

2

COPY

AD-A215 693

Modernizing the Soviet Textile Industry

Implications for Perestroika

Steven W. Popper

DTIC
ELECTE
DEC 18 1989
S DCS D

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

RAND

89 12 18 063

Library of Congress Cataloging in Publication Data

Popper, Steven W., 1953-

Modernizing the Soviet textile industry : implications for
perestroika / Steven W. Popper.

p. cm.

"October 1989."

"R-3779."

Includes bibliographical references.

ISBN 0-8330-0994-X

1. Textile industry—Technological innovations—Government policy—
Soviet Union 2. Soviet Union—Economic policy—1986-

3. Perestroika. I. Title.

HD9865.S652P66 1989

338.4'5677'00947—dc20

89-39110

CIP

The RAND Publication Series: The Report is the principal publication documenting and transmitting RAND's major research findings and final research results. The RAND Note reports other outputs of sponsored research for general distribution. Publications of The RAND Corporation do not necessarily reflect the opinions or policies of the sponsors of RAND research.

Published by The RAND Corporation
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138

R-3779

Modernizing the Soviet Textile Industry

Implications for Perestroika

Steven W. Popper

October 1989



Accession	
NTIS	☒
DTIC	☐
Unannounced	☐
Justification	
By	
Distribution	
For the Director	
Dist	
A-1	

RAND

PREFACE

This report presents a case study of the investment program to modernize the Soviet textile industry. The work was undertaken as part of a continuing research program in International Economic Policy, the principal focus of which is to explore the connection between international economics and national security issues, within RAND's National Security Research Division. The present report is designed to assist analysts in understanding the actual practice of Soviet industrial modernization under Gorbachev's drive for *perestroika* by examining the experience in one sector of the economy. In the course of doing so, it identifies issues that may be determinants of the likelihood of success in modernizing more crucial sectors of the economy, particularly machine building.

SUMMARY

This study is an attempt to gain a closer look at the practice of modernization in Soviet industry, particularly the machine building sector. It principally examines how information and decisions flow among the various parties in the modernization effort—the ministries, the users of industrial machinery, and the machine builders. The goal is to identify the way the modernization process is actually proceeding and to determine the likelihood it will provide Soviet industry with more productive equipment.

To gain as disaggregative a view as possible, one branch of industry, textile manufacture, was chosen for a case study. Information was expected to be more readily available about textile manufacture than about other sectors more directly affecting Soviet national security concerns. Moreover, the industry's output is fairly homogeneous and the technologies are well-established and yet not so complicated as to dominate the study with technical detail. At the same time, they are complex enough to illustrate many of the systemic ills besetting Soviet manufacturing. The sector has suffered from underinvestment for decades but has recently received greater priority making it a prime candidate for modernization. Yet, as a traditionally low-priority sector it may serve as an indicator for problems of feasibility in the larger design of Soviet industrial modernization.

Employing industrial journals and secondary source material, the study provides four "data" sections that group recurring themes according to the decisionmaking agents primarily affected.

The central authorities continue to play a more obtrusive role in the sector than intended by the recent economic reforms. The Ministry of Light Industry tends to concentrate on volume indicators of output at the expense of true quality improvements. Although the ministry bears primary responsibility for developing and coordinating the modernization scheme, coordination is frequently lacking and the plans themselves are often unrealistic. The ministry does not merely outline a general technology policy but also selects machinery types for series production. **Although the textile enterprise is the ultimate consumer, the machine builders' true customer remains the ministry.** The ministry has often placed its confidence in single technologies rather than in a range of equipment suited to varying conditions. For example, the decision to emphasize open-end spinning and drop the older ring spinning technology meant that the latter underwent no further development. Because the new

technology will not produce as wide a range of yarn types, output assortment has narrowed.

The textile enterprises operate in an environment of increased financial responsibility without increased authority. The ability of the ministry to tailor norms to individual enterprises means that little has changed in their relations in practice. Enterprises also lack effective authority over the choice of machinery to be acquired. Persistent shortages and the market power of the machine builders who are frequently the sole source vendors of specific capital types make it difficult for enterprises to force the production of equipment suited to their needs. Although self-financing is now the rule, enterprises possess insufficient means to undo decades of neglect. They must rely on outside sources for funds.

The ability of the machine builders to respond to the needs of the users is hampered by the long time required to develop machinery for series production and the limited contact with the users. Other factors also make it more attractive to produce general design machinery than to produce equipment customized to meet the needs of specific users. The different indicators of success used by machine builders and users leads to mutual frustration. The users idealize a machine that will allow them to perform their work as accustomed in a more productive fashion. The machine builders produce a machine that will allow them to claim an objective increase in the quality of their output. There are two different machine concepts stemming from two systems of evaluation, two separate schedules of indicators of success, but only one physical realization of the actual machine. **Each party is often disappointed and the machinery is often more expensive than its predecessor but no more productive in practice.**

Modernization is further hampered by bottlenecks originating in other sectors. Construction resources are limited and the emphasis of the program on the reequipping of existing plants inhibits modernization. New equipment cannot achieve its full effect because it is often larger than the old, placing floor space at a premium, and requires the installation of supporting facilities. Additionally, the authorities direct scarce resources to modernization and reconstruction of the main facilities for production rather than auxiliary services, detracting from the efficacy of modernization. **A patchwork of mismatched technologies causes new equipment to be fettered by its enforced linkage to the older installations upon which it depends.** Further, the tendency to modernize the most labor-intensive aspects of production without modernizing the preparatory processes that precede them reduces the effectiveness of new equipment. For example, labor shortage and the emphasis on quantity output targets often means the

weaving shop will be modernized first, when in fact modernization of the preparatory, spinning, and perhaps finishing plants should take precedence in light of the sector's goals. The resulting manufacturing facilities are poorly integrated.

So far modernization in textiles has provided the branch with neither consistently more productive machinery nor the capacity to meet the output goals set by higher authorities. It is of greater interest to ask whether the hopes of the modernizers are likely to be met after a longer period of transition. The present system of quasi-reform could conceivably contribute to a worsening of the Soviet economic situation. Obstacles in the system will frustrate the larger intentions of modernization and are not unique to the textile branch. **Further, they are likely to endure in the absence of more fundamental economic reform.** These obstacles take form in two problems that remain unresolved by present Soviet institutions.

The first is how to determine the appropriate level of quality for the new machinery that is to modernize the branch. The question arises because "quality" is a term that has many aspects. **The enterprises routinely lack information, incentives, and authority to ensure that the equipment they receive is appropriate to their needs.** The ministry, upon whom the choice devolves both by default and in law, does not possess the means to discriminate between technological alternatives. The Soviet solution is to apply a standard whereby equipment must meet an identified world technological level in order to be produced. Although that seems a logical way out of the quandary, given Soviet concerns about technological lag, it introduces a bias away from least-cost solutions to manufacturing problems. By looking at what emerges on the leading edge of industrial machinery produced in the West, rather than at the total stock, machinery is produced that is too expensive and complicated for specific tasks. Yet both the political leadership and the branch authorities have made it clear to the machine builders that their performance will be judged on the technological level of their output, rather than on suitability to the needs of the users. The study cites examples of equipment, such as certain shuttleless looms for which there has been permanent excess demand, being discontinued in favor of more expensive, "higher technology" looms found by the users to be less productive in practice.

Second, a modernization effort directed to supplying manufacturers with modern technical means misses a crucial point. If these means are not used appropriately, the ultimate purpose of modernization will not be met. The primary Soviet need is not for high technology capital; it is for the efficient use of the existing capital, whatever its

technological level. The act of adoption of new equipment is not enough. Successful adoption often requires conscious adaptation of the environment in which it is to be set. **The poor results of Soviet attempts at modernization show that systemic inadequacies make the process of adaptation for efficient utilization particularly difficult in the Soviet setting. This is not peculiar to the textile branch; indeed, it may apply with greater force, the more advanced the technology employed.** The Soviet conceptual design for modernization is that if the material and technological base is improved, then the efficiency of production will increase accordingly. Attention is directed to machine types and not to the changes in management required to operate them properly.

The major ills affecting the implementation of modernization will not be adequately addressed without a more radical implementation of economic reform. A system of efficiency prices, accompanied by increased competition, is necessary to the search for least-cost solutions. In addition, the roles to be played by enterprises and ministries must be better defined. Particular attention needs to be paid to the subtle problem of determining who is to have responsibility for decisions that in the West fall under the authority of the firm. Modernization and economic reform appear, as a practical matter, to be pursued along two tracks, with advances in the former often preceding further developments in the latter. However, the efforts at modernization will realize less than their potential if the setting in which economic decisions are made is not substantially modified as a prerequisite.

ACKNOWLEDGMENTS

Helpful reviews were provided by RAND colleagues Kent Osband and Charles Cooper. The author is grateful to the staff of the Institute of Textile Technology in Charlottesville, Virginia, and to Dean William C. Harris and President Charles G. Tewksbury in particular, for their generous assistance in elucidating the mysteries of modern textile manufacture. Any errors are the sole responsibility of the author.

Research assistance for this study was provided by Nathan Brooks, Lubov Fajfer, and Alona Grinberg.

CONTENTS

PREFACE	iii
SUMMARY	v
ACKNOWLEDGMENTS	ix
FIGURES AND TABLE	xiii
Section	
I. A CASE STUDY OF SOVIET INDUSTRIAL MODERNIZATION	1
The Purpose of the Study	1
The Choice of the Textile Industry	3
Methodology	4
Outline	6
II. THE GOALS OF MODERNIZATION	8
The Soviet Textile Industry	8
Immediate Goals of Modernization	10
The Textile Production Process	12
III. RECURRENT THEMES: THE CENTRAL AUTHORITIES	16
The Role of the Central Authorities	16
Quantity vs. Quality	17
Lack of an Integrated Modernization Plan	19
Performance in Technology Policy Role	21
IV. RECURRENT THEMES: THE TEXTILE ENTERPRISES	26
Authority Circumscribed by Ministry	26
Choice of Machine Types	28
Insufficient Resources for Self-Financing	31
Monopoly and Quasi-Monopoly	33
The Ill-Defined Enterprise	34
V. RECURRENT THEMES: THE MACHINE BUILDERS	35
Long Development Time	35
Limited Contact with Users	35
General vs. Specific Design Solutions	37
Quality, Price, Size Inflation	38
A Diagnostic	41

VI.	RECURRENT THEMES: OBSTACLES TO MODERNIZATION	44
	Material Supply Bottlenecks	44
	New Construction vs Reequipping	46
	The Emphasis on Main Production	48
VII.	ASSESSMENT OF MODERNIZATION IN THE TEXTILE INDUSTRY	53
	The Results So Far	53
	Prospects for Future Development	60
VIII.	A PARADIGM FOR ASSESSING SOVIET MODERNIZATION POLICIES	61
	Modernization Questions and Policy Responses	61
	The Navigation of Technology Policy	63
	Fundamental Sources of Inefficiency	68
	Economic Reform: Sine Qua Non of Modernization	74
	BIBLIOGRAPHY	77

FIGURES

1. Process flow in textile manufacturing	12
2. New textile machinery compared with old	40
3. Annual textile output compared with trajectories toward 1990 production targets	55
4. Production of selected machine types in physical units	59

TABLE

1. Capacity increases from reequipping existing enterprises	56
--	----

I. A CASE STUDY OF SOVIET INDUSTRIAL MODERNIZATION

THE PURPOSE OF THE STUDY

This report provides a case study of investment for modernization in one branch of Soviet industry. It analyzes the institutional details and economic trends affecting the ability of that sector to modernize and to meet the targets set for it. The purpose of the study is to identify and examine the micro level phenomena, necessarily lost in more aggregative approaches, upon which success in the current Soviet modernization program depends. This will allow more informed assessment of the likelihood that the current program, as applied to the full range of industry, will lead to long-term, self-sustained growth in the Soviet economy. The goal of the study is not, therefore, to provide a detailed analysis of investment in the textile sector;¹ rather, it is to use this microcosm to provide insights into the issues that will affect the prospects for renewal in the late 1980s and early 1990s.

The Modernization of Soviet Industry Writ Large

A major theme of General Secretary Gorbachev's program for revitalizing the Soviet economy has been the emphasis placed on the delivery of new machinery to Soviet industrial enterprises. This equipment is to consist of new types, possessing advanced technological characteristics, that will provide more flexibility to manufacturing enterprises, which will then operate with greater efficiency.

The model implicit in Soviet statements on the course the current modernization² program is to follow emphasizes increased investment

¹The term "sector" as used in this study is broader than the Soviet definition, which would apply only to the textile manufacturing enterprises. In this study, the term will often refer to an idealized complex that would also include the manufacturers of textile machinery, who are not under the immediate authority of the Ministry for Light Industry, but not the suppliers of raw material inputs. The term "branch" will retain its Soviet connotation and refer only to the constituent enterprises of the textile *otrasl'* of the Ministry.

²The term "modernization," used throughout this study, is a term of convenience. The Soviets do not use it widely, perhaps because of its pejorative connotations for the current state of Soviet industry and agriculture. Rather, it covers approximately the same ground as do the words "acceleration" (*uskoreniye*), "re-equipping" (*perevooruzheniya*), "renovation" (*obnovleniye*), and the by now familiar "restructuring" (*perestroika*), which have all been used at different times and with changing degrees of emphasis. Modernization will be used to refer to a spectrum of policies and programs

in the Soviet machine tool building sector as a first step. This front loading of investment resources is then intended to yield increased deliveries from machine tool builders to the enterprises of the various machine building ministries. The machine building enterprises would, in turn, use this new productive capacity to increase machine deliveries to the manufacturing enterprises themselves. The implicit hope is that new types of advanced machine tools will allow sectoral machine builders to respond flexibly and efficiently with a wide and changing assortment of productive capital of the sorts industrial producers need most.

The ultimate purpose of Gorbachev's modernization and reform design is to retrieve the Soviet economy from what he himself has called the present state of incipient crisis and to lay the foundations for guaranteeing self-sustained economic growth through the end of the century.

And Small: The Worm's Eye View

Although the means and targets for this modernization drive are set in aggregate terms, the program's success will depend on a complex web of intersectoral and interenterprise linkages and interactions. Indeed, a second major theme of Gorbachev's efforts to revitalize the Soviet economy is to improve the way economic agents interact at the very lowest stratum of Soviet industry and agriculture, entailing a limited reform of Soviet economic institutions. Although this reform effort is analytically separable from the modernization program, the redrafting of Soviet practices of economic management carries the leadership's hope that the Gorbachevian investment-led modernization program will come closer to achieving its intended goals than have past Soviet investment campaigns.

