States had never before had a national technology policy. The paper recommended that the federal government act as a facilitator and funder to support the private sector with generic technology, pre-competitive research, and enabling R&D. In reflecting on this policy change, one should ask not only what it means to the United States, but also how it might be applicable to Hungary.

Taking the floor, Dr. Lowell Steele noted that the subject of national technology policy has been extremely controversial in the United States. When President Bush declared his position, three of his White House advisors openly disagreed with him. Regarding having a technology policy, semantics is a major problem, as people casually toss around words. "Competitiveness" is an extremely complex word only whose simplest meaning is used, and the word "policy" implies a coherence that does not exist. Dr. Steele argued that small policies with specific goals are better than trying to impose large, umbrella solutions.

In the near future, Dr. Graham Mitchell (GTE) stated that the federal government would not do anything, adding that they should not do anything. Providing some numbers, Dr. Mitchell explained that in 1990 46% of R&D money came from industry and 49% came from the U.S. government. The estimate for this year is that the industry share will rise to 51.5%. It is not only important to note that the government share is declining, but one should also understand that very little government funding addresses the issue of industrial competitiveness. It is the industrial community which tackles these problems and research managers have to fight competitively for company funds.

Disagreeing with Dr. Mitchell on the role of the government, Dr. Ben Slay (Bates College) felt that there are many important things that the government could do. It is simply that people are unwilling to pay for them. Dr. Schillinger noted that the basic thrust of Dr. Steele's and Dr. Mitchell's comments was that we should not focus our energy on the federal government, but rather on the private sector.

Dr. Fortin reminded the audience of the different roles of the state and federal governments in the United States. Citing Dr. Shields' presentation, Dr. Fortin noted that effective state industrial policies are operating in the absence of a na-

tional policy, and furthermore these state policies often conflict with the goals of the federal government. Dr. Fortin then turned her comments to the importance of education in sustaining economic growth. She stressed that Hungary now has a tremendous opportunity to revamp its educational system, which has historically been strong.

TECHNOLOGY MANAGEMENT

Because of the decentralized nature of U.S. industrial policies, the credibility of technology management has become critical. Over the last ten to fifteen years, technology managers have had to worry less about the technology and more about general management questions. There are a number of major issues facing research directors today. One is the globalization of R&D. Companies no longer have the resources to generate as much research from within the firm, so they must be better hunters and gatherers of technology. The rapid commercialization of research discoveries has brought product cycles down to one year. And finally, the growth of the information industry has had wide impacts of how we think of technology. Therefore, it is incorrect to say that the federal government only must expand R&D activities to increase the competitiveness of American firms.

CONCLUSION

Echoing many of the previous thoughts, Dr. Mel Horwitch (Theseus Institute) concluded with the following points:

- In the foreseeable future, our focus must be on the firm level. Linkages are very important and although these links may include or be facilitated by the federal government, we should not be so concerned with government policy.
- The area where the government does have a role is in creating human talent. In other words, the government should be active in educating and training.
- Taking one of the messages from Dr. Schillinger's talk, there must be easy interaction between government, universities, and industry. This does not happen in Europe. In particular, Hungary must consider how to break down these barriers.
- In a broad sense, we must think about the spirit of the times. We have entered a period of pessimism and this is not just in Hungary or the United States. Again, here it is not government policy that should concern us, but the need to recapture a global spirit of optimism.

Fiscal, Tax and Other Financial Policies that Affect Jobs and Innovations

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There are two inescapable facts relative to fiscal and tax policy: 1) governments must raise money through some form of taxation to provide the services necessary for the orderly conduct of government; and 2) the amount, form, and incidence of this taxation affects the behavior of the populace and can impact the government's continuing revenue generation processes. Due to the circularity of these concepts, the taxing authorities must carefully consider the form in which taxes are to be levied, the ways monies are to be spent, and the objectives of the spending in order to ensure that the expenditures are made in the optimum manner.

Taxation systems and fiscal policies play an important role in resource allocation in all economies. To insure the optimum use of resources, the government must identify its most critical functions, identify its economic objectives, and place priorities on the use of its tax resources. These three roles are described below.

CRITICAL FUNCTIONS

There are certain functions usually reserved for the national government, such as provision for national defense and administration of a national taxing system to provide the revenues necessary for the support of the government. In identifying the national government's other critical functions, conflicts often arise between it and local units of government. These conflicts center around determining which governing body is better positioned to decide exactly how revenues should be raised and the most efficient mechanism for spending these funds. Without coordination between local and national governments, there will be gaps in

services and wasted resources. While there are no easy answers to the questions of coordination, an emerging democracy has the opportunity to reexamine its entire government structure and establish new patterns of revenue generation and spending, which can provide increased benefits to the populace.

ECONOMIC OBJECTIVES

How a government raises and spends its resources can have numerous direct and indirect effects. Understanding some of these effects requires understanding different types of tax levies and a tax system's functions. The different type of tax levies include:

Income taxes: This raises questions about how income is measured, and about how the tax is levied.

Consumption taxes levied on spending: While many regard these taxes as regressive, they do tend to encourage saving.

Wealth taxes: In addition to measurement problems, this form of taxation creates incentives for wealth-holders to exchange their wealth for productive assets.

Wealth-transfer taxes: While these taxes can encourage consumption, they also break up large concentrations of family-held wealth and can have a socially-leveling effect.

With regard to spending money, differences exist in the impact on the economy whether the government spends money directly by purchasing goods and services or whether it puts money into the hands of the populace through some form of welfare-type payment. Government "expenditures" can also include special tax provisions to certain classes of taxpayers. Such tax provisions are frequently employed to influence the behavior of enterprises. For example, tax preferences may be used to spur the long-term goal of promoting research and development at the enterprise level. The following are some common tax policies with this aim:

R&D Credits: R&D credits reduce corporate taxes when the firm spends money to develop new products and can be tailored to encourage research in specific fields. In the United States, one such example is the "orphan drug credit," which grants pharmaceutical companies substantial tax breaks to develop cures for uncommon diseases. Without such credits, research in this field would not be economically viable.

Investment Tax Credits: Investment tax credits, which were removed from the U.S. tax code by the 1986 Tax Reform Act, allowed industries additional tax write-offs as they expanded plants and equipment.

Depreciation Allowance: Firms also benefit from depreciation allowances. In Western Europe firms can immediately write-off new equipment, but U.S. firms can only deduct the depreciation of equipment.

Credits for ESOP and Pension Funds: Finally, the government has tax breaks relating to Employee Stock Option Plans (ESOP) and pension funds. Company ESOP programs partially compensate employees with stock options, which in turn gives the employees a greater stake in the health of the company. Many pensions funds are partially funded by investments in company stock, tying retirement benefits to stock performance. ESOP programs and these types of pension funds increase company productivity.

In a newly democratic country with a history of limited private ownership, the government must encourage the transfer of ownership from the public to the private sector. Tax and fiscal policies can have dramatic effects on privatization, savings, and investments. Such policies, therefore, play a role in developing new industries, but they require a critical analysis of the resources already available for those industries as well as the possibilities for generating new resources from both internal and external sources. In light of limited investment resources, tax and fiscal policies must also encourage foreign investment. Hungary, however, is competing with every other nation seeking outside investments. The incentives must be adequate to make the foreign investment economically sound, while being of long-run benefit to the nation as a whole.

Tax policy is also present in formulating industrial and trade policies, since changing tax or tariff rates on a given sector can have a strong influence on its export performance, as well as its ability to attract joint ventures. For example, most West European and South American countries have value-added taxes, but firms receive tax rebates on goods that are exported. The United States, on the other hand, has domestic sales taxes, so exported goods are not taxed domestically.

SPENDING PRIORITIES

By far the most difficult task facing Hungary, given the limited resources available, is determining its spending priorities. To be a player in the world economic markets, Hungary must be competitive with other countries. To do so, it must up-

grade its industries through capital investment. The government can offer numerous incentives for capital investments through its tax policies, some of which were mentioned above, as well as through more direct means, such as the transfer of ownership to the private sector.

But capital is not the only requirement for successful competition in the world markets. The other, and probably more important, side of the equation is the investment in human capital; that is, management and labor. Management must be trained in the efficient use of capital resources available to them. Labor must willingly become part of a changing industrial society -- one which may have been very labor intensive -- but which to be competitive may become more and more capital intensive. Labor must have incentives to grow and change as industries grow and change.

Excellent public education has been the lifeblood of industrialized economies. Education, both at the management level and at the technical skills level, must be encouraged and supported. Innovative management techniques must be encouraged; technical education to meet the labor needs of new industries and processes must be established.

Most of all, the people in Hungary must have an incentive to become a major factor in its emergence as a competitive economy. To do this, there must be concentrated efforts to ensure an increased standard of living as the work force contributes to the economic prosperity of the country. There must be confidence that outstanding work will be rewarded.

THE LONG-TERM VIEW

The challenges facing Hungary as it moves into the world markets are many and diverse. To meet the needs outlined above requires wisdom and dedication. But one of the major dangers facing Hungary is one faced by most governments and industries: short-run objectives often conflict with long-run goals, and personal objectives differ from institutional objectives. Hungary has a grand history--it can have a grand future. To meet these challenges, Hungary's political leaders cannot be self-serving in their decision processes. They must look to this future--in ten, twenty, and thirty years--not to the next election. Sound economic policies are the means by which Hungary will move into the 21st century.

DISCUSSION

The presentation provoked considerable discussion on the formation and real impacts of tax policies. When the point was made that tax policy is fundamentally a political question, Dr. Fortin lamented that one of the major disadvantages of

the U.S. tax system is that its principle purpose is to reelect incumbents. Every four years there are major new tax laws, but the difficult questions are rarely addressed.

One participant argued that the most important thing the government could do for industry was to reduce their tax burden. The person continued by stating that although businesses were in favor of R&D tax credits, there is no evidence these credits encourage R&D. Dr. Fortin countered that there is heavy pressure on the U.S. Congress by research managers to keep the credits whenever they are set to expire. Another participant believed that there is a greater linkage between the credits and R&D in small firms than in large ones, adding that President Bush supports making the R&D tax credits permanent. Continuing on the theme of causal relationships, one participant felt that the change in U.S. tax policies in the 1980s had a positive impact on the growth of venture capital.

In light of the complexity and political nature of the U.S. fiscal and tax policy, there was some question whether it was an appropriate model for Hungary. When Hungary's problem of bringing the second economy into the open was mentioned, Dr. Fortin related similar problems in the U.S. of unpaid taxes. If the compliance rate in the U.S. was at the same level as it was in 1980, there would be no budget deficit. In order for compliance rates to rise, the population must understand the tax system and accept it as fair.

Another participant wondered whether the tax and fiscal policies of the newly industrialized nations in Asia would be a better model for Hungary. The markets of these countries are less "free" than those of the United States, but their fiscal and tax policies are effective in guiding resource allocation.

The Capability and Willingness of Hungarian Firms to Innovate

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INTRODUCTION

When Robert Oppenheimer left the room, the remaining four chaps with the faint idea of the atomic bomb caught each other's eye. After a necessary scientific break, one of them, Leo Szilárd, said to the others: "Guys, at last we can speak Hungarian!" The other three were Eugene Wigand, Edward Teller and John Neuman. Every Hungarian scientific greenhorn knows this story, which proves the first axiom of this paper:

Hungarians are able to produce innovations, especially abroad.

Now for the second axiom. An innovation more explosive than the atomic bomb can flash through the mind of a Hungarian even at home. This happened to Mr. Rubik when he invented his damned cube. But who could carry out this world famous innovation - including the lion's share of the profit? The skillful manufacturers in Hong-Kong, Taiwan, and Singapore. So the second axiom says:

If a Hungarian innovator is clever enough to have a fine new idea at home, he also has to be clever enough to sell it abroad.

After this short introduction, let me honor our scientific seminar with a more scientific, i.e. really boring, approach to the given topic. I will outline the capability and willingness of Hungarian enterprises to innovate from two point of views. First, I shall list the well-known Western requirements to stimulate innovation within the firms and describe how these requirements have functioned in Hungarian enterprises during the last 40 years. Second, I shall enumerate the characteristics of the present Hungarian scene which are real barriers to the full innovation processes at home.

STIMULATING INNOVATION FROM WITHIN THE FIRM

The following are the Western requirements to stimulate innovations at the firm and the Hungarian answers to these Western challenges:

1. For innovation, managers need **people** who want to accomplish something in their work, who have brave new ideas and who take the risks of untried approaches. During the last forty years, the Hungarian employee had to fulfill the plans of the company as specified by the Planning Office. Quite soon he learned how to be a gray man without any revolutionary idea, because the socialist guillotine--in contrast with the well-proven French one- -worked not in the vertical, but in the horizontal direction.

2. To stimulate innovation you must imbue the whole firm with **information** about the technical and economic environment, and create a **free communication** within the company that breaks through the barriers of classical functions and hierarchies. In Hungary, all information about the firm flowed up to the top. Once there, the managers prevented it from leaking back down, creating an information monopoly.

3. For a good innovative climate with the company, you need **incentives** (financial and others) which are proportional to the profit realized by the innovation. Following the brave old models of Maslow and Herzberg, the less financial the incentives, the more efficient they are in a wealthy society. But money comes first for the Hungarian innovator, who struggles with financial problems. Unfortunately for him, the money comes only in drops, because in an egalitarian society it is not the realized profit that determines the scale of performance, but the ungifted and lazy colleagues.

4. Western innovation experts emphasize that company management must provide **time** to the potential innovators to dream, risking that sometimes management itself will also dream about prospective innovations. Under the old Hungarian system, working hours were never for dreams. Everybody had to pretend to work eight full hours, although there is no question that during 30-40% of working time there was no output at all and worker productivity was only the half that of neighboring Austria. Of course, to imitate hard work and dream about new innovations at the same time was too much for the Hungarian workers, particularly at Hungarian wages, which are half (in real terms) of Austrian wages.

5. A manager, receiving a suggestion to start an innovation process, has to make **timely decisions.** This is not only because changes in the technical and economic environment occur quickly, but also because every decision, whether positive or negative, must strengthen the innovative spirit of the employees. But if the responsibility for decision-making is not clear, overcentralized, or a struggle against internal power centers (as it happened in Hungary), the decision will come too late and management will be viewed as completely disinterested in innovation.

6. Accepting an idea for an innovation is not enough; nor is paying a high fee for a good idea enough. An innovator wants to see his **idea realized**, and the more noisily the idea is realized, the more charming the music is to encourage the next innovation! This is an easy lesson for a society with capital surplus, where profitable ideas can easily meet the capital needs for their implementation. But in Hungary, a country with a "debts surplus", a country only supported by nearly exhausted companies, thousands of accepted ideas lie closed in the desk drawers of managers.

7. To implement the accepted ideas for innovation, at least in cases of product and technology innovations, **mixed teams** or task forces are needed. The basic requirement for those is flexibility of the company structure and team spirit in the individuals. But if the individual's professional existence is not based on professional skill but on the benevolence of the boss and on the incompetent potentates of company management, even the best professional does not dare to leave his seat for a second. And suffering in this defenselessness, the best professional is used to communicating much more about his fellow sufferers behind their backs, than discussing the common professional problems with them.

8. Innovation is also stimulated by **in-house competition.** At last, an idea beloved by state enterprises, the so-called "socialist work competition"! But this was largely measured in tons, yards, or minutes, not in carats of gray matter. Later gray matter was more appreciated, but by then the stupid theory of "no losses caused by the parallel use of resources" had put brakes on the competition of innovation endeavors.

9. Briefly to the macro-economy level, innovation needs **national and international competition.** Based on the above- mentioned theory of "no losses caused by the parallel use of resources", competition was destroyed within COMECON as well as domestically. As a consequence, firms in "socialist" countries worked in the artificial conditions of a greenhouse. No innovation was necessary as low quality and old-fashioned goods were easily sold; the importer had no intention to pay a higher price for an improved product anyway. The greenhouse effect caused more and more out-dated technology.

10. Only one competition existed in the planned economy: the murderous **competition of business partners** active in the same vertical line of production and trade. In trying to gain advantages from each other (such as higher profit margins and exclusive information) and from the government (special subsidies and credits), these business partners prevented the existence of the vertical innovation chain. As a result, many good innovation ideas and even processes were mishandled.

11. Western experts know the important role **of small- and medium-size enterprises** in innovations. In the over-concentrated company structure of the Hungarian economy, there were practically no small- and medium-sized enterprises generating innovations and supporting innovations in cooperation with large companies.

12. Last but not least there was no **government support** for innovation. R&D targets were financed without considering the vital interest of the implementing institutions/companies and without these institutions/companies taking part in the risks of the innovation processes. No one dreamed about such up-to-date supports as special credits, taxes, customs, or the creation of innovation parks to increase the capability and willingness of entrepreneurs to innovate.

CURRENT SPIRIT OF INNOVATION IN HUNGARY

Given this short overview of the last 40 years from the point of view of innovative spirit in Hungarian enterprises, let us turn to the present. First, consider some basic remarks: Hungary's economy is now in a phase of transition from a planned to a real market economy--a unique process that has never occurred during the turbulent history of economics. But sometimes it is easier to change the basic economic system than to change the mentality and attitude of people.

