

THE IMPLEMENTATION AND INTEGRATION OF INNOVATIONS IN SOVIET-TYPE ECONOMIES

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Introduction

Karl Marx believed that technological progress would flourish under socialism, once the capitalist fetters on production were burst asunder and the alienation of workers from the production process was removed. Oskar Lange argued that innovation would flower under his model of market socialism, because firms would have no motive to withhold innovation in order to preserve the value of old assets, as was the case with capitalist firms. Soviet spokesmen have long maintained that centrally planned socialism would prove superior in managing the innovation process, because it could centralize research and development, avoid wasteful duplication of effort and mistakes, remove all barriers to rapid dissemination of information, and mobilize resources to implement the most "progressive" new technologies.

Instead, decades of experience in the Soviet Union and Eastern Europe have shown that the institutions of centrally planned socialism have seriously fettered the innovation process. The result has been persistent technological lag compared with Western market economies. This situation, much deplored by the political leaderships in these countries, seriously reduces their ability to improve living standards of their people and limits the expansion of East-West trade. The lag is large and has been growing, at least in the past 15 to 20 years. Taking GNP per employed worker as a rough gauge of relative levels of technological development, we find that in 1987 the level of the USSR and Eastern Europe combined was about half that of the major OECD countries as a group; it was about 56 percent

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in 1960.¹ Consumption gaps are similarly large and have been widening in comparison with Western Europe and Japan. According to Jan Winiński (1988, pp. 142, 161), the share of these countries' exports of manufactures in total exports to the West has been low and falling, as has their average price. Finally, numerous studies of specific industries and technologies support these general conclusions.² To cite one example, the Birmingham in-depth study of eight key technologies found no evidence of a substantial diminution in the overall technology gap between the USSR and the West; in the science-based technologies (computers, electronics, advanced chemicals), however, the gap clearly had widened (Amann, Cooper, and Davies 1977, pp. 47–66).

Growing technological backwardness of Soviet-type economies relative to the West is not the result of their failure to allocate resources to the task. Shares of national product devoted to investment and education in Soviet-type economies tend to be large relative to countries at comparable levels of development, as does the share devoted to research and development (R & D) in the USSR (Hanson and Pavitt 1987, pp. 53–56). Rather, the explanation lies primarily in the economic institutions typical of these economies. Pervasive secrecy and lack of personal and civic liberties, along with the collectivist bias of political ideologies, are contributing factors. The key institutions that directly affect the innovation process are public ownership of property, central dictation of outputs and allocation of material and capital inputs, hierarchical organization of the production and distribution process, administratively determined prices, and a system of incentives tied to meeting production targets. Curbs on freedom have limited the exchange of technical information so critical to innovation. The collectivist bias manifests itself in a revealed preference for subordination of individual interests to those of society, for collective rather than private endeavors, and for formal cooperation rather than free competition in the economic process.

Since the mainspring of technological progress is innovation, defined here simply as the discovery, development, and diffusion of new production processes and products, we need to know why socialist institutions and ideologies have proven so inimical to rapid innova-

¹Calculated on the basis of data given in CIA, *Handbook of Economic Statistics, 1988* (CPAS 88–10001, September 1988), pp. 30–31, 48–49, 58. For similar estimates of the gap, see Bergson (1987) and Bolotin (1988, p. 134).

²With regard to the USSR, see Amann, Cooper, and Davies (1977); Amann and Cooper (1982); and Hanson (1981, pp. 39–48). Many other sources are cited in Hanson and Pavitt (1987, pp. 68–76). With regard to Eastern Europe, see Hanson and Pavitt (1987, pp. 71–76), Gomulka (1985), and Poznansky (1988).

tion. This theme is treated in many different ways in a vast and largely uncontroversial Western literature.³ In recent years, Soviet and East European scholars also have been saying many of the same things. Economic reforms perennially introduced in these countries in recent decades have attempted to remove the sources of the drag on innovation. This paper focuses on economic institutions and the impact they have had on the behavior of organizations, firms, and individuals. It first examines the innovation process and its consequences in the socialist centrally planned economy as exemplified by the experience of the Soviet Union and Eastern Europe, then considers the reasons why successive waves of economic reforms have failed to change the outcomes in any significant way, and finally examines the latest spate of reform programs and the likelihood of a breakthrough. For specific details, we refer to the Soviet Union for the most part. While institutional details differ among the countries of Eastern Europe, their experience has been similar to that of the USSR.

The Innovation Process and Its Consequences

Since Soviet-type economies lack a spontaneous mechanism to generate technical progress, most innovations must be "introduced" into the economy administratively. The mechanism for accomplishing this task has been the annual and five-year economic plans. In turn, an organizational structure has had to be created to formulate and implement the plans and to monitor the results. Since business firms—the producers and users of new technologies—could not be counted on to behave like robots, incentive schemes had to be devised to enforce the center's priorities.

Organization for Innovation

Innovation has been directed from the center. Typically, the key players have been a State Planning Committee, a State Committee for Science and Technology, and numerous ministries delineated by branch of industry and sector (ferrous metallurgy, machine tools, construction). Interacting with one another and with academic research institutes, these central agencies have had to forecast scientific and technological developments; select the technologies and products to be introduced via the plans; estimate the concomitant requirements for trained personnel; assign R & D tasks to appropriate institutes typically subordinated to ministries and allocate the necessary

³See, for example, Berliner (1976); Amann, Cooper, and Davies (1977); Amann and Cooper (1982); Hanson and Pravitt (1987); Gomulka (1986); Hanson (1981, pp. 49–80); and Levine (1983).

resources; assign to enterprises the tasks for producing new machines and products and for introducing new processes and allocate the necessary resources; establish new institutes and enterprises as required; establish the structure of rewards and penalties for complying with assigned tasks; fix the rules for pricing the innovations; and devise ways to assess the results. Out of sheer necessity, this gargantuan task has become routinized and thoroughly bureaucratized.