The drafters of the current modernization program will not be content with tracking quantitative output targets to monitor fulfillment of the intentions of the central authorities. Great emphasis is being placed upon changing the qualitative characteristics of industrial output, particularly by the machine-building sector. It is by strengthening the decisionmaking authority of the lower strata of the economic hierarchy, by strengthening the horizontal linkages between economic agents, and by changing the roles played by such central agents as the ministries and the state organs of quality assessment that this end is to be achieved.

Past Soviet experience suggests that such linkages are taxed under exceptional circumstances. Their relative underdevelopment is a prime

intended to increase the efficiency of Soviet industry by simultaneously increasing the quantity and improving the quality of the output of the machine-building sector.

cause of retarded modernization in Soviet industry. During a period of reconstruction—of changes in technological base, of greatly shifting investment, supply, and delivery relationships—these fragile linkages will be subjected to extraordinary stress. Will the apparatus be able to answer the challenges set before it? Attention directed toward such micro-phenomena may gain analysts a fuller understanding of the nature and prospects of the Soviet restructuring drive.

The difficulties occurring at the micro level during the course of implementing a broad modernization strategy in an industrial sector may be viewed as being of two types. The first type arises in establishing effective information, material, and command links among enterprises, and between enterprises and higher economic authorities for setting and implementing investment decisions. The primacy of pronouncedly vertical hierarchies has often made such linkages difficult to erect and maintain. The second type stems from unresolved questions about the aptitude of the enterprise itself as the fundamental implementor of modernization. For example, substantial reequipping has often required reorganizing production practices and intraenterprise structure itself to make effective use of new capital once it is put in place. Upon what authority may an enterprise freely do so? A large question remains whether the Soviet enterprise, as currently constituted, is adequate to play the role of self-reliant decision agent analogous to the corporate firm in the Western market type of economic system.

These two classes of problems both result from a failure to adequately delineate the boundaries of decisionmaking authority, leaving open the question of which agent—the enterprise, the industrial ministry, or the senior political authority—is to fulfill the role of entrepreneur. There are instances where some management prerogatives appear to fall between the cracks of assigned responsibility and do not reside at any level of the Soviet system. Although this study will emphasize the first set of problems, some attention will be drawn to those of the second group where appropriate. The concept of “linkages” between economic agents at the level of the enterprise will be stressed to determine the likelihood of success of modernization at the sector level and the likely subsequent effects on industrial performance.

THE CHOICE OF THE TEXTILE INDUSTRY

The analysis uses a case study approach to observe and analyze the implementation of the present Soviet modernization strategy. The emphasis is on problems of investment in one sector of industry. This

permits an initial appraisal of the actual mechanism being used to implement modernization and to indicate possible problems that might arise and may be generalizable to modernization in Soviet industry as a whole.

The textile industry was chosen for several reasons.

- It is not a sector with a central role in Soviet defense procurement and so information will be more readily available than if this sector were considered more sensitive.
- The output of the textile industry is fairly homogeneous and well-defined.
- The manufacture of textiles is simple enough that it is possible for the uninitiated to grasp the relationship between the technology employed and the essential steps of the production process. Furthermore, technique in this industry generally follows world-wide standards, so it is possible to draw upon the expertise of non-Soviet specialists.
- As a sector that has not received much investment in the past, it was a likely candidate for modernization. Indeed, the emphasis that the political leadership has recently placed on the importance of improving the productivity of this industry, while giving a greater responsibility to the nation's defense industries for providing the necessary equipment, also warrants the selection of the textile industry.
- Despite the best intentions of the Soviet leadership to develop this sector, the scale of the full economy-wide modernization program makes the task an ambitious one. As a traditionally low-priority consumer branch sector it may be an early indicator for problems of excess demand and shortages developed in the course of modernization.

The purpose of the research contained in this report is to test an approach for determining the efficiency of Soviet investment for modernization. This study should be viewed as a pilot for more detailed studies directed toward crucial sectors of Soviet industry.

METHODOLOGY

The principal method of this study has been to cull the secondary source material of the Soviet general and specialized press for specific references to the issues of greatest importance for modernization in the textile industry. The resulting material was then organized into a database by individual enterprise to amplify the collected material.

Data Sources

The method employed in this study explores the possibility of utilizing Soviet secondary sources to build a portrait of a Soviet industrial sector. The policy of increasing *glasnost*, or publicity, that characterized the period being studied made such an approach feasible. The two major data sources were the monthly journal of the textile industry, *Tekstil'naya Promyshlennost*, and the general industrial daily, *Sotsialisticheskaya Industriya*. This dual reliance served the purposes of the research well. Whereas the former speaks with the editorial voice of the Ministry for Light Industry and its central research and design organs, the latter tends to lend voice to the textile and textile machine building enterprises and consequently tends to be more muckraking in tone. The two together provide a more balanced treatment than would either alone.

Material was collected from the inception of the XIIth Five Year Plan, and the modernization program proper, in 1986, and continued to be collected through the third quarter of 1988. The bulk of the material appears to fall within the last three quarters of 1987 and the first quarter of 1988, then tapers off. There are several reasons why this might be so.

There was a major change in the institutions of textile modernization on March 1, 1988, when the Ministry for Machine Building for the Light and Food Industries was dissolved and its constituent enterprises parceled out to other ministries, mostly in the defense sector. The dearth of stories on textile modernization after early 1988 might stem from editorial decisions to wait out the inevitable shakedown period before returning to the subject.

Another explanation might be that 1987 was the first year in which all the enterprises of the sector shifted over to the full cost-accounting system (*polnii khozraschet*). Therefore, coverage tended to focus on the difficulties of shifting over to this system. A final explanation of the shift in emphasis might be that in 1987 the higher political leadership paid considerable attention to those aspects of the program for improving the civilian material standard of living that could be aided by the efforts of the textile and clothing industries. In 1988, the emphasis appears to have shifted more to diet and therefore to food production.³

Whatever the reason for this shift in coverage, inasmuch as the picture of Soviet modernization presented in this study depends upon the material appearing in the Soviet press, editorial decisions to reduce the amount of coverage given to the textile sector affect the quality of the analysis and may well skew the image of the program that emerges.

³A fourth possibility is that the situation markedly improved. The evidence of the Soviet press in the latter half of 1988 would lead one to discount this.

Methodological Problems

In several instances, references to the same textile enterprise in multiple articles on different topics permitted a remarkably full portrait of the enterprise to be developed in the database. However, it was rare for the volume of information to be adequate for constructing such vicarious enterprise interviews. In most instances the picture is necessarily impressionistic, based upon brief anecdotes. This raises two major questions in interpreting the data. How widespread are the phenomena that are illustrated by stories based upon the experience of individual enterprises? Second, what do such stories mean? Do anecdotes about dislocations and misdirections tell us that the modernization program is not working as intended, or should they be treated as the birth pangs of the new order that modernization and economic reform—*perestroika*—are intended to bring forth?

On the question of generalizability of reported phenomena, the stance of this study is that the Soviet press takes seriously its hortatory role and is still given to instruction by illustration. More than ever before, *glasnost'* makes the Soviet press the coryphaeus of *perestroika*. In other words, the assumption is that where there is smoke there is fire: if in the case of one hundred textile plants all is well in ninety-nine of them, the one that is experiencing difficulties would probably not be considered news-worthy in Soviet terms. Therefore, a rash of articles on negative phenomena in several enterprises will be presumed to indicate that the problems are general if not predominant.

The second question, on interpretation, raises issues at the core of this study. Further discussion will be postponed until later. Consideration of this question will lead directly to a discussion of the meaning that the course of modernization of the Soviet textile industry holds for the likely direction of Soviet modernization in the aggregate.

OUTLINE

Section II will provide some background on the Soviet textile industry and the intentions behind the present modernization effort. It will also give the general reader a brief guide to the process of textile manufacture to make the balance of the discussion accessible.

Sections III through VI may be considered the data sections of this report. They introduce the major themes that recurred in the secondary sources searched. They are grouped according to categories by making each section focus on the economic agents whose behavior is being characterized or who are most affected by the phenomena. The sections will treat the central authorities, the textile manufacturers, the textile machine builders, and more general phenomena.

Section VII offers a brief assessment of the progress of modernization in the textile industry to date; Sec. VIII presents a unified interpretation of much of the phenomena presented in the earlier sections. This will provide a means for considering what lessons the experience of modernization in this small sector might hold for the rest of Soviet industry.

II. THE GOALS OF MODERNIZATION

THE SOVIET TEXTILE INDUSTRY

The current state of the textile industry is the result of decades of low priority in the allocation of resources. The sector's role was to service the demands for civilian consumption without being a drain on investment that could otherwise be applied to heavy industry. It is not an export-oriented industry. The sector is characterized by aging physical plant and increasingly acute labor shortages. It faces chronic excess demand for high quality output while supplying an excess of low quality goods.

In the textile branch of Ukrainian light industry, more than 40 percent of the total capital stock has been completely depreciated—more than 50 percent in the linen and knit sub-branches (Nikitenko, 1987). In the Union-wide linen industry, more than 80 percent of all looms are between 5 and 20 years old (Telen', 1987). Jacquard looms over one hundred years old are still in use (Lyasya, 1984). The branch is a likely one for modernization, not because of aged equipment alone, but because of low productivity, high maintenance costs, and limited production possibilities.

In recent years, there has also been a greater political will for modernization. In addition to the reasons given in Sec. I for studying textiles, economic and political developments in the Soviet Union have increased interest in this sector. One of the earliest acts of Gorbachev's broad program was to emphasize the need to increase the quality and quantity of consumer goods supplied by domestic light industry. According to the Materials of the XXVII Party Congress, the economy is to be rebuilt on the basis of scientific-technological progress "with priority given to light and other sectors of industry that operate for the direct satisfaction of the needs of the populace. Not just in specialized sectors, but also other sectors of industry engaged in producing progressive equipment for them." Indeed, by the latter half of 1988 it became clear that the average Soviet citizen equated *perestroika* with performance on this criterion and viewed his or her degree of allegiance to that program as depending upon its ability to satisfy basic needs.

By the end of 1986, the first year of the current five year plan period, the perception of shortage was strong. By 1988 the situation was even

worse.¹ Although these phenomena cannot wholly, or perhaps even largely, be attributed to insufficient capacity, Gorbachev's encounter with the citizens of Krasnoyarsk in September of 1988 certainly brought into stark relief the importance of satisfying long-neglected consumer needs if *perestroika* were to develop any sort of constituency.

A decree, "On Measures to Increase the Production of Consumer Goods and to Accelerate the Filling of the Market with these Goods," adopted by the Council of Ministers in August 1988, prescribed additional measures to accelerate modernization of light and food industry enterprises through equipment imports, and charged heavy and defense industry enterprises with taking on a larger part in putting out consumer goods.² These events have given extra force to the priority of modernizing the textile sector.

The retooling of textiles is not a new program, nor is the concentration on rebuilding as opposed to new construction. Intensive retooling was begun during the VIII Five Year Plan in the last half of the 1960s. By the early 1980s, retooling, reconstruction, and expansion accounted for two-thirds of total capital investment. Modernization is deemed to be especially important in the traditional textile centers of European Russia—Ivanovo, Moscow, Leningrad. Soviet calculations from the Ivanovo region show that reconstruction programs cost 25–30 percent less than new construction (Vilenskii, 1987).³ What makes the present program different is the scale on which it is being pursued, the priority it is to enjoy, and the elements of restructuring of economic management that are to guide its course. The emphasis is on building up the machine building sector to bolster the performance of the consumer sector in the production of improved quality consumer goods, thus advancing the progress of the "social development complex." This is to enjoy priority status, although it is difficult to say what that means when there are 44 priority areas where substantial quantities of new-generation equipment is to be produced.⁴ But the intent for 1989 is still to emphasize the growth of consumer oriented industries at the expense of the traditional "Group A" producer-oriented industries (Valavoi, 1988).

¹See Lavrovskii, 1989; Rytov, 1988; and Tolstov, 1987.

²TASS communique, August 23, 1988, as reported in *FBIS Soviet Union: Daily Report*, August 24, 1988, pp. 42–43.

³This considers only the cost of actual inputs, of course. It does not speak to the question of how cost effective such reconstruction might be in the light of improved results.

⁴See the report by I. S. Silayev, Chairman of the Machine Building Bureau, in Tass, "Torzhestvennoye Sobraniye," *Sovetskaya Rossiya*, September 24, 1988, p. 2.

Along with the traditional policy instrument of shifting the priority of investment, modernization has been accompanied by changes in the system for directing that investment. As of January 1, 1987, all production in light industry was to be solely on the basis of trade orders contracted between producers and retail organs.⁵ At the same time, the Law on the State Enterprise, which came into full force in 1988, was intended to increase the amount of direct horizontal contact between textile machine builders and users so that the desires of the latter could be incorporated in the designs and production programs of the former. These elements of reformed economic relations were a prominent component in the formulations of the drafters of the modernization effort. As will be seen below, modernization and reform have been pursued on two separate tracks.

IMMEDIATE GOALS OF MODERNIZATION

Although the Soviets speak of a program for technologically reequipping the textile sector, there does not appear to be a concrete plan as such for doing so. The documents refer to the goals to be reached and speak in aggregate terms of the means for achieving these goals, but a well-defined program is not laid out, although the goals set out by the documents are quite ambitious.

The XII Five Year Plan called for 3.5 billion rubles worth of domestically produced technology to be delivered to the enterprises of the textile industry (Loginov, 1988). This represents an increase of 20 percent over the performance of the previous five year period (*Narkhoz.*, various years).⁶ The plan for the Ministry for Machine Building for the Light and Food Industries called for the value of output to increase by 42.1 percent (versus 26.1 percent in the previous plan period), an increase in labor productivity of 42.9 percent (versus 34.4 percent), reduction in expenditures per ruble of output by 11.9 percent (5.5 percent), and production of specialized industrial equipment was to increase "1.46-1.50 times in the five years." At the same time the aggregate of enterprise production development funds was to grow 53 percent, the material incentive funds by 50 percent, and the socio-cultural and housing funds, 150 percent. In addition, the machine building ministry planned to increase total exports by 136-140 percent

⁵Speech by M. V. Kovalev, Chairman of the Byelorussian Council of Ministers, at June 29 Session of Union Supreme Soviet of Nationalities, *Izvestiya*, July 2, 1987, p. 3.