After a one-year period of hesitation and lack of concepts on part of the new Hungarian government, the transformation of the economic system now means a real race with time, where the loser has to face the possibility of heavy social and political unrest.

Returning to the problems of innovation, a distinction must be made between the large Hungarian companies and the small-and medium-sized size enterprises.

For large Hungarian companies, scientific institutes, and universities, an increasingly threatening phenomenon is brain-drain. The wages of young scientists in Hungary is about 2500-3000 per year, the research facilities have become more and more outdated, and young people must fight very hard against the privileges of the former generations. The brain-drain means a fateful decrease in the most valuable human factor of innovation capacity.

At large companies innovation is blocked even now by the rigid hierarchy of the companies and the deficiencies in the organization of the innovation processes. Even well organized processes deteriorated under the effects of the shortage economy.

To implement innovative ideas, new technology is needed as the existing technology is outdated. However, Hungarian companies do not have funds for investing, partly because 85% of their profits go to the government. Borrowing is unfeasible because the interest rate is too high, even for an economy with a 40-50% inflation rate.

Last but not least, the everyday management of companies is slow. If a Western company thinks in terms of minutes, the average Hungarian company thinks only in hours. This is a consequence of poor management, low wages, poor working attitude, and overstaffed company structures. Slowness not only means diminishing the efficiency of the planned innovations, but it also kills the innovators' creativity.

Small- and medium-sized enterprises face many of the same problems as large companies, though there are difficulties particular to small and medium firms. In order to start a small- or medium-sized firm in Hungary, an entrepreneur needs an extraordinary entrepreneurial spirit. To keep it going, he must continuously employ his creative powers to overcome all of the unforseen difficulties in this hostile environment. Usually the entrepreneur's weakness is in his knowledge of economics and managerial skills. They are simply not acquainted with Western managerial techniques, which examine marketing possibilities and calculate real profit/cost ratios, ROI indices, and the limits of risk taking.

Even promising human factors is not enough in itself. In most cases, innovation still needs investment. Very few new entrepreneurs have the money and when asking for credits, they must consider the very high interest rates. The average small business cannot start with prices reflecting costs, taxes, a reasonable profit, and a 40-50% interest rate on loans.

The last innovation problem of the Hungarian small- and medium-sized enterprises is the unfriendly economic attitude of the government. Government slogans encourage entrepreneurs to start businesses, but taxes are high, credits are expensive, and government regulations are vague and ever changing. Therefore, entrepreneurs generally only flourish in sectors where there is a fast return on investment. The government policies prevent the establishment of small- and medium-sized enterprises in industry, which would alter this overcentralized sector. As small- and medium-sized enterprises are the most innovative sphere of industry, the dearth of new small- and medium-sized enterprises in Hungary retards the innovation capability of industry as a whole.

While blaming the hesitating and confused attitude of the government, I must also show the other side of the coin. The Hungarian economy is now in a very delicate situation, one in which the driving force behind growth and efficiency is privatization. However, it is surrounded by a "fateful diamond" (Figure 1), whose vertexes represent disastrous contradictions. The future capability and willingness of Hungarian enterprises to innovate will be highly influenced by the aptitude and firmness of the government in balancing the contradictions of this "fateful diamond".

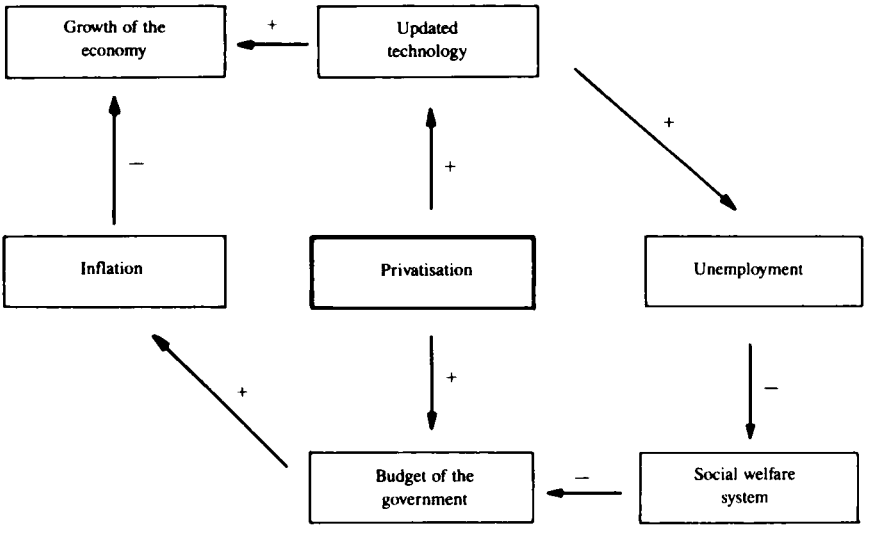
CONCLUSION

To conclude this overview of the innovation capabilities of Hungarian companies and enterprises, let me summarize my views in a third axiom:

> **A Hungarian has an innovative spirit by character, because he is an individualist with rich imagination; and he can be hindered only by his own government, which although freely elected has a very poor imagination.**

Figure 1.

1. The ,,fateful diamond": contradictions of the environment from the point fo view of innovation — the future



DISCUSSION

The beginning of the discussion focused on the importance of education in creating an entrepreneurial spirit. The paper by Nádasdi and Dányi mentioned that the Hungarian education system is being reformed from the top down. However, it is critical to change education so that it encourages innovation and creativity in the early years instead of indulging in pure memorization. One NAS participant concurred, noting that in the United States there is an increased awareness of the importance of education in the early years.

Later responding to a question on whether Hungary will overcome its difficulties in 3-5 years, Dr. Hoványi first turned to the needs of large enterprises. They need technology, capital, management skills, and marketing skills, which will only come through joint ventures. So, the recovery will be a long process. If the question is how long will it be until Hungary reaches the level of Western Europe, the answer is 15-25 years.

Finally, one NAS participant argued that the "fateful diamond" was flawed, because the problems of innovation are more like a pearl, cloudy and circular. He continued that it was also a mistake to look at innovation as a national problem, as challenges and solutions come from all over the globe. No government can be expected to solve all of these problems.

Post-Communist Privatization: Efficiency, Justice and Anti-Trust Issues

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PRIVATIZATION: ISSUES IN IMPLEMENTATION

Fostering research and development in Hungary requires the privatization of its industries. Different strategies exist for privatizing state enterprises, and they must be viewed in a broad socio-economic context that considers the consequences for capital and labor allocation. These strategies can be grouped into the following five cases:

Capital Privatization: The state transforms the enterprises it owns into joint-stock companies and then sells the stock or, in some cases, gives it away.

Spontaneous Privatization: The state does not play a direct or guiding role in the privatization process. The transfer of property rights to private agents occurs on the basis of non-market, "law of the jungle" criteria (most frequently connections, favoritism and "squatters' rights").

Asset Privatization: The state sells the assets of state firms to private actors, either in whole or in part. This approach may take the legal form of enterprise liquidation, but may be applied to profitable firms as well.

Worker Ownership: Property rights to state enterprises are sold or transferred, in a conscious and general way, to the firms' workers.

Reprivatization: Property expropriated after 1945 is returned to the original owners or their heirs.

Evaluating the efficacy of these strategies requires judgments about their costs and benefits in terms of various normative criteria (the selection of which is also a normative matter). If, however, rapidity of privatization, efficiency of the

resulting capital markets, and social justice are taken as normative criteria, the following conclusions emerge.[1]

CAPITAL PRIVATIZATION

While capital privatization may be the most ambitious (and, depending upon one's views about the groups slated to become the privatized firms' new owners, the fairest) strategy, it is also the most artificial. If effective, capital privatization is the strategy most likely to create an efficient, Western-style stock market by dispersing ownership shares as quickly and as widely as possible. Unfortunately, the absence of pre-existing capital markets poses serious problems in estimating the value of state enterprises since there are no comparable stock offerings according to which the "market" value of a given firm's stock can be determined, and no well-functioning debt markets to generate discount rates. Furthermore, both over- and underestimating a firm's value can have negative consequences. The government will likely encounter difficulties when selling the shares of an overvalued firm, which both prevents the complete transfer of ownership rights and can be politically embarrassing. Undervaluation, by contrast, can cause the stock offering to be oversubscribed and leave the government open to charges of "giving away" the national wealth. So while the lack of capital markets may not keep this strategy from working, it does render capital privatization problematic.

In addition to the absence of capital markets, none of the institutional components of this strategy (including the stock market, brokerage houses, underwriters, and government regulatory bodies) exist prior to the start of the process. The government must either create these actors from scratch or, to the extent possible, entrust (surrender) these functions to foreigners. As the Polish experience with capital privatization shows, this method can generate high transactions costs (in both a financial and temporal sense) that tend to defeat privatization's original purpose.[2] Moreover, the population's money holdings may be insufficient to purchase shares in the companies offered.

[1] As used in this paper, "social justice" refers to the desire to: prevent "excessive" changes from the relatively equal distributions of income and status between managers and workers in the traditional system; and remove the members of the communist nomenklatura from positions of power and privilege, or at least those members of the elite unqualified to hold their present positions.

[2] A related problem with capital privatization lies in determining who the new owners will be. If, as the logic of this approach suggests, stock in the privatized firms is to be distributed on a universal basis, then property rights may be too widely dispersed for the new ownership to effectively control the firms' management. Redressing this requires creating institutional investors (e.g. mutual funds) able to pool the resources of small investors into larger blocks of stock. But this requires the appearance of yet another type of actor--the institutional investors that either must be created from scratch or brought in from abroad. Kornai describes the weaknesses of the former approach (Kornai, J., The Road to a Free Economy, New York, 1990, Norton.), while the latter approach raises national-security issues.

SPONTANEOUS PRIVATIZATION

In contrast with capital privatization, spontaneous privatization is not ambitious; nor is it likely to be either efficient or just. It is, however, a more organic process in which ownership rights to state enterprises are transferred to private actors in a decentralized manner, largely outside the purview of state regulation.

In the post-communist economies, spontaneous privatization is likely to enfranchise the nomenklatura. The new owners may not be the best qualified either in terms of efficiency ("who ran these firms into the ground in the first place?") or equity ("I thought we fought a revolution to get rid of these people"). In fact, the popular reaction against the initial wave of spontaneous privatization in Hungary and Poland (prior to the 1990 creation of the State Property Agency and Ministry of Ownership Transformation in the two countries) was so strong that the concept of privatization itself became somewhat tainted in the public's eyes.

On the other hand, spontaneous privatization avoids the valuation problems, since market criteria do not necessarily play a direct role in the transfer of property. Moreover, since ability to pay is not a central point, the relationship between the demand for ownership rights and the firms' book value is not an issue. Spontaneous privatization is also rapid. Finally, to the extent this approach genuinely enfranchises workers (or bodies representing worker interests at the enterprise level, like workers' councils) spontaneous privatization may have desirable implications for labor.

ASSET PRIVATIZATION

Asset privatization is a functional, building-block strategy to privatization. By emphasizing the sale of enterprise assets, asset privatization avoids the valuation problem as only those components of the firm are sold for which markets (and market prices) already exist. If a firm's market value can be determined simply by summing its component assets, firms can be sold in their entirety by this approach as well. Moreover, by deepening those capital markets already in existence, asset privatization helps lay the foundation for more complex, aggregated capital markets (i.e. stock markets for purchase and sale of entire firms), thus paving the way for capital privatization in the future. And since assets are sold at market values, asset privatization is likely to be efficient, *ceteris paribus*.

As with capital privatization, however, asset privatization may be hindered by gaps between the firms' book value and the population's wealth. Asset privatization is also a slow, deliberative process unable to quickly transform ownership relations.

WORKER OWNERSHIP

Worker ownership is the privatization strategy most consistent with the egalitarian ethos prevailing in many Central and Eastern European countries. Privatization that leads to worker ownership can be understood in a number of ways. To the extent working-class movements played important roles in overthrowing the old system, worker ownership can be seen as a reward for labor's political support in the struggle. It can be perceived as the extension of participatory democracy into the workplace, as well as compensation for the sacrifices workers made during the decades of the "construction of socialism". Worker ownership can also be seen as a guarantee for labor of at least a modicum of security and dignity during (and after) the hardships of the transition to capitalism.

The efficiency and equity aspects of a worker-ownership approach to privatization are ambiguous. Social democratic advocates of participatory institutions believe that enfranchising workers with ownership and managerial rights and responsibilities will create more consensual labor-management relations and a more sophisticated, modern work force. Social democrats point to the extensive codetermination mechanisms present in Germany and Sweden, and credit these mechanisms with maintaining labor peace and relatively good labor-market performance. Economic liberal critics of worker ownership emphasize the disastrous results associated with the Yugoslav self-management experiment, as well as the need for a genuine capitalist owner able to resist wage demands and impose tough, unpopular solutions. As Leszek Balcerowicz, Poland's leading economic liberal, puts it, worker ownership is an "experiment", and the countries of East-Central Europe have had enough experiments. There is only one system which has been shown to work, Balcerowicz says--capitalism.

The fairness of the worker-ownership approach is also debatable. Arguments that workers deserve enfranchisement do not take into account the random fates worker ownership would visit upon different firms and their workers. As a journalist put it:

> "Why should miners at a particularly productive mine, for example, get to keep their wonderful facility when miners at a much less productive, largely tapped-out mine down the road (miners who have worked at least as long and hard as their neighbors) get stuck with that junk pile? Is there any justice in that?"[3]

[3] Weschler, L., "Reporter At Large: Shock", The New Yorker, December 10, 1990, pp. 86-136; p. 99.

In other words, the rents workers in different factories would receive upon becoming owners would be essentially random, and inconsistent with any systematic definition of justice.

On the positive side, however, a worker-ownership strategy can be implemented rapidly. Stock in the privatized firms could be distributed for free or for a nominal fee to the workers employed in those firms, creating the broad dispersion of shares across small investors necessary for a stock market to function. After the initial allocation of shares, workers as owners would be well-suited to obtain information and form expectations about the future performance of their firms, thus creating differentiated demands and prices for different stocks.

REPRIVATIZATION

Reprivatization, in the sense of returning property expropriated by the communist governments to their previous owners (or their heirs), is a similarly ambiguous proposition. While the stereotype of the emigre businessman returning home to set his old firm to rights may be an alluring one, reality is likely much more complicated. First, some of the pre-1945 owners of nationalized property are objectionable on moral grounds (i.e. some collaborated with the Nazi occupiers during the Second World War). Second, given the widespread confusion and destruction associated with the war and its aftermath, local and national borders were often changed, property demarcations blurred, and property destroyed, thereby complicating the task of proving title to property. Third, since fewer and fewer pre-1945 owners remain alive, the legal issues pertaining to heirs and inheritance introduce additional complexities.

The high transaction costs and length of time associated with resolving these issues raise questions about the efficiency and rapidity of reprivatization. Issues of war-time culpability raise questions about the reprivatization's fairness. By returning expropriated assets to their former owners, reprivatization also means the state transfers property ownership without receiving compensation in return, which may be especially onerous for countries with large monetary overhangs or for countries desperately in need of foreign exchange. For these reasons, reprivatization would only be a relevant option for a fraction of state enterprises in most countries in the region.

Evaluated in terms of efficiency, rapidity and justice, privatization is no panacea for the Central and East European economies; a conclusion in-

creasingly accepted in the region. In fact, privatization poses other problems that have not yet received significant attention. These include the link between privatization and demonopolization efforts, joint ventures, and labor issues.

PRIVATIZATION AND THE MONOPOLY PROBLEM[4]

The problem of monopoly in socialist and post-socialist economies has only recently been recognized. While its nature differs from monopoly under capitalism, some important similarities are present. According to neoclassical theory, monopoly is a major cause of market failure, with the partial exception of natural monopoly. By producing less and charging higher prices than would be the case under perfect competition, monopolies cause allocative inefficiency. Also, short-run disincentives to select cost-minimizing production methods and long-run disincentives to innovate and invest in new technologies can be linked to monopoly behavior. More generally, neoclassical and other schools of thought connect monopoly with undesirable concentrations of economic and political power.

Socialist ideology traditionally ascribed the problems of monopoly to capitalism and imperialism, implicitly denying its relevance for socialism. Central planning was supposed to prevent enterprises from independently determining prices and quantities, preventing monopolies from misallocating resources away from "optimal" uses as identified by planners. Instead, the captains of socialist industry regarded monopolies as useful for two reasons: 1) they were seen as instruments for capturing economies of scale and scope, thus promoting economic development; and 2) the task of centrally planning and managing a small number of large units was thought simpler than planning and managing a large number of small units. This view resulted in the creation of large, vertically- and horizontally-integrated monopolies.

Because of their size and importance to the national economy, monopolies under traditional central planning possessed considerable bargaining power. Representatives of large state enterprises held seats in the party Central Committee and the parliament, thereby enjoying an inside track in the bureaucratic battles for investment capital and other resources. Monopolies often oppose economic reforms, since consistent implementation of reform principles might bankrupt these organizations endowed with significant capital stock and employing thousands of workers. Moreover, reforms that decentralize authority for price and output decisions to the enterprise level provide monopolies with market power that can be used to restrict output and raise price, thereby permitting the traditional problems of capitalist monopoly to reappear.