This "center knows best" approach to innovation has proved to be seriously defective. Many aspects of technological backwardness of the Soviet-type economies stem from such a predilection. The process of scanning the technological frontiers, selection, prioritization, and choice of executants by higher government echelons has imparted a strong conservative bias to innovations and fostered uniformity rather than diversity. Thus, despite a relatively large R & D resource base, innovations have tended to be imitative of developments abroad rather than reflections of domestic discoveries. They also have tended to be evolutionary and incremental rather than revolutionary in nature. Ministries have been instructed to implement a "uniform technical policy" for their sectors and have been motivated to do so. Because central planning needs stability and predictability to produce even tolerable results, agencies have shown a strong proclivity to shun the radically new and to suppress major spontaneous innovations from below that might prove disruptive. The innovative process has been overwhelmingly supply-driven, with little of the feedback and impetus from the demand side that has driven innovation in the West. Centralized management has resulted in an inordinate prolongation of the discovery-development-implementation process, so that many innovations are already obsolete by world standards when introduced. In the USSR, for example, lead times typically are more than double those in the West.⁴ This holds true, although to a somewhat lesser degree, for technology purchased abroad.⁵

Central administration of innovation has had other adverse consequences. Because the administrative task is eased when the number of units is small, both R & D and production have tended to become ever more concentrated; the administrative factor has been reinforced by the planners' conviction that greater concentration always brings greater efficiency. But concentration has resulted in monopoly in many areas and a near absence of the numerous small

⁴See, for example, Hanson (1981, pp. 39-43), Martens and Young (1979), and Zaichenko (1988).

⁵See Hanson (1981, pp. 186-208). Evidence for Eastern Europe is given in Winiecki (1988, pp. 171-204).

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firms that have hastened innovation in the West. In addition, planners have been prone to introduce major new technologies by establishing large new firms, but the diffusion of these technologies to older firms has been slow and difficult to manage. Although the USSR has established an All-Union Institute for Scientific and Technical Information to centralize the collection of knowledge from abroad, the lengthy process of dissemination to potential users often renders the knowledge obsolete. Moreover, organization of the innovation process through sectoral ministries has created serious barriers to the transfer of information outside the sector and hampered the diffusion of technology across ministerial lines.

A notable feature of the organization of R & D is the separation of the activities of the numerous research and design organizations from the introduction stage of the innovation cycle. Typically subordinated directly to industrial ministries, these organizations have little or no contact with the ultimate producer of the technologies they are developing; indeed, the ministry typically selects a producer only after a project has been completed. Designers are similarly cut off from potential users of the end product of their design. All this has given a kind of "ivory tower" atmosphere to this stage in the innovation process, with consequent delays, mismatches, and waste of effort. The mission-oriented institutes exist to serve their respective sectoral ministries and tend to be isolated from developments in related areas. Similarly, selection of potential producers and users of a new technology tends to have a "departmental" bias, as Soviet sources would describe it.

The services performed by research and design organizations usually have been priced at the cost of the labor and materials involved or more recently on the basis of the estimated "useful effect" expected from the project (Bornstein 1984). The first approach provides no incentive for efficiency, and the second leads to exaggeration of the price of such services. Inventors (individuals or groups) may patent a novel technology, but the patent certificate (at least in the Soviet Union) carries no right to exclusive use; rather, the inventor is paid a lump sum fee related to the estimated "useful effect" of his invention, with a low ceiling imposed (Martens 1982). The employees of research and design organizations typically are paid salaries in accord with centrally set scales. Bonuses have been related to fulfillment of the organization's budget rather than to completion of projects, an arrangement that encouraged proliferation of projects. Employees of design agencies often were rewarded by the number of designs, which encouraged triviality and low quality. Efforts to shift the basis of rewards to potential or actual "economic effect" of the individual's

or group's work have not solved these problems and have created their own perversities. Finally, a relatively egalitarian approach typically was used in the distribution of group rewards among members.

The Position of the Business Firm

Probably the most serious drag on rapid innovation in Soviet-type economies is to be found in the behavior of the enterprise. The socialist business firm has turned out to be notably risk-averse, as predicted some 70 years ago by Ludwig von Mises. As he put it, a firm's behavior stems from its "position in the economic process." In Soviet-type economies, the firm is state-owned; as a consequence there are no capital markets for bundles of assets (shares in firms), and the *usus fructus* property rights accorded the firm out of administrative necessity have been greatly attenuated. The firm has not had to find customers for its products or seek suppliers for its material inputs. Its capital has been provided free or at a nominal charge, and funds for expansion or modernization have been based largely on investment decisions taken by the central planners. Organizationally, the firm is formally subordinated to its ministry, which plays a crucial role in the fortunes of both the firm and its managerial personnel. It has had little leeway either in fixing the prices for its products or in deciding the disposition of its profits. Finally, firms have had to function in an economic environment of taut planning and in a perennial sellers' market.

The firm's position, however, has been one of extraordinary security, necessitated by the logic of central planning and allocation of resources (McAuley 1985). Because economic competition has been absent, the firm need not fear a loss of market shares to others. If its products are of low quality or obsolescent, they could be "sold" anyway through the allocation process. The firm's principal routine problem has been to obtain essential supplies from chronically malfunctioning distribution channels. But the firm's manager knew he could count on assistance from his superiors in the hierarchy, as well as their tolerance of a network of informal ties, often semilegal or illegal. If the firm failed to make the planned level of profits, or even made losses over a protracted period, it could count on the banks and the bureaucracy to pay its bills or write off its debts. Bankruptcy posed no threat, even though the laws permitted it. Thus, the firm faced a soft budget constraint. With such an institutional environment, it should not be surprising that business firms have shied away from innovation "as the Devil shies away from incense," as Leonid Brezhnev once put it.⁶ Rather, one might marvel that the centrally

⁶*Pravda*, 31 March 1971.