⁶According to *Narkhoz.*, the results from the first two years of the current plan, if extrapolated, indicate that the pace of output will be unchanged in aggregate value terms. In fact, the output for 1987 declined 7.7 percent from the level of the first year of the plan, 1986.

overall, and by 150-190 percent to the hard currency area. Machine imports were to be largely based on contacts with Council for Mutual Economic Assistance (CMEA) partners and were intended to produce new forms of equipment as well as to reduce dependence on the West (Yegorshev, 1987).⁷

The purpose of the new investment is to provide light industry with the means of fulfilling its assigned tasks. The plan for textiles laid out by the XXVII Party Congress called for production of raw fabric to reach 14-15 billion square meters by the end of the current five year plan period, an increase of 17-25 percent.⁸ In addition, the output of knit goods is to reach 2.2-2.3 billion items (compared with 1.6-1.7 billion in the previous plan period), production of knit goods and wool goods with improved finish to increase by 70 percent, the production of man-made fabrics to double, and ordinary nonwoven textiles to increase by 130 percent.⁹

The planners clearly intended a sharp break with the previous patterns of output for both the enterprises that provide the means of production and those that use them to supply the markets with consumer goods. Furthermore, from the ambitious targets set and the statements that attended the introduction of the modernization program both in textiles and for industry in general, the hopes for success rested upon an expectation that there would be a qualitative change in the character of the machinery provided to the manufacturing enterprises. The dedication of the leadership to meeting these goals by the end of the decade, rather than quietly abandoning them during the plan period, may be seen in the program adopted by the Council of Ministers to produce 24 billion rubles of consumer goods *above* plan in the two years 1989-90.¹⁰ It will be seen that more recent discussion now speaks of the present period as one of transition, with full fruition to be expected only by 1995. The balance of this study will consider why the earlier prospects have not been fulfilled.

⁷This notwithstanding, in May 1988, Deutsche Bank led a consortium establishing a DM3.5 billion line of credit for modernization of the food and consumer goods industries.

⁸Output increased from 11 to 12 billion square meters (i.e., by 9 percent) during the previous plan period. Excluding industrial textiles, the output of fabrics suitable for clothing increased by 0.6 billion square meters in the five years (*Narkhoz.*, 1985).

⁹*Materials of the XXVII Congress of the CPSU*, 1986, p. 27.

¹⁰Announced by TASS on August 20, 1988. The communique offered no details on how this was to be achieved.

THE TEXTILE PRODUCTION PROCESS

This section gives a stylized overview of the textile manufacturing process. It is intended to provide the general reader with a simple background to the discussion of sectoral modernization. The process to be described is a general one subject to modification due to type of fiber—flax, cotton, wool, artificial, or synthetic—and the type of textile to be produced. Figure 1 illustrates the order of the steps followed in textile manufacture.¹¹

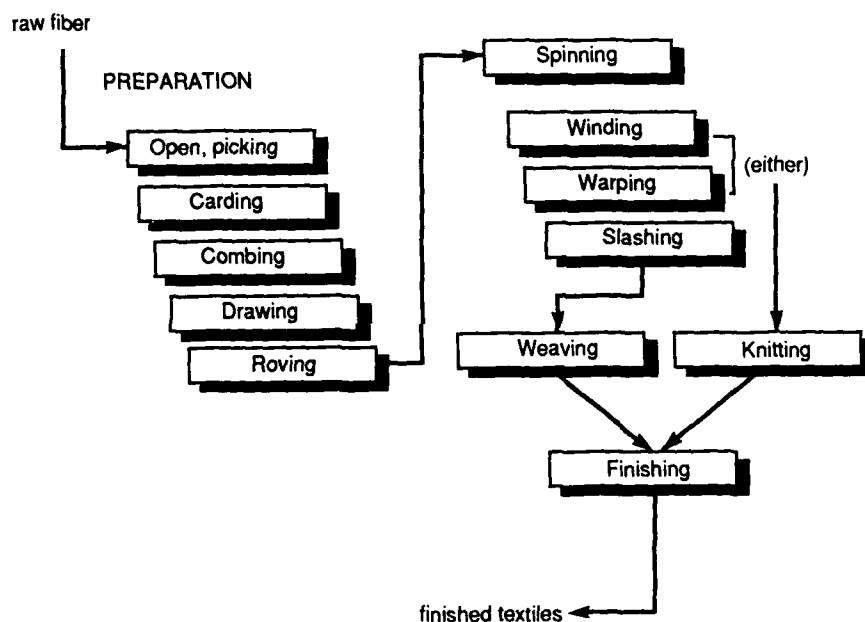


Fig. 1—Process flow in textile manufacturing

¹¹The discussion in this section is based upon personal communication with the staff of the Institute of Textile Technology in Charlottesville, Virginia, and of the Museum of American Textile History in North Andover, Massachusetts. Any errors are the responsibility of the author.

Preparation

Bales of raw fiber are fed into machinery to *open and blend* the material. The purpose is to partially clean the raw fiber and to provide a uniform quality material for later stages.

The opened fiber is then *picked*. This process further removes impurities and produces a sheet or web of fiber that is then formed into a picker lap. More modern approaches circumvent the picking step by using a chute system to feed opened fiber directly to the carding machinery.

A *carding* machine, or card, is used to remove the remaining tangles, partially parallelize the individual fibers, and remove any remaining fine trash. The card contains a large cylinder covered with metallic teeth that hold one end of the fibers while the other ends are brushed by wire-covered, slowly traversing segments called flats. The output of the card is a thin, ropelike strand of fibers known as a sliver, which is then wound into a large can. At this point the processed fiber first resembles the yarn it is to become.

Combing is a process used only in the production of higher quality cotton yarn. The card sliver is combed to remove the fibers of shorter length that will cause greater breakage and lower quality when the fibers are woven. The comb, or combing machine, is the most complicated machine in a textile mill. The waste fibers, known as noils, are still valuable and are used in other processes.

The process of *drawing* combines up to a dozen card slivers into a single drawing sliver by running the card slivers through a drafting system consisting of a set of pinching rollers. The machinery used is called a drawing frame. The main purpose is to even out the variability in sliver weights. Drawing is usually done twice.

A *roving* frame is then used to make the sliver strand finer. Roving also imparts a slight twist to the sliver to maintain the integrity of the cohesion. The resulting material is then wound onto bobbins in preparation for the spinning process.

Spinning

Spinning finally turns raw fiber into yarn, the first intermediate product of the textile manufacturing process. Spinning stretches (*drafts*) the material contained on the roving bobbins, gives the drafted yarn some twist, and winds it onto another bobbin that is rotated on a spindle. This was the first textile processing step to be mechanized. Indeed, some date the beginning of the industrial revolution from the date that Arkwright's water-frame spinning machine was introduced, 1769 (Mann, 1958).

Several types of spinning technology are available. The oldest and most common is ring spinning. More recently, several types of open-end spinning, particularly pneumatic spinning, have been developed. Ring spinning is energy-intensive and requires preliminary roving. It requires adding a winding operation to combine the smaller output packages into a larger one for further processing. Open-end spinning is more economical in that several subsequent processing steps may be eliminated because they produce larger yarn packages; but the equipment itself is more expensive than that for ring spinning, and the resulting yarn is not as strong, therefore less fine. Open-end spinning technologies give less flexibility in the breadth of potential yarn assortment. Ring spinning still gives the most control over yarn types and is the most flexible. It can also most easily yield a yarn of high quality for weaving.

Although yarn spun in any process may be used on any weaving machine, one has to be aware of what the loom is going to be to impart the necessary characteristics to the yarn. Lower strength yarn may be woven on traditional shuttle weaving equipment, but several shuttleless loom types require stronger yarns. One way of controlling yarn strength is to vary the number of twists that are put into the yarn during the spinning process.

Weaving

The next major step is to combine yarns into a fabric. This may be done by weaving, knitting, or bonding in order to create nonwoven fabrics. (The last are not widely used for clothing and will not be treated in this study.) This outline will concentrate on woven textiles for purposes of illustration.

Before yarn can be woven it must first go through several preliminary steps. The smaller yarn packages, held on bobbins, must be combined to provide a larger volume of material for weaving. This is done by *spooling* or *winding*. The processes of *warping* arrange lengths of parallel yarns to form the warp through which other lengths of the yarn will be interlaced during the weaving process on the loom, while *slashing* applies a baked-on sizing compound to increase the strength and lubricity of the warp yarn on the loom beam.

It is the process of weaving (or knitting, a different process) that turns yarn into fabrics. The traditional loom operates by moving a shuttle, containing an internal supply of yarn, across the warp yarns in the loom beam. The filling yarn is cut off at one end and the process is repeated. This process requires considerable energy and the size of the yarn package carried by the shuttle is limited. Further, the shuttle itself is large and stresses the yarns, causing frequent breakage. The

major innovation in weaving of the last three decades is to replace the shuttle by using one of several shuttleless means for carrying the filling yarn across the loom beam. Shuttleless looms may carry the yarn by air or water jets, rigid metal rods called rapiers, or small metal grippers called microshuttles. In each case, the yarn supply is external to the means of conveyance, hence larger; the energy required per cycle is much less; and, if operated correctly, the breakage is reduced. Therefore, shuttleless weaving technology is inherently less labor demanding per pound of fabric produced. Shuttleless weaving is three to four times faster than traditional shuttle weaving. Typically, one operator in the United States can operate 60 to 100 shuttle looms or 20 to 30 of the more productive shuttleless looms.

The type of shuttleless technology actually employed will vary with circumstances. Pneumatic (also called air-jet) looms are the most cost effective, but they are not flexible and cannot be applied to a variety of fabrics. Microshuttle looms are more flexible, but are more expensive. Rapier shuttleless looms are versatile and can use very light or heavy yarns, but are limited in width. They also have more moving parts and are harder to maintain than a pneumatic loom. If the yarn is uneven in thickness, or is too hairy, then the pneumatic weaving operation is difficult and a rapier loom would be preferred. The nature of the preparatory and spinning processes employed in manufacturing the yarn will be as important as the decision about the type of textile to be produced in determining the type of weaving technology to be used.

Finishing

The finishing operations include removing the sizing agent applied during the slashing process, scouring cotton and wool to remove oils and fats from the fiber, singeing to remove superfluous fibers, and bleaching. The textiles may then be sold "grey," or else may be dyed or printed. One can also add desirable features by using rot proofing, flame proofing, mildew proofing, wrinkle resisting, and soil repelling agents. Finally, the textile is washed. Perhaps even more than break-free weaving, the finishing steps are the most important in determining the quality of the final output.

III. RECURRENT THEMES: THE CENTRAL AUTHORITIES

This section and the three that follow report the principal findings of the study. They identify major themes that recurred in the secondary source material. These themes are categorized according to the decisionmaking agents primarily affected. The first group is called "the central authorities," principally the union and republic Ministries for Light Industry, the Ministry for Machine Building for the Light and Food Industries, and their major administrative and attached functional units. The next two groups are the textile enterprises themselves, and the textile machine-building enterprises. The last group will capture themes that are more general in character and that affect the process of modernization throughout the sector.

THE ROLE OF THE CENTRAL AUTHORITIES

An important feature of the new model for economic management as presented in the Law on the State Enterprise (Association) is that the role of the central authorities and especially the ministry is to change.¹ No longer the source of authoritative, detailed output plans for the enterprises, it is to concern itself with issues of a more long-run character. Central planning is to be less detailed with a greater degree of decision authority allocated to the enterprise. A major role for the ministry remains in the allocation of capital for investment in the absence of a capital market. In addition, the ministry is formally charged with charting the development of the branch by formulating technology policy.

Reality does not yet accord with the reform design. The ministry continues to play a more obtrusive role in the sector than intended by the reform. The situation, as it appears in the textile industry, was well put by the headline of a story appearing in *Pravda* at the end of 1987: "New Conditions, Old Methods" (Kalinin, 1987).

The ministry resists relinquishing its now extra-judicial authority. There has been heavy criticism of the Ministry for Light Industry's approach to improving the perpetual deficit of consumer goods. The Central Committee Plenum of June 1987 said: "The position of the

¹In the course of this study, the term "ministry," unless otherwise specified, will refer to the Ministry for Light Industry.

Ministry for Light Industry and of Comrade Minister V. G. Klyuyev is an example of how departmental interests are put before the needs of society and, consequently, the needs of the people" (Nikitin and Shabashkevich, 1988). As long as the ministry is held accountable for shortfalls, it is unlikely to view the unrestrained actions of enterprises passively when these appear to countervail the ministry's understanding of the responsibilities of the branch.

Further, it is not at all certain that in the current regime of partial reform, with the persisting problems of effective monopoly, shortage, and perhaps inappropriate indicators of success, enterprises would be willing or capable of undertaking the rigors of modernization in the absence of prodding and direction from the ministry.

The result has been a large role for the ministry in the modernization process. Its performance in forwarding the tasks of modernizing the textile branch has been criticized by the textile enterprises and outside observers.

QUANTITY vs. QUALITY

There is a persistent tension between indicators of quantity and of quality in Soviet planning. This is no less the case in the present era of reform. If anything, the increased emphasis on quality improvements in output calls the potential tradeoff between the amount produced and the nature of the resulting goods into sharper relief. It is at the level of the ministry that competing claims must be reconciled. The way the ministry chooses to resolve this tradeoff affects the nature of modernization.

The Ministry for Light Industry has been made acutely sensitive to these concerns because of the attention that its shortcomings have received in the press. Most often, it has been accused of using the expedient of inflating the actual quality of the goods produced, and therefore their prices, to appear to meet the plan laid down by the political authorities. "When money is the indicator, there is no incentive to produce cheap products. It's difficult enough to meet the plan" (Mel'nikov, 1988). A Pravda article states that "the industry presents this increase [in the production of allegedly more fashionable items] as a growth in capacity. This would be acceptable were it not for the fact that fashionable articles are produced in place of cheaper ones," and refers to the production figures of the Ministry for Light Industry as window-dressing [*butaforiya*] to cover its inadequacies (Nikitin and Shabashkevich, 1988).

