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KNOWLEDGE, INFORMATION, AND INNOVATION IN THE SOVIET ECONOMY

INNOVATION AND INFORMATION IN THE SOVIET ECONOMY*

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In the Soviet view, technological progress is not only virtually synonymous with human progress, but is also an overriding national goal and a major element of legitimation of Communist rule in Russia. From Lenin's "communism equals Soviet power plus the electrification of the whole country," through Stalin's injunction to his subjects to "master technology," to Khrushchev's and Kosygin's "construction of the material-technical base of communism"—each additional machine or kilowatt, every just-trained engineer, has been identified simultaneously with yet another forward step on the direct historical path to social perfection and human bliss as well as with the strengthening of the internal and external power of the Soviet state. The "world-historic victory of socialism over capitalism" is assured, we have been repeatedly told, because socialism (Soviet-style, of course) removes the obstacles to the full productive use of man's ingenuity and creativity and is capable of planning and organizing the productive forces of society for unstinted technological advance and, hence, economic progress.

A consequence of this approach has been the elaboration of a new social technique: the routinization of economic growth. This is to say, virtually everything connected with the process of economic growth—the accumulation of society's saving, capital formation, education and training, invention, research and development, technical modernization and innovation, dissemination of technological information, and (last but not least) the massive take-over of technology from abroad—has been centrally organized and planned and subjected to standardized, repetitive, routine methods and procedures. The technique is not exclusively Soviet or Communist; some of the just-cited functions have also been routinized for some time elsewhere; for instance, research and development in large "capitalist" corporations or the defense and space programs of major Western governments have also been in large

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measure routinized. But its comprehensiveness and extent within the national economy are distinctly Soviet-style.

In the present paper we shall be concerned with only one aspect of the routinization of growth in the Soviet economy: the routinization of innovation and the related problems of information. By innovation we mean something rather broad; namely, the introduction and diffusion of relatively more advanced production techniques, whether indigenously developed or not and whether the given technology is finding its first application in the Soviet Union or is already known there in practice. Innovation, as we use the word, thus comes close to the standard Soviet phrase, *vnedrenie novoi teckhniki,* often translated as "the introduction of new technology."[1] If the phrase "routinization of innovation" has the appearance of a contradiction in terms, it also reflects the dilemmas and paradoxes inherent in the planning of rapid technical progress in any "going" economy and especially within the rigid context of Soviet economic and administrative institutions.

We begin, therefore, with a few words about that context. The economy is centrally managed by means of detailed output and input targets assigned to enterprises and intermediate entities. Nearly every material producer good of importance is centrally allocated. Short-term planning aims at (1) mobilizing production resources to the utmost and (2) achieving minimal consistency between production capacities, output targets, and supply allocations. In the event, this consistency is quite poorly achieved. Labor, however, is deployed largely through a free market (a major exception being that the mobility of collective farmers is administratively restricted). Investment—which has in recent years accounted for something like one-third of GNP—is nearly entirely centrally planned and controlled. Its purpose is not only to propel the steady and rapid expansion of the country's productive capacity in the desired directions, but also to serve as the chief vehicle for the introduction of modern technology into the economy.

Prices for producer goods are administratively set (or, at least, approved) according to complicated principles and procedures which may have their rationale but in any case do not purport to seek our either scarcity or equilibrium levels. Given also some other aspects of the Soviet economic system, especially materials allocation, the result is that for most important producer goods demand exceeds supply and the usual phenomena of a seller's market prevail.

From the early days of the Plan Era until July, 1957, and again since October, 1965, industry has been formally organized according to

[1] This phrase, however, does little justice to its Russian counterpart. The verb *vnedriat'* bears the connotation of an organic process (to implant, to cause to take root), while *tekhnika* embraces both the technique or technology of production and the physical equipment that embodies it.

the "branch" ("product-line," "ministerial") principle; i.e., the enterprises belonging to a given branch of industry have been subordinated to the corresponding ministry (earlier, commissariat), usually regardless of their geographic location. Between 1957 and 1965, the "territorial" principle of industrial organization obtained—most enterprises were subordinated to regional economic councils (sovnarkhozy). The organizational "partitioning" of the Soviet economy is important for our inquiry because it tends to determine (1) the pattern of information flow and (2) the structure of what Peter Wiles has called "subordinate autarky"; that is, the tendency of each administrative level to be self-sufficient. The latter phenomenon, conditioned by the system of success indicators and by the prevalence of the seller's market, appears in the form of either "departmentalism" or "localism," and, together with the tendency of communication lines to coincide with those of authority, creates the malignant situation known in Soviet parlance as "departmental barriers"—the failure of enterprises or higher organs to effectively communicate or cooperate with each other.[2]