[4] For more on this see Slay, B., "Monopoly and Marketization in Polish Industry", Jahrbuch der Wirtschaft Osteuropas, vol. 14/1, 1990.

The monopoly problem under socialism is therefore more than an efficiency issue--it is a problem of large organizations not subject to effective social control through either the plan or the market. To the extent that a rapid transition from socialism to capitalism is impossible, the monopoly problem remains a pressing one in the post-communist economy. While capitalist monopolies may worry about bond ratings, stock prices, and the appearance of potential (international if not domestic) competition, these controls are not present under either traditional socialism or during the early stages of the transition. The absence of capital markets in these economies prevents the formulation of "objective" -external judgments on the value or efficiency of monopolies. It also deprives decision-makers of information about alternative methods of organizing production and supply through mergers, acquisitions and, more importantly, divestitures and dissolutions.

PROBLEMS OF ENACTING ANTI-TRUST POLICIES TO END MONOPOLIES

Privatization in Poland, Hungary and other countries in the region has proceeded largely in the absence of, and at times in conflict with, anti-trust (or anti-monopoly) policy. In their haste to sell privatized firms at the highest possible price, policy-makers are tempted to forget that monopoly power and monopoly rents increase the market value of an enterprise without creating commensurate social benefits. Investors, by contrast, prefer to buy a monopoly, even if the economy is stronger without the monopoly.

Anti-trust policy can work at cross purposes with privatization. Although the authorities could launch anti-trust proceedings against a monopoly after it has been sold, such tactics could cast a pall over all future sales of state enterprises. Waiting to demonopolize the economy until all firms with monopoly power have been privatized implies suspending active anti-trust policy for the foreseeable future. However, breaking up a state-owned monopoly may do more than reduce the income that privatizing the firm will generate for the state treasury; it can also deprive the country of a possible player in the international economy. When joint ventures are involved, breaking up domestic monopolies also has technology-transfer implications in that dissolution may reduce the attractiveness of local firms to foreign partners, the sources of much-needed capital and technology.

No country in the region has a comprehensive, integrated approach addressing the interrelationships between these issues. In fact, only Poland and Hungary have even established anti-monopoly agencies and begun to develop the foundations for anti-trust policies.

PRIVATIZATION AND LABOR ISSUES

Privatization raises old and new questions about relations between capital and labor. Workers under Soviet-style socialism effectively concluded a Faustian bargain with the state: in return for job security and benefits provided by the state as manager/owner, labor surrendered claims to participate in enterprise governance and the right to form trade unions independent of the party-state *nomenklatura*.

In breaking this bargain, enterprise privatization puts labor-management issues at the center of the transformation process. Worker ownership is perhaps the most obvious manifestation of this. Worker ownership aside, creating new institutional structures to articulate and protect worker interests also constitutes an important element of the enterprise- transformation process.

Despite obvious and important differences between workers, labor in the traditional Soviet-type economy was characterized by a greater degree of homogeneity than in many capitalist countries. Trade union structures were highly centralized, government policy measures often contained uniform treatment for all workers, and the prevailing ideology emphasized the commonality working class "solidarity" and "culture". This homogenizing process can be seen in what might be called the "Soviet-type socialization" of work: the spread of the "they pretend to pay us, so we pretend to work" ethos throughout the working class. Worker-class struggles against the traditional system did not encourage greater individualism: Solidarity in Poland also emphasized unity in the struggle against the common enemy.

The collapse of traditional socialism is likely to reverse this homogeneity and fragment the unity. As pointed out above, worker-ownership privatization bestows differential rents on different groups of workers in an essentially random fashion. Even if worker ownership is not pursued on a broad basis, the redistribution of rents across firms and industries that accompanies the transition will enrich some workers and pauperize others. Combined with macroeconomic stabilization, which is likely to depress real wages, the resulting social and working-class dislocation could be extensive.

In such an environment, a more individualistic ethos is likely to replace the emphasis on group solidarity. Workers interests would presumably be more closely linked to the branch, region, or firm in which they are employed. A decentralization and regionalization of the institutions devoted to articulating and protecting worker interests is therefore expected.

The growth and development of genuine trade unions and workers' councils are suggested by this process. Trade unions responsive to their rank and file offer workers a measure of economic and job security, but their nature also encourages adversarial labor-management relations. If the worker management option is not taken and the new capitalists take a "hardball" approach to labor relations, a radical, confrontational, and populist trade union movement could result. While in

the short run such structures may protect the rights and positions of workers, the resulting labor-management acrimony and instability could make everyone worse off in the long run. To the extent that privatization takes the worker-ownership route, or if state labor policies and the new owners seek to develop institutions of worker participation and codetermination, conflict and instability may be less likely. On the other hand, workplace democracy also has its costs, such as reduced managerial flexibility, difficulties in making and enforcing unpopular decisions, and problems in interacting with an international economy comprised largely of firms without such institutions. In any case, policies to ease labor's transition to the new system and increase labor mobility (e.g. job retraining programs) would be desirable.

CONCLUSIONS

Socialism cannot be transformed into capitalism without transferring the ownership of state firms to private actors. But the process itself is fraught with difficulties, and none of the possible privatization strategies seems particularly promising in terms of speed, efficiency, and justice. Moreover, the efficiency consequences of any privatization scheme are made even less clear by the conflicts between privatization and demonopolization.

The labor implications of these conclusions are similarly unclear. While the combination of privatization and macroeconomic stabilization policies is likely to impoverish many workers and fragment institutions for articulating and protecting worker interests, new possibilities are appearing for building consensual, participatory labor-management/ownership mechanisms. While primary attention may be focused on the specifics of privatization and the development of capital markets in Central and Eastern Europe, it must be remembered that every twist in the privatization road has implications for these countries' emerging labor-market institutions as well.

DISCUSSION

The presentation provoked a number of remarks regarding methods of privatization and the applicability of the experiences of other countries. Asked about the feasibility of distributing shares of a development fund, Dr. Slay explained that although it may be a just and efficient solution, there are still potential problems associated with it: Who controls the fund? What happens if it goes bankrupt? Where does the money come from in the first place? Dr. Slay expressed his own preference for worker ownership, but admitted he could not make an airtight case for this option.

As members of the audience sought comparative privatization experiences, Dr. Slay stressed that the East European undertaking is fundamentally different. The only example of significant privatization was Chile in the mid-1970s. Chile, however, only transferred 400 firms (mostly to previous owners), had a functioning stock market, and had a complete banking system. In terms of development, Dr. Slay acknowledged that the experiences of the "Asian tigers" could provide Hungary with valuable lessons.

Labor Implications of Industrial Restructuring*

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The labor market constrains efforts on industrial restructuring. Looking at the recent experiences of Romania, Poland, and East Germany, one can see the validity of this statement. Specifically, industrial restructuring has a negative impact on three areas: unemployment, poverty, and the fall of real income.

The early attempts by Eastern Europe's governments have assumed that there is a causal relation between the three. However, it now appears that the correlation is not as strong as originally thought. For example, the unemployment rate of the poor is high, but the poverty rate of the unemployed is surprisingly low. As there are not many newcomers into the ranks of the poor, meaning they must have been poor for a long time, the poverty is not caused by the risen unemployment rate. Each problem must be examined in its own context.

UNEMPLOYMENT BENEFITS SYSTEM

As illustrated by Table 1, unemployment has been rising rapidly.

Table 1

The Unemployment Rate

December 1986	0.1%
December 1987	0.2%
December 1988	0.4%
December 1989	0.7%
December 1990	1.2%
February 1991	2.7%
April 1991	3.1%

* Short version of the lecture.

The regions with the highest unemployment are either those with a high concentration of heavy industry or those that suffer from traditional rural underdevelopment. The unemployment rate by region is shown is Table 2.

Table 2

The Unemployment Rate by Region

Szabolcs-Szatmár	7.7%
Nógrád	5.8%
Borsod A-Z	4.8%
Békés	4.5%
Heves	4.2%
Tolna	3.8%
.	.
.	.
Györ-Sopron	1.6%
Vas	1.1%
Budapest	0.4%

Unfortunately, there is no good data on the average duration of unemployment, which makes it difficult to design unemployment benefits. It is estimated, however, that the average duration of unemployment is 15 months.

The implication of this data is that unemployment benefits system should be a generous insurance based with a maximum time limit. Some economists from the World Bank have recommended that Hungary implement a system of unlimited time duration. There would be four problems with such a system. The first is that the cost of maintaining it could rise dramatically in the next 1-1.5 years. Second, many who would be covered by the system would have never paid into it. Youth unemployment, for example, is currently at 35%. There could also be categories of people who pay but then are not covered, and people who do not pay and are not covered, but need the benefits.

The third problem of the current system is that it grants unemployment benefits based on the person's last salary. In the first year, a person receives 70% of their last income, in year 2 it is 50%. There is a cap on benefits, which is now set at three times the minimum wage. This means that high-paid persons who become unemployed will earn more than many workers. Finally, with the high rate of inflation, it is likely that the real value of the benefits will decrease as the government will not be able to keep pace with inflation.

MINIMUM WAGE LEGISLATION

There is growing pressure to raise the minimum wage, which is now at 7000 ft. Chart 3 shows the percentage of person working below the minimum wage in various sectors.

Table 3

Minimum Wage 1991

	as claimed by unions (8000 Ft)	accepted in tripartite agreement (7000 Ft)
Workers below the respective minimum wage in per cent:		
Agriculture	52.7	40.2
Industry	32.8	17.6
Trade	33.3	18.1
Construction	15.8	6.9
Transportation	36,1	20.1
All firms	31.5	17.0

There are a number of sources of the pressure to raise the minimum wage. One is the increase in the wage differentials, illustrated by Chart 4, which shows the Lorenz-curve of gross monthly wages in 1984 and 1990. Another source is the connection between wages and the standard of living, which is falling. Still, the poverty level is determined by empirical, not normative, criteria. The current poverty line is 27,000 ft a month for a family of four.

UNEMPLOYMENT AND THE SECOND ECONOMY

It is difficult to discuss what is happening in the second economy as there is little reliable data. However, there are a number of factors that benefit those working in the second economy. For employers, they do not have to pay taxes and wages are considerably lower. Persons who are officially unemployed could supplement their benefits with jobs in the second economy and live rather well. One thing known about employment in the second economy is that it is growing, and this is largely because of the growing numbers of illegal immigrants.

Financing Entrepreneurial Activities and the Growth of Small Business in Hungary

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In order to provide information on how entrepreneurs and small- and medium-sized enterprises (SME) see their present situation, at the end of 1990 we conducted a survey of 214 SMEs with industrial activity. Table 1 presents the responses on the rankings of problems confronted.[1]

The assessment of the enterprises/entrepreneurs reflects the extent of problems with financing, high taxes, social insurance contributions (54.5%), inflation (about 35%), interest rates (about 40%), and banking. Although some tax relief and preferential credit schemes have been introduced recently, the funds are limited, the conditions offered are not attractive enough, and the procedures are too complicated. In addition, Hungarian banks (also in a transitional stage) are not very interested in SME's, although this attitude is changing slowly. Finally, access to venture capital is extremely constrained.

In Hungary, as in the other centrally-planned economies, private business had only been tolerated and restricted to a marginal role. This did not change much after the economic reform of 1968. In 1977 the role of private small business was again redefined as to meet the population's demand in services and repair. Special individual licences were needed for start-ups and the number of employees was limited to 6 persons, including family members and three apprentices. Private enterprises were discriminated against in terms of material supplies, contracting state-owned enterprises, and export. Finally, business success was usually accompanied by an increasing number of inspections.

[1] The responses were evaluated according to two methods. First, points were assigned to the 4 possible answers: it causes no problem--0; small problem--1; moderate problem--3; heavy problem--6. Then the number of points were aggregated and the distribution of points calculated. Second, the distribution of the "it causes heavy problem" responses were determined (Total B).

Table 1.

Ranking of the problems confronted by SMEs

Problems	Micro-firms	Small firms	Medium sized-firms-	Total	Total B/
Inflation	10,32	12,94	12,15	11,91	12,90
Interest rates	10,65	11,56	12,26	11,64	14,20
Social insurance contribution	14,20	13,94	10,63	12,53	14,50
Taxes	12,55	12,69	12,48	12,54	14,60
Credit possibilities	9,28	9,30	8,78	9,06	9,20
Government regulation	10,51	7,79	8,89	8,99	7,90
Too much paperwork	8,77	7,58	8,51	8,37	6,40
Realizing sales	6,71	6,99	8,34	7,52	6,80
Shortage of parts and materials, domestic	9,28	8,37	8,34	8,60	7,40
Shortage of parts and materials, imported	4,54	4,56	4,25	4,42	3,10
Availability of qualified manpower	2,70	3,64	4,92	3,96	2,40
Other	0,48	0,64	0,45	0,46	0,51
Total	100,00	100,00	100,00	100,00	100,00

From 1981 on licencing became more liberal and the employee limit was gradually raised; to illustrate the slow changes: 1981 - 9 persons, 1983 - 12, 1988 - 30, 1989 - 500, 1990 - no limit at all. The prohibition turned to benevolent tolerance. Now instead of administrative measures, only the financial conditions and the lack of infrastructure kept back the growth of small business. Until the free election in March/April 1990, there was also a lack of confidence regarding start-ups and expansion.

From 1981 to 1989, impressive developments in small enterprises can be seen, especially in retail trade, catering, and transportation. Table 2 illustrates the rapid growth in private small businesses after the political changes.

Table 2.

Number of private entrepreneurs / small business owners

	31 December 1981	31 December 1989	31 December 1990
Industry (including construction and services)	112	176	212
Retail trade and catering	15	42	75
Other activities	.	22	28
Total	127	240	315

At the end of 1989, private small businesses employed about 100,000 persons in addition to 40,000 family members. At the same time, 20,000 licences were used by pensioners and 54,000 as second jobs. This means employment in private small business was less than 10% while in market economies this share is about 50%.

In 1988 the Parliament approved Law VI, which widened the choice of the legal forms of the state-owned enterprises, allowing the formation of unlimited partnerships, deposit (or limited) partnerships, unions, joint enterprises, limited liability companies, and companies limited by shares (joint stock companies). The law also opened the gates for enterprises with mixed (state, foreign, private) ownership and Law XXIV/1988 on Foreign Investments made foreign investments in Hungary more attractive. Another important act, Law XIII approved by the Parliament in the spring of 1989, regulated the transformation of the enterprises from one statute to another.

From 1989 on, the establishment of joint stock companies and limited liability companies has greatly multiplied, as shown in Table 3. According to these figures, the number of cooperatives, state-owned enterprises, and other economic organizations did not change significantly, but this hides the fact that many cooperatives became limited liability companies and many subunits of state-owned companies had also been transformed into this legal form. Most of the limited liability companies are small firms; from the 38122 "economic organizations" in Table 3, more than 80% have less than 50 employees.

Table 3.

The number of economic organizations according to new and "traditional" legal forms

	1988	31 Dec. 1989	1990	31 March 1990
Joint stock companies	116	304	646	777
Limited liability companies	451	4 485	18 317	26 837
Co-operatives	6 880	7 076	7 132	7 160
Other economic organizations	3 298	3 301	3 375	3 338
Total	10 745	14 869	29 470	38 122

The Hungarian Central Statistics Office (CSO) provided data on enterprises primarily by ownership form and to a limited extent by size; the CSO has started to adjust its services to the systemic changes, but was not able to follow them in time. Therefore, the aggregate figures on the size of small businesses are not available and only estimates can be made.

As Table 4 illustrates, at the end of 1989 there were 3686 industrial organizations (state-owned enterprises and cooperatives), 49,934 private firms, and 13,115 sub-units of non-industrial organizations engaged in industrial activities.

Table 4.

The share of SME's engaged in industrial activities (end of 1989)

	Small enterprises (-100)	Medium sized enterprises (101-500)	SME's (-500)	Large enterprises (501-)	Total
	Number of enterprises				
Industrial organizations	2 080	979	3 059	627	3 686
Private firms	49 934	-	-	-	49 934
Non-industrial organizations	13 115	-	-	-	13 115
Total	65 129	979	66 108	627	66 735
Percentage	97,6	1,5	99,1	0,9	100,0
	Number of employees				
Industrial organizations	60 473	220 750	281 223	1 075 204	1 356 427
Private firms	78 912	-	78 912	-	78 912
Non-industrial organizations	217 557	-	217 557	-	217 557
Total	356 942	220 750	577 692	1 075 204	1 652 896
Percentage	21,6	13,4	35,0	65,0	100,0

Including the semi-autonomous industrial subunits of the non-industrial organizations indicated in Table 4, which, with a few exceptions, have less than 100 employees, already in 1989 the share of small businesses in industrial employment amounted to 21.6% and the share of SMEs 35%. Without these semi-autonomous sub-units, these figures were 9.7% and 25.1%. So, the share of small and medium-sized enterprises in Hungary was and still is significantly less than in market economies (this share in the EC is 67.1%), but it is higher than in the other Eastern European countries.