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planned economies did as well as they have in generating technical progress.

Having sketched the institutional framework, we next examine some specific features that explain the enterprise manager's behavior with regard to innovation. Despite the centralized approach, the authorities did permit and even encourage firms to be innovative both within and outside the plans. In practice, however, spontaneous innovations typically have been undertaken to cope with chronic supply problems and only if they could be concealed from the authorities. If revealed, cost-cutting or output-enhancing innovations would lead to higher plan targets in the future—the consequence of the “ratchet” approach to planning (Furubotn and Pejovich 1974b).⁷ The manager's ability to implement spontaneous innovations, though, was limited by a deficient supply of information about technological opportunities and uncertain access to requisite material inputs, which might be different or of higher quality than his routine allotments. If his firm's own research laboratory came up with a promising new product that was patentable, implementation had to await successful clearance through the bureaucracy—a slow and uncertain process. When foreign technology was purchased, the firm not infrequently found that the new machine did not fit well in an old plant, that employees had to be trained to use it, and that needed auxiliary materials were not available domestically. Problems such as these contribute to a pervasive attitude that innovation is not worth the bother.

Perhaps the greatest impediment to innovation at the level of the firm, however, lies in the system of incentives—the risk/reward assessment that the manager has to make. Typically, the success of the firm and the bonuses of its managerial staff have depended on its ability to meet plan targets for output, measured variously (gross value of output, sales, physical units) and calculated monthly, quarterly, and annually. The bonus rules were structured so as to impose a heavy penalty for even a small underfulfillment of target, a sizeable reward for meeting the target, and only a small reward for going above it (which was deterred in any case by the threat of the “ratchet”).⁸ Introducing new machines, processes, and products disrupts production routines, as production lines are shut down while the novelty is assimilated. The disruption is likely to be greater, the more radical the innovation. Thus fulfillment of the production plan is jeopardized.

⁷Gomulka (1986, pp. 15–16) makes a similar point with regard to East European experience.

⁸These matters are discussed in depth in Berliner (1976, pp. 397–423).

dized, along with the bonuses for managers and workers. The assorted special bonuses directly rewarding innovation did not provide sufficient offset. So risk-averse managers dragged their feet. Even if an innovating manager somehow avoided plan shortfall, his reward was small and the risk large. Not being an owner, he of course could not capture reward through enhancement in value of the firm's assets.

A further deterrent to efficient innovation in enterprises stems from the inability to assess the real payoff, given the pricing distortions that prevail in the Soviet-type economies. Indeed, the pricing rules that pertain to new products have encouraged spurious innovations and contributed to inflation. As noted earlier, new products are priced either at cost plus a fixed profit markup or on the basis of estimated "useful effect." Faced with strong administrative pressure to produce new products, managers have been led to make minor changes in old products, classify them as "new," and assign them high prices. This practice facilitates meeting output plans expressed in value. Spurious "new" machinery finds customers anyway, because they have little option, and incentives to minimize investment costs are weak. On the other hand, pricing rules have deterred the introduction of genuine new products, especially when economic reforms have raised the importance of profits in the manager's calculus. He often finds it much more profitable to produce old products with high "permanent" prices set when they were new and low current costs resulting from mass production.

Finally, firms in socialist countries have not been spurred to innovation by the threat of competition, either domestic or foreign. While rewards to innovating firms have been small, the penalty for the non-innovators has been largely absent. The "invisible foot" (Berliner's words) of competition for survival that has been a powerful spur to innovation in market economies has been lacking; the substitution of "socialist competition" and administrative pressure has not been an effective substitute. With foreign trade planned by the center, firms have not had to compete for planned exports, and imports have been arranged to supplement rather than replace domestic production.

The Treadmill of Reforms in Soviet-Type Economies

During the 1960s and 1970s, both the Soviet Union and the countries of Eastern Europe were engaged in varying degrees in a seemingly endless process of modifying the institutions and working arrangements of socialist central planning.⁹ These economic "reforms" were

⁹There is a large literature on these reforms. For the USSR, see, for example, Hewett (1988, pp. 221-56) and Schroeder (1979, 1982). For summary treatment of Eastern Europe, see Bornstein (1977) and Lavigne (1975).

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aimed at raising efficiency in general and obtaining a product mix that better satisfied both domestic and foreign customers. An explicit objective of the reforms, however, was to speed up and make more effective the introduction of new technologies, processes, and products. This focus was particularly evident in the 1960s, when the political leaderships in these countries became aware that their economies were only feebly benefiting from a "scientific-technological revolution" that they perceived to be taking place in the West.¹⁰ Although technological borrowing was seen to be essential, the reforms aimed to create a milieu more conducive to the effective introduction, adaptation, and rapid diffusion of foreign technology as well as to spur indigenous innovations. Although the reform programs differed among countries in timing, specific provisions, and extent of implementation, they took similar approaches in regard to making the innovation process more effective. One common approach was to reorganize structures concerned with scientific-technical progress at various levels in the administrative hierarchy. Another common theme involved measures designed to improve the process of forecasting scientific and technical developments and planning for the implementation of targeted "progressive" innovations. A third feature concerned attempts to find more effective incentives for researchers and designers of new products. Finally, most of the reform programs included provisions to revise incentives at the enterprise level to overcome the manager's manifest aversion to doing something new. The reform programs often were modified in the process of implementation because they were not yielding the desired results, most prominently on the innovation front.