As we might expect from the opening observations of this paper, technological information of all kinds and from all sources is avidly gathered, assiduously translated, processed, and compiled, and aggressively distributed. The volume of technical publication is enormous. Throughout the Soviet period, highly organized efforts have been made to import technology from the more advanced countries in the form of stray information, systematic documentation, production processes, prototype equipment, and live advisers. The All-Union Institute for Scientific and Technical Information (*VNITI*) is unique in the world in the range and thoroughness of its collecting and publishing activities, although it is only one of many Soviet organizations devoted to this end.[3] Commerical secrecy as practiced under private enterprise is not supposed to exist (will the current efforts to raise the role of profit in the Soviet economy tend to revive it?) but departmental jealousy and what might be called subordinate secrecy (concealing one's true capacities from one's superiors) are practiced widely. Lastly, much technical information is also dispensed, often in directive manner, in the form of input-output coefficients ("norms") for planning, technical specifications and standards, and the like.

Much more complex is the picture with regard to economic information. As we have noted, producer goods prices are poor representations of the goods' relative scarcities for either the short or the long run.

[2] For further information on the structure and functional characteristics of the Soviet economy and on its prices, the reader is referred to [2] [9] [11] and [16].

[3] See [13, pp. 73-76] for a concise account of such organizations. This study by Peter Knirsch is so far the only systematic inquiry into Soviet planning of technical progress published in the West.

Now that state enterprises are about to begin paying interest on their fixed and working assets, capital will be carrying a price in current cost accounting as well as in planning, but it may be doubted that the rate—or, more correctly, the many "branch" and special rates—will accurately reflect the social marginal opportunity cost of this factor.[4] Land remains unpriced, though some other natural resources will supposedly soon bear rent charges. The exchange rate is of doubtful fidelity. Farm prices, even if somewhat more sensible than before, are still a country-wide crazy quilt. The wage structure does make some sense, but only with reference to supply and demand in the labor market—a circumstance from which Soviet labor was supposedly liberated by the advent of socialism.

For day-to-day production decisions, the most important economic information consists of plan targets, supply allocations, and success indicators. Both short-term and long-term planning rest on an enormous flow of statistical data, most of which is probably superfluous and in any case costly to collect and often of doubtful reliability. More important, while it forms the basis for all the planning in the traditional—centralized and "manual"—way, the information generated either in intrafirm bookkeeping or in hierarchical reporting is poorly suited to either management decisions[5] in the firm or to the prospect of mathematized planning at the top. Surely, at the enterprise level, and even considerably above it, there is little reliable indication from economic (as against administrative) signals of the socially most desirable directions for investment, as things now stand. Another serious defect is the very inadequate state of interfirm communication—lack of technical catalogues, advertising, salesmen—which makes it difficult to know what goods are actually or potentially available for use in production.

Perhaps even more inimical to technological progress and economic growth than the dubious quality of economic information generated by the Soviet economy is the lack of appropriate motivation for innovation at the enterprise level. The problem has been treated in the Soviet literature at the greatest length; we have had occasion to discuss it in this *Review* several years ago.[6] Complex in its many details, the matter is essentially quite simple: given the success indicators and the system of bonuses to management, the "taut" plans, and the "ratchet principle" of raising plan targets on the basis of most recent performance, management has little to gain and much to risk by espousing new products or processes. Besides, any change in the routine runs into in-

[4] Cf. [6, esp. Chap. 11].
[5] Recent analyses of the Soviet use of the rate of return in choosing among alternative technologies will be found in works by Bergson [2, Chap. 11] and Collette [7, Part III].
[6] [10]; see also [16, pp. 167-71] [19, Chap. 9] [3, p. 86].

numerable bureaucratic obstacles at all levels. Hence, widespread aversion below to anything new; i.e., a reluctance to act innovatingly on information that more than offsets the commercial secrecy of the market economy.