In the structural adjustments in 1970s and 1980s, the urgent need to change the pattern of production by branches and products was emphasized. Now in the framework of the on-going systemic changes, two other kinds of structural adjustment come to the fore in all Eastern European economies. These are the radical modification of the size and ownership patterns of enterprises.

Several objective trends and necessities point to the necessity of reversing the proportions SMEs and large enterprises. Some areas are listed below without ranking in terms of importance:

- Technical progress diminishes the minimum efficient scale of production in most branches.
- With higher incomes, the demand for the special products and services of small business is increasing; it first takes place in the export sector, but gradually occurs in the domestic markets, too.
- There is a growing need for autonomous work and entrepreneurship in these countries, and small business offers more possibility for them.
- Many large unprofitable or even loss-making state-owned enterprises can be reorganized by breaking them down into smaller units.
- Unemployment is increasing in these countries and it can be partially absorbed by the growth of small business.
- In most branches, the flexible production and marketing system is based on the balanced proportion and on the cooperation of small-, medium, and large-sized enterprises.
- According to historical trends, the share of sectors where plant sizes is smaller is increasing.
- Democratic societies need a strong middle-class and market competition, which presupposes a significant SME sector.

The strengthening of SMEs implies a number of aims. These include increasing their competitiveness and their contribution to the implementation of all major targets of the economic policy. From this point of view, we must take into account that--like the other the Eastern European countries--Hungary faces a number of tasks to be performed simultaneously:

- To implement the changes in the political and economic systems
- To increase their competitiveness by "doing things better"
- By "doing better things" which means to accelerate structural adjustment
- To manage foreign indebtedness and the state budget deficit
- To handle inflation, unemployment, and poverty.

These tasks are closely interrelated. The timing of the steps, forecasting the possible negative side-effects, and looking for synergic impacts are of utmost importance. An OECD Economic Outlook publication (June 1990, p. 48.) presented data on per capita GDP. The OECD average was 14,637 and the estimates for the East European countries ranged from 4,117 (Rumania) to 9,361 (GDR), while Hungary was at 6,491. Since employment is higher in all these countries, the differences indicate a substantial gap in productivity. According to other calculations, this gap is wider than these figures, particularly when the quality and reliability of the products and services are taken into consideration.

In a shortage-economy without market competition, poor quality and reliability is a general phenomenon. In such an environment small businesses can and frequently do excel with better quality, but in a quasi-monopolistic situation they

can also survive without it. There was seldom competition among the subcontractors and until recently SME's were isolated from export markets. Quality improvement, therefore, is a first order imperative for both for small, medium and large enterprises--particularly with the preparation for the Single Market 1992.

All the measures aimed at training, consultancy, easier access to credits, infrastructure, up-to-date technology and equipment, and preferential treatment for the SMEs should pay special attention to competitiveness, quality, and productivity. Trade associations, which are building new structures and redefining their tasks, should not only be interest groups in the narrow sense; they must enhance the competitiveness of their members by joint actions, services, and networking. Also, the experience and assistance of the market economies can be a significant benefit.

This leads back to the problem of financing. Usually preferential credit and guarantee schemes for small business will be elaborated and introduced in order to promote start-ups. Less attention will be paid to assist modernization, buying new machines, adopting new technologies or new managerial methods to improve quality, efficiency, and cost-competitiveness. Thinking about the need to increase the role of entrepreneurs in privatization, financial assistance for buying the state-owned assets will usually be offered. However, the requirements to restructure the company and modernize its production capacities will be forgotten. Therefore, the access to capital should be facilitated, its costs reduced, and its risk shared, but special consideration also must be given to the needs for modernization and upgrading competitiveness, a prerequisite for survival and growth in an international market environment. For this purpose, separate funds, schemes, and institutions will also be needed.

Financing Entrepreneurial Activities from Within the Firm

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LOWELL STEELE

Innovation is the topic at hand--a continuation of our theme of change and turmoil. It is important to distinguish between "good trouble" and "bad trouble." Good trouble can generate stress and anxiety, but it has the potential to lead to good results. Based on our discussion, I believe that Hungary is experiencing good trouble.

Much, if not most, entrepreneurial activity involves innovation--the introduction of change. Innovation is inherently risky because there is no way to demonstrate a priori that the change will be beneficial, is needed, or will be successful. It is important to recognize that no management technique or method of analysis can eliminate these risks.

I helped General Electric (GE) innovate for over 25 years, and I have concluded that innovation is a very local phenomenon. One can find innovative and noninnovative businesses in the same enterprise, and, in a similar fashion, a business that has been innovative can cease to be so. Innovation ultimately results from a happy merger of market opportunity and an individual or groups of individuals who have the vision and courage to seize that opportunity. Management can create a climate that encourages innovation, but it cannot make it happen. Innovation is somewhat like motherhood--study and analysis are poor preparation.

Innovation includes a wide spectrum, from incremental improvements in a product or process to the use of new capabilities that supplant existing ones but perform the same general function to entirely new products or systems. Most attention is given to dramatic discontinuities, such as transistors, lasers, and Xerox. It is arguable, however, that the continuing refinement and improvement of existing capability is, in the aggregate, of greater importance. The steam engine benefitted from 100 years of improvements, without which its impact would have been much less.

THE ODDS OF SUCCESS

Despite the publicity associated with successful innovations, most innovations do not succeed. Certainly less than 5% of efforts succeed--some would say less than 1%. Most innovations fail because they do not offer sufficient advantage to warrant the risk and cost of introducing them. Therefore, performance and cost barriers to success perform a useful function, because they protect the economy from the upset of uneconomic change. Since most fail, managers can be lured into the trap of always rejecting innovation because failure is the most probable outcome.

Successful management has two faces. One face seeks certainty, works to preserve order, and resists change. Only by such rigorous behavior can predictable, efficient performance be sustained. Another face accepts risk, encourages innovation, and nurtures a certain creative disorder, because only by such action can the innovations that assure the survival of the enterprise be nurtured.

FINANCING INNOVATION

Financing innovation requires establishing a specific plan and budget for this aspect of management's work; i.e., a strategic budget to finance change. For example, Texas Instruments prepares separate operational and strategic plans and has a specialized management system to deal with each. A number of techniques can be used to provide financing mechanisms with no inherent advantage for any single one: separate line items representing uncommitted funds to be spent opportunistically; a special corporate growth fund; a requirement for a certain percentage of the engineering or R&D budget to be spent on new products or processes; the creation of a separate new business development component whose sole objective is to create new businesses.

Because of the expense and risk involved, a number of techniques have evolved that help spread the risk of innovation among companies: venture capital pools, special limited partnerships, joint ventures and consortia, and intimate relationships with selected vendors.

A number of issues emerge as more or less universal problems that must be addressed in financing innovation, e.g. corporate- level vs. operating-level control, sole responsibility vs. mixed with other duties, patience vs. generosity in providing funds, gentle vs. tough demands for performance, reward vs. penalty for success and failure. The choices made regarding these options will strongly affect the chances of success.

MANAGING INNOVATION

In general, the closer to operations that an innovation can be located, the greater its chances of success. Sooner or later an innovation must begin to act like an ongoing business and if it has been nurtured in an overly protected environment, the transition to reality can be painful.

Innovation suffers a virtually fatal handicap if it is assigned to people who have other responsibilities. It requires almost fanatical commitment to succeed and the diversion from other responsibilities often prove fatal.

"Patient money" is often invoked as a requirement for success. In my experience, demanding appraisal of results is equally, if not more, necessary. The market is a demanding taskmaster and living in a forgiving environment is poor preparation.

Innovation requires such intensive dedication that those involved become poor judges of the prospects for the innovation. One painful but necessary function that management must perform is to monitor progress against agreed-upon goals and to determine when to terminate an effort.

Since innovation is such a risky undertaking, great care must be exercised to see that the rewards are not only be financial. Promotion to a position of greater responsibility can be a valuable incentive for innovators in an ongoing business. The opportunity to create a new enterprise can in itself be a powerful incentive for independent entrepreneurs.

For an established enterprise, one difficult but important responsibility of senior management is to distinguish between an adequately managed attempt at innovation that was simply fated to fail and one in which inept management was an important contributor to the failure. In the former case, it is important that the failure does not damage the careers of those involved. 3M is an excellent example of a persistently innovative company that protects people associated with failed innovations.

DISCUSSION

Members of the audience were interested in further details on the origin of innovation.

- One participant asked if innovation more commonly originated from within the firm or from the firm's sales force that related market demands back to the researchers. Dr. Steele responded that the standard classification of demand-driven and supply-driven innovation is a great oversimplification. Still, he explained, the big breakthroughs are usually technologically driven, but the majority of innovations are demand driven. By

definition, an innovation that succeeds finds a market demand but great ingenuity and persistence may be needed to identify and energize that demand.

- One participant noted that the presentation began by stating innovation is local and ended with an emphasis on external funding and globalization of R&D. Dr. Steele explained that research is local, development is global. Also, one should distinguish between doing R&D and creating an innovation. They are related, but very different kinds of work. R&D creates opportunities for innovation, but it does not exploit them.
- There were also questions regarding the psychological profile of a good R&D manager. Dr. Steele explained that the profile is not obvious. One common trait, however, is that they tend not to criticize the work of others themselves. Their position of power makes them too threatening. Rather, they send proponents of new ideas to others for critical review in the early stages. He continued that it is easy to sort potentially good managers from good researchers very early in their careers, often within their first year with a firm.
- The discussion concluded with an inquiry about the role of government in R&D, citing the Concorde as a project with a strong government role. Dr. Steele felt that in general the government is ineffective in guessing the demands of the marketplace and in targeting funds for specific projects. Regarding the Concorde, while it was a technical success, it was an economic and social failure: it never achieved its goal of changing the way people travel.

Hungarian Experiences with Joint Ventures

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In Hungary the possibility of forming a joint venture (JV) has existed for nearly 20 years. However, only in the second half of the 1980s, particularly after the 6th and 24th Law of 1988, has the number of JVs grown rapidly. In 1989 the total number of JVs registered in Hungary was 282. By November 1989 this number had increased to 803 and by mid-1990 the number nearly doubled to 1500 Most of these companies (ca. 60%) are small with less than FT 5 million (ca. 70.000) in capital and most are in the service sector (ca. 70%). According to some estimates and the data of Central Statistical Office, there are about 4000 companies in Hungary with some level of foreign participation.

There are 3 main ways for foreign capital to invest in Hungarian firms. The easiest method is to buy shares of a Hungarian company. Until recently, however, very few Hungarian companies were joint-stock companies. A 1989 law details how state-owned firms may transform themselves into a joint-stock company, but a license from the State Property Agency is needed.

The second way, which is quite common, is when Hungarian and foreign entrepreneurs (either a company or a private individuals) decide to establish a new firm. This newly established firm can easily be registered within one month. With regards to Hungarian regulations and laws, it operates as a normal Hungarian company, although it may be granted some special allowances, such as a tax holiday and free profit repatriation.

The third way of establishing a JV is when a foreigner buys part or all of an existing Hungarian company. The result of this is generally a new Limited Liability Company (Ltd), in which common ownership exists among the foreign partner, the Hungarian State, and some private Hungarians.

There are several factors that influence the foreign entrepreneur's decision on whether to invest in Hungary. The following factors are based on interviews and hypotheses:

- New market possibilities is one of the most important concerns, especially in the case of the large and well- known multinational companies. Hungary is a relatively small market, but many entrepreneurs and Western companies feel that with experience in Hungary and with an office there, they would be prepared to enter the markets of other previously socialist countries.
- Profitability and monopolistic market situation is also a positive aspect, especially for the small- or medium- sized companies.
- Geographical location of the country is good, and the climate and the general conditions can be quite pleasant.
- Nostalgia and other emotional aspects could play an important role in the decisions.
- The political situation and the cultural life are accepted.
- The quality and the price of manpower are positive.
- Legal and regulatory frameworks are not bad for running a business.
- Liberalization is growing, competition among the Hungarian suppliers is stronger than before, and selection among the partners is not too difficult.
- Importation has been almost completely liberalized and profit repatriation in hard currency is possible.

Besides the advantages of the Hungarian market, there are many weaknesses and problems that frighten away foreign entrepreneurs and companies. As it was noticed by one of the managers of DIGITAL, which has established a JV in Hungary, "...the footprints of the 40 years communism can be seen everywhere in the daily life." The following is some of these "footprints":

- The entire infrastructure is weak, but there are particular problem with the telecommunications system and the energy sector.
- Bureaucracy is still high. It is difficult to find competent partners and to follow the laws and regulations. Because of the uncertainties in the economy and the legal structure, risk taking and decision making are still a problem.
- Taxation and the entrepreneurial laws (6/1988) are better than it was or than they are in the competing countries, but they are not similar to western regulations.
- Language and communication as well as the performance of workers could be a problem.
- The currency is not convertible, and inflation is high.

Summarizing the situation, there are three main economic factors that could frighten or encourage the foreign capital: laws and regulations, infrastructure, and competitive advantages. All three factors must work together in a complex system. While laws and the infrastructure can be developed within a relatively

short period, creating competitive advantages cannot be. These are the key factors of the future of Hungarian economy.

While on one hand many Hungarian economists are trying to discover how the country could be more attractive for foreign capital, politicians, some economists, sociologists and other prominent persons are involved in a permanent debate on the positive and negative effects of allowing foreign capital into the Hungarian economy.

There are two extreme views on the possible effects of foreign capital in the Hungarian economy. The proponents of the first platform claim that foreign capital is the "one and only" medicine for the very sick economy. This argument points to joint ventures and foreign capital imports as the only solution for privatization, economic growth, competitiveness, and repayment of the 22 billion debt. The other party cries that this is the way of the destruction, that these "anti-Hungarian" movements are the main tools of selling out the country.

All of these extreme arguments have one important common characteristic: the ideas have some examples to back them up, but no research or data as proof. Today, even with over 4000 JVs, joint ventures only play a peripheral role in the economy. Nobody could find any significant economic field where their share would be 5-10%. However, their attractiveness and continuing growth makes them the center of curiosity.

For the creative and research oriented economist, this show on the "Hungarian stage" illustrates some important conclusions. First, one should not debate without researched and proven arguments. Secondly, one should strongly fight for introducing research projects that can closely follow the economy, analyze statistical data, and forecast.

There are questions typically at the center of these debates that should be answered sooner or later. The answers are needed not only for the above-mentioned arguments, but more importantly to create an effective strategy to encourage or limit foreign capital participation in Hungary.

To conclude, the typical arguments that urgently need to be researched and answered will be listed.

ARGUMENTS IN FAVOR OF JOINT VENTURES

- JVs and foreign capital accelerate the whole economy.
- They create new jobs, positively affecting unemployment.
- They help transform the economy from centrally planned status into a market oriented one by introducing market behavior and help deregulate and liberalize the laws.
- They help the economic structural change, particularly in industry, and can automatically find and develop the competitive advantages of the country.

- They are the only source in the near future that could stop the recession.
- They can create and develop competition on the domestic market, they would help balance supply and demand, and the monopolistic situation would be destroyed.
- They could help with exporting to competitive markets, which would have a positive effect on the balance of payment problem.
- They would provide opportunities for the import and adaptation of advanced technology and advanced methods of marketing and management.
- They are the easiest and fastest tool for privatization.
- They have a direct, positive impact on democratization.

ARGUMENTS AGAINST FOREIGN CAPITAL PARTICIPATION

- Enjoying the profit repatriation possibilities, they take out Hungarian national income in hard currency.
- They destroy the balance of payment and the balance of trade.
- Familiar within market oriented circumstances, they abuse Hungary's underdeveloped laws and regulations.
- They take skilled and talented manpower away from Hungarian firms.
- They create more environmental degradation.
- They export everything in Hungary with value.
- They create anarchy and do not want to introduce any kind of social support.
- They only introduce the "second hand" technology and their contribution is only unsalable products.
- They do not want to help, but rather want to hinder the competitiveness of Hungarian products on foreign markets.
- Most of the entrepreneurs coming to Hungary are unsuccessful, untalented people who were unable to survive in existing market economies.
- They accelerate inflation, they do not pay taxes, and they are only trying to make a high profit in the short-term.

The arguments could be continued, but these are the most important. Again, Hungary's most important task is to analyze the economy. Then, with the help of correct and clear information, Hungary can determine: "How could or should a country with an economy like ours apply or refuse foreign capital?"

DISCUSSION

The discussion continued the debate on the positive and negative aspects of joint ventures. One NAS participant commented that the alternative to joint ventures may be no business, as foreign firms will be such a critical source of resources and expertise. Dr. Benedek explained that many Hungarian firms are under the illusion that their products would be competitive on Western markets if only they could enter these markets.

Turning more specifically to whether JVs have brought tangible benefits to Hungary, the NAS participant argued that JVs are creating wealth in Hungary. One of the MTA participants provided two additional reasons why Hungarians have negative attitudes towards JVs. First, there have been a number of highly publicized scandals involving JVs. Secondly, most of the JVs are in the service sector, and many people still believe that these non- productive enterprises do not contribute to the economy.