To give insight into the approaches taken to solve the innovation problem in these reform programs, we take the case of the Soviet Union. There, the major reforms that directly or indirectly addressed the innovation process occurred in 1965, 1968, 1973, and 1979. The 1965 reforms applied generally to the industrial sector, and the 1968 reforms applied them in detail throughout the R & D and innovation process.¹¹ The thrust of both decrees, however, was to retain the *idee fixe* that the process must be managed from the center. The 1965 reforms created a seemingly powerful State Committee for Science and Technology (Gostekhnika) charged with overseeing and facilitating innovation throughout the economy. Together with the State Planning Committee (Gosplan) and the newly restored industrial

¹⁰For an in-depth assessment of the political factors involved in managing technical progress in the Soviet Union, see Parrott (1983).

¹¹For details, see Nolting (1976).

ministries, Gostekhnika was directed to prepare long-term forecasts of scientific-technical developments to provide a "scientific" basis for the annual and five-year economic plans. Coordinated and integrated programs were to be prepared in detail and incorporated in a separate section of the plans, something not done earlier. Programs deemed most promising were to be accorded priority, planned in detail as separate "complexes," and implemented through appropriate plan targets and resource allocations to R & D organizations and enterprises. The 1979 decree, in effect, reiterated these approaches, placing even more emphasis on the importance of planning and implementing scientific-technical programs through these "complexes."¹²

The several reforms also reflected a conviction that revisions in organizational forms held the key to solving the innovation problem. In addition to establishing Gostekhnika, the reform decrees, particularly the 1968 decree, made several changes in the way the R & D stages of the innovation process were organized. One set of changes aimed to put under a common management all research and design institutes engaged in developing specific lines of related technologies (e.g., for improving the technology of steelmaking); such "complex scientific research institutes" were subordinated to individual ministries. A second organizational innovation addressed the rift between R & D and production long characteristic of Soviet arrangements. A new form—the Science-Production Association—was created to integrate research institutes, experimental facilities, and production units under a single management. In theory, these associations, each directed by a head research institute, were to focus on the development and introduction of new technologies into production rather than on production alone. At the end of the 1970s, there were some 200 such entities subordinate to particular ministries, mostly in the machinery industries.¹³

The 1968 decree also introduced complicated arrangements for financing R & D, for carrying it out, and for rewarding performers. Essentially extensions of earlier initiatives, these arrangements called for a reduced role for the state budget and a greater role for clients in financing projects; for making research institutes independent and self-financing; for a large-scale extension of contracting between performers and customers; and for evaluating performance and

¹²For details, see Bornstein (1985).

¹³For a good discussion of the experience with these associations and with organizational approaches in general, see Cocks (1983).

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rewarding employees in accord with the estimated "economic effect" of their work.

With regard to the industrial enterprise, the 1965 reforms aimed to fundamentally alter its traditional attitude toward innovation by granting it somewhat greater leeway for decisionmaking, especially in the areas of managing its labor force and small-scale investments; reducing the number of centrally set plan targets; establishing new enterprise investment and bonus funds formed from profits; and tying the size of these funds and the bonuses of managers to success in meeting plans for sales and profitability. The underlying premise was that the focus on sales would spur managers to improve quality and produce new products to please customers and that the greater stress on profits would induce managers to cut costs by adopting new technologies. Also, possession of the firm's "own" investment fund was supposed to encourage managers to buy new machines and to be more demanding about their quality.

When these hoped-for gains were not evident, the government responded with a stream of reforms of the reforms. In 1973, new rules required enterprises to meet fixed targets for raising the share of high-quality (mainly new) products in total production and added that target to the list of determinants of incentive funds and bonuses. Various changes were made in the rules for pricing new products. Ministries were allowed to set up funds to compensate innovating enterprises for losses in bonuses during the course of mastering new production techniques or products. The 1979 decree required ministries and their subordinate firms to shift to complete self-financing of all outlays, with profits to be shared between the ministry or firm and the state budget in accordance with specified rules. This scheme met stiff opposition and was only partially implemented.

These many alterations in organizational forms and the rules of the game over some two decades failed to produce a more technologically dynamic economy, and the gap with the West evidently widened. The new organizational forms and incentive arrangements soon became enmeshed in the routine of central planning, which was made even more difficult by the penchant for grafting the separate planning of assorted "complexes" onto established procedures. Firms behaved much as before with regard to innovations. Indeed, by increasing uncertainty, the frequent alterations in rules may have made managers even more risk-averse. The failure of the many alterations—each seemingly sensible in itself—to achieve their overall objectives stems from the fact that, taken as a whole, they left the system intact. Most important, the position of the business firm in the economic process was not changed in any essential way. The

firm's property rights were the same, its production autonomy became even more fettered, it faced no competition, and its incentives remained oriented toward pleasing administrative superiors rather than customers, with whom it still had little contact in any case. This unfavorable institutional environment also hampered the assimilation and diffusion of Western technology that was imported in large quantities during the period.¹⁴

While the reforms in the Soviet Union amounted to mere tinkering with the system of socialist central planning, one East European country—Hungary—introduced sweeping changes that seemed to have the potential to create a new system conducive to faster technological progress. The New Economic Mechanism (NEM) introduced in 1968 appeared even radical. It abolished directive targets for firms, forced them to find their own customers and suppliers, made price-fixing more flexible, tied the firm's success and viability to its profits, introduced profit-sharing, and permitted firms to engage in foreign trade. The idea was to create a "socialist, regulated market economy," in which Hungarian firms were expected to behave relative to innovation as they did in the West. But after a dozen years of the NEM no breakthrough had been achieved. Using a framework developed by Christopher Freeman (1982), Hungarian economist A. Abonyi (1981) concluded that the reforms failed to create three essentials for an innovative industrial sector: a strong scientific and technically oriented environment for firms, a strong professional in-house R & D capability, and the presence of compatible technological levels in backward and forward linkages.¹⁵ Abonyi attributes this failure to the continued large role of the central planners in R and D and investment, the many conflicts among regulating agencies and their regulations, and a continued orientation of enterprises toward bargaining with government agencies rather than toward the market. Tamas Bauer (1984, p. 53), a leading Hungarian economist put the outcome thus: "We have departed from the system of plan directives, but have not arrived at the harbor of a regulated market economy."