It must be noted that machine-building enterprises are also prey to this phobia of innovation. Thus, precisely the industry which in the Western market economy, through its sales campaigns, is responsible for much of the diffusion of innovations, in the Soviet Union has the opposite role of imposing technical conservatism on itself and its clients. Accordingly, it has been machine building that has been the chief beneficiary of various schemes to reward managerial and technical personnel responsible for innovation—especially since 1960—and to relieve the costs (and, thus, prices) of new products of expenses incurred at the development stage.[7] The Soviet literature does not give a strong impression that these schemes have as yet been markedly successful in lessening resistance to innovation.[8]

Of course, much—and in the earlier period, most—of what is technically new enters the Soviet economy by being embodied in newly built plants, where the dead hand of the present has not yet appeared. By now, the Soviet Union possesses an enormous establishment for the design of new (or redesign of old) production facilities. In 1963, there were some 1,300 so-called "project-making" organizations (engineering design bureaus); in late 1965 they employed over 450,000 persons and had an aggregate budget of 900 million rubles (*Pravda*, Dec. 8, 1965, p. 5). For reasons of space we cannot inquire into their operation. Suffice it to say that the project-making organizations have been under much attack in the Soviet literature over the years because of their slowness to innovate on the drawing boards, among other things. Doubtless, the fault is not entirely with the subjective qualities of their engineering personnel; they have had to contend with inadequate economic signals, faulty incentives, and a refractory, overcentralized system.

Insofar as it has been overcome, the resistance to innovation at enterprises and in project-making organizations has been overcome in large measure by continuous administrative pressure from above. Crucial to its success are the communication channels through which it is transmitted—a problem to which we shall return toward the end of this

[7] On these schemes for the "stimulation of new technology" see [1, pp. 98 ff.; V. Markov in *Planovoe khoziaistvo* (hereafter *P.Kh.*), 1960] 16, English text in *Problems of Economics*, III] [10; E. Slastenko in *P.Kh.*, 1964] [2; A. Basistov in *Voprosy ekonomiki*, 1964] [5; and *Ekonomicheskaia gazeta* (hereafter *E.G.*), Jan. 20, 1965, p. 37].

[8] But, not unexpectedly, these schemes may have aggravated conflicts of interest between innovators and production personnel within enterprises; cf. Bassitov, *loc. cit.*, pp. 31-32.

paper in the context of the recent reorganization. But now we turn our attention to two of the most distinctive Soviet institutions in the field of technological progress, "uniform technological policy" and "the plan for the development and introduction of new technology."

Uniform Technological Policy

A frequently cited concept, uniform technological (or technical) policy (*edinaia tekhnicheskaia politika*) is also a most elusive one. We know of no rigorous definition of it in the Soviet literature. Often it merely refers to the dictator's whim in technical matters or to the particular technological hobbyhorse that the given author is riding. Insofar as it does have substantive content, the concept of uniform technological policy amounts to the centralized determination and mandatory enforcement of the technological aspects and parameters of a production process. This may refer to the basic characteristics of the process (e.g., thermal or hydraulic power generation, type of railroad traction, automation), its main technological parameters, the types and varieties of required equipment, standardization, typical size of plant, degree of vertical integration in production, etc. An example will be found in the Resolution of the 1959 Plenum of the Central Committee CPSU which selects many dozens of technological processes in virtually all branches of industry and transport for high-priority attention [17, pp. 501 ff.]. No doubt even starker examples could be culled from the early years of Soviet industrialization.

That something like the notion of a uniform technological policy should have evolved in the U.S.S.R. is hardly surprising. It is, first and foremost, a corollary of the central planning of investment, especially where economic advance has been seen largely in technological terms to begin with. Second, investment has to be supported by specific materials allocations, which has also been highly centralized in Soviet practice. That is to say, technological specifications determine precise material requirements, which cannot be honored except at the top. Third, under Soviet conditions, the necessary linkages with other industries can be properly handled only at a very high level. Fourth, centralizing technical decisions at the center is presumably an economical way of utilizing engineering and other scarce skills. Thus, A. Kostousov, chairman of the State Commission for Automation and Machine Building which was created in 1959 expressly to lay down a technological policy in that area, wrote soon after assuming his new post:

> [Technological progress requires] uniformity of technological policy in machine building. There cannot be isolated technological policies in Riasan', Minsk, Moscow, or Leningrad provinces in regard to, say machine-tool building. The coordination of technological policy is a most important task at the present stage. It will allow to save the efforts of

scientists and engineers, to eliminate unnecessary parallelism and duplication, and to create the conditions for the developing the most progressive technology in all branches of machine building.[9]

On the other hand, we may well ask how feasible—under actual Soviet conditions—would have been the decentralization of basic technological decisions given the inadequate motivation, the absence of reliable economic signals, vagueness in regard to decision rules, and—we must add—far from perfect identity between the goals and values at the center and at the economic periphery.