That the tendency to concentrate on volume indicators of output at the expense of true quality improvements emanates from the top is illustrated by the article that carries the comments of V. Klyuyev, the Minister for Light Industry:

We are trying to improve both turnover and quality, but we must be realistic. Unless the cash plan is fulfilled the economy will stagnate. Yet how is it that some people realize this while others place local interests above everything?

He then gives an example comparing shirts produced in Moscow with those produced in Tiraspol. The latter placed first in quality comparisons, yet cost less than the Moscow shirts. "Every Tiraspol shirt is making our sector miss the retail plan. It's not the time to play around with the public. . . . It is not only [the director of the Moscow enterprise] who should be fulfilling the cash plan" (Nikitin and Shabashkevich, 1988).

The reference to "local interests" is telling. It illustrates the unresolved tension between a reform intended to empower enterprises to take responsibility for a wider range of economic decisions and the existing institutions, which are not sufficient to permit indirect signals to guide these actions in the appropriate directions. Clearly, as the passage illustrates, one of the more serious impediments is the persistence of cost-based pricing schemes. The ministry is then forced to reconcile the enterprise actions with the greater interest, which is identified, not surprisingly, with the institutional interests of the ministry. In the present circumstances this manifests itself as an abiding concern for the gross value of output.²

The de facto predominance of quantity indicators in the calculations of the ministry has two consequences for the pace and direction of modernization. The first is that the ministry will naturally tend to favor innovation and modernization that improves the capacity of the branch to meet its volume indicators rather than increasing the ability of any given enterprise to improve the quality of output.³ This is not to say that matters of quantity are the sole concern of the ministry, but rather that when priority allocations must be made, the problem of output volume receives primary attention.⁴

²This has been exacerbated in recent years by the anti-alcohol campaign. The reduction in vodka sales has caused the retail sales plan to be underfulfilled. That has, in turn, caused local liquidity problems leading to missed payments to workers in state enterprises.

³This is in the context of a pricing system that undervalues high demand, high quality output while supporting the price of less desirable goods.

⁴An indicator of ministry concerns is the campaign for increasing production of nonwoven fabrics. These may be made more cheaply than either woven or knit fabrics but have inferior comfort and wear characteristics and are not considered suitable for

The second consequence, suggested by several sources, is that there may be a predisposition to favor new construction over reconstruction of existing facilities in the allocation of investment resources. This tendency is constrained by the overall decision to emphasize modernization of existing plant during the current five year plan period, but it does occasionally manifest itself. It has been stated that a good deal of the most modern capital is going to new construction or newly constructed plants in older enterprises rather than to replacing worn existing capital (Vilenskii, 1987). Another article carries the complaint of the director of a textile enterprise. His plant had been granted only 36 new shuttleless looms while being forced to operate 3,200 of the older variety. The ministry is still pushing for new construction and reserving resources for this purpose rather than beginning the reconstruction of the existing enterprises immediately (Tell', 1986).

There may have been a gradual readjustment of priorities as the program proceeded. But it is not surprising that the ministry should have a fundamental interest in favoring new starts of plant construction. At first glance, a high-level decision to devote the larger share of investment funds to reconstruction and renovation of existing plant suggests a more efficient use of these resources. But how is the renovation and modernization to proceed while the sector and its enterprises still have a responsibility to produce? How is the work force to be maintained—a problem for this sector under the best of conditions—when conditions deteriorate, or if the plant is forced to shut down, during reconstruction? Once again, the ministry is forced to assume responsibility for the dislocations caused by incompleteness in the design for modernization.

LACK OF AN INTEGRATED MODERNIZATION PLAN

The ministry bears primary responsibility for developing and coordinating the modernization scheme for the enterprises under its control. The modernization effort, and by implication the Ministry for Light Industry, has been openly criticized by enterprise personnel for its failures in this role. The criticisms have suggested that there is both a lack of sufficient coordination of these plans and that the plans themselves are often unrealistic.

The ministry (in concert with the machine building ministry) did develop schemas, styled as Integrated Systems of Machinery and

apparel in the West. Nevertheless, increasing nonwoven output could conceivably reduce the pressure on the suppliers of cloth intended for consumers also to supply textiles for industrial uses.

Equipment for the Textile and Light Industries for the Period to 1995. They were drafted to cover the full technological cycle of production for each product line. Primary attention was duly given to installing low-waste automated equipment. The perception is that these plans will guide development so that the "relative share of equipment at the world technical level" in the sector will reach 95-100 percent by 1996 (Loginov, 1988).⁵

From the perspective of the typical enterprise, however, this seems an academic exercise divorced from reality. These systems do not take into account the practical problems faced by enterprises. A former textile enterprise technical director calls modernization a crucial matter, but only if it is "unified and serious":

But it is not so with us. In the last year, as directed by party, soviet, and other higher organizations, we have worked out eight different integrated plans for the modernization [*perevooruzheniya*] of the factory. How will we carry it out if supplied with domestic equipment? If from member states of CMEA? If from capitalist countries? Or from mixed sources? How will we work in the year 2000? In 2010? And in 2030? Then again, in 1990, but broken down by quarters. . . . For whom is this necessary? And how is it possible to plan some forty years in advance if we don't know what we are doing tomorrow? Of the 500 tons of wool we require, we received scarcely 50. There is no dye stuff. The domestic chemical enterprises can do nothing and the material imported under contract will come only in the second half of the year. The finishing equipment can fall apart at any moment, and the factory will come to a halt. But we waste time making projections that are of no use to anybody (Mel'nikov, 1988).

The ministry's planning also comes in for criticism because of its lack of realism about the capital types available for modernization. Before the advent of Gorbachev, during the period of low priority status for textiles, development plans were not dynamic in character. During the period of the last five year plan, the Moscow oblast' authority for the cotton textiles industry of the Russian republic (RSFSR)⁶ produced a development plan through the year 2000 using only equipment currently available in 1983. Much of this capital was clearly not adequate even then (Lysaya, 1984). The opposite problem appears to obtain now. At the beginning of the modernization drive a ministry planning institute worked out a series of coordinated textile machine ensembles to provide a rationalized set of plans for reequipping.

⁵The same source suggests that 50 percent of the present stock of equipment in the enterprises of the Ministry for Light Industry needs to be replaced.

⁶Important because, along with Leningrad and Ivanovo, Moscow is one of the country's major traditional textile centers.

However, according to the plans of the machine building enterprises, several of these machines were not scheduled to go into series production until four or five years later, some of the designs still needed to be reworked based upon experience gathered with prototypes, while for others series production is still not visible in the near future. These barriers caused the integrated systems to be reworked. The research institute admits, however, that thanks to the price, energy usage, and occasionally the size of the substituted equipment, installation of these ensembles will not, in fact, improve the technical-economic indicators of the adopting enterprise (Garber, 1988).⁷

A certain amount of the muddle is beyond the control of the ministry. To the extent that modernization requires marshaling resources outside the sector, the familiar problems of coordination arise. For example, it has not been possible to install less detrimental technologies in the mercerizing shops of finishing plants.⁸ Whereas the old, hazardous, lye-concentrating equipment is no longer in series production, the relevant research institute of the Ministry for Chemical Machine Building will not commit itself to provide designs for new installations until 1988-89 (Garber, 1988). Given the traditionally long development times required to bring designs into series production, this alone would suggest that the ministry's goals for modernization will not be met by the target date of 1996.

PERFORMANCE IN TECHNOLOGY POLICY ROLE

One of the two major policy roles that remain to the ministry under the new design for the Soviet economic system is to be the drafter of branch technology policy. The previous discussion considered the ministry's performance as the arbiter of the current modernization program. The present discussion will consider the effects of having the general function of technology choice fall within the province of the ministry.

The Machine Builders' Customer

In a recent article, the deputy director of the All-Union Scientific Research Institute of the Textile Machine Building Industry (*VNII-Tekmash*) states that the outward forms of the industry have changed

⁷These installations might actually decrease such indicators.

⁸Mercerization is a process that treats cotton fabric under tension with caustic soda as a precursor to dying.

drastically from the days when the ministry decided what equipment was to be produced and to whom it would be delivered. The payment also came from the ministry. The branch has now shifted to operation under the rules of self-financing.

One might say that in the [new] inter-relations of machine builders with light industry the principle, "He who pays the money calls the tune," is beginning to function. But we won't rush. The enterprises now pay the money. But who calls the tune? Strangely enough, it is by no means the enterprise. The selector of equipment is the ministry (Khavkin, 1987).

The research institutes of the Ministry for Light Industry formulate the technical demands and specifications of the equipment to be used by the textile branch. In doing so they are operationalizing a major aspect of the ministry's role in making technology policy and are operating within the letter of the reform documents. It is, to be sure, the broadest possible definition of this role: not merely to outline a general technology policy but to be the prime selector of specific types of machinery for series production.

The result is that although the textile enterprise that orders specific equipment is the ultimate consumer (*potrebitel'*) of the machine builders' output, their true customer (*zakazchik*) is the ministry that orders series production. This is a result of separating authority for technology policy from financial responsibility for investment decisions, and has led to some dislocation among the textile machine builders. Because the ministry and its organs are not the ultimate consumers of the machinery produced, under the new system they can by no means guarantee demand for it. "When the time comes to buy, the ministry and the branch research institutes stand aside. And the enterprises aren't rushing to place orders" in spite of their great need for new equipment (Khavkin, 1987). The system often leads to improper choice between capital types, from the point of view of the textile enterprises.

Imbalanced Approach to Technology Choice

In the past, the ministry's approach to technology choice has been narrow-gauged and marked by a tendency to mandate universal solutions to textile manufacturing problems. The ministry continues to place all its eggs into one basket represented by a single technology rather than to develop a range of equipment suited to varying conditions. An extended example will serve to illustrate this point.

As noted in Sec. II, open-end spinning is the newest technology in the spinning of yarn. Pneumatic open-end machines have higher productivity than the machines using the earlier ring spinning process because several intermediate steps may be dropped. The ministry had judged that this represented a new and higher technological level according to a range of technical and economic indicators.

The customer [the ministry] has dictated: "intensify the output of pneumatic spinning machines." And as for the traditional ring spinning machines: "to the scrap pile" (Khavkin, 1987).

The ministry calculated that the productivity of the new technology was 1.5-2 times that of ring spinning, used 40 percent less energy, and substantially less raw material. The machines designed by the machine building ministry's design bureau were favorably received at international fairs and went into serial production. By 1987, however, production of one machine, produced by the Tadzhik *tekstilmash*, stopped altogether. There were no orders; the textile enterprises refused to take it (Biryukova, 1987a).

There are drawbacks to applying the pneumatic process in spinning. Pneumatic machines will not permit as wide variation in yarn types and therefore will support only a narrow assortment of fabrics. Some enterprises have discovered that a total adoption of the pneumatic spinning equipment would mean that some textiles in their traditional line could no longer be produced. But the ministry unilaterally declared that ring spinning was outdated and pressed for the new equipment without paying attention to its potential defects. "Of course," says the director of a cotton textiles combine, "pneumatic spinning machines are also necessary, but the scale of their introduction often exceeded what would have been optimal for the level of the branch" (Molodtsov, 1987). This has led to the phenomenon of enterprises refusing to purchase the machinery, leading to crises at the plants producing it.⁹

On the face of it, this situation might be expected to be self-correcting under the new system of economic relations. The machine builders would come to realize in a practical way what the textile enterprises actually require. However, the forces compelling such a readjustment are counter-vailed by branch institutions and policies on price formation. The totality of ministerial authority over such decisions in the past has removed many alternatives from practical application, and there is an unwillingness to apply the lessons of the past to present circumstances.

⁹The Penza *tekstilmash* textile machine building plant has been particularly affected in this instance (Khavkin, 1987).

The ministry, in fact, made two errors when setting development policy for spinning. The first was to overemphasize one technology. The second was to tell the machine builders that ring spinning machinery was no longer required in any circumstances. All continuing development work on this technology ceased (Molodtsov, 1987). Therefore, for the foreseeable future it is not only the machine builders who are affected by the shortsightedness of past choices. Textile enterprises have no high-speed spinning technology for the production of high quality fabrics because no one has worked on its modernization for the past decade.

The importance of this extended example is that many sources suggest that the orientation of the past continues. "Our customers [the ministry] have not profited from this lesson. They continue to follow their own course" (Khavkin, 1987). This is, in part, an amplification of more general complaints of a lack of integration in the modernization strategies formed by the ministry. In one article an enterprise director explicitly draws a connection between the conflicting goals of the ministry and the enterprises it administers, and the absence of a joint, mutually agreed upon technical policy, as well as to a fundamental lack of proper communications between the two levels (Tell', 1986). In some instances at least, the ministry continues to formulate policies for development that are at odds with the perception of requirements by enterprise personnel.

The result is to attenuate the signal the machine builders receive from the textile enterprises. The message, based on revenues, is that pneumatic spinning is not as widely applicable as branch authorities had originally believed. The message from the ministry, however, is that ring spinning technology is not to be pursued and that equipment embodying that technology can be offered only at a penalty price. In short, the means for setting technology policy by giving guidelines to the machine builders is still predicated on an earlier model where the ministry "scattered" the resulting output by directives to the subordinate enterprises as well. Although the enterprise is now responsible for capital investment decisions, the ministry remains the entity that determines the type of equipment produced. Both the economic and the command directive mechanisms are at work influencing the output decisions of the machine builders. Under current conditions it is the ministerial directive that remains authoritative. The enterprise is constrained to select from among a limited number of technologies, none of which may be completely appropriate to its needs. This creates a conflict between the reform intent of giving more responsibility for investment and output decisions to the enterprise while giving the ministry the leading role in formulating technology policy for the sector. It

means that there is a fundamental difference of opinion over what form modernization should take and what the appropriate signals to the machine builders should be.

The ministry cannot be held solely responsible for the misdirection surrounding decisions over technology choice. In particular, the Soviet leadership, concerned with accelerating the pace of modernization, cannot assume that in the absence of ministerial prodding, the textile enterprises would necessarily make better choices operating in an environment of complete autonomy.