Venture Capital's Role in Industrial Strategies and Policies for Economic Growth

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SUMMARY

Collaboration between Western venture capitalists and East European scientific institutes holds significant promise for economic growth. Although the conditions necessary for such collaboration are currently rare, they are becoming more prevalent. One such U.S.-USSR collaboration in the field of molecular biology is enjoying early success. Sierra Ventures, a California-based venture capital firm, and the Institute of Protein Research of the USSR Academy of Sciences began collaborating early in 1990. What follows is a review of this particular undertaking and its implications for economic development for other scientific research institutes in Eastern Europe.

BACKGROUND

RiboGene is a start-up company in the field of molecular biology jointly formed by Sierra Ventures and the Institute of Protein Research. The objective of this California company is to commercialize the cell free protein synthesis technology developed by the Institute of Protein Research. The Institute of Protein Research is a major shareholder in RiboGene, collaborates with RiboGene on research and development, and is represented on both RiboGene's Board of Directors and its Scientific Advisory Board. The Institute's main representatives at RiboGene are its Director, Alexander Spirin, and its Deputy Director, Vladimir Filimonov.

This pioneering collaboration was undertaken because of the world-wide importance of the Institute of Protein Research's discoveries. Very briefly, the Institute has discovered techniques for enabling ribosomes, the source of protein assembly in cells, to continuously and economically produce proteins in a cell-free

environment. Their insights are based upon a comprehensive understanding of the mechanisms by which proteins are assembled by the ribosomes. The initial commercial significance of these discoveries is the ability to improve the speed, purity, and cost of synthesizing a wide variety of proteins, especially drugs. In the longer term, the Institute's discoveries may serve as a means of producing both naturally occurring proteins not manufacturable using conventional technology and protein-like compounds not currently present in nature.

PREREQUISITES

Sierra Ventures undertook forming RiboGene with the Institute of Protein Research because several necessary conditions existed. Foremost of these is a truly world-class scientific discovery. We estimate that RiboGene now has a one to two year lead over competitors in the United States, Japan, and Europe. Sierra Ventures was able to recruit a California-based start-up team capable of understanding and enhancing the Institute's work. This team is headed by Dr. K. P. Wong, Dean of Science, California State University at Fresno and Adjunct Professor of Biochemistry and Biophysics, University of California, San Francisco Medical School. The Institute, following the advice of scientific colleagues in the West, had also sought world-wide patent protection for its discoveries. Furthermore, Sierra Ventures was able and willing to undertake the international negotiations and secure the government approvals required for RiboGene's formation. Finally, the Institute of Protein Research was willing to let a Western partner set the pace and direction of future collaboration.

This set of conditions is likely to be required for comparable collaboration in other fields. Social and governmental changes in Eastern Europe should facilitate the creation of these conditions. Sierra Venture's success with RiboGene has increased awareness of and interest in such collaboration among other U.S. venture capitalists.

CURRENT STATUS

RiboGene has met with both scientific and financial investors as it begins commercializing its technology. Several California venture funds are close to investing in the company and initial reactions of target customers have been extremely favorable. Scientific investigation also continues, and RiboGene's recent discoveries suggest that cell-free protein synthesis technology will be widely applicable.

The Institute of Protein Research and the USSR Academy of Sciences are receiving several benefits from this collaboration, which should encourage fu-

ture economic development in the USSR: the Institute's scientists have more frequent and more extensive interaction with their Western counterparts, RiboGene is subsidizing the Institute's hard currency budget for equipment and reagents, and the value of the Institute's stock in RiboGene has increased handsomely. In the longer run, the Institute hopes to license from RiboGene's customers the right to make their newest drugs for use within the Soviet Union. Success here would result in a world-class drug industry within the USSR, meeting both the currently unserved health needs of the Soviet people and creating numerous high-technology jobs.

Ministerial and Academy leaders who approved the Institute of Protein's collaboration also hoped that personnel involved with RiboGene would become familiar with the economic and managerial tools used by the Western venture capitalists. Skills in the areas of market assessment, project management, product definition, international negotiation, corporate partnering, and corporate finance are badly needed by Soviet industry and science to improve both the efficiency of their domestic activities and the competitiveness of their international activities. Acquiring these skills is particularly important for those institutes now allowed to conduct limited production of products previously monopolized by production ministries. These skills are being transferred to the Soviets collaborating with RiboGene.

IMPLICATIONS FOR OTHER INSTITUTES

This example of successful collaboration suggests several means by which scientific institutes can serve as the initiators of economic growth. Direct involvement with Western venture capitalists should produce comparable successes in other fields when prerequisite conditions are present. The institutes may also be able to engage in related collaboration with existing companies in venture capital portfolios. However, in these cases the institute's technology must be synergistic to the technology already pursued by the companies. Still, attracting the attention of the management of these small companies may be difficult. Expanding existing relationships with major Western corporations also may be possible. Closer collaboration with major corporations and increased participation in business decision making could provide additional benefits to scientific institutes.

Finally, continued collaboration with Western venture capitalists, their portfolio companies, and even major corporations will convincingly contribute to future economic development. First, collaboration over many years should contribute to higher levels of scientific and business competency and international competitiveness within East European societies. The resulting efficiencies in research and development, product design, production start-up, and use of financial resources should carry over into other enterprises through transfer of person-

nel, publicity of success, and business education. Second, the development of several successful collaborations should reduce the perceived risk of Western investment in Eastern Europe. Several Western financial organizations are already in discussions with Sierra Ventures about using our experience in their investing activity.

DISCUSSION

The discussion illuminated the following important additional aspects:

- Ventures vary in their political risk as well as economic risk. Least risky along both dimensions would be establishing a Western sales subsidiary. Somewhat more risky would be a Western-sponsored startup based on East European technology. Most risky, both economically and politically, would be a joint venture focused on internal East European markets.
- Projects involving venture capitalists can be expensive and take a long time to develop. For example, Sierra Ventures negotiated with the Institute of Protein Research for eighteen months before the Institute agreed to the deal. To date Sierra Ventures has invested 400,000 into RiboGene and expects to spend 10 - 15 million before it sees any return on the investment.
- There were questions on whether world-class biotech advances were being created in Hungary. The Hungarian government invested FT 400 million on biotechnology research from 1987 through 1990, but some workshop participants felt the money was poorly spent. Still, Hungarian researchers have been involved in important work in the biotech field, but they lack the funds and the knowhow to either develop discoveries or sell them. Currently domestic banks are unprepared to make the necessary risky investments. If Western funds are to be attracted, a healthy dialogue at both scientific and business levels will be necessary. Mutual trust must be developed, and both parties must perceive potential benefits.
- Much more than promising new technology is required to turn a scientific discovery into an economic success. Venture capitalists bring skills in strategy, finance, marketing, and business planning, as well as additional skills from the West in science and technology. Furthermore, venture capitalists are deeply and actively involved in managing a new enterprise. Their relationship to the news enterprise is much broader and more intimate than that traditionally associated with bankers. They represent a potentially important resource in efforts to revitalize the Hungarian economy.

- The key role of new venture firms is not their effect on employment, because that will be minuscule. Venture firms will probably only make up 1% of new joint ventures. However, jobs in those new ventures will be very attractive in terms of skill levels and pay. A much more important benefit will result from Hungarian partners learning about Western business practices and management. The value of the learning acquired by Western partners is at this stage less clear, but activities are still at a very early stage.

Enterprise Crisis, Privatization and International Challenges: The Case of a Major Hungarian Electronics Company

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The Hungarian electronics industry has plunged into the deepest crisis of its history. The reasons for this are many, but perhaps the most important is this sector's former privileged status in the centrally planned economy. The crisis has been deepened by the fact that most firms in the field opted for a survival strategy strongly dependent on further financial commitment by the state.

The company in this case study has been one of the major employers of the Hungarian engineering industry and is the biggest electronics firm. Its employment peaked at 20,000 in the best year of its history, 1988. The extent of the firm's crisis is shown by the downward trend in employment that crossed the 10,000 mark in June 1991.

The company has been a "15 million firm" in terms of exports to the West and a "70 million firm" in terms of total output. Its current main product lines have been consumer electronics, computer products, and military products. In the area of consumer electronics, product mix was wide in order to compete with practically all Western imports on the Hungarian market. The market was heavily protected, but even under the conditions of an import-licensing system the efficiency of protection is conditional upon the availability of domestically produced goods. This production had the home market as its main outlet. In the company's best years, it also included about 15 million worth of exports to the West.

Computer equipment was a typical case of product and technology development aimed at the Soviet market. A product line still available in 1989 was based on a French license bought in the mid-1970s. The firm could become "incumbent" on the Soviet market with extensive sales and servicing networks there primarily owing to this product line. The Soviet buyers insisted on the same product in its unchanged form even in the 1980s, because the Soviets used the Hungarian computers for country-wide networks, such as railways and pipeline

systems, where the use of imported equipment was limited. As imports were allocated by annual chunks, the Soviets used the computers to build up each network on a piecemeal basis and they thought compatibility could best be achieved if the key product remained unchanged.

More than 70% of the military products were also directed to the Soviet market. This kind of military telecommunication equipment was produced by semi-skilled workers who were well-paid because of the classified character of their work and not because of the quality of their work. Furthermore, military trade between the Soviet Union and Hungary was carried out separately from civilian trade and did not figure in public statistics. No deficits were allowed on either side of bilateral military trade when annual clearing accounts were closed. This means that when the Hungarian government decided after 1988 to cut the defense budget further and further, the corresponding part of Hungarian exports lost their orders from the Soviet Union.

THE CRISIS: "PSEUDO-PRIVATIZATION" AND "FINANCIAL OVERSTRETCH"

In 1988, the privatization strategy the firm's management opted for was still based on the old Austro-Hungarian corporate law from 1875. The basic idea was to separate state ownership from direct financial and administrative control by the government. The hypothesis was that a holding-based group of enterprises using the same brand name would be able to capitalize on the existing competitive edges of the firm. Direct state ownership, however, had to be limited to a holding company operating on the basis of the 1977 Law on State Enterprises. The holding had to be a senior partner in all the 25 enterprises of the group, but these had to be formally independent firms. All 7 members of the Board of Directors of the holding, however, held several posts on each of the individual boards of the companies within the group.

The holding then became a special interface between the government, by which it was directly and completely owned, and the subsidiaries, in all of which the holding was a majority partner. Thus, the holding could behave either as a state firm, asking for government funds in case of financial trouble, or as a leader of a pack of formally private companies with no direct dependence on the government.

The control of the holding over the firms was assured through legal guarantees as well as by a special form of financial dependence. This was secured through individual leasing agreements between the holding and the subsidiaries. The corporate agreements of most subsidiaries stipulated that most of the machinery and equipment to be used by them had to remain property of the holding. Leasing fees were fixed at a rate 30-50% above the market level because of the holding's

serious debt situation. Therefore, the subsidiaries had to carry a disproportionately high burden of operating costs even when they were formally debt-free.

There have been a few interesting details of "pseudo- privatization", many of which revolve around the composition of ownership. First, there have been only a few Hungarian partners other than the holding company in these subsidiaries and their share of equity has never exceeded 20% in any member of the group. Also there have been some interesting cases of "cross-ownership" within the group. For example, subsidiary A owns 20% of the shares of company B, while the latter has 10% of the shares of company A.

A number of interesting phenomena also exist in the area of foreign participation. There has been foreign direct investment in more than half of the members of the group with all the tax advantages to be expected from this situation. More than 90% of the approximately 20 million of foreign-owned stock capital came from one German retail firm with several subsidiaries across Europe. This German company received financial help in the form of a low-interest loan from the electronics firm in the early 1980s. This loan has not been repaid, but the amount of foreign investment by the German group in the subsidiaries of the Hungarian holding in 1988 and 1989 is very close to the value of this "forgotten" credit.

Finally, an interesting loophole in the Hungarian joint venture regulation was exploited by the firm. Tax advantages were linked to the share of foreign stock ownership, usually with a minimum of 20%. As Hungary had an increasing trade surplus in non-convertible currencies after 1986, it was counterproductive to have investment from the Soviet Union. But tax incentives were not conditional upon the currency of the investment. Therefore, the holding sold part of the shares of its most important subsidiary to a Soviet firm for rubles. These rubles, valued at 1 million, were then exchanged into forints by the National Bank of Hungary and the amount of frozen Hungarian ruble assets increased further.

TYPES OF ENTERPRISES IN HOLDING COMPANIES

There are three types of enterprises in the holding companies. The first is the leading subsidiary, which has about 80% of total employment and the bulk of production. It retained the key products of the former three divisions: computers (informatics), color TVs (consumer electronics), and non-civilian telecommunications products (military division). Part of the privatization and restructuring strategy was that this major subsidiary would itself be divided later and its own subsidiaries would be created. The strategic purpose was that this subsidiary should gradually be transformed into a "second-degree" holding with no production in it. In this case, two "interfaces" would already have been created. The purpose of this idea was partly to put military production into the background and thereby make the "front" holding an acceptable investment target for Western firms.

Secondly, there were the other productive subsidiaries, which had products of less strategic weight but nevertheless had an appropriate marketing perspective. These subsidiaries have included firms manufacturing hi-fi equipment, CDs, robotic products, thicklayer-based components, telephone equipment, and software. Most of these subsidiaries were more financially sound than the holding or the major subsidiary. Due to their small size, however, they could not have any significant impact on the overall employment and sales picture of the group.

Lastly, there are subsidiaries with logistics or other supporting functions. This sub-group has included firms which did not have significant sales outlets outside the group. Their role has been to provide the group with one key element, namely "Related and Supporting Industries" of the famous Porter-diamond.[1] The basic idea was that due to the instability of the domestic market, most suppliers should be brought under the umbrella of the group. They had to be kept under the holding's control in order to avoid their turning towards "outside" markets. A system of transfer pricing with high transfer prices has been maintained for subsidiaries with less capital-intensive activities and/or those with which the holding was for some reason unable to conclude leasing agreements. This sub-group included service and infrastructure firms, such as foreign trade, domestic sales and after-sale services, manufacturing of tools, manufacturing of PCs and other components for internal use, housing and transportation services, and factory maintenance.

The term "financial overstretch" was coined for this paper. Not coincidentally does it strongly resemble historian Paul Kennedy's term "imperial overstretch"[2] (or "military overstretch"). Kennedy's term is applied to any politico-military giant (the Roman Empire, 16th century Spain, 19th century England, Third Reich Germany, the USSR etc.) that is financially overcommitting itself in order to preserve its "superpower" status and then must accept a substantial loss of global political weight and influence due to its growing economic ailment.

The Hungarian electronics firm had been a strong "power" on the domestic economic scene for various reasons. First, it was and still is the most important employer in a "heavyweight" industrial region. Second, it had achieved a key status in Hungarian civilian and military exports to the Soviet Union and had therefore become involved in political and trade bargaining between the two governments. Third, it had acquired "high-tech" reputation by East European standards. It no doubt became capable of incorporating up-to-date technologies from leading international firms. It also developed an ability to independently produce impressive R&D results. Finally, the firm could always be presented as a success story in the electronics industry as no other East European firm was a promising partner for Western investors. This success story was meant to show

[1] M.E. Porter, The Competitive Advantage of Nations, The Free Press, 1990.,pp.100-107.
[2] Paul Kennedy, The Rise and Fall of the Great Powers, Random House, 1987.

the ability of the "semi-market" type Hungarian economy to match world market standards outside of traditional "smokestack" industries.

"Superpower" aspirations of the firm within the Hungarian industry were supported by the government and this is where the "financial overstretch" most likely originated. The firm accumulated large debts from the government, banks, and other enterprises.

The debt to social security and to the state budget consists of unpaid social security contributions, personal income tax payments, and customs duties. According to various estimates, these obligations have totaled FT 1-1.5 billion. Unpaid social security and income tax bills carry a more than 10% real interest per annum. Also, any firm with unpaid customs duties is not allowed to be served by Customs from January 1991. All these obligations can be waived only by Parliament.

Banking debts totaled FT 3.3 billion (approximately 45 million) plus accumulated interest. Most of this debt is from a 1985 credit agreement on a military telecommunications equipment production project. The management felt that this would lead to a huge financial disaster due to the expected Hungarian defense budget cuts, so the credit was rerouted into several consumer electronics projects.

Finally, the company was unable to pay its debts to other enterprises, a phenomenon know as "queuing". In Hungary in 1989 the total amount of unsettled inter-enterprise debt had reached FT 200 billion (about 3 billion). "Queuing" had its origin in the severe credit crunch initiated by the government in early 1988. A series of enterprises got into liquidity trouble and their only plausible reaction was to delay payment of their bills to other enterprises. This unleashed a chain reaction and whole "loops" of non-payment (i.e. involuntary credit) were formed among several dozen enterprises in each loop. Very few if any "queuing" cases were taken to court, partly because of the lack of appropriate receivership legislation and partly because many producers feared losing their most valuable domestic clients.

This electronics firm has indulged in one of the most spectacular cases of "queuing". The amount of inter-enterprise debt unpaid by the holding and its subsidiaries reached FT 5 billion (90 million) by the end of 1990. The "queuing" claims of the group totalled FT 3 billion at the same time. These credits and debts could not be swapped, of course, due to their completely different enterprise structure.