The "Radical" Reforms of the 1980s

Still another wave of economic reform has now engulfed the socialist countries. Beginning in the early years of this decade, Hungary modified its NEM through successive legislative acts, permitting more privatization and attempting once again to create a market

¹⁴See Hanson (1981, pp. 186–210) and Hanson (1985).

¹⁵See also Comulka (1986, pp. 49–50).

environment for state enterprises (Marer 1986). In Poland, Hungarian-type reforms have been introduced in stages by legislation, although practical implementation has been severely hampered by political factors (Fallenbuchl 1988). In the second half of the decade, these pioneers were joined by Bulgaria, Czechoslovakia, and the Soviet Union with programs that closely resemble one another. In all countries, the reforms aim to remove the barriers to innovation that have characterized their economic systems in the past, particularly at the enterprise level. The architects of the reforms declare that this task is to be accomplished by creating a competitive market milieu for business firms in an economy that, nevertheless, is to remain "socialist." We examine the innovation-accelerating potential of these reform packages as now adopted, taking the Soviet Union as a case in point. We also look briefly at Hungary.

Soviet Reforms—Description

Since becoming General Secretary in March 1985, Mikhail Gorbachev has launched a self-styled "radical" economic reform that is "revolutionary" in nature. The reforms are designed to attack head-on the problem of the USSR's relative technological backwardness and the threat it poses to its status as a superpower and as a model for successful socialism. Gorbachev puts the matter directly: "In our country, scientific and technical progress is slowing down . . . mainly because of the economy's lack of receptiveness to innovation. . . . The chief question for the theory and practice of socialism is how, on a socialist basis, to create more powerful stimuli than under capitalism for scientific-technical and social progress."¹⁶ The provisions of the reforms are laid out in a set of General Guidelines, 10 government decrees, and a Law on the State Enterprise, all adopted in mid-1987. They are to be fully implemented over the next several years.¹⁷ With regard to the development, introduction, and diffusion of innovation, the provisions of these documents alter the approach to central planning, create new organizational forms, and substantially change the milieu of business firms. Other legislation significantly enlarges the scope for economic activity by private individuals and producer cooperatives.¹⁸

In accord with the stated intent to "strengthen centralized planning," the reforms enlarge the role of central agencies in shaping the

¹⁶*Pravda*, 26 June 1987.

¹⁷The complete package of reforms is described in Schroeder (1987).

¹⁸*Pravda*, 21 November 1986 and 8 June 1988.

direction of technical progress. Gosplan is required to develop a 15-year "prospectus" for planning that is to be based on scientific-technical forecasts made by the Academy of Sciences and other responsible agencies. Gostekhnika is required to incorporate these forecasts into a "Comprehensive Program for Scientific and Technical Progress," made for a 20-year period and revised periodically. The central agencies are to select the "most promising" programs to be incorporated into the 15-year prospectus and implemented through 5-year and annual plans. Gostekhnika is required to monitor the scientific and technical (S & T) programs of ministries to ensure their orientation toward achieving world levels for key technologies; and ministries, in turn, are to monitor such activity at enterprises.¹⁹

Besides demanding a sharp rise in the number of science-production associations, the reforms sanction two new organizational forms intended to better integrate R & D and production and to remove bureaucratic barriers to development of technologies that involve several ministries. One form is the State Production Association, an intersectoral body organized to integrate all phases of the research-production-marketing chain for groups of products (e.g., materials handling equipment). The other form is the Inter-branch Scientific-Technical Complex, a collection of research institutes and production enterprises put together to develop selected critical technologies, such as robotics. The reforms also have created several overarching sectoral Bureaus (Energy, Machinery) which oversee, among other things, all ministerial S & T programs for the sector. A new State Committee for Computers and Information Sciences also has been established. Finally, the ministries, while being enjoined to eschew petty tutelage over enterprises and having their staffs sharply reduced, are explicitly made responsible for "ensuring that the product meets world technical and quality standards" and for "developing and implementing branch S & T programs."²⁰

The reforms aim to make business firms more receptive to innovations spearheaded from above as well as to encourage spontaneous innovation from below. The new Law on the Enterprise greatly enlarges the production autonomy of firms. The firm now formulates its own production and sales plans on the basis of mandatory state orders and contracts it has concluded with customers and suppliers. State orders, however, are to include "very important types of new products." State orders are supposed to be placed on a competitive basis, and firms supposedly will have to compete for sales of their

¹⁹For details on these "new" approaches and organizations, see Cocks (1989).

²⁰*Pravda*, 1 July 1987.