To be sure, insofar as we know, the central authorities have not had the benefit of much better economic parameters or much more precise decision criteria than those available to their subordinates. They, too, have tended—perhaps even more consciously—to mistrust internally generated price-cost information and to put their faith in more strictly technological criteria and into imitation of foreign practice. The latter, particularly, seems to have been an important criterion—both for want of others and as a convenient hedge for the individual decision-maker against the risk of being accused of deciding wrong. After all, American (or German, or British) technological solutions could hardly be wrong! And besides they are already at work. Where the central organs, however, have indeed had a clear advantage over the periphery is in their overview of the physical requirements of the whole investment program. This, of course, has only tended to support the notion of uniform, centrally-determined technological policy—even if in the event the requisite consistency and coordination have apparently been minimal.

Nor is much known as to the roles of various planning bodies and political organs in this connection. There is little doubt, however, that the abolition of the ministerial structure in 1957 adversely affected communication along branch lines and thus militated against innovation insofar as it depends—as it largely does in the U.S.S.R.—on planning and administrative pressure from above. The progressive multiplication of the State Commissions for individual industries between 1957 and 1962, and even the enhancement of their authority in matters of technological policy in 1962-63, seems to have more complicated than strengthened planning along branch lines. These difficulties have provided the main reason for a return to the formerly discredited ministerial (branch) system of industrial organization.[10]

In sum, uniform technological policy has been both reality and mir-

[9] *Kommunist*, 1959:8, pp. 11-12; cf. *idem* in [18, pp. 108 ff.].

[10] The implications of the 1957 reform for economic growth were discussed by us in [10, pp. 70-71]. A useful and concise Soviet analysis of the implications of branch and territorial partitioning may be found in Birman's booklet [4, pp. 49-64]. Knirsch gives a good account of the many organs engaged in planning technological advance in the U.S.S.R. [13, pp. 76 ff.].

age in Soviet practice. It has certainly been a reality in the sense that huge industries have been built up on the basis of particular technologies. But the economic wisdom of these technological solutions has been quite uneven, and often probably insufficiently or inefficiently investigated in the first place. Moreover, the very goal of technical uniformity itself may have been irrational where economic conditions require a variety of technical solutions; witness the patent case of agricultural machinery. But seen on its own terms and with all the technological biases to which it has been prey, uniform technological policy in the U.S.S.R. seems as often as not to have been unattainable. Even within individual industries this has often been so owing to conflicts of personal or departmental interests, bureaucratic empire building, "departmental barriers," materials shortages, resistances to innovations, and all the other facts of Soviet economic life. It has frequently lacked continuity—or has continued for much too long (as in the case of traditional emphases on coal, steel, or railroad steam traction). As we shall presently see, it has not been effectively supported by the expressly-designed "plans for the development and introduction of new technology." And there seems to have been relatively little connection between technological policies in different industries.

Plans for the Development and Introduction of New Technology

Though far from being the only vehicle of technical progress in the Soviet economy, these plans have been the chief formal documents through which the authorities have been trying to carry out technological policy in industry and construction. Begun in the late 1940's, they are constituent parts of annual economic plans (and only of the annual plans) on each level, from the union government down to the individual enterprise. Unlike production plans, at the higher levels these plans do not aggregate the provisions of those at lower levels but rather select items of requisite importance. In recent years these measures have been a rather varied assortment, falling under six main rubrics: (1) Directives for the mechanization and automation of production processes and the introduction of advanced technology; (2) directives for the development and production of prototypes of new, important machines and articles; (3) directives for the most important research, development, and experimental projects; (4) a list of obsolete machinery, devices, etc., whose production is to be terminated; (5) directives for quantity production of new kinds of industrial products; and (6) a statement of the requirements of materials, equipment, etc., for the implementation of this plan.[11] The last provision

[11] The fullest description of the plans for new technology will be found in [8]. A brief historical sketch is in [14, pp. 135 ff.], while the situation in the early years is described by Sokolov in *P.Kh.*, 1951:6.

dates only from 1962; financial requirements were included in the plans for new technology also for the first time only in that year.