The typical Soviet enterprise, confronted with the realities of almost perpetual shortages of inputs, quasi-monopolies, and specific and limited performance indicators, has traditionally exhibited a conservative, if not openly antagonistic, attitude toward innovation.¹⁰ The current tide of reform has brought little real change in the milieu for enterprise decisionmaking, hence there is little reason to believe the disinclination to be innovative has changed, posing a dilemma for the policy of reform in the Soviet Union. Under present conditions, there appears (to Soviet planners) to be a legitimate role for some external agent, logically the ministry, to press the enterprise to be innovative. Accepting this proposition, it then follows naturally that the ministry will formulate views on the appropriate direction that technological development should take.

This perpetuates a basic conundrum for establishing where the decision authority for technology choice should lie. To have the ministry play a large role in investment decisions runs counter to the spirit and the intentions behind most of the major elements of reform. In particular, all parties to the transaction will recognize that the opinion of the using enterprise itself is the least decisive in the technology choice decision. However, until there is a more substantial change in the institutions and incentives governing enterprise behavior, the autonomous enterprise will probably not divest itself from a pronouncedly reserved attitude toward change in production technology. Therefore, the current environment of partial reform, where the power of the ministry is to be attenuated but the enterprise is not yet in a position to be an autonomous interpreter of indirect external signals, could lead to a system that may work even a bit worse than the one it is intended to replace.

¹⁰This phenomenon has been fully treated in a classic study by Berliner, 1976.

IV. RECURRENT THEMES: THE TEXTILE ENTERPRISES

In the current Soviet system, the enterprise is intended not only to be the recipient of the new equipment designed to achieve greater rates of productivity, but is also expected to be an active participant in the modernization effort. The Law on the State Enterprise was designed to widen the sphere of decisions for which manufacturing enterprises are responsible. One of these is the area of investment decisions. Although the legal *responsibility* of enterprises has been increased, the new responsibility comes unaccompanied by much of an increase in enterprise *authority*—that is, the ability to make the results of the new decisionmaking processes binding upon other agents.

AUTHORITY CIRCUMSCRIBED BY MINISTRY

The sector's central authorities have generally shown themselves unwilling to be bound by the new conditions that are supposed to govern relations with subordinate enterprises. As a result, the enterprise has less ability for maneuver and responsible decisionmaking than was envisioned by the authors of the modernization program and the economic reforms. In the words of a critical article in *Pravda*, "*perestroika* in the ministry [of Light Industry] has not really begun. No general plan has been produced yet for running the sector in line with the spirit of reform" (Nikitin and Shabashkevich, 1988). The ability of the ministry to establish norms that are not general but rather are tailored to individual enterprises means that little has changed in practice in the relations between central administrators and enterprises. One director (of the Experimental-Technical Sewing Factory in Kiev) says that

our work was to have been evaluated on the basis of three main parameters: profit, fulfillment of delivery under contracts, and development of the enterprise fixed capital assets. But we celebrated the victory of common sense too early. Bureaucrats at every level engendered from these basic indicators such a quantity of production norms that we again found ourselves bound hand and foot (Savinov, 1987).

The sentiment is echoed in an open letter from a weaver who asks after three years of *perestroika*, after giving the rights of independence

and initiative to enterprises, what does this mean in practice? Enterprises may discuss problems internally, but they are still settled by the ministry whose directives "determine the fate of enterprises and their workers" (Kovshova, 1988).

The complaint is general. Even M. V. Kovalev, the chairman of the Byelorussian Council of Ministers, has stated,

It must be frankly admitted that many enterprises [in light industry] that have been transferred to the new management conditions do not yet have a sense of economic independence. In many cases the long-term economic normatives laid down for them do not take into account the actual state of production and the need to develop the production base and the social sphere.¹

The complaint from enterprises is not only that the norms set by the ministry are overly restrictive, but that they are also often divorced from the economic realities confronting the enterprises. The director of the Pechorskii Knit Factory states flatly that the planning methods of the branch are the same as before. They were given a plan for 1988 calling for a 6 percent increase in the number of articles produced with a planned profit increase of 860,000 rubles. "But these two indicators 'from above' do not fit each other." They are not reconcilable with the nature of the goods produced nor with expected increases in productivity (Kalinin, 1987)." This is the case not only with all-Union ministries; it occurs on the level of the republics as well.

Even under the new management conditions, despite the recommendations of the planning agencies, the [Uzbek SSR's] Ministry for Light Industry and Uzshveyprom [the republican garment industry authorities] are continuing the practice of planning from the top down, without any consideration of the real situation, without taking into consideration the opinion and views of the working collective (Sadykov and Parfirova, 1987).

These passages suggest that there is a tendency for the ministry to broadly interpret its function of setting norms for the branches, using it to maintain substantial control over the operations of the subordinate plants. This prevents enterprises from deciding for themselves what their production program is to be. These decisions are an important part of any comprehensive approach to planning the form that modernization should take in an enterprise. The result is to provide administrative and, perhaps even more important, psychological limits to the exercise of enterprise authority.

¹Speech at the June 29 session of the Supreme Soviet of Nationalities, *Izvestiya*, July 2, 1987, p. 3.

These limits go beyond interference by setting restrictive norms. The evidence is that the ministry persists in directing the disposition of output from textile enterprises even though the intent was for state orders to account for no more than 70 percent of total output. Direct sale trade is welcomed in name at the ministry, but only 0.6 percent of the output of light industry is sold this way (Nikitin and Shabashkevich, 1988). The republic ministry does not allow a sewing factory in Kiev producing stylish men's suits with imported French equipment to realize the greatest opportunity for revenue wherever that may be, but have directed that the output may be sold only in the Ukraine. Even there this independence is circumscribed. "So where are your direct contracts? Where is your independence?" asks the reporter. "As you see," replied the director (Savinov, 1987). Again, the ministry is justified in its own view; it is setting the good of society above that of enterprises when it comes to guaranteeing supply. It should assure the production of "special purpose goods" ("gauze and cotton wool for health needs, woolen fabrics for school uniforms in public education, sport and leisure goods . . .") that are currently not advantageous for enterprises to produce.² The effect is to stifle enterprise initiative. One important check to increased enterprise authority over the full range of decisions required to effect modernization is that this authority must come at the expense of the ministry who refuses to relinquish it.

CHOICE OF MACHINE TYPES

Enterprises also lack effective authority over the major decision facing a modernizing plant. They have little practical say in the choice of machinery to be acquired. In this area as well it is difficult to detect any difference in substance in the operation of the current system compared with its predecessor.

As was already noted, this disenfranchisement begins before the enterprise ever has an opportunity to exercise decision authority. Ministerial choices over technology policy will have narrowed the assortment of equipment types that actually enter serial production.

Other factors affect the balance of free choice by enterprises, one being the familiar persistence of shortage phenomena. Short supply further reduces the ability of textile producers to influence the type and assortment of machines produced for their benefit. Thus, the director of the Sovyetskaya Gruzziya Worsted Cloth Combine:

²See the letter of V. Klyuyev, Minister for Light Industry to the USSR Council of Ministers, *Pravda*, May 30, 1988, p. 2, trans. *FBIS USSR Daily Report*, June 1, 1988, p. 53.

Under the conditions of an equipment shortage, just try to raise persistently the question of urgently modifying the equipment. You can pose the question. Please do! . . . You will hear the reply, 'Come to your senses! We've got a long waiting line' (Mgeladze, 1987).

The imperative of achieving the required level of machinery output militates against both general quality and the specific tailoring of equipment to meet the needs of small groups of textile producers. In recent years the demand by enterprises in light industry for domestically produced equipment has only been 70-75 percent filled (only about 39 percent in the cases of knitting and sewing machinery). Worse, more than 80 percent of domestically produced equipment is judged inferior to its foreign counterparts in productivity, reliability, quality, and degree of mechanization and automation (Loginov, 1988).³

The inability of the textile producers to receive the types of equipment they require, and to have those machines perform to the standards they wish, seems to be widespread. One knit goods combine in Kharkov waited 20 years for reconstruction. Finally, they received the new MT-2 winding machines from the Tadzhik *tekstil'mash* in Dushanbe. The old machines yielded 750 kg of yarn per shift, but the new ones yielded 100 kg less. Similarly, the knitting plant received 15 new D2LK knitting machines from Tula. Even though the machines were already in series production, five fundamental changes had to be made to their mechanisms before they would work. They also received 81 OZCh-14 (cleaning?) machines. Within the year, 21 were down in need of repair. They were told that because the machines were now judged inadequate and were no longer in production, no spares were available (Zenkovskii, 1986).

One of the measures taken to address criticisms of this course of modernization was the decision, enacted on March 1, 1988, to abolish the Ministry for Machine Building for the Light and Food Industries. The subordinate enterprises were reassigned to several other ministries, including several in the defense industry.⁴ The apparent intent was to increase the level of support the machine building complex was

³Loginov's statement may be balanced by the following: "The effectiveness of intensive renewal of enterprises in the textile industry depends on the technical level of the equipment provided, and satisfaction of the demand for such equipment. The massive kinds of equipment now being produced by Soviet industry are on par with the best models produced elsewhere" (Vilenskii, 1987). For the present, the apparent contradiction may be resolved by noting that one result of the system of state acceptance (*gospriemka*) has been to reveal that technological specifications and norms for the production and operation of equipment are not sufficiently adhered to (Lavrentyev, 1987). One author may be speaking in positive terms, the other in normative.

⁴The Aviation Ministry now produces knitting machinery. The Machine Building Ministry produces some textile machinery along with its more traditional output of ammunition and propellants.

providing to the textile modernization program by giving this sector the benefit of the more effective economic management thought to obtain in defense industry. In addition, ministries that have been the traditional recipients of priority and used to its management would know how to use the priority investment assigned to textile machine building that is supposed to result in a modernized textile branch. Finally, this was the quickest way to remove what had been widely perceived as a "bad" ministry from the scene.

It is still too early to detect substantial changes stemming from this realignment, especially regarding giving textile enterprises more control over the type of machinery produced. Several factors might be expected, *a priori*, to attenuate the results that the political leadership hopes will ensue. It remains to be seen if the authorities made newly responsible for administering the output of this equipment will view it as something other than the lowest priority production of high priority ministries, especially since the defense industries have been geared to the production of high revenue output, not the low value likely to be realized in tailoring textile equipment to the needs of individual manufacturers. Further, the defense ministries are used to dealing with customers having a great deal of clout and may see little reason, other than political pressure from higher up, to be overly attentive to the views of their newest clients. Most important, there is little reason to expect that this move will change the interests of machine builders. They will remain quasi-monopolists who take their prime direction from the Ministry for Light Industry.⁵

The only organic changes that have been made while charging defense industry with providing machinery for civilian sectors have been to transfer the enterprises of the Ministry cited above to defense ministries while decreasing the orders for the traditional output of these ministries. Therefore, political pressure from the highest levels will be necessary to guarantee adequate performance. Admittedly, this pressure was acute through the first half of 1989, but it remains to be seen whether political resources will be applied any more constantly than has been the case with earlier political/administrative solutions to easing the capital bottleneck for light industry.⁶

⁵Again, as long as great possibilities remain for individual enterprises, particularly the machine builders, to achieve effective monopoly power, ministerial interference could be viewed as a force that might reduce the welfare loss to the economy.

⁶A partial list of such initiatives would include creation of the Bureau of Machine Building, emphasizing horizontal linkages between enterprises, CMEA science and technology programs, shifts of personnel from defense to civilian sectors, the system of *gospriemka*, and engaging large Western credits for importation of equipment imports. If the latest stratagem, shifting production into defense sectors while increasing the priority allocated to civilian output, does, in fact, continue for several years, it might bring about a fundamental change in the system of priority allocations for defense that has existed for the last five or six decades.

The problem of ensuring that the machines the machine builders build are the machines the machine users want and need remains unresolved. The production of shuttleless looms, for example, is important for the development of the sector as a whole. Textile enterprises for years have pressed for increased production of a loom using the rapier system, the ATPR series. These have been produced by only a single plant, the Klimovskii Textile Machine Building Combine (Lysaya, 1984). The weaving plants want the machine because it is inexpensive—five to seven times cheaper than the alternatives—small, and can process low quality yarn. However, the production of this equipment is not to be increased. In fact, it will be decreased because, in the assessment of the central authorities, the ATPR looms are not judged as corresponding to the world technological level.

The general implications of this approach to modernization will be discussed in Sec. VIII. For the present, the message is that “the factories know what sort of music they need and are prepared to pay for it. The only pity is that it is not they who select the tune” (Khavkin, 1987). Again, the gambit of shifting production to defense ministries may exacerbate these difficulties. Now machines will be built by manufacturers completely unfamiliar with the needs of the users and who are used to dealing with a customer possessed of considerably more bureaucratic muscle than the average textile mill. This shift alone will not endow the textile sector machine user with sufficient market power in Soviet terms.⁷

INSUFFICIENT RESOURCES FOR SELF-FINANCING

Self-financing is one of the means through which the information possessed by enterprises is to influence the course of modernization. Enterprises are now to be responsible for providing a large portion of investment funds. Less successful enterprises will be penalized, and the more successful the enterprise, the more the opportunity for growth. It is also intended that the more successful operators will have greater influence over the output decisions of machine builders. Problems with actually implementing this reform in the textile industry have once again provided a large avenue for intrusion by central authorities into decisions legally within the province of the enterprise.

The history of the textile branch's development undermines the possibility of having a meaningful portion of modernization underwritten by

⁷However, this very lack of familiarity may lead the new producers of this equipment to seek more contact with the users than had the traditional suppliers who were confident they “knew” what the customer needed.

the enterprises themselves. For decades, the siphoning of surpluses from light industry to support investment in heavy industry has been standard practice in Soviet industrial development. Now that self-financing is the rule, it is asking a great deal of the funds formed from profits in the textile sector to provide the means to finance the reconstruction put off for decades (Telen', 1988). The situation was further aggravated in the past if the funds for plant renovation had to come from the enterprise's own sources. They were likely to be drawn from the fund for capital repair. This then led to neglect of maintenance and upkeep (Lysaya, 1984).

The current problem is not only that enterprises find themselves in a considerable hole to start. The norms applied to net revenues to form investment funds are not realistic. For example, calculations for the textile industry in the Ukraine show that at the current rates it would take 37 years for the cotton subbranch to renovate its capital (*obnovit' svoi fondy*), 32 years for the linen subbranch, and more than 20 years for the others (Nikitenko, 1987). Similarly, the Izmailovskii Fabric factory in Moscow reports that of its R3.5 million profit, the norm established by the ministry leaves less than one-third at the enterprise. More than half that remainder is earmarked for social needs, and even this is deemed insufficient for the purpose. Only 6 percent of enterprise profit remains to develop the industrial base of production⁸ (Smirnov, 1987).