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remaining production. Firms are also now permitted to engage directly in foreign trade and to retain a portion of hard currency earnings from exports to finance desired imports. "Guided by the uniform technical policy of the branch," firms are allowed to set up in-house R & D facilities and to contract for such services with any supplier. Firms are required to finance all of their operations, including most investment, from sales revenues; if they persistently make losses, they can be declared bankrupt and liquidated. Profits are shared with the state budget on the basis of fixed percentages (normatives), and such normatives also regulate wage payments and the distribution of retained profits. Although the state still sets prices for all important products (fixed for 5 years), firms are allowed to negotiate contract prices and to fix prices for other products, subject to central guidelines and monitoring. Supposedly, the firm also can formulate and implement its own investment program and can negotiate with the banks for financing. The firm remains state-owned and formally subordinate to its ministry, which fixes the rules for awarding managerial bonuses. Finally, the reforms mandate the creation of Enterprise Labor Councils with considerable decisionmaking authority, especially with regard to the use of enterprise incentive funds, and require the workforce to elect managers from the enterprise director to shop foreman, subject to ministry approval with respect to the director.

Soviet Reforms—Evaluation

Gorbachev's package of reforms will not bring the technologically dynamic economy that he so much wants. Although they move in a direction conducive to spurring innovation, the reforms do not adopt fundamentally new approaches or abolish any of the institutions that have fettered innovation in the past. Bureaucratic determination of the directions of technological development and management of the implementation of new technologies are retained and even reinforced. At least in this critical area, the Soviet leadership evidently has no faith in decentralized processes. The new organizational forms set up to plan, coordinate, integrate, and monitor the innovation process can only make matters worse. In particular, the existence of so many overlapping organizations charged with managing technological progress is likely to create massive confusion. Most critical of all, however, is the fact that, despite all the rhetoric about creating competitive markets, the reforms do not do so, and the status of the business firm is not fundamentally altered. Therefore, its behavior in regard to innovation is unlikely to change much. While the firm is accorded nearly complete freedom to innovate, its ability to do so will be hampered by the problems it will have in obtaining materials

and labor of the required quality. Similar factors will limit its ability to use its expanded investment authority and funds to upgrade its capital stock with machinery of modern vintage, for firms that might produce such new machinery will face similar problems.

The reforms also do not create the powerful incentives, both positive and negative, that drive innovation in a market economy. Production in Soviet industry is highly concentrated already, and the assorted amalgamations fostered by the reforms likely will increase the extent of monopoly or oligopoly. While the ministries are enjoined to "prevent monopoly behavior" by their firms, competition is not created as a consequence. Unless Soviet foreign trade policy changes radically, firms also will not face significant import competition. While the newly authorized producer cooperatives, which have been given wide latitude, are supposed to provide competition for state enterprises, cooperatives hardly will be large enough to operate in sectors that matter most for technical progress. By providing small-scale services, however, they might increase the ability of state firms to innovate. As now, managers of state firms have no ownership stake in the firm. Successful entrepreneurs cannot become rich or have their services bid away because of market appreciation in the value of the firm's assets. Conversely, laggards are not penalized; managers who fail to innovate lose none of their own money, even if the firm goes bankrupt. The requirement for self-finance is supposed to induce managers to chase after profits through cost-cutting or customer-pleasing innovation. Instead, the requirements to make profits well might increase managers' aversion to risk in an environment of weak competition and small personal reward. Innovative activity also may be dampened by the increased uncertainty of the regulatory environment that will accompany implementation of the reforms. Finally, neither the center nor the firm can know the real payoff to innovation unless the prices of inputs and outputs reflect their relative scarcities reasonably well. They will not do so under the approach to pricing now taken in the reform documents.

In the West, innovation is promoted through the relatively easy formation of small businesses and the existence of multiple sources of financing. Under Gorbachev's reforms, state-owned firms are created and dissolved by ministries, as before. The Law on Cooperatives allows any group of citizens to form a cooperative to produce almost any legal good or service. But cooperatives, too, will operate in a highly uncertain regulatory environment. Thus, they are likely to have a short time horizon, reinforcing that bias against risk-taking that seems to be inherent in worker-managed firms for other rea-

sons.²¹ In the state sector also, progress in innovation will not be served by provisions of the reforms that give decisionmaking power over distribution of profits to worker collectives.

Hungary

After more than a decade of operation under the NEM, the economy had failed to generate the expected gains in productivity and innovative capacity. To remedy matters, the government introduced one measure after another in a persistent attempt to create the intended socialist regulated market economy. These measures have sought to create competition and more effective property rights in the state sector and to expand the scope of the private sector. Specifically, a single Ministry of Industry with limited powers vis-à-vis enterprises replaced the several industrial ministries; a movement was begun to break up large state-owned firms, and diverse ownership forms for small firms were sanctioned; private firms were permitted to hire as many as 500 workers, and completely private foreign firms were allowed; many changes were made in the financial regulators (taxes, credit, subsidies); and laws were adopted that created the beginnings of a capital market. Nonetheless, the state sector remains overwhelmingly dominant in the industrial sector, its enterprises still are not subjected to the discipline of the market, and market forces are not allowed to determine many prices. As Bauer (1983, p. 310) put it, the Hungarian economy is "neither plan nor market," and no breakthrough in technological progress or in competitiveness in Western markets has occurred. Another noted Hungarian economist, Janos Kornai (1986, p. 1733), suggests that success may not come unless the system of state ownership of property is fundamentally altered.²²

Conclusion

As would be expected, the governments in Soviet-type economies have proved able to mobilize resources for investment and R and D on a scale that presumably should have produced rapid technological progress through assimilation of a continuous flow of innovations. At the outset, moreover, these countries were technologically backward relative to major capitalist countries in the West. As Moses Abramovitz (1986) and others have shown, these economies could have been expected to steadily close the gap. While some narrowing did occur in the early years, such has not been the case in the past decade

²¹On this point, see Furubotn and Pejovich (1974a), Bergson (1983), Bonin and Putterman (1988), Gomulka (1986, pp. 62-72), and Brewer (1988).