Soviet sources leave little doubt that the plans for new technology are among the least effective or successful in the industrial sector of the Soviet economy. Year after year, the nominal fulfillment of the union-level plan for new technology is of the order of 50-60 percent [17, p. 728] [18, p. 264] (Grishin in *Pravda,* Nov. 22, 1962). Even this may overstate the real effect in that the percentages refer to proportions of the number of items (projects) carried out or completed; there is accordingly a tendency to carry out or complete—whatever this may mean—the smaller items (projects) first for the sake of a better record. The reasons for the poor fulfillment record are many. Those most frequently cited are the lack of support with materials allocations (even since 1962), lack of financial backing, and the usual resistances to innovation.

But the plans for new technology seem to be very poorly drawn up to begin with. They are on a strictly annual basis with little if any reference to any long-term projections, let alone plans, of technological development. The selection of items and projects seems to be unsystematic, even chaotic, and with little carry-over from year to year. There is little coordination between this aspect of the annual plan and such important aspects of it as those pertaining to production, labor, supply, costs, and profits. For that matter, there is little coordination between the various parts of a plan for new technology.[12] Notably, few projects in the plan are supported by any kind of economic justification, and those that are tend to be those for which bonuses to the innovating personnel are to be paid, which renders the economic calculations suspect from the start. And so forth.[13] Perhaps it is just as well that the plans for new technology tend to be only half-fulfilled.

One can consequently appreciate all the more the intense search for institutional improvement, especially in regard to innovation and growth. The following passage, by L. Gatovskii, the recently-appointed director of the prestigious Institute of Economics of the U.S.S.R. Academy of Sciences, underscores the issue:

> Under the conditions of the present-day scientific revolution and of the competition and struggle between the two world systems, the planning of scientific and technical progress must, objectively, be the leading link of the whole system of national economic planning.

[12] In a similar vein, it was alleged by no less an authority than Kostousov *(Pravda,* Aug. 28, 1959) that the planning of machinery output for the Seven-Year Plan (1959-65) proceeded without reference to the investment plan.

[13] Criticisms of the plans for new technology are legion. To cite a few almost at random: [17, *passim*; 18, *passim*; G. I. Samborskii in 15, pp. 268-83; P. Abroskin in *P.Kh.*, 1961:3; I. Kasitskii in Kommunist, 1961:2; A. Pliner in *P.Kh.*, 1962:10; N. Semenov in *Pravda,* March 23, 1962; G. Kozlov in *E.G.*, 1965:46, p. 6; L. Gatovskii in *E.G.*, 1965:48, p. 5]. For analysis once again refer to Knirsch [13, pp. 88 ff.].

Yet, hitherto, this link has perhaps actually been the most lagging link in the whole complex of national economic planning and in the whole system of material incentives for production.[14]

In a society as rich in paradoxes as is the Soviet, the area of technological progress and innovation contains its aliquot share. Everywhere in the U.S.S.R. the technologically most advanced and most backward are to be observed side by side. There is centralization of the highest order and at the same time failure to achieve some of the putative advantages of centralization; for instance, surprisingly modest progress has been made in the field of industrial standards.[15] Or there has been so far remarkably little progress in automation, despite an impressive scientific base and the absence of the institutional features that allegedly hold back automation in decentralized, pluralist economies.

Soviet technical achievements are generally not in dispute; it is the paradoxes by which the outside observer is fascinated and for which he seeks explanations. To be sure, many of the instances of lingering technical backwardness have their economic justification, if not historical explanation, in factor proportions (although on this score the foreign observer may be more generous than the domestic critic).[16] But as often as not Soviet contrasts have little economic rationale: their explanation must be sought in motivational, organizational, and institutional causes. We have already had reference to some of these, particularly those pertaining to the quality and transmission of information, incentives, and the methods of drawing up plans for new technology. We now return to the concept of routinization of innovation.

The routinization of innovation on a national scale presumably means: (1) forecasting of technology for a substantial period, say a decade; (2) an economic methodology for selecting among technological alternatives, supported by projections of economic parameters; and (3) an organizational set-up to realize the desirable innovations. All three are much easier listed than accomplished. Although forecasts of technological progress are notoriously uncertain and risky, this part may be the least difficult in the Soviet case. In the recent past and for the near future the Soviet Union could and still can set its sights largely on the technology already developed and applied in the other industrial countries; thus fortunately avoiding much of the uncertainty

[14] *Loc. cit.*

[15] Cf. [20] [12, pp. 67 ff.]; V. Agranovskii in *E.G.*, 1961:9, pp. 26-27; V. Boitsov in *Izvestiia*, July 9, 1964; editorial in *Pravda*, Feb. 6, 1965; V. Tkachenko in *F.Kh.*, 1965:7. On the economics of industrial standards generally see Brady [5, Chap. IV]. Soviet problems in the area of industrial standards seem to rest on such institutional conditions as "departmental barriers," which block or delay agreement on specifications, and the opposition by producers, who dislike standards because they impose a quality constraint to quantitative plan fulfillment.