Another factor reducing the scope for self-financing has been the pernicious effect of fines for failure to perform according to contract. Research conducted at three silk fabric⁹ associations in Moscow found that 90 percent of all assessed fines were caused by tardy or skipped delivery. The problem is that unlike most industries where enterprises have been able to balance assessed fines against penalty payments received, in textiles the fines are considerably higher than the compensation received. The silk enterprises paid eight times more in fines than they received for the nondelivery of raw material that caused the delay (Yelshina and Ponomarenko, 1988).

There is a strong perception that to make self-financing operationally meaningful, the norms for payment to the state budget and for

⁸The example is illustrative. Its generality is difficult to determine because of the phenomenon of "individual normatives," norms individually tailored for each enterprise by the ministry. The net winners or losers are partly determined by central administrators rather than by objective economic results. See Bunich (1988) for a discussion. One source suggests that from 1987 there were stable (which is not to say standard) norms for distribution of profits. At the named enterprises the remainder has been less than 20 percent, and intended to be used for all purposes, not just capital investment (Yelshina and Ponomarenko, 1988).

⁹In Soviet parlance, enterprises producing textiles from man-made fibers are located in the "silk" (*shelkovo*) industry.

fund formation must be redrafted. The ministry has been criticized for this as well:

In the sector's relations with the state budget and financial organs there is indeed much that is obsolete and runs counter to the spirit of radical reform. . . . The planned joint session between [the ministry's] collegium and the USSR Ministry of Finance has still not been held. . . . The unanimous reluctance of . . . sector leaders to face and solve urgent problems is also amazing (Nikitin and Shashkevich, 1988).

In the absence of such a redrafting, the influence of the ministry remains preponderant since it is truly the source from which any resources for modernization must flow.

MONOPOLY AND QUASI-MONOPOLY

Although the persistence of monopoly and near-monopoly situations is implicit in much of the previous discussion, it is worthwhile treating the phenomenon explicitly in this recounting of recurring themes.

The ability of the textile enterprises to influence the design and production programs of machine builders through their newly increased role in investment decisionmaking is restricted in practice. Quite often the machinery is produced at a sole source, greatly reducing the bargaining position of the purchasing enterprises. As an example, the Tula Tekstilmash is the only machine building association producing knitting equipment that supports a wide range of products. The director of a knit goods association in Kharkov complains that despite unsatisfactory response by this machine builder, there is no one else to turn to. "It is not we, but they who dictate what [machinery] we take" (Zenkovskii, 1986). There are 58 linen producing associations in Byelorussia and a great demand for thread and fabric of pure, natural linen. However, the Orlovskii Tekstilmash Association, the prime producer of machinery for this industry, does not produce equipment designed to process pure flax fiber (Shagun, 1986). The inability of the present system to enable the users of textile machinery to help direct the type of machinery actually produced has led to calls for the creation of some centralized enterprise that can, presumably, be directed by an authority higher than the textile enterprises to create nonstandard equipment (Ivanova, 1987). There is still a need for a powerful ministry, because enterprises have little clout with the machine builders.

THE ILL-DEFINED ENTERPRISE

In addition to consequences associated with the Soviet price system, there is another strong common thread connecting several phenomena reported under the themes presented so far. The reformed Soviet enterprise and its boundaries are not as well defined as in the case of the Western firm. Inherent in the definition of the firm is an understanding of what types of decisions fall under its authority. In many instances the decisions made by the Western firm's management would, in the case of the Soviet textile enterprise, either fall to the "external" management authorities, especially in the ministry, or not have been formally assigned to any economic agent.

This has consequences for modernization. Ministries are necessarily concerned with issues that affect more than an individual enterprise. Decisions taken by ministries to enhance the process of modernization will not necessarily be optimal for the welfare of a single collective. Decisions over pace and form of modernization are a fundamental prerogative of firm management. A competitive selection process, to be effective, requires different agents to follow different strategies based upon local information. To the extent that an increase in competitive behavior is part of the logic behind the new strategy for economic organization in the Soviet Union, the lack of sufficient authority on the part of the enterprise will undercut the ultimate effect of the changes.¹⁰

Lack of specificity about where the authoritative boundary of the enterprise lies will affect the shape of reform as well as modernization. A concept of "direct links" between enterprises could imply independent, authoritative producers whose interactions are mediated by market types of contacts and institutions. However, it would also permit an interpretation that takes form in "organizational complexing": dealing with insufficient enterprise decision authority and the consequences of underdeveloped markets and competitive forces by formally linking enterprises into some form of association that will permit a new hierarchy to perform many of the functions of linkage and management. This propensity, if unchecked, would lead current reform efforts back along roads already traveled in the past without arriving at solutions to the economic troubles of the Soviet economic system.

¹⁰These issues receive fuller treatment in Popper, 1986.

V. RECURRENT THEMES: THE MACHINE BUILDERS

LONG DEVELOPMENT TIME

The lengthy period required to design and produce a new type of capital equipment, or substantially modify an existing type, is a considerable brake on the responsiveness of the Soviet machine building sector to the needs of its customers. It places a practical limit on the degree that the users and the builders of machines can coordinate the production of suitable machinery through direct links.

The problem is not confined to the textile machine building industry. In the Soviet Union, the average duration of the development stage alone is six to eight years for new machine types. In the United States the entire cycle of research, development, and introduction is 6.4 years on average. It is 5.6 years in West Germany, and 3.6 years in Japan (Zaichenko, 1988). A recent letter to *Pravda*, complaining about ministerial interference, illustrates the persistent nature of this phenomenon in textiles. The writer, describing a machine to produce rug braid, called attention to the unusually favorable circumstances of its development. It was designed through an intense effort involving cooperation with the end user. "Matters requiring a year of correspondence with agencies would be resolved by co-workers together with the customer directly on site." Even so, a full six years were required before the prototype was developed and series production could even be considered.¹

LIMITED CONTACT WITH USERS

In several comments, enterprise personnel noted how long it had been since anyone connected with the machine building enterprises or the appropriate design bureaus had come to their plant to view the conditions under which the machinery was to operate. Limited contact between users and builders of equipment appears to be more the rule than the exception. The result is a good deal of mutual recrimination. The machinery that is delivered does not meet the needs of the textile

¹Lev, 1987. Four more years passed, with time still elapsing at the time the letter was written, because the Ministry for the Chemical Industry had been sitting on the design, while pressing for importation of similar machinery from abroad.

producers and they, in turn, accuse the machine builders of shoddy work. The machine builders feel that this is merely a cover for incompetent operation of the machines they have built.

Several examples of chronic miscommunication may be cited. One indication that the problem is of long standing is that even though almost all textile machinery is operated by women, and has been for several decades, ergonomically they are constructed to be operated by average adult males. Women are forced to jump, carry heavy weights, and be quite athletic to service the machinery, resulting in higher than average rates of industrial accidents and chronic health complaints among textile workers (Telen', 1988).

Machine builders show resentment when the textile enterprises attempt to step over onto "their turf," because regular contact with machine users has not been made a part of the design process. A director of a cotton textiles association describes how factory personnel had to build their own modifications into the equipment they were given so that the weaving plant could be modernized with shuttleless looms without, at the same time, "losing" their assortment. They attempted to share their experience with the equipment's manufacturer so the improvements could be built in more efficiently at the factory.

It would seem that the creators of the new technology should be interested in our experience and the experience of other enterprises and adjust the output of their current machine types themselves. Nothing of the kind. [The textile factory personnel] turned to the machine builders of the Cheboksarskii factory: here are our designs, our sketches, make us machinery with these characteristics. In answer they heard things of the following sort: What are you trying to pull? [*ne moroch'te nam golovu*] (Molodtsov, 1987).

One additional example illustrates the mutual misunderstanding engendered by two organizations each proceeding in its own direction toward a common end. A new knitting machine, the Gamma-202, had been created to replace the D2LK machine. As has become usual, the supposedly finished machine required considerable modification by the recipients on the shop floor. When the textile enterprise personnel asked the manufacturer whether the changes they had been forced to make had been subsequently incorporated into the new design, the chief of the Tula *tekstil'mash*'s design department answered "Yes, but not all." The changes had been made in blueprints, but not yet "in metal." Further, the machine builder maintains that "theoretically" the productivity of the Gamma-202 will exceed that of the machine it replaces. But the users at the knit goods enterprise point out that a productivity figure is not included in the papers for the new machine for the simple reason that in practice it is less productive than the old

D2LK. The machine builder retorts that one must look at the machine's performance in producing the particular type of output for which the machine was designed in order to calculate the productivity benchmark (Zenkovskii, 1986).

What has happened in this instance is that two different machine concepts exist, stemming from two systems of evaluation and two separate schedules of indicators of success, but only one physical realization of the actual machine. The users idealize a machine that will allow them to perform their work as accustomed in a more productive fashion. The machine builders produce a machine that will allow them to claim an objective increase in the quality of their output; the users must adjust their production process to make certain the machine is used in the optimal manner. The equipment that is produced does not fit the needs of the enterprise as they conceive them, nor when placed on line does it achieve the usefulness that the builders envisioned. The result is disappointing for each party. The users resent what they view as an inappropriate machine type being forced upon them because of a lack of alternatives, while the machine builders feel that their superior machine design has been traduced through misapplication by the users. Note that the article states that it had been ten years since anyone from the textile machine design bureau responsible for the new design had been to the plant.

GENERAL vs. SPECIFIC DESIGN SOLUTIONS

A correlative to the lack of contact between the users and builders of textile machinery is that the equipment is designed to meet the general needs of textile producers rather than the specific needs of particular enterprises.

Other factors favor the general over the specific. The enterprises to whom the machine builders sell have the right to refuse delivery of contracted machinery up to 45 days before the start of a plan quarter. The rate of such rejections is rising (Yegorshev, 1987). The complaint is that either the textile enterprises do not properly assess their needs before ordering, or perhaps are writing themselves insurance policies at the expense of machine builders by ordering more than they intend to purchase. Under the new rules, machine builders who produce customized machinery for a specific customer are put at risk by the insolvency of, or inadequate planning by, the purchasing enterprise. The total overdue debt to enterprises in the Ministry for Machine Building for the Light and Food Industries doubled during 1986 and was more than 25 percent of average monthly planned sale volume. The Ministry for

Light Industry was specifically blamed for failing to reconcile planned investment with centrally allocated capital. It is accused of ordering new machinery without due consideration for the financial means of the customers (Yegorshev, 1987).

The prospect of refusal is going to affect the willingness of machine building enterprises to tailor output to the narrow needs of a specific customer. Thus, the textile enterprises may be dependent upon the machine builders, but it is a two-way street. If a machine builder produces highly specialized output that can not easily be redirected to other purchasers, the risk of serious financial loss may be great. This phenomenon also affects the credibility of the ministry as the formulator of technology policy for the industry. In 1985, the ministry insisted on increasing planned deliveries of ChMM-14 cotton-combing machines to 1,150 units. Subsequently the intended recipients refused 600 machines, leaving the producing plant's plan only 88 percent fulfilled (Yegorshev, 1987).

Although a textile enterprise may refuse a delivery of equipment, there is no guarantee that alternatives will be readily available. The only solution, then, is to maintain completely depreciated, sometimes obsolete, equipment (expensively) in repair and continued operation. The STB-250 shuttleless loom, a standard piece of equipment, will weave custom patterns in only two colors. Old Jacquard looms, some dating to the nineteenth century, must be retained to preserve the capacity for producing six or seven color patterns (Lysaya, 1984).

QUALITY, PRICE, SIZE INFLATION

Between 1970 and 1984, textile output increased by 48 percent while labor productivity increased by 47 percent, as measured by official statistics. At the same time, the value of the sector's industrial productive capital per worker increased by 159 percent.² The growth in the capital-output ratio that was epidemic in the Soviet Union during this period was more rapid in the textile industry (a 75 percent increase) than in industry as a whole (40 percent). Further, in the three years from 1985 through 1987, the capital-output ratio in textiles continued increasing at twice the rate as that for all industry.

Even more disturbing to textile machinery users than the increased cost of equipment is the observation that the increase in quality claimed for the new machinery is often not observable in the actual

²The corresponding figures for all industry are 106 percent (output), 76 percent (labor productivity), and 146 percent (capital per worker) (all figures from *Narkhoz.*, various years).

technical and economic results of the firm's activity. A 1986 editorial claimed that not infrequently the "new" machines built for the textile branch turn out to be the old ones with only minor modifications. The major difference is that they require more space and are "several times" more expensive.³

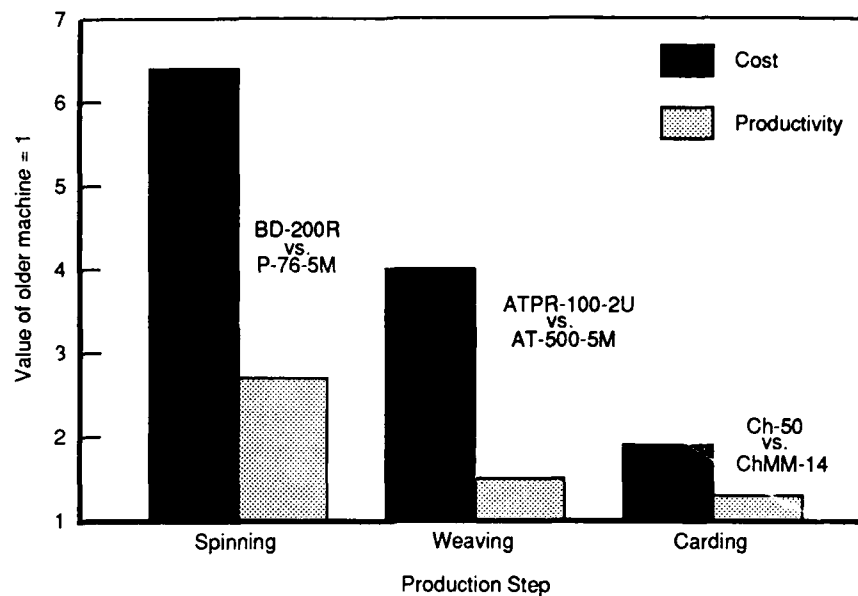
Illustrations of this phenomenon are legion. They antedate the modernization program: "The new embroidering machines produced by the Poltava plant are approximately 20 percent less productive than the old ones" (Lysaya, 1984). And it has continued during the campaign. An article by a Soviet expert in the technology of textile production contends that existing ring spinning machinery, as well as that to be produced through 1990, will not affect the technical-economic indicators of the using enterprises because of size, cost, and energy considerations. This applies to shuttleless looms as well (Garber, 1988).