²²See also Tardos (1986).

or two, when the gap evidently has widened. Soviet-type economies now find themselves with sluggish rates of growth and factor productivity and with chronic difficulties in selling their manufactures in Western markets. Thus, the relative payoff to large injections of technology-oriented resources has been small. Experience in these countries also bears out Schumpeter's surmise that socialist economies would be characterized by slow, routinized, and predictable technical change. Such an outcome might be tolerable if there were no capitalist economies around, notably the newly industrialized countries (NICs), to show what can be achieved.

The blame for this outcome can be laid squarely at the door of the curbs on liberty and the particular institutions that have characterized Soviet-type societies. Restrictions on freedom of discourse, movement of people, interactions with the international community, and excessive secrecy have not been conducive to a dynamic innovation process. Even more inimical, however, have been the behavioral consequences of central planning and public ownership of firms. Bureaucratic determination of R & D priorities and strategies, and central management of the entire innovation process have produced costly mistakes, a conservative bias, long lead-times, sluggish response to developments abroad, and a preference for solving problems by reorganizing agencies. Management through multiple hierarchies has resulted in fragmentation of the innovation cycle, which has fostered delays and inflexibility and created bureaucratic barriers to diffusion. Propertyless managers of firms oriented toward meeting the demands of their organizational superiors for current production have been reluctant to innovate. Weak connections with suppliers and customers and a seriously defective price system have deprived managers of the information needed to search for and evaluate the return to developing a new product or introducing a new production technology, even if they were willing to do so. These obstacles to speedy innovation adversely affected both the development and diffusion of indigenous technology and the payoff to technology imported from abroad.

Successive waves of reforms undertaken by socialist governments have aimed to remove these systemic obstacles to innovation by minor modifications of organizational arrangements and incentive rules, while leaving the basic institutions in place. That strategy failed, and the political leaderships have now come to view the technological backwardness of their economies as being of "crisis" dimensions. As a result, the reforms of the 1980s are much more comprehensive, involving political as well as economic change. In varying degrees, they expand personal and civic liberties, enlarge

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the scope of international involvement, and introduce assorted forms of political participation. Gorbachev's policies of openness and democratization are notable in this regard. The economic reforms in the industrial sector, however, do not root out the old institutions that have impeded innovation and replace them with fundamentally new ones. The sector remains dominated by large, state-owned firms, even though small-scale private endeavors are being encouraged. By and large, governments still control the direction of R & D and investment, and central agencies still play a large role in matters that determine the success or failure of business firms—prices, credits, taxes, subsidies, and various kinds of regulations.

The reforms now occurring in Soviet-type economies do not go nearly far enough to create the environment that has caused innovation to flourish in market economies. The key features of that environment may be summarized as follows: management of R & D by business firms, with the government playing a supportive rather than a directing role; strong incentives stemming from an ability of innovators to capture large rewards if successful and the certainty of large losses for failure to try; and strong competition both at home and from abroad in the race to develop new technologies, particularly those that make large breakthroughs. Institutional change in Soviet-type economies, while moving in the right direction, has yet to be radical enough to create such an environment. Unless this is done, these economies likely will continue to lag, perhaps by growing margins. But to create the needed institutions will entail a redefinition of socialism and perhaps may also require a revolution.

References

- Abonyi, A. "Imported Technology, Hungarian Industrial Development, and Factors Impeding the Emergence of Innovative Capacity." In *Hungary: A Decade of Economic Reform*, pp. 132–60. Edited by Paul Hare, Hugo Radice, and Nigel Swain. London: George Allen & Unwin, 1981.
- Abramovitz, Moses. "Catching Up, Forging Ahead, and Falling Behind." *Journal of Economic History* 46 (June 1986): 385–406.
- Amann, Ronald, and Cooper, Richard. *Industrial Innovation in the Soviet Union*. New Haven, Conn.: Yale University Press, 1982.
- Amann, Ronald; Cooper, Richard; and Davies, R. W. *The Technological Level of Soviet Industry*. New Haven, Conn.: Yale University Press, 1977.
- Bauer, Tamas. "The Hungarian Alternative to Soviet-Type Planning." *Journal of Comparative Economics* 7 (September 1983): 304–16.
- Bauer, Tamas. "The Second Economic Reform and Ownership Relations." Translated in *East European Economics* (Spring/Summer 1984): 33–47.
- Bergson, Abram. "Entrepreneurship under Labor Participation: The Yugoslav Case." In *Entrepreneurship*, pp. 177–233. Edited by Joshua Ronen. Lexington, Mass.: Lexington Books, 1983.