Approximately 40% of the holding's "queuing" liabilities as well as two-thirds of its assets are obligations within the group. Net creditors are mostly the "supporting" firms, whereas the biggest debtor is the major subsidiary. This firm's exports to the Soviet Union are still not completely paid and their consumer electronics products have suffered a dramatic decline of their domestic market shares due to extensive import liberalization; for example, their color TVs have fallen

from 60% to under 30% of the market share in two years. In addition to its stock of unsold finished goods, it has been carrying an inventory of unused components worth more than FT 1 billion (15 million). These components had been ordered for military exports, but they are incompatible with almost all non-Soviet electronics product.

The size of the financial disaster of the firm (or the group) is clearly much beyond its own scope for action. It became a "value-subtractor", although not really in the McKinnon sense[3] because it is a loss-maker even without considering the cost structure of its products. Interest on the group's current debt increases by roughly FT 10 million each day. This means the net book value of assets is slowly approaching zero.

"ASSET-SUBTRACTION" AND PRIVATIZATION

The experience drawn from the case of the "asset-subtracting" firm might help to clarify a few important elements of the necessary and feasible industrial strategy for Hungary. Three main issues can be brought to the fore.

The first issue is the government's general attitude with respect to "asset-subtractors". The existence and the very bad perspectives of "asset-subtracting" firms cannot justify the comeback of interventionist industrial policies. As a rule, the government should aim to privatize most of these firms in the long run. It has to see, however, what could be done immediately in order to stop these company's assets from shrinking. Direct financial help to reduce their debt burden is usually out of the question. The government could, however, provide effective support in designing, financing, and carrying out regional programs to help individuals create small "supporting" enterprises around larger, but rapidly dwindling firms with considerable job losses. These concentric circles of small "supporting' firms might soon become export-oriented, as shown by the fast development of Spanish and, to a lesser extent, Portuguese and Greek subcontracting firms.[4]

However, the dynamism of these firms was partly attributable to the beneficial effects of micro-level European economic integration.

The second issue is trade policy. Hungarian consumer electronics firms were hit very hard by a quick and comprehensive dismantling of the protection system based on import licensing. This trade liberalization took place between 1988 and 1990. Now the Hungarian consumer electronics market is only protected by low-

[3] R. McKinnon, "Financial Control in the Transition to a Market Economy," paper presented in Prague, March 1991.

[4] C. Charbit, J. T. Lavix, and P.M. Romani, "Sous-traitance et intégration industrielle européenne", Revue d'Economie Industrielle, No. 55, 1991, pp.186-187.

level tariffs, which average less than 10%. Now Hungary stands out in Europe as a country not applying any sort of "new protectionist" measures to protect its consumer electronics industry.

It would probably not be appropriate to suggest the introduction of "informal" market protection in this industry, especially because the low-economy of scale of the Hungarian consumer electronics market. Moreover, the domestic firms now fighting for survival have practically the same product mix as 2-3 years ago. So, the government should use the lack of "New Protectionism" on the Hungarian side as an argument when bargaining for more trade concessions with EC and EFTA officials.

Another trade policy problem linked to "asset-subtractors" is that of effective protection.[5] The McKinnon-model of "value-subtracting" firms made reference to energy-intensive companies implicitly subsidized through low energy prices by the government. McKinnon shows that negative-value created by, for example, Soviet firms using artificially cheap energy will not turn into a positive one just because the government gives more incentives on the input side (for example, further lowers the price of energy) or devaluates the currency.[6] Practically the same goes for our "asset- subtracting" company as far as the impacts of effective protection are concerned. For a numeric example: if the average tariff rate for components used for final product A is 10%, the tariff rate for A is 25%, and the share of the imported components in the market price of A is 50%, the rate of effective protection is (0.25-0.50x0.10)/(1-0.50) = 2/5 = 0.4 or 40%. This means that if no domestic components are used, the firm gets a 40% bonus on its value added.

This case becomes rather special if value added turns out to be negative. Then effective protection can help to keep an otherwise largely uncompetitive product on the market by reducing the "loss margin". The liberalization of Hungarian imports of electronic components resulted in a price decrease of 20-60% for components used. Domestic components priced 3-4 times higher than the world market level disappeared from the domestic market. This meant the appearance of inexpensive components from imports dramatically reduced input costs inducing a significant increase in "real" effective protection. "Real" in this context means that costs of component imports can be compared only with previous costs of component inputs from a time when imports were still practically excluded from the market.

This increase in "real" effective protection has created a "false incentive" for our firm to consume its assets by maintaining loss-making production. The usual explanation offered by its managers is that incumbent positions on the domestic

[5] R. E. Caves and R.W. Jones, World Trade and Payments, Little, Brown, and Co., 1985.,pp.233-235.

[6] McKinnon, pp. 6-9.

(and eventually on the Soviet) market can be preserved only at a price paid through financing own loss-making production. According to this approach, the declining net book value of assets could be offset by the growing value of the group as a whole due to the presence on markets that are gaining importance in the eyes of major international exporters.

SCENARIOS FOR PRIVATIZATION

The latest developments in the group's crisis have shown that the government has not been able to come up with a feasible privatization strategy. The State Property Agency and the Board of Control have been successful in blocking the "pseudo-privatization" process and the creation of the second holding. A major West European consulting firm was given the task of elaborating an efficient privatization strategy and identifying foreign investors ready to acquire at least part of the group. Five months and nearly 1 million in consulting fees have not gotten these tasks finished.

In mid-May 1991, the government decided that the group could and should be subject only to "piecemeal" privatization. So, the time and money spent to keep the group together and the brand name intact were completely wasted. Now the ultimate loser from the "asset-subtracting" process will be the holding. It will have to disappear like a shipwreck from which everything of some value has been taken ashore.

The holding has most of the group's financial assets and debt. Therefore, its well-organized bankruptcy might be enough to save most of the valuable physical capacities and those subsidiaries which are or can be made competitive. This would be a blend of the two main privatization scenarios.

The first scenario can be called the "throw-away" option. This means the government or the State Property Agency has the priority of avoiding further "asset-subtraction", even at the cost of a relatively low sales price of the enterprise's assets. There is a tradeoff between the speed of "asset-subtraction" and the development of the assets' sales price. An optimum point can probably be defined in the case of each enterprise where the acceleration of the "asset-subtracting" process is expected at any moment while sales prices still do not reflect such expectations. It is very likely that this optimum point has already been reached in the case of this holding.

The other main strategic option can be called the "conditioning" approach. This means sales prices have gone much further down than could be justified by "value-subtraction". In this case, the government can avoid a major financial loss only if it invests in the state enterprise to be privatized. Such an investment might pay off unexpectedly well due to its psychological effects. These are linked to the perception by the market of the fact that the "throwaway" strategy has not been

opted for. Thus, even a relatively minor "conditioning" investment might help to optimize the difference between the book value and the market value of the assets of the firm.

It seems that the second approach prevails in the Hungarian government's strategy for most of the group's subsidiaries. Although the modalities of the realization of this strategy are not yet known, it is likely that a merchant bank with majority state ownership will acquire the holding's stake in most subsidiaries and finance their "conditioning". This will probably mean the reversal of their "asset-subtraction" process.

DISCUSSION

During the discussion, one of the NAS participants argued that this firm's problems have nothing to do with the economy or the government. In the United States, Zenith is the only television manufacturer left. The French have been irrational in their fight to stay in the consumer electronics market and the Dutch firm Phillips has been battered recently. This sector is dominated by the Japanese and Koreans and there is little this Hungarian firm can do. Another NAS participant noted that one of the latest Sony plants is completely automated, employing only 50 workers. So unless the government is willing to subsidize 20,000 employees, the Hungarian plant should get out of the business.

Dr. Török shot back that this Hungarian firm had partnerships with some major European consumer electronics firms, which are looking to Eastern Europe to make up their declining market share in Western Europe. Therefore, it would make sense for this firm to hang on and reap the benefits of these partnerships also by trying to get access to new markets.

Case Study of a U.S. Electronics Firm: Increasing Importance of Technology for Services

GRAHAM R. MITCHELL
GTE Laboratories Incorporated

OVERVIEW

In 1990, GTE had revenues of over 21 billion from businesses in telecommunications, lighting, and precision materials. The central laboratories in Boston carry out the R&D for all the corporation's business areas. During the last decade, the focus of this work has shifted from products to services, reflecting both the increasing emphasis of services in the U.S. economy and, in particular, the growing need for technical innovation in telecommunications as the U.S. industry is deregulated. During this transition, researchers have become aware that because much of the conventional wisdom on managing R&D and industrial innovation has been developed for process and manufacturing industries, many of the familiar management assumptions need to be reexamined for the newer and technologically sophisticated service industries. For example, the core of industrial R&D programs in manufacturing companies is often centered on materials, product design, and manufacturing processes. By contrast, technical skills in the service industries often need to be broader to address physical systems or networks, operations, and applications or services. The scientific and technical skill base needed for industrial research has to be extended beyond hard physical sciences to information technology and even further to include human factors and social sciences.

TECHNOLOGY FOR SERVICES

Technology for services has received relatively little attention in literature on managing technology. This is surprising since the service sector now dominates both the developed and developing market economies. In 1987 the service sector accounted for 72 percent of the U.S. Gross National Product and 76 percent of

U.S. employment. Yet, there is widespread misunderstanding of the character and importance of services, and a tendency to significantly underemphasize the importance of technology. This tendency is even more extreme in Eastern Europe. In the U.S., Quinn and Gagnon[1] have characterized the attitudes of senior management as follows:

> Although they know better, most executives still think of the service sector in terms of people making hamburgers or shining shoes.

A better understanding of technology in services is critical to the technical management throughout U.S. industry for two major reasons. First, many important technical advances with broad relevance to U.S. industry are pioneered by services companies. This is particularly true in information technology. (The service sector owns 84 percent of the capital stock of information equipment and products in the United States.) Second, non-services companies have responded to the opportunities for business growth over the last two decades by developing or acquiring services operations. There are many examples of manufacturing corporations that have, with appropriate acquisitions, translated expertise in repair, engineering design, financing, communications, or distribution into separate fast-growing services within the corporate portfolio. This usually presents the existing technical management with the perplexing question of how, if at all, to support these new services businesses.

STRATEGIC PLANNING FOR SERVICES

Why is it difficult to understand technology for services? The first step is to ask the question, how is the service sector different in a strategic sense from the goods producing sector? Unfortunately, many of the most familiar strategic planning approaches, and the frameworks managers most naturally reach for to sort out basic and long-range priorities, provide little guidance on the differences between services and goods producing industries. This is because these frameworks analyze business strategy from the perspective of the individual firm and largely build on structural relationships common to most corporations. Therefore, all companies are seen as having characteristic issues and options when dealing with generic customers, suppliers, and competitors. This kind of approach has the virtue that strategies can be developed without reference to whether the corporation is in the services, manufacturing, or even the materials resource sector. However, precisely because these frameworks obscure the

[1] Quinn, James Brian and Gagnon, Christopher E. (November- December 1986), "Will Services Follow Manufacturing into Decline?," Harvard Business Review, Volume 64, No. 6, p. 95.

differences between services and manufacturing businesses as a class, their use adds to the confusion over the debate on services rather than helps resolve it.

An important step in clarifying the difference between goods and services is to apply the notion of the value chain in considering a segmentation by industry sector. Different industrial segments may be arrayed in a sequence illustrating the added value at each stage. Starting with raw materials, value is added as these materials are processed and then turned into components, products, and systems which provide services to the ultimate consumers. Successful companies exist at all points in the progression and operate with widely varying degrees of vertical integration. Steele[2] has observed that most corporations assume they must control operations over a specific length of this chain- -that these are in effect their core businesses.

The value chain simplifies the actual situation as some of the output of the services and manufacturing sectors is fed back into earlier stages of the process and provides the interlocking infrastructure for the total economy. However, there are at least four characteristics of the services sector which come about because of its position in the value chain. The first is that the services sector is the major customer of manufacturing. This characteristic implies that many services industries have a generic need to specify, or in other ways control and influence, the design of the products they buy. The specification and procurement activities of government, transportation, public utilities, communications, and financial services industries provide very visible examples of this. The second general need in the services industries is to assemble, build, or otherwise integrate these products into a system or organization. The third is to run or operate the system so that it delivers appropriate services, keeping in mind that the direct customer of the services sector is often the general public or individual consumer. The fourth characteristic of services arises from the fact that success in banking, retailing, transportation, communications, government, and many other services depends to a very large extent on an ability to understand and deal directly with the general public and individual consumer. Successful service companies place great emphasis on understanding the needs of individual consumers. Information technology is providing the opportunity to economically tailor services to these individual needs, for example in automatic banking, telecommunication entertainment and retailing services, and a host of travel-related and financial services.

[2] Steele, Lowell W. (1989), Managing Technology: The Strategic View, McGraw-Hill Engineering and Technology Management Series, Michael K. Badawy. Ph.D., Editor-in-Chief, McGraw-Hill Book Company, New York.

DEFINITION OF TECHNOLOGY

The language system used to classify industrial research is of critical importance. Steele[3] has pointed out that it must communicate both the technical character of the work and its purpose. It must be understood by the technical community who performs the work and by the business and management community with whom they interface. In addition, it must allow both groups to jointly allocate resources to the highest strategic priorities and track operational progress.

When asked to define technology, the technical community thinks in terms of skills and disciplines, or the input to the process; for example, heat transfer, solid-state physics, and circuit analysis. Business management, on the other hand, tends to think of technology in terms of products and systems, or the output of the process; that is, integrated circuits, computers, or even communications systems. As a result, some corporations recognize that in order to build a language with which to manage industrial R&D, and to communicate with both communities, definitions of technology should combine both skills and applications.

Mitchell[4] and Bitondo[5] have called these kinds of classifications "Strategic Technical Areas" (STAs) and have shown that by formally combining skills with applications in the definition of technology, technical strategies may be analyzed and implemented across multi-business corporations. More importantly, from the viewpoint of the present discussion, these STAs are used to manage and set the strategy of the corporate laboratory. The precise definition of the required technical skills, the selection of the highest priority business areas to which they should be directed, and the long-term allocation of resources to them effectively define the strategic direction of a corporate research laboratory.

Once technologies are defined and recognized as having both a skills component and an applications component, some of the mystery surrounding technology and R&D for services is removed. Scientific knowledge and technical skills may be effectively applied along all parts of the value chain; however, these skills and expertise must be coupled with the applications reflecting the priorities of a particular business area to have something around which to focus strategies and build programs.

[3] Steele, Lowell W. (1975), Innovation in Big Business, American Elsevier Publishing Co., Inc., New York.

[4] Mitchell, Graham R. (Number 2/3, 1985), "New Approaches to the Strategic Management of Technology," Technology in Society, Volume 7, p. 227.

[5] Bitondo, Domenic S., "Technology Planning in Industry: The Classical Approach," Chapter 4, Interdisciplinary Planning: A Perspective for the Future, M. J. Dluhy, K. Chen, (eds.), New Brunswick: Center for Urban Policy Research, Rutgers University.

EXAMPLES FROM THE TELECOMMUNICATIONS INDUSTRY

One of the clearest ways to understand the difference in the role of R&D for products versus services is to observe the contrasting responses of managers in products businesses as opposed to managers in services to the same successful laboratory experiments. When presented with a research breakthrough in, for example, fiber optic transmission capability, a manufacturer of transmission equipment immediately raises the question, "How can I incorporate these advances into the next generation of equipment design?" Other technical issues covering access to the components, patent or know-how protection, and product obsolescence are typical initial concerns common to product manufacturers in many industries.

For a telecommunications services company, such as a telephone or data network operator, the implications of the same research advance may be very different. A possible conclusion could be that bandwidth is going to be both plentiful and inexpensive in the near future. The most critical question for the provider of services is, What will customers do with this new bandwidth? What new services-video, data, or voice will we need to create and market? Not only is the question different, but the subsequent priorities and actions follow a very different path. To pursue these questions, skills in human factors and psychology are needed along with more familiar engineering software and physical science expertise. In addition, the services company may also have to establish R&D programs to address other technical issues that follow directly from the advance in transmission components; programs to cover the design, evolution, and operation of networks; and even whole systems incorporating the new transmission equipment.

IMPACT ON R&D AT GTE LABORATORIES

The difference between R&D for products versus R&D for services is clearly illustrated at GTE Laboratories by the formal definitions of technology used to manage the corporate research program. GTE Laboratories serves both products and services businesses, and these different perspectives need to be understood in some depth by the researchers. Mitchell[6] has shown that in defining research areas (STAs), formally coupling (1.) disciplines, techniques, and skills to the (2.) applications and market area accomplishes this goal. Three examples of this approach are described below.

[6] Mitchell, Graham R. (No. 3, 1988), "Options for the Strategic Management of Technology," International Journal of Technology Management, Volume 3, p. 253.

A typical definition used to target R&D to telecommunications equipment manufacturing shows how GTE expects to transform skills in fundamental physical sciences into products. The area is Integrated Circuit Processing.