Figure 2 compares old and new machine types in three production venues (Vilenskii, 1987) and illustrates a general trend of productivity gains failing to keep pace with increasing machinery prices. Clearly, these particular machine types were chosen to make the point and probably represent exaggerated instances. Yet, complaints about this tendency are widespread. In addition, the actual situation of the users of these machines may be worse than the figures represent. The productivity figures offered in the example are those officially claimed by the manufacturer; productivity in application may be less. Indeed, the new equipment may prove less productive in practice than the old. It may also be more restricted in applicability and not perform the same tasks as the equipment it replaces.

Instances of these shortcomings are widely reported. The director of a cotton enterprise described the result after tens of millions of rubles were spent for new equipment for the finishing and dyeing factory. The workers refused to work with the new equipment because of its terrible quality.⁴ All seven lines needed to be reconstituted *in situ*. The director went further in his remarks. When comparing new with old equipment for the spinning and weaving processes, the new is often more quiet and pleasant to use. It may even be somewhat more productive. He notes, however, that when using the old equipment, they could produce any kind of fabric while on the new they can produce only the most simple types for which there is reduced demand at present (Molodtsov, 1987).

³"To Saturate the Market with Goods," *Sotsialisticheskaya Industriya*, December 9, 1986, p. 1.

⁴It was produced by the Ivanovo Tekstilmash association.



Source: Vilenskii, 1987

Fig. 2—New textile machinery compared with old

Another implicit assumption is that greatly increased machine size will not reduce the numbers of machines that may be employed. This assumption is usually unwarranted. On average, machine size, and thus floor space requirements, has grown 22 percent faster than officially rated productivity for looms, and 17–25 percent faster for spinning frames (Vilenskii, 1987). However, under a program where the emphasis is on modernization of existing plant by the installation of new machinery and not on new construction of facilities, the size of the shop floor is fixed by lack of access to construction resources. Because of space considerations, one enterprise was able to replace its 420 ATK looms with only 350 ATPRs, leading to little gain in production (Lysaya, 1984). This phenomenon is not a general property of modern textile technology. It appears to be peculiar to Soviet domestically produced equipment. The STB-2-220 shuttleless loom is 2.9 times the size of the similar loom produced by the Platt Co. of the United Kingdom, yet, it is only 1.2 times as productive by official calculation (Vilenskii, 1987).

Additional implicit assumptions when comparing productivity are that the new machines will be as reliable, repairable, easy to operate for the existing cadre, and cost as much to operate as the old. Evidence already cited suggests that in several cases the first three of these assumptions are problematic. On the last point, there is also a problem with increased power intensiveness. On average, the capacity of electric motors for new equipment increases 40 percent more rapidly than their productivity (Vilenskii, 1987). This not only means greater cost for power but also increased requirements for transformers, transmission lines and equipment, air conditioning requirements because of higher heat output, and so forth.

A DIAGNOSTIC

Changes in the provision of spare parts for textile equipment provides an empirical diagnostic of change in the relations between machine builders and machine users. In the past, the problem of receiving adequate spares has been severe. Textile machine manufacturers, building to satisfy plan output targets, had little reason to waste valuable time and capacity to produce spare parts. Unless the production of spares was a specific indicator of performance, not only of the enterprise but of the supervisory ministry as well, manufacturing activity was devoted to increasing the number (or weight) of new units produced. Often, the fundamental problem was exacerbated by the unwillingness of manufacturers to produce spares in support of equipment types no longer current. There was no central domestic warehouse for spares although the utility of having such an institution was cited by textile enterprise personnel (Lysaya, 1984). The interests of the users of textile machinery did not enter into the calculations of the machine builders when determining the planned output of spare parts.

The new relations that have been introduced are intended to cause the machine builders to pay more attention to the requirements of their customers by binding their material interests more closely to the effect that their activities have on those of the textile manufacturers. To the extent that machine builders find they need to cater to the needs of these customers, an easing of the perpetual spare parts problem might be expected.

At many textile enterprises machines are still forced to stand idle because of a shortage of spare parts. At the Moscow Silk Combine almost half of the ATPR shuttleless looms are down for lack of spares. They received three rubles worth of spare parts from the Klimovskii Tekstil'mash. The enterprise calculates it lost 7.5 million rubles

because of idleness forced by the lack of spare parts. The experience in other countries is that it is necessary to keep spare parts on hand in the amount of roughly 10-15 percent of original equipment cost. Soviet textile enterprises ask only for one-third to one-half that amount. Yet they receive less than two-thirds of their requested spares. As of 1986 it was stated that sufficient spares are produced for no single machine type (Kochetkov, 1986).

The early indications were that the problem of spares was exacerbated by the modernization effort. An enterprise accustomed to receive only five or six new machines a year could maintain the existing stock by having the internal repair service manufacture the necessary spares. Now that modernization means massive renewal of old and worn machine stocks, the situation has changed (Zenkovskii, 1986).⁵

There is little correspondence between the spares produced and those that are demanded by textile enterprises. The absence of standards for spare part norms allows machine builders to choose which spares to produce. They prefer those that are most expensive or easiest to produce, according to their own needs. Complicated or rare spares are not produced. As an example, of some 1,464 different types of spares requested from the Uzbek *tekstil'mash*, only ten or so were included in the association's output plan. Almost two million pieces of the remaining part types were produced by the textile plants themselves at high cost while yielding low quality (Kochetkov, 1986).

The trends for this phenomenon are not fully clear. Previously, an enterprise needing spare parts would purchase additional machines and cannibalize what was needed (Khavkin, 1987).⁶ If textile manufacturers are finding their financial situation more strained, this expedient would be reduced and would place pressure on the machine builders to find other means for improving revenue performance. Some recent articles do suggest, in passing, that problems of scarce spares and expensive repair continues.⁷

There are apparently now 15 centers designed to deal with rapid servicing of spare part needs. However, these were established by the Ministry of Light Industry, the ministry of the machine users, in con-

⁵The local fabrication of necessary spares, though widespread, is not an optimal solution to the problem. Spare parts manufactured by the using enterprises are expensive to produce and not sufficiently accurate for modern equipment, and the fabricators often lack access to the proper metals and other inputs.

⁶This suggests another reason why machine builders were not eager to produce spares. Not only would this reduce capacity for producing complete units, their main indicator of success, but it would also reduce the number of orders for units.

⁷See Ol'shanskaya et al., 1988; and Keiretbaev, 1988.

junction with CMEA.⁸ Their establishment suggests that the system had not succeeded in changing the outlook of the machine building enterprises to the point where direct contacts and contractual relations would prove sufficient to address the needs of the machine users.

⁸Their purpose may be primarily to provide spares for imported machinery, a problem even more bedevilling than providing spares for domestic equipment.

VI. RECURRENT THEMES: OBSTACLES TO MODERNIZATION

Where the preceding sections presented recurring themes that could be ascribed to individual groups of economic decisionmakers in the textile sector, this last section presents themes of greater generality. They are phenomena having a direct bearing on the potential of the modernization program without being directly attributable to any one group.

MATERIAL SUPPLY BOTTLENECKS

The discussion of the possibilities for modernization considered the problem of assuring the delivery of appropriate types of capital equipment.¹ However, the results actually obtained from the equipment that is delivered may be materially affected by persistent shortages² of more prosaic materials. These shortages may on occasion have a profound effect on the course of modernization.

Under the branch system of planning, items needed by the textile sector from other ministries may not be produced at times. The work done to implement modernization in the textile industry may be undermined by the lack of the trivial-seeming item that becomes a bottleneck. As an example, textile firms depend on the paper industry for supply of the cardboard needed to operate the guidance mechanisms on Jacquard looms. The domestic production of this product has completely stopped (Lysaya, 1984).³ The Pechorskii Knitting Factory recently purchased three foreign knitting machines and committed themselves to contracts based upon expected output. But the new machinery soon stopped working: Tekhnopromimport, the foreign trade organization, had not thought to order a sufficient supply of needles. The republic ministry advised them that only toward the end of

¹The story of the Samoilov Cotton Fabric Association is typical of the complaints along this line. They developed a series of new, fashionable designs that were never put into actual production because of the lack of the appropriate machinery (Bystrova, 1986).

²To use the term "shortage" is to observe the phenomenon through the eye of the recipient enterprise. What appears to be a shortage of a certain good may also be due to distribution problems, a conscious decision to forgo production of that good entirely, or the profligacy of the consumers.

³The decision was probably based upon advice from the Ministry of Light Industry that this technology was no longer to be pursued domestically. However, textile enterprises retain the old equipment because the new looms do not allow production of the same complicated patterns.

the next year would it be possible to obtain that critical part (Kalinin, 1987). The machine builders also have complaints. Modernization has been hampered by shortages of optical equipment and other measuring and testing devices (Yegorshev, 1987).

Garment makers have lodged frequent complaints against the textile enterprises for failure to supply.⁴ The textile enterprises usually point to a failure to receive expected raw material deliveries as the proximate cause of their own shortcomings. The director of a worsted wool enterprise is consistently dissatisfied with the quality and schedule of raw material shipments received. "There is no regular rhythm to the shipments [of inputs] and consequently it is necessary to change the makeup of blends" (Mgeladze, 1987). Episodic deliveries have other implications for modernization that are a bit more subtle. For best product quality and most efficient utilization of modern textile equipment it is necessary to allow the moisture content of raw fiber to equilibrate to the level of humidity existing in the shop where it is to be worked. Allowing the material to sit for a few days reduces the breakage rate for the resulting yarn. If textile enterprises are not allowed this luxury because of late or random deliveries, the modernized shop will not be able to produce the quantity or quality of fabric that it was designed to produce.⁵

The chemical industry has come in for especially sharp criticism for its failure to adequately support modernization in textiles. Its ability to lend assistance may be circumscribed in part by the decision to reduce new construction starts throughout the economy. The chemical industry has generally operated under the rule: "new products—new factory," rather than by having existing plants respond flexibly to the changing input needs of customers (Evgen'ev and Zhagel', 1988). The director of the Silk Fabric Association in Mogilev complains that his problem is not with new machinery but with the failure of the chemical industry to deliver the new synthetic yarns without which it is impossible to produce modern fabrics. All such synthetics must be derived from imports (Evgen'ev and Zhagel', 1988). The assortment of man-

⁴See, for example Biryukova, 1987b; and Savinov, 1987.

⁵A centrally directed approach to reducing this bottleneck is construction of production facilities next to sources of supply. This is an expedient of only limited applicability (see, e.g., Tell', 1987). Existing enterprises have made use of local *gospriemka* officials to deal with suppliers of inferior materials (Lavrentyev, 1987). This seems a positive development but also suggests that more direct means for causing an upstream supplier to conform to the requirements of the customer are limited. Another solution, overordering so as to establish a large, emergency inventory at the enterprise, is restricted by the availability of storage areas and by the fact that when all textile manufacturers employ this strategy, the perpetual shortages are made that much more acute.

made fibers and yarns is quite narrow and has not fundamentally changed in 20 years.⁶

Equally serious is the shortage of modern fabric dyes. The chemical industry does not provide textile manufacturers with the stable, bright dyes necessary for modern, fashionable fabrics (Kotova et al., 1987). Further, failures to deliver the existing range of chemicals lead to enormous losses. Because of shortages, lagged deliveries, or abruptly discontinued production of specific dye stuffs, contracts for textile delivery are left unfilled and penalties accrue (Bystrova, 1986).

NEW CONSTRUCTION vs. REEQUIPPING

The Twelfth Five Year Plan calls for 70 percent of capital investments in Light Industry to be directed toward reconstruction of existing plant and technical retooling—that is, replacement of machinery—rather than construction of new facilities (Loginov, 1988). At the same time, the May 1986 decree of the Central Committee and the Council of Ministers explicitly calls for a businesslike approach to retooling textiles. An article reporting the pronouncement interprets this as making it incumbent upon Gosplan and Gossnab to provide increased shipments of construction machinery, transport vehicles, and other hardware to the Ministry for Light Industry to develop the capacities of its construction organizations. The decree gives the ministry permission to add new wings and construct auxiliary facilities only for enterprises built before 1950.⁷

A statement of official policy that reequipping is to have priority over new construction would not appear to be objectionable in the circumstances of the Soviet textile industry. Indeed, it seems to make a great deal of sense. However, expansion and reconstruction of existing facilities are also often necessary concomitants to the successful retooling of older plant. The extent to which construction is required varies with the circumstances of individual enterprises. Therefore, it is not possible to make a blanket decision that reequipping will be the priority for investment. To reequip without expanding or rebuilding often leads to lower effectiveness of newly installed equipment. Matching the pace of reequipping to that of reconstruction and expansion will effectively slow the pace of modernization. It makes the construction sector a bottleneck and adds one more priority demand to the already

⁶"To Saturate the Market with Goods," editorial, *Sotsialisticheskaya Industriya*, December 9, 1986, p. 1.

⁷The decree, "On Improving Planning and Economic Stimulation, and Upgrading Management of the Production of Consumer Goods in Light Industry," as reported in *Ekonomicheskaya Gazeta*, No. 20, 1986, p. 16.

long list of "priorities" for modernization. Sufficient attention has not been paid to the volume of construction resources required to make modernization effective.

Of the enterprise buildings in Ivanovo, the great traditional textile center, 90 percent were built before the Revolution. Some date to the eighteenth century (Telen', 1988). Only in plants of more recent construction—e.g., the Ivanovo Worsted Combine, which began in 1963—has simple retooling proven possible. For the majority of the 49 combines and plants in Ivanovo, expansion and reconstruction will be required as well (Vilenskii, 1987).