[16] Cf. S. Kheiman [1, pp. 136 ff.].

attendant upon the projection of technological progress. Offsetting this advantage is the rigidity of the Soviet economy which resists adjustment occasioned by earlier faulty projections.

For lack of space, we shall not discuss here methods of economic choice among technological alternatives, except to note that for a long time these methods—and the corresponding informational requirements—were neglected in the U.S.S.R., although there is now a strong revival of interest in them among Soviet economists.

Much attention has lately been focused on the organizational side, thanks to Mr. Khrushchev's frequent tinkering between 1957 and 1964, and his successors' economic reform of October, 1965. Here we find many fundamental dilemmas. Should the locus of innovative initiative and activity be primarily centralized or decentralized? What are the informational implications of each alternative? If primarily centralized, what should the formal economy-wide organization be? If decentralized, how are particular and social goals to be reconciled? How to best ensure appropriate motivation and the right incentives?

To take up first the centralized alternative, which is of course the traditional Soviet approach: The "territorial" principle of organization, as we have seen, severs the vertical, "branch-specific" lines of communication and thus impairs the transmission of information and pressure for technical advance and innovation. Khrushchev's attempts to establish a complementary structure of branch organs (State Commissions) to deal with dynamic aspects of planning hopelessly complicated and confused things. We have now (October, 1965) witnessed a reversion to the ministerial (branch) principle of industrial organization, although the authors of this reform must have been fully aware of its sins. But the problem is not thereby solved. How intimately integrated should planning for innovation be with planning for current production? If they are closely combined, the day-to-day pressures of production management will tend to deflect energies and attention from long-range matters, following a kind of Gresham's Law of Planning. If they are separated, the vertical lines of communication will remain at least partly impaired. How formidable will the new "departmental barriers" prove to be? In the past, innovation that cuts across industry lines has had a particularly hard time of it. (The slow progress of automation may be partly explained this way.)

More fundamental is the problem of inserting planning for innovation into the rigid, Soviet-style system of planning and management. This system rests heavily on routine, repetition, minimal disturbance, stability; it resists all new departures. But—as the sorry record of the "plans for new technology" amply shows—the routinization of innovation can be achieved only by at least partly deroutinizing other aspects

of planning, especially that of production and supply. Can it be done in a centralized system? Does Soviet-style planning at all permit of a "delicate moving balance between order and innovation"?[17] Or does it allow only gross, discrete, forced injections of innovation into an otherwise inert order?

The reforms of October, 1965, do not constitute much of a decentralization, in our opinion, despite a few steps in that direction (which is not to say that they may not eventually lead to substantial decentralizations). Unexpectedly, the most significant such step relates to investment (rather than to current production): by 1967, some 20-25 percent of all gross fixed investment in industry will presumably be undertaken in a decentralized way. Uniform technological policy is reasserted, but enterprises are called upon to exercise initiative and to innovate within its framework.[18] In the past, decentralization of investment decisions on an even much more modest scale has been handicapped by the rigidities of the highly centralized environment, especially when it came to obtaining the necessary materials.[19] Since the system of materials allocation and other centralist features are being retained, it is not clear how the much-expanded decentralized investment will now manage to fare better. Nor is it clear by what mechanism uniform technological policy will be enforced without, presumably, squashing decentralized initiative.

The irony is that, in the Soviet case, the imperative for innovation, on the one hand, and the severe obstacles with which innovation has to contend (including many of the inadequacies of information), on the other hand, derive from essentially the same root cause: the extreme historical urgency for the amassing of industrial power combined with the logic of preservation of political control by the authoritarian regime. The Soviet system is not unique, of course, in facing such grand dilemmas or such grandiose ironies. It will be interesting to see how unique will be its solutions.

[17] The phrase is Brady's [5, p. 108].
[18] See Kosygin's speech, *Pravda,* Sept. 28, 1965, and related materials; also, Gatovskii in *E.G.*, 1965:48, p. 5.
[19] We have analyzed this problem at some length in [21].

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