> (1.) The principal skills include lithographic techniques (photo, x-ray, electron beam) for defining fine geometries on semiconductors, as well as high-temperature solid-state chemistry and thin-film processing. (2.) These are applied to the fabrication of semiconductor integrated circuits, which are used in a wide range of switching and transmission products throughout the telecommunications industry.

For the services provider, applications have to extend well beyond the individual product. A typical description of what might be included in an STA that addresses Network Planning is the following:

> (1.) Major mathematical disciplines include decision, queuing and game theory, simulation, regression analysis linear programming, as well as algorithmic techniques applicable to the solution of computationally large network problems. (2.) These are used to develop network and engineering design tools and systems for public telecommunications networks.

The multidisciplinary nature of R&D for Network Services, which has to reach beyond the physical system and address consumer needs directly, may be defined as the following:

> (1.) Major disciplines include statistics, market science, signal processing, human factors, as well as hardware, software and communications systems engineering. (2.) These will be applied to develop techniques for the creation of interactive services for specific customer applications on the public network.

In all three examples, the particular expertise required by the researchers is identified at the beginning. The second part is needed to complete the definition of technology by clarifying how the expertise will be used. Taken in sequence, the definitions illustrate a progressive shift from manufacturing to services as the focus of application moves along the value chain from components and products through systems to consumers.

Strategy for GTE Laboratories is managed through 15-20 STAs. When a majority of programs within the GTE portfolio were directed to products, major portions of the telecommunications R&D program were characterized as electronics/photonics, software, and telecommunications systems, reflecting the well-understood and intuitively recognized linkage between these skills and their application in telecommunications products. However, as more of the program addressed services, increasing dissatisfaction was expressed with this classifica-

tion as it became clear that electronics, photonics, and software were ubiquitous in telecommunications services and were not useful concepts around which to build strategic priorities or communicate with business management. Even though a need existed for many of the technical skills required when the program was directed more heavily toward telecommunications manufacturing, new names were needed at the highest level of aggregation to capture the overall shift in focus of the entire portfolio down the value chain.

Ultimately,

- networks and systems
- operation of networks
- applications and services

emerged as more closely portraying the purpose of the R&D program for services.

TECHNICAL STRATEGIES FOR THE SERVICES SECTOR

What is true for GTE and the telecommunications industry is relevant to the services sector in general. Technical strategy for communications, transportation, banks/financial services, and even some wholesale/retail businesses is implicitly focused towards three generic targets: the physical system, operation of the system, and applications or products (that is, services).

The **physical system**, or equipment, is usually supplied by manufacturers and assembled by the service company. For example, the analog of the network for telecommunications systems is the airline fleet and communication systems in the case of airlines; computer networks and information systems for banks/financial services; generation, transmission, and distribution systems for an electric utility; and the network of wholesale and retail outlets, together with their information systems, for trade.

The degree to which the services company needs to be technologically sophisticated and carry out R&D into the physical system depends on several factors. One is the number and diversity of individual components for the system. When the system is built from a large number of different elements supplied from many manufacturers, as is clearly the case in many large systems for transportation, communications, and financial services, the burden on the services company to design, specify, and integrate the elements into a working system is substantial.

The second generic focus of technology strategy in services is **operations**, including the development of efficient procedures and information systems for maintenance and control. Often these systems become a source of strategic advantage for services companies and may even provide a separate source of

revenue, as with reservations systems in airlines, mutual fund management systems in banks, and directories in telephone companies. A wide range of mathematical and computational skills are often required, and Larson[7] has illustrated that Operations Research has provided added value in industries as diverse as government services, railroads and transportation, banking, electrical power and many others. Not surprisingly, top management in the services companies often exhibit considerable sophistication in information technology.

The third area of strategic focus in services is **applications** or products of the system; that is, the actual services. The technical skills required need to ensure close coupling to the customers wishes and needs. Many of these skills are poorly represented in more traditional industrial research laboratories, where physical sciences and engineering disciplines often dominate. The overall need for this research is strongly influenced by the range, variety, and technical sophistication of the output or products of the services company. In telecommunications and airlines, as well as in banking and financial services industries, deregulation is leading to an explosion in the variety and number of new services products. As the services infrastructure grows, the cost of introducing new services escalates. Technical programs that attempt to simulate radically new services can resolve true consumer needs and responses before major investments are made. This kind of program lowers the risks and accelerates the introduction and deployment of the new services.

CONCLUSIONS

The U.S. economy can be considered to consist of four interlocking and vital sectors: agriculture, mining and material resources, manufacturing, and services. The largest sector, services, is in many ways the least understood, and in particular the role of technology is only slowly being recognized. Much of the literature on innovation and R&D is drawn from our history in the process and manufacturing sectors, and these familiar paradigms often contribute to the confusion over technology in services. Over a transition period of less than 10 years, GTE Laboratories has had to manage its corporate R&D portfolio as it has moved from a major focus on products to a program dominated by R&D for services businesses. Because this has occurred in a single laboratory with a reasonably stable environment, management, and research staff, the experience offers a longitudinal experiment on the inherent differences between technology strategy for manufac-

[7] Larson, Richard C., "Operations Research and the Services Industries," Managing Innovation: Cases from the Services Industries (1988), National Academy of Engineering, Bruce R. Guile and James Brian Quinn, (eds.), National Academy Press, Washington, D.C., p. 115.

turing compared with services. The experience suggests that as technical skills and resources are applied toward the end of the value chain, i.e., to the service sector, generic needs such as the design and building of the physical system or network, operation of the system, and the services products-of-the-system inevitably form the R&D program's focus.

This experience also suggests that the technical sophistication of human resources in the service sector is increasing, thereby creating parallels with manufacturing. Not only is the sector providing increasing competition for information professionals, but the operating role of information executives increasingly resembles that of traditional R&D managers as they fit internal program resources to the strategic priorities of their corporations.

DISCUSSION

Several important points surfaced during the discussion.

- One participant noted that the presentation illustrated where Hungary should go, but left no clues as to how Hungary should get there. Dr. Mitchell responded that the first key was education. In the United States, if you ask someone for what s/he is training a child, the answer is college and eventually work in the service sector. In the near-term, a participant commented that Hungary's first step should be to overemphasize the development of telecommunications, because the service sector is so heavily dependent on telecommunications systems.
- Dr. Mitchell emphasized Hungary can learn many lessons from America's transition from an industrial to a service economy. Hungary cannot go the same route, but should recognize the value of the service sector and the importance of information technology. Too many people seem to treat the service sector as some big levitation trick, something with no lasting value.
- One participant noted that it is exceedingly difficult for a company with a tradition of hardware to transform itself into a service firm, much less for an entire country to undergo this transformation. As Hungary looks to the future, it will either choose manufacturing, which is a shrinking part of the world economy, or services. But it is important to redefine services and manufacturing. For example, in the United States only 2-3% of the work force is farmers, but the agricultural sector involves much more, such as the agro-chemical industry and marketing services. The same is true in manufacturing. Providing statistics on California, one participant noted that manufacturing was only 18% of the state economy, but the sectors related to manufacturing total 75%.

- Continuing the theme of links between services and manufacturing, it was argued that the relationship was even more complex. One must differentiate between high-value (knowledge intensive) and low-value products. Even within high-value, a difference exists between economies of scope and scale, and ideas and creativity. Even if Hungary or the United States was good at high-value/creative products, it may not be able to compete in the area of economic scale.

Biotechnology R&D at Monsanto Company: a U.S. Case Study

ROBERT W. ELTZ
Monsanto Company

This discussion touches on the nature of industrial research and development (R&D) in biotechnology in U.S. firms. Although it focuses on Monsanto Company, a large diversified chemical company, the points herein are largely generic to R&D in all manufacturing companies.

Biotechnology is the application of modern biology to a number of useful ends. Since the late 1970s, biotechnology R&D has exploded, especially due to advances in biochemistry, genetic engineering and protein chemistry as well as to concomitant and complimentary advances in analytics, computation, information sciences, and other fields. Biotechnology applications currently under development include animal/plant breeding, human "gene therapy", industrial processes, new industrial products, forensic medicine, and new methods and materials for fundamental biology (e.g., differen tiation, evolution, disease mechanisms).

THE BUSINESS CONTEXT

Hundreds of U.S. companies, large and small, are actively pursuing a wide array of biological interests. Labeling any of these companies as "biotechnology firms" is often inappropriate or misleading, either because some also use many other technologies, or, more importantly, because they must sooner or later address, and internally organize for, the specific external regulatory and market environment in which their products compete. Hence, they are better identified by their specialization (i.e. pharmaceutical firms, seed producers, agro-chemical firms), understanding that they happen to pay high attention to the techniques of modern biology.

Monsanto Company can be introduced with some rounded 1990 figures. It places among the top five U.S.-based chemical companies with sales of 9 billion dollars, 42% of which are outside the United States. Technically based on processes and equipment to make, purify, and formulate chemicals, it is largely oriented toward industrial and professional customers rather than ordinary household consumers. Its 41,000 employees worldwide are decentralized into many profit centers focusing on specialized markets in specific geographic areas. These businesses are clustered into five major units: Monsanto Agricultural Company (19% of sales; crop chemicals, seeds, animal feed ingredients); Monsanto Chemical Company (45%; industrial chemicals and materials); Fisher Controls International (10%; process equipment); NutraSweet Company (10%; food ingredients); and Searle & Company (16%, drugs). The company is broadly owned by the private sector; 62,000 individuals, funds or institutions own a total of 126 million shares which are traded on 10 exchanges in the U.S., Europe and Japan.

Monsanto Company devotes fairly intensive efforts to technological innovation, spending 7% of sales on R&D and another 0.7% on engineering, commercial development and patenting, for a total of 692 million in 1990. That compares with 750 million on capital expenditures and 546 million net income after taxes. Internal R&D is used along with divestiture, in-licensing, acquisitions, and venture capital investments to achieve its strategic goal of a diversified business portfolio that collectively (a) produces high value-added products with good proprietary positions (b) yields at least a 20% return on shareholder's equity, (c) is reasonably cushioned against raw material and energy cost perturbations and the usual business cycles, and (d) has high regard for and by shareholders, employees, neighbors, suppliers, customers, and the environment.

Monsanto's R&D includes a high, but certainly not a singular, interest in biotechnology; it is integrated with other chemical and material sciences. The biology programs emphasize productivity enhancers for plant and animal agriculture, industrial chemicals, drugs, food, and improved crops. In plant breeding, insect- resistant cotton and a number of other transgenic plants are under development. Industrial bioprocessing has centered on fine and specialty chemicals such as somatotropins (for cattle and hogs), aspartame, atrial peptide, tissue plasminogen activator, and N- butyl-deoxy-nojirimycin (an experimental AIDS drug). However, making fuel-grade ethanol and treating wastes biologically are also of interest. Biotechnology is also important at Monsanto in providing powerful methods and newly available materials needed in the discovery of new drug and agro-chemical, even if later made non-biologically. For example, significant quantities of a human enzyme can be generated microbiologically for extensive laboratory study as a potential target against which a new therapeutic agent might be designed or discovered.

THE MANAGEMENT CHALLENGE

As with other technologies, companies successful in modern biology applications will likely be those that understand the technical innovation process in industry and how to meet its requirements, especially in specific market places. As shown in Chart 1, that process passes through the stages of conception, research, development, commercialization, and commercial operations. In each stage, appropriate refinement is required in seven aspects: product, market, process, economics, patent, engineering/ manufacturing, and "company fit". Each aspect involves a considerable checklist of items for attention. For example, "product" means defining the final product form and includes everything involved in meeting regulatory requirements; "company fit" means assuring top business management's true interest and ability to commercialize and operate the projected venture. These seven aspects require inputs from distinctly different functional groups or expertise, preferably from at least the start of the development phase, if not sooner.

Chart 1

Phases of technical innovation

	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
PHASES	SCOUTING	RESEARCH	DEVELOPMENT	COMMER-CIALIZATION	ON-GOING BUSINESS
ASPECTS	Define project concept via laboratory, library, and/or outside contacts.	Define product (compound) and intended use. Determine technical feasibility. Define develop ment cost and justification.	Clarify all aspects for decision to commercialize.	Final design, financing, construction, staffing, start-up.	Maintain viable operations, requiring QC/QA support and tech service to mfg. and marketing
PRODUCT		Concurrent progress on all aspects of the projects.			
MARKET					
PROCESS					
ENGINEERING/ MANUFACTURING					
PATENT					
ECONOMICS					
FIT w/COMPANY					

Over the past 15 years, many U.S. firms have started or greatly enlarged their "biotechnology" R&D. In the American pluralism of large and small enterprises, universities, and government, a large number of creative alliances have been

forged to help manage and enable innovation. The top managers have had to deal successfully with the following five broad concerns:

1) **Establishing a critical mass of resources (money, technical and business knowledge/skills (= people), facilities, equipment) to address all the aspects of Chart 1.** Some of these skills are not peculiar to "biotech". Some may be available via alliances with outside parties. All must be available.

At Monsanto, a new Life Sciences campus was established in the early 1980s to house about 1200 people in biology-oriented laboratories, greenhouses, and bioprocessing facilities. New research farms were established. Companies were also acquired in the pharmaceutical, food ingredient, and seed businesses. Over the same period, businesses were sold in petroleum/ natural gas production, petrochemicals, silicon wafers, and a few other areas.

2) **Exercising skillful judgement for each project in assuring that each aspect in Chart 1 is making progress commensurate with the progress in all other aspects.** Managers must avoid overspending for refining any one aspect while another aspect remains in "early darkness".

3) **Changing to different types of project leaders (coordinators), reviews, and reviewers as projects progress through the phases and migrate from technical to business emphasis.**

In Monsanto, the business managers of the profit centers are interactive by at least the development phase.

4) **Sustaining the critical mass of resources through high and low loads.** Project concepts will die; some will get repackaged into more viable forms. The early phases inherently require a large number of project concepts to generate the much smaller number of successful commercial innovations. An organization with only one or two projects may be unsustainable. The expensive resources needed in later phases may be sustainable only with a large number of internal concepts, or by acquiring projects from external sources, or by sharing these resources with other parties. Conversely, when too many concepts instantaneously exist for the size of the affordable internal pipeline, advantageously "selling" immature projects for others to develop may make sense.

At Monsanto, the scouting phase of drug innovation efforts are heavily supplemented by supporting university projects in biomedical science, most notably at Washington University and Oxford University. An occa-

sional project is also started under collaborative research agreement with a federal government laboratory. Monsanto has been active in funding new start-up companies via venture capital firms as a window on new fields and new product concepts. Universities are often very important in the development phase, for example in the clinical evaluation of new drug candidates. The molecular biology and bioprocessing units at Monsanto benefit from participating in a wide array of projects in several business areas, and in all the research, development, and commercialization phases. On the other hand, when certain very specialized expertise is occasionally required, for example in the genetic manipulation of certain organisms, contracts are established with outside providers, which are often comparatively small firms. Similarly, an early arrangement was made with Genentech to jointly explore the animal somatotropin field, and toll manufacturing in Europe has been contracted for certain products. More recently, a number of alliances are being established with outside seed companies to commercialize various transgenic plants. Indeed, each profit center must seek the most favorable route of commercialization.

5) **Balancing their project portfolios with respect to risk and timing.** For new small companies, adequate funding must be assured, especially where, as in pharmaceuticals, there are several costly years to financial return. Some "small return/low risk" venture(s) may be needed along with "high return/high risk" ventures in order to earn income and to establish and sustain the critical masses mentioned above. Often these sources of income are contract research and out- licensing (for royalties).

Monsanto R&D is funded by a large number of existing businesses, many of which are not biotechnology-based. Many of the "biotech" projects involve long and sophisticated paths in highly regulated businesses. The successes of biotechnology must increasingly fund this R&D in the future.

THE GOVERNMENT INTERFACES

The several roles of U.S. and state governments have been amplified in the earlier papers of Dr. Schillinger and Dr. Shields, but a few remarks peculiar to biotechnology are noteworthy. As shown in Chart 2, the various government agencies primarily serve two functions with regard to innovation: promotion and regulation.

Regarding this promotional role, it is striking that the expansion of "biotech" activities was largely stimulated by federal funding of basic research in biology, primarily with a long-term view toward health targets such as cancer and infectious diseases. Today, similar efforts continue, especially toward publicly- accepted missions in areas like health, defense, environment, and safety. Separately, the federal government is promotional in granting patents, protecting trademarks, and granting "orphan drug" status (for target diseases of low incidence). State and local governments have often provided tax and other incentives to attract new companies or operations, such as small "biotech firms", which create new jobs and revenues.

The focus on regulation consists of protecting the public from undesirable innovations, such as unsafe or ineffective products, as well as worker safety and environmental pollution. The focus of regulation is not the socialist concept of planning production, quality, or distribution, although treading somewhat into those areas, as in international trade and agricultural production, is not without precedent or great public controversy. Biotechnology products and practices are regulated primarily by the several federal agencies shown in Chart 2. For the special case of bioprocessing to manufacture drugs, Chart 3 shows the primary federal interfaces.

Chart 2

Government Agencies

U.S.