The typical textile plant of the nineteenth or early twentieth century is a multi-story building made of brick. One problem in modernizing such a plant is that the large dimensions of new equipment may reduce the volume of output from a unit of shop floor if, as appears often to be the case, there is no sufficiently large increase in the fundamental productivity of the new equipment. Large weight increases lead to problems with vibration. The walls would most likely require dampening and the floors bracing. Besides this, retooling requires construction of subsidiary facilities. Reequipping should be accompanied by fire and environmental protection measures along with improvements to the systems of pneumatic transport, ducting and ventilation, electrical wiring, and lighting (Garber, 1988). Special attention must also be paid to air conditioning, since variations in humidity could mean a higher stop rate because of more breakages on high-speed equipment.

Several enterprises have found it difficult to gain access to the requisite construction resources. There is a fundamental problem because the branch, in line with the guidelines from the highest political authority, has placed official emphasis on the need to modernize the equipment without allocating sufficient resources to supporting construction activity. Enterprises have also experienced difficulty in having construction work performed even after obtaining such funds as have been made available. One enterprise was included in the local construction plan twice and twice dropped. When funds were obtained, the *oblast glavstroi* tried to delay because such construction work is time and labor-intensive while being of fairly small scale. The ability of the construction workers to achieve their own indicators is harmed (Lysaya, 1984). Finally, there are difficulties in having construction work be adapted to suit the particular situation of a given enterprise. There are general, all-union rules for planning the modernization of textile plants that are not always applicable to older factories. Yet the system for getting permission to deviate from the standard rules involves negotiation with *Gosstroi* and is very time-consuming (Garber, 1988).

THE EMPHASIS ON MAIN PRODUCTION

Several phenomena deleterious to modernization stem from the campaign aspects of the program that stress the improvement of specific indicators as a means of marking progress. Aspects of enterprise activity considered to be auxiliary to the main production activity are not brought to the same level of modernization. The result is not an integrated approach to modernization. Rather, the style of modernization is selective, where only a subset of production activities receives emphasis. The result is to undermine the effectiveness of those aspects that do receive preferential attention. This is not peculiar to the period of intensive modernization in textiles. It is an endemic problem in Soviet industry and appears to have been pronounced in the branches of light industry and those that support them. As an example, the level of mechanization for lifting and transport activities in machine building enterprises generally is only 50 percent that of other aspects of production when measured in terms of the proportion of workers actually operating machinery. This figure dips to 25 percent in the enterprises of the Ministry for Machine Building for the Light and Food Industries (Fal'tsman, 1985).⁸

Several sources suggest that this unbalanced emphasis continues under the modernization program and causes productivity to be held back. At the beginning of the modernization drive, the Darnitskii Silk Combine received official word from the ministry that the enterprise was to be reconstructed and technically reequipped during the course of the XII and XIII Five Year Plans. However, a further letter, dated July 1987, only spoke of technical reequipping. How, asks a weaver in an open letter, is this supposed to work if there is no additional space to place the new machinery, nor a fundamental rebuilding of auxiliary facilities (Kovshova, 1988)? Instead, they are left to operate these facilities with 30 year old machinery incapable of producing the quality or quantity necessary to be competitive. Equipment for salvaging cotton waste from spinning shops is not being produced and so cannot be used to conserve fuel as is the practice in other countries (Garber, 1988). The experience of retooling main production in the cotton enterprises of Moscow shows that it does almost nothing to stem the general tide of personnel turnover. Such reequipping has done little to affect working conditions for those employed in subsidiary or auxiliary

⁸The breakdown on the structure of fixed productive assets offered in *Narkhoz*, 1987, shows that in the traditional priority sector of heavy industry, buildings, manufacturing machinery, and tools account for 53.7 percent of capital stock. In light industry, this figure jumps to 85.5 percent. The remainder would include auxiliary installations; materials handling equipment; transport vehicles; computing equipment; and regulating, measuring, and analytical equipment.

jobs; there are still better material conditions (and no night-shift work) at nearby enterprises in other sectors (Vilenskii, 1987).

Automation for Labor Reduction

Indeed, the concern with labor shortage in the textile branch further skews the form that modernization takes. Not only is main production emphasized over auxiliary activities, but some aspects of main production receive more resources than others. The logic is less to make the branch better able to meet its goals than to deal with the specific, short-term problem of labor saving.

Because of poor working conditions and low wages, labor has long been a problem in the branch. As the older textile workers are pensioned, fewer young workers are coming to replace them. In 1984, in the textile enterprises of the Pavlovo-Pokrovsk rayon, 80.5 percent of the weavers and spinners were operating several machines in excess of the branch norm.⁹ In the flax industry, weavers are servicing, on average, 53 percent more looms per worker than called for in the norms. In cotton, the average excess is 22 percent (Telen', 1987). Workers in the branch spend 90 percent of their working time in actual production activities, and the work can be categorized according to official standards as hard or very hard labor. Further, the average number of work shifts per day is twice as high in textiles as it is for machine building (Telen', 1988). Past attempts at modernization have been affected by the lack of personnel. "Routing of capital investments to construction of new enterprises has in some cases led to a minimum level of utilization of the latest production capacities because of a shortage of skilled working personnel at newly constructed enterprises. Only one enterprise out of six assimilates the planned capacities in the established normative time" (Vilenskii, 1987).

In a regime of limited resources, what course should modernization follow? The opinion of Western experts is that it is inappropriate to modernize an enterprise's weaving operation first.¹⁰ If the concern is to be competitive or to produce more stylish textiles, the finishing operation (dyeing, printing, etc.), where a great share of value is added, would be the place to begin. After that, the natural order would be to modernize the operation of the card room where the fiber is prepared, then the spinning of the yarn. Only after that would it be efficient to modernize weaving.

⁹In weaving, the average number of looms per operator was 24 when producing satin, and 25 for calico, against a norm of 18. In the case of the ATPR shuttleless looms, the average was 48-56 against a norm of 36 (Lysaya, 1984).

¹⁰Personal communication with staff of Institute for Textile Technology.

The evidence suggests that in the Soviet Union, it is often the weaving operation that is first modernized by the addition of high-speed shuttleless looms. The technology for modernizing this operation is fairly simple, self-contained, and well-developed, there is a chronic shortage of labor that hits weaving and spinning particularly hard, and the orientation of the branch has historically been to emphasize increased speed and quantity of output over fabric quality. This orientation largely remains. It is acknowledged that the performance of the branch may best be improved by better utilization of equipment, rationalization of production, and product specialization.

However, in consequence of a shortage of working personnel, the down time of weaving and spinning equipment is considerable at some enterprises. Therefore, the main direction of scientific-technical progress in the textile industry is retooling based on creating and introducing comprehensively mechanized and automated shops and enterprises that reduce the labor intensiveness of production and the need for working personnel (Vilenskii, 1987).

Given that wages are limited by pricing policies and Soviet employment practices, capital is being used to take up the slack. There are two results from this approach. Other aspects of production that might be better poised to reward modernizing investment by placing the branch on a better footing to provide the types of output now being demanded are not receiving due attention. Many types of finishing and dyeing equipment, the necessary determinants of the quality of finished textiles, have been manufactured for decades without any modernization and are clearly obsolete (Loginov, 1988). The other result is that the sequence of modernization does not proceed in the most efficient manner. Modernizing aspects of production out of sequence reduces the effect provided by the newly installed equipment.

Uneven Development

The preceding discussion has illustrated the origins of the problem of uneven development and varying speed of modernization. The phenomenon appears to be general and has seriously compromised the results of the modernization program. This theme is not only recurrent; it is quite common. This is partly because of stop-gap responses to immediate concerns like the labor shortage. However, it is also partly the result of unilateral decisions made by the higher authorities. These decisions do not reflect an integrated approach to modernization or a firm understanding of the problems faced by the enterprises where modernization is to be implemented.

The chief of the technical department of Oktyabr'skaya Spinning-Weaving Plant criticizes the Lenkhlopprom's program of technical

modernization on the grounds of not fully dealing with the complex of problems associated with modernization. According to her, the program does not guarantee the full integration of production. Basic production sections have complex, modernized equipment while in auxiliary sections the work is still carried on primarily by hand. The means to achieve small-scale mechanization have not been provided. The result is that the whole process is compromised by the weak links in the chain (Ivanova, 1987).

The juncture between spinning and weaving shows mismatched technologies most readily because the results are immediately tangible in the form of increased breakage rates and incompatible semi-finished goods. Shuttle looms operate with very small yarn supply packages called quills, while pneumatic spinning frames of the BD type use larger bobbins that can carry such a large load that one may be enough for a half shift or more (depending on yarn fineness). Because some enterprises still find it necessary to operate the obsolescent shuttle looms, modernized spinning cannot be efficiently used. In those plants that have modernized weaving before spinning, however, ring spun yarn is less even than rotor spun yarn and is not well suited to the type of shuttleless equipment available (i.e., one would prefer to weave with microshuttle or rapier technology rather than on an airjet loom).

The Astrakhan Knitting Combine was provided with 180 of the new types of spinning machines. They had also asked for machinery that would allow the enterprise to prepare the raw fiber to the correct consistency, a necessary concomitant to facilitate the introduction of the new technology. But the directorate for development of the wool sub-branch of the ministry sent the machinery to another plant. Higher authority failed to understand the complementarity necessary to increase the effectiveness of each process two or three fold (Biryukova, 1987a).

In a worsted wool combine it is claimed that one-third of the equipment needs replacing even after a "fundamental remodelling" that replaced 150 weaving installations. "Right now the technological cycle at the combine reminds one of a road where stretches of first-class highway alternate with a rut-filled country road that leads eventually to a tricky mountain path" (Mgeladze, 1987). Along the same lines, "it was noted long ago that it is precisely in the quality of the output that one sees the most complete expression of the technological level of production. . . . The shops have become somewhat cramped, some of the equipment is obsolescent or completely worn out, and there are several unconnected production entities where new technology and backward technological schemes exist side by side" (Sadykov and Parfirova, 1987).

The failure to properly integrate the modernization of production activities is exacerbated by the totality with which reequipping is approached. Several press comments have addressed the problems of sudden shifts in technology without adequate preparation and testing. The new replaces the old without assessing compatibility with existing production activities that remain unchanged.

Take, for example, the pneumatic spinning machines. When they were put into operation old equipment was dismantled. Thus before the textile workers could bat an eyelid, they "dropped the size." In other words, they began producing more and more thin yarns, which drastically reduced and narrowed down the assortment of yarns manufactured. [Several fabric types] were lost on the sharp turns of this kind of technological upgrading. . . . It is no wonder that when the rare export order comes in, it invariably has the proviso: the yarn should come from ring spinners. But where are these ring spinners? (Bystrova, 1986.)

The prevalence of the phenomenon of uneven development and the frequency of complaints by enterprise personnel suggest that the bulk of major development decisions are not within the province of local decisionmakers. The decisions reached by branch and ministerial authorities remain decisive.

VII. ASSESSMENT OF MODERNIZATION IN THE TEXTILE INDUSTRY

This section and the one to follow will suggest an interpretation for the phenomena outlined in the previous four sections. The prevailing sense of dislocation and misdirection could mean that the modernization program is not working as intended. However, there is a problem in interpretation. How may a perception of general dissatisfaction be distinguished from the inevitable dislocations that would attend the birth of a fundamentally new mechanism of economic management in the branch—that is, true *perestroika*? This section will consider what the effect of modernization has meant so far for the textile sector. The one to follow will derive lessons for Soviet industrial modernization in general.

THE RESULTS SO FAR

To determine the success of the modernization program in textiles it is necessary to be specific about the criteria for assessment. The question of success may be decomposed into two main parts. First, has the modernization program shown the intended positive results to date? Then, if the program follows its present course will the sector achieve the capacity for self-sustained growth and the ability to fulfill the tasks set for it?

Output

The first large question can be decomposed further. To what extent has the program increased the assortment, quality, and amount of textile products available to Soviet consumers? There are several reasons to believe that modernization has not yet had a large effect judged by these criteria.

Although the aggregate statistics show an increase in output in value terms, this does not answer the question unequivocally. The value of gross output for the textile branch increased by only 0.7 percent during the three years before 1985. The increase for the period 1985–1987 has been 6.1 percent (*Narkhoz.*, 1985, 1987). Most of the recent increase in fabric available to consumers has come from the synthetic and knit goods subbranches. The production of cotton, woolen, and linen

textiles has been fairly constant over the period.¹ It is more difficult to say what such figures mean. A good part of what increase has occurred could be ascribed to inflation.² Under the branch's new retail trade mechanism, enterprises, "having acquired a taste for self-financing," sought ways to be profitable. The result has been a sharp increase in "N" (new) quality output. In fact, as recently admitted by Gosplan deputy chairman Yefimov, these goods scarcely differ from the old, but trade at premium prices (Romanyuk, 1988). These shortcomings could be ascribed to several factors that may prove to be short term: switching over to a new system of economic accounting, the inevitable dislocations caused by reequipping, bottlenecks in the supply system, and teething problems with the new retail trade system.

When measured in physical units, output has not shown a dramatic increase. In the three years before 1985, the increase in the production of fabric suitable for clothing,³ measured in physical units, was 4.8 percent. The increase for the three years 1985-1987 was 5.7 percent. Figure 3 illustrates the reported rate in output growth for all fabric and for knit goods and compares them with the mid-range of the 1990 plan targets. Actual performance is off the straight line trajectory for meeting these goals and is little different from the pattern shown before modernization.

The key word that is often used in reference to the goals of the sector is "assortment." The aggregate figures do not illustrate how the industry has met this goal. It may be inferred from several of the sources cited in the previous sections that the manner of carrying out the modernization of the branch has frequently had a negative effect on the ability of manufacturers to offer a wider assortment of output or, on occasion, to continue producing their previous lines. In this respect, the mechanism of modernization would seem to undercut its ultimate purpose and would account for continued consumer dissatisfaction. Indeed, failure to increase the assortment of goods available to the Soviet consumer figures prominently in recent criticisms of light industry.

The Soviets do publish a statistical series showing the increase in productive capacity stemming solely from technical reequipping of

¹The increases over the last two years for which figures are available, 1986 and 1987, are cotton, 0.0 percent; linen, 1.0 percent; and wool, 2.2 percent.

²Soviet specialists calculate that increases in average retail prices accounted for 30 percent of the growth in trade turnover for consumer goods in the years 1971-1975, 50 percent from 1976 to 1980, and fully 60 percent in the first half of the 1980s (Nikitin and Shabashkevich, 1988). However, the figures cited above are based upon wholesale prices. The method of calculation is not specified.

³This excludes fabric made from hemp, jute, and all textured nonwoven textiles.