- Bergson, Abram. "Comparative Productivity: the USSR, Eastern Europe, and the West." *American Economic Review* 77 (June 1987): 342-57.
- Berliner, Joseph. *The Innovation Decision in Soviet Industry*. Cambridge: The MIT Press, 1976.
- Bolotin, V. M. *Sorevnovaniia dvukh sistem*. Moscow: Nauka Publishing House, 1988.
- Bonin, John P., and Putterman, Louis. *Economics of Cooperation and the Labor-Managed Economy*. Chur, Switzerland: Harwood Academic Publishers, 1988.
- Bornstein, Morris. "Economic Reform in Eastern Europe." In *East European Economies, Post-Helsinki*, pp. 102-34. Washington, D.C.: Government Printing Office, 1977.
- Bornstein, Morris. "Pricing Research and Development Services in the USSR." *Research Policy* 13, no. 2 (1984): 85-100.
- Bornstein, Morris. "Improving the Soviet Economic Mechanism." *Soviet Studies* 37 (January 1985): 1-30.
- Brewer, Anthony. "Technical Change in Illyria." *Journal of Comparative Economics* 12 (September 1988): 401-15.
- Cocks, Paul. "Organizing for Technological Innovation in the 1980s." In *Entrepreneurship in Imperial Russia and the Soviet Union*, pp. 306-46. Edited by Gregory Guroff and Fred V. Carstensen. Princeton, N.J.: Princeton University Press, 1983.
- Cocks, Paul. "Central Planning and the Innovation Process." *Nordic Journal of Soviet and East European Studies* (forthcoming 1989).
- Fallenbuchl, Zbigniew M. "Present State of the Economic Reform." In *Creditworthiness and Reform in Poland: Western and Polish Perspectives*, pp. 115-30. Edited by Paul Marer and Wladzimirz Siwinski. Bloomington: Indiana University Press, 1988.
- Freeman, Christopher. *The Economics of Industrial Innovation*. London: Frances Pinter, 1982.
- Furubotn, Erik G., and Pejovich, Svetozar. "Property Rights and the Behavior of the Firm in a Socialist State: The Case of Yugoslavia." In *The Economics of Property Rights*, pp. 227-51. Edited by Erik G. Furubotn and Svetozar Pejovich. Cambridge, Mass.: Ballinger Publishing Co., 1974a.
- Furubotn, Erik G., and Pejovich, Svetozar. "The Soviet Manager and Innovation: A Behavioral Model of the Soviet Firm." In *The Economics of Property Rights*, pp. 203-16. Edited by Erik G. Furubotn and Svetozar Pejovich. Cambridge, Mass.: Ballinger Publishing Co., 1974b.
- Gomulka, Stansilaw. "The Incompatibility of Socialism and Rapid Innovation." In *Technology Transfer and East-West Relations*, pp. 12-31. Edited by Mark E. Schaffer. New York: St. Martin's Press, 1985.
- Gomulka, Stansilaw. *Growth, Innovation, and Reform in Eastern Europe*. Madison: The University of Wisconsin Press, 1986; Brighton, England: Wheatsheaf Books, 1986.
- Hanson, Philip. *Trade and Technology in Soviet-Western Relations*. New York: Columbia University Press, 1981.
- Hanson, Philip. "Soviet Assimilation of Western Technology." In *Trade, Technology, and Soviet-American Relations*, pp. 63-81. Edited by Bruce Parrott. Bloomington: Indiana University Press, 1985.

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- Hanson, Philip, and Pavitt, Keith. *The Comparative Economics of Research, Development and Innovation in East and West: A Survey*. Chur, Switzerland: Harwood Academic Publishers, 1987.
- Hewett, Ed A. *Reforming the Soviet Economy*. Washington, D.C.: Brookings Institution, 1988.
- Kornai, Janos. "The Hungarian Reform Process: Visions, Hopes, and Reality." *Journal of Economic Literature* 29 (December 1986): 1687-1737.
- Lavigne, Marie. "Economic Reforms in Eastern Europe: Ten Years After." In *Economic Development in the Soviet Union and Eastern Europe*, pp. 42-64. Edited by Zbigniew M. Fallenbuchl. New York: Praeger Publishers, 1975.
- Levine, Herbert S. "On the Nature and Location of Entrepreneurial Authority in Centrally Planned Economies: The Soviet Case." In *Entrepreneurship*, pp. 235-67. Edited by Joshua Ronen. Lexington, Mass.: Lexington Books, 1983.
- Marer, Paul. "Economic Reform in Hungary: From Central Planning to Regulated Market." In *East European Economies: Slow Growth in the 1980s*, vol. 3, pp. 223-97. Washington, D.C.: Government Printing Office, 1986.
- Martens, John A. "Soviet Patent and Inventor's Certificates." In *Soviet Economy in the 1980s: Problems and Prospects*, pt. 1, pp. 531-39. Washington, D.C.: Government Printing Office, 1982.
- Martens, John A., and Young, John P. "Soviet Implementation of Domestic Inventions." In *Soviet Economy in a Time of Change*, vol. 1, pp. 472-509. Washington, D.C.: Government Printing Office, 1979.
- McAuley, Alastair. "Central Planning, Market Socialism, and Rapid Innovation." In *Technology Transfer and East-West Relations*, pp. 32-49. Edited by Mark E. Schaffer. New York: St. Martin's Press, 1985.
- Nolting, Louvan E. "The 1968 Reform of Scientific Research, Development, and Innovation in the U.S.S.R." Foreign Economic Report No. 11. U.S. Department of Commerce, Bureau of Economic Analysis, September 1976.
- Parrott, Bruce. *Politics and Technology in the Soviet Union*. Cambridge: The MIT Press, 1983.
- Poznansky, Kazimierz Z. "Economic Determinants of Technological Performance in Eastern Europe." *Eastern European Politics and Societies* 2 (Fall 1988): 577-600.
- Schroeder, Gertrude E. "Soviet Economy on a Treadmill of Reforms." In *Soviet Economy in a Time of Change*, vol. 1, pp. 312-40. Washington, D.C.: Government Printing Office, 1979.
- Schroeder, Gertrude E. "Soviet Economy Reform Decrees: More Steps on the Treadmill." In *Soviet Economy in the 1980s: Problems and Prospects*, pt. 1, pp. 65-88. Washington, D.C.: Government Printing Office, 1982.
- Schroeder, Gertrude E. "An Anatomy of Gorbachev's Economic Reforms." *Soviet Economy* 3 (July-September 1987): 219-41.
- Tardos, M. "The Conditions of Developing a Regulated Market." *Acta Oeconomica* 36, nos. 1-2 (1986): 67-87.
- Winiecki, Jan. *The Distorted World of Soviet-Type Economies*. Pittsburgh: University of Pittsburgh Press, 1988.
- Zaichenko, A. "Risk and Independence in Innovative Activity." *Voprosy ekonomiki*, no. 1 (1988): 41-51. Translated in *Problems of Economics* (October 1988): 29-46.