Federal	Promote	Regulate
Patent/Trademark Office	+	
Food & Drug.Admin.	+ (orphan drug)	+
Occupational Safety & Health		+
Environmental Protection		+
U.S. Dept. Agri.	+	+
National Institute of Health	+	+ (advise)
Natl. Sci. Foundat.	+	
U.S. Dept. of Energy	+	
U.S. Dept. Transpt.		+
U.S. Dept. Defense	+	
States (50)		
Local (community, township, city, village)		
ex U.S.		

Chart 3

Bioprocessing/ pharmaceuticals

Protecting 5 Aspects:

	Agencies Involved
Product	FDA
Process	FDA
Workers	OSHA, NIH, DOT
Environment	EPA, USDA, NIH, DOT
Organism/ Intellectual Property	Patent

For the most part, progress in biotechnology has posed new and sophisticated technical challenges and loads for the regulatory agencies: the U.S. Patent Office recently had a backlog of 18,000 cases in this field. Monsanto and most other firms in the field have voluntarily abided by biocontainment rules promulgated for federally-funded laboratories. In addition, all firms have participated in open public debate on establishing new policies and standards.

Especially valuable to U.S. companies in this rapidly evolving field, with its considerable technical and financial risks, has been the ability to operate in the large U.S. economic community, with the added hope for success in other world markets. Despite the difficulties for the U.S. Patent Office and the federal regulatory agencies/advisers to keep pace, we have more-or-less succeeded in coordinating and setting policy and standards at a single federal level (for over 250 million people), rather than within each of our 50 states or with the even larger number of local governments. The sheer cost to taxpayers of handling both the load and the sophistication at each lower government level would be staggering. As it is, there is still a considerable cost in time and money for Monsanto and others to deal with all the separate countries where manufacturing and/or marketing will occur. The trend toward larger common market regulatory groups is generally welcomed and will probably hasten the availability of biotechnology innovations in smaller countries.

Role of Government in Biotechnology Innovation

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INTRODUCTION

In Hungary, there is a broad debate on the role of the government in the economy. Under a centrally planned economy, the government's main task is to control the economy at any price. This form of government economic management is at the opposite extreme of complete "laissez faire" economic policies, which many Hungarian economists now propose. Taking the middle road, some economists believe that the government should serve the economy, but not control it. Hungary is certainly in the process of learning.

The government's role in the field of biotechnology development is an interesting case study because of its growing economic importance and because of the degree of regulations associated with it. In the last decade, biotechnology has become an area of particular attention in Hungary as well as in COMECON and the developed industrial countries.

GOVERNMENT BIOTECHNOLOGY POLICIES

The governments of both the East and the West endeavour to exploit biotechnology's scientific and technical potential. Based on new achievements, they expect that biotechnology production will increase and profitable new undertakings will arise.

Although there are no clear patterns in government biotechnology policy, the general principles are identical. Biotechnology is regarded as an important factor in structural economic change and international competitiveness, so its development is a priority in national economic policies. Individual government biotechnology policies, as well as institutions destined for enhancing biotechnology development, widely differ from one country to the other. The factors influencing

biotechnology development are organic parts of political, economic, and cultural traditions. The following factors are considered by governments in developing biotechnology- related programs and institutions:

- The possible sphere of government action in biotechnology development
- The level of development of traditional and new biotechnology bases
- The sectoral structure of the economy, the state of development, production traditions in industries exploiting new results of biotechnology
- The role of new biotechnology accomplishments in solving actual economic and social problems, such as protecting the environment and improving health care
- The international competitiveness of biotechnology
- The possible volume of government resources on biotechnology development
  - the state of cooperation between universities, laboratories, firms, and institutes engaged in biotechnology research;
  - the development of infrastructure;
  - biotechnology specialists in the country.

BACKGROUND ON BIOTECHNOLOGY DEVELOPMENT IN HUNGARY

In several specific areas, Hungary's biotechnology has a good international reputation and has achieved promising results. An example is the pioneering work at József Attila University in elaborating the protoplast fusion technique and improving the productivity of industrial microbial strains. The Biological Center of Szeged (SZBK) is also a pioneer of Hungarian biotechnology.

SZBK was founded in 1971 with the aid of the United Nations Development Program (UNDP). It comprises 5 research institutes and employs 300 people. In its first years the research conditions were very good. Also, the average age of researchers was 30, all of whom were sent to foreign research institutions where their research topics were further cultivated. SZBK spent considerable sums on research and part of the UNDP allotment was given to the researchers in hard foreign currency so that they could obtain necessary materials. This effort had its rewards as SZBK became a forerunner in many areas of biotechnology, such as molecular biology and molecular genetics.

Despite some positive results, Hungary's research on biotechnology has been retarded by a number of factors. First, compared to industrialized countries, Hungary's central economic management was late in realizing the importance of biotechnology. Another problem was that the Council of Ministers initiated the biotechnology development program, not the research institutions or firms. Upon the request of the Council of Ministers, in 1982 the MTA formed a commit-

tee with the Ministry of Industry, the Ministry of Agriculture and Food, and the National Committee for Technical Development to survey the results and prospects for the biotechnology development. The committee concluded that Hungary had not yet missed the chance of joining the international competition in this field. Unfortunately, this committee's program recommendations were not followed by government measures that could have given an impetus to the development of biotechnology. Some measures encouraged biotechnology-related activities, but others continued to block them.

FINANCING BIOTECHNOLOGY ACTIVITIES

After 1982 the volume of resources earmarked for biotechnology R&D gradually increased and it was subsidized by various government programs. Venture capital, which would suit the credit requirements of biotechnology activities better than government funding, has been used rarely.

As part of the 1983 National Medium-Term Research and Development Plan, a central biotechnology R&D program (called A/16 and after 1986 G-3) was launched. Between 1983 and 1985, FT 140 million was earmarked for this purpose, while FT 1.8 billion was allocated for the period 1986-1990. Biotechnology R&D was also financed from other medium-term R&D programs as well as from the National Scientific Research Fund. Programs launched by the Ministry of Agriculture and Food also have included biotechnology research projects, and the Ministry of Education and the Ministry of Health each have supported several biotechnology projects as well. One sub-program of the Ministry of Industry's T-3 program aimed to advance the domestic manufacturing of biotechnological equipment.

Between 1986 and 1990 a total FT 4.5 billion was spent on biotechnology purposes, 70% of which came from central sources (the state budget and the central technical development funds of economic organizations). This sum was much larger than the comparable expenditures of the previous five years, but still did not reach the critical volume required to bring breakthroughs in biotechnology development.

The two bodies most involved in the development of biotechnology, the Ministry of Industry and the Ministry of Agriculture and Food, formed scientific consulting teams and contributed to the establishment of biotechnological research centers. Unlike other countries, the Ministry of Health (i.e. the medical sciences) did not join the major biotechnological programs. This has been a grave shortcoming of Hungary's biotechnological program.

In the last decade, there have been changes in the distribution of research and development resources, but more modifications are needed. There have been some steps away from simple institutional financing towards a competitive grant

system. Several elements of this new system, however, have put into question the advantages resulting from the transformation of the financing mechanism:

- Only a part (40-50%) of resources allocated under central R&D programs were grants, while the rest were essentially interest-free loans.
- Considering the size of the domestic research network, it was impossible for review bodies to be impartial.
- Problems of ownership of state-subsidized research have yet to be solved. Unlike other countries, research results in Hungary are owned by those doing the research and not by those financing it. For example, the Protein and Biotechnology Division of the National Committee for Technical Development could not have the right of ownership over results of research backed by it even if it covered most or, as in the case of certain university research projects, all of the relevant expenditures.

Research institutes and educational establishments have been increasingly forced to conclude research agreements with companies. This cooperation has advantages for those institutions and individuals engaged in applied research, but at the same time it has adverse impacts on research institutes and university departments engaged in basic research. Universities have begun to give priority to applied research, which, as neglecting basic research inevitably does, leads to lower education standards.

Therefore, it is not surprising that certain patterns emerged in the distribution of money among central R&D programs. Industry, agro-business, and infrastructure were granted roughly equal sums from the G-3 program. A "remarkable" feature of the T-3 program was that the three big pharmaceutical firms were given nearly identical sums. Part of the funds distributed by National Scientific Research Fund financed the basic needs of institutions.

In February, a new R&D financing system was introduced by the National Committee for Technical Development. There are no separate central development programs for specific fields, such as biotechnology and electronics, as there is one central R&D program with one central fund, the Central Technical Development Fund. However, some biotechnology fields were listed as priorities.

BIOTECHNOLOGY AND ECONOMIC REGULATION

The current economic regulations have failed to effectively manage biotechnology or encourage its development. Because of the current fiscal policy, most firms have only set short-term goals. However, as the majority of biotechnology investments only pay off in the long term, few firms are willing to risk investments in biotechnology.

It should also be noted that biotechnology activities do not enjoy any tax allowances, so research teams and firms pay taxes on their R&D activities just like any other economic area. For these reasons, it is not surprising that according to a survey, 30% of R&D funds were spent on purposes besides research, such as taxes and partial repayment of central subsidies.

One precondition for providing a sound environment for technical development is that companies function as centers of innovation. Despite the long-heralded economic policy guidelines, companies are still unable to exert themselves in the area of scientific research. In most companies, money earmarked for development is insufficient even for a simple reproduction. With this level of support, not even domestic or foreign demand could guarantee the practical application of a promising scientific achievement. The financial positions of some biotechnology companies forced them to sell their technology and sometimes all or part of the firm, like Meriklón and Chinoin have done, to foreign companies.

PATENTS

Parallel with the emergence of new findings and the acceleration of biotechnology development, the entire problem of protecting intellectual property gained attention. This issue cannot be solved within the original framework of patent rights. There are no special patent regulations related to biotechnology inventions in Hungary, and this means the role of the legal system is too unpredictable. Currently the most hotly debated question is about the patent protection of living organisms and new biotechnological objects, such as vectors.

Apart from this, there are other features of the Hungarian patent system that in the long run may hamper the development of biotechnology. Currently the patent system performs a function it should not. Patents are often used as a means for specialists to receive extra income over and above their low wages. As not all inventions are classified as corporate inventions, researchers are paid for their patented invention until the protection expires. So, until the patent expires, they are not interested in replacing their own inventions with more advanced achievements.

As for the procedure of patent registration, Hungary is one of the most exacting countries in the world. Its patent law requires "full examination" of novelty, progressive or technical nature, and formal requirements. The administration of patents is time-consuming and cumbersome. It may take 5 to 7 years until a biotechnological patent is granted and, considering the pace of worldwide development, this can be a serious obstacle for research work in Hungary.

MEASURES TAKEN TO COORDINATE SUPPLY AND DEMAND

Because of limitations imposed on the operation of market mechanisms, during the last decade central economic bodies played an active role in balancing financial possibilities and actual funds. Their measures, however, lacked the necessary flexibility, bearing the indelible mark of red tape, or they were often confined to help weaken constraints caused by mechanisms established by another official body. Program offices, for example, often undertook coordination tasks that should normally have been performed by commercial organizations. So the government in Hungary has played an active role in establishing the industry for biotechnology inputs. The most meaningful of those measures was the above-mentioned program of the Ministry of Trade, under which Ft 379 million between 1986 and 1990 was set aside for establishing the engineering and instrumentation background for biotechnological R&D.

PROVIDING FOR SKILLED LABOR

In Hungary there are far fewer biotechnology specialists than needed. Neither research institutes nor companies can fill their vacancies. Part of the problem is that university admission quotas are too low; only 10% of secondary school graduate are accepted into universities. The number of biotechnology graduates has increased over the past decade, but it is too little and too late. There are some examples of successful programs. The Department of Agricultural Chemical Technology at the Budapest Technical University provides an example of a good response to the challenges posed by biotechnology. As early as 1970 the department organized a fermentation research group and began training biologist-engineers in 1974. In the field of post-graduate education, the National Committee for Technical Development finances extension courses for company specialists through its G- 3 program. Specialists from companies work and study with university research teams for one year and write a report at the end.

The Biological Center of Szeged has an important role in the educating specialists. One of its original aim was to train specialists for universities and industrial firms. However, this aim did not materialize because industry was unwilling to either financially contribute to the SZBK or to accept the trained specialists. Now, the SZBK has many problems because of its limited financial resources (the UNDP contributions ended during the 1980s). The history of this research center is very instructive for those who analyze the domestic development of new technologies.

There are also general higher education problems that affect biotechnology research. First, basic research institutes were separated from universities, which most research workers, university professors, and company experts consider a

mistake as research institutes have substantial capacities that could be used for educational purposes. Second, the real value of funds allocated for higher education has shrunk over the past years. Most universities have expressed the view that the funds granted by the Ministry of Education do no more than cover the basic costs of education. Finally, the special socialist method of selecting students has been practiced in the all educational fields, but this method is at its worst in the sciences.

However, merely streamlining the education system would hardly result in the proper number of biotechnology specialists in the right places. It should be noted that many specialists left the profession in the 1980s. This is because highly skilled people often leave their original job for one calling for lower qualifications but promising higher incomes, like in entrepreneurial activities. There are also more and more people who go to work abroad because of the deterioration of domestic income and research conditions.

CONCLUSIONS

The problems in the field of biotechnology embody the rigidity of the Hungarian economy. By international standards, its operation mechanism lacks proper incentives, fails to encourage progress, and even contains elements blocking development. It is clear that the conditions created by the current system of economic regulations and financing institutions do not reflect the declared goals of scientific and technical development.

Without a certain critical mass of positive efforts, there is little hope for changes in the development of Hungary's biotechnology. If conditions do not change, or at least, if encouraging developments do not soon take place in one of the essential fields (know-how, manpower, equipment, economic environment), then efforts in other economic fields may also be doomed to failure.

APPENDIX I

Itinerary
National Academy of Sciences
of the United States - Hungarian Academy of Sciences
Interacademy Workshop

GENERAL INFORMATION, DISCUSSIONS, FACTORY VISITS

April 22-23

Research Institute of Industrial Economics of the Hungarian Academy of Sciences
Ádám Török, Director

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Balázs Botos, Under Secretary of State

Ministry of Finance
Gusztáv Báger, General Director, Division of Economic Policy

National Committee for Technical Development
Sándor Bottka, Vice President
Lajos Nyiri, General Director, Head of Department of International Relations

Ministry of Labor Affairs
Katalin Nagy, Manager, Division of International Programs
Erika Nagy, Economist

State Property Agency
Péter Kazár, Deputy Director
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Ministry for International Economic Relations
Dr. Kund Bándi, Director, Foreign Investment and Trade Promotion Agency
Budaprint SECOTEX Textilfestő
Győző Zemplén, General Director

Kőbányai Sörgyár (Kőbányai Brewery)
István Németh, General Director
Ágnes Gasztonyi, Technical Secretary

Evening Discussion
Gyula Tellér, Member of National Assembly, SZDSZ

INTERACADEMY SEMINAR
"INDUSTRIAL STRATEGIES AND POLICIES FOR ECONOMIC GROWTH IN THE 1990'S"

April 24 - 26

Opening
István Láng, President, Hungarian Academy of Sciences

I. General Overview

Perspective Changes in U.S. Industry, Including Increasing Development of Global Markets and International Business Alliances
Mel Horwitch, Massachusetts Institute of Technology

Division of Labor Among Universities, Government and Industry in Supporting Innovation in the United States
George Schillinger, Polytechnic University

Barriers of Privatization in Hungary
Mihály Laki, Institute of Economics, MTA

Export Orientation of Hungarian Industry including Consideration of EC '92
Gyula Zeller, Janus Pannonius University

II. Role of the Government

Promoting Innovations by State and Local Government
L. Donald Shields, California Council on Science and Technology

Role of the Banking System in Hungary and Monetary Policies in the 1990's
Rezsó Nyers Jr. National Bank of Hungary

Role of the Government in Promoting Technical Innovations
István Dányi and Ferenc Nádasdi, Ministry of Industry and Trade

Role of the U.S. Government in Supporting Industrial Competitiveness
NAS Panel Discussion

III. Applied Reseach and Development

Fiscal, Tax, and Other Financial Policies that Affect Jobs and Innovations
Karen Fortin, University of Miami

Capabilities and Willingness of Hungarian Firms to Innovate
Gábor Hoványi, Institute of Industrial Economics, MTA

Effects of Privatization
Ben Slay, Bates College

Labor Implications of Industrial Restructuring
János Köllő, Institute of Economics, MTA

IV. Financing Private Sector Activities

Financing Entreprenuerial Activities and the Growth of Small Business in Hungary
Zoltán Román, Hungarian Small Business Association

Financing Entreprenuerial Activities from within the Firm
Lowell Steele, Private Consultant

Hungarian Experiences with Joint Ventures
Tamás Benedek, Insitute of Industrial Economics

Role of Venture Capital
Vince Tobkin, Sierra Ventures

V. Case Studies

Enterprise Crisis, Privatization, and International Challenges: The Case of a Major Hungarian Electronics Company
Ádám Török, Research Institute of Industrial Economics, MTA

Case Study of a U.S. Electronics Firm: Increasing Importance of Technology for Services
Graham Mitchell, GTE Labs

Case Study of a U.S. Biotechnology Firm
Robert Eltz, Monsanto Company

Role of the Government in Biotechnology Innovation
Veronika Frigyesi, Research Institute of Industrial Economics, MTA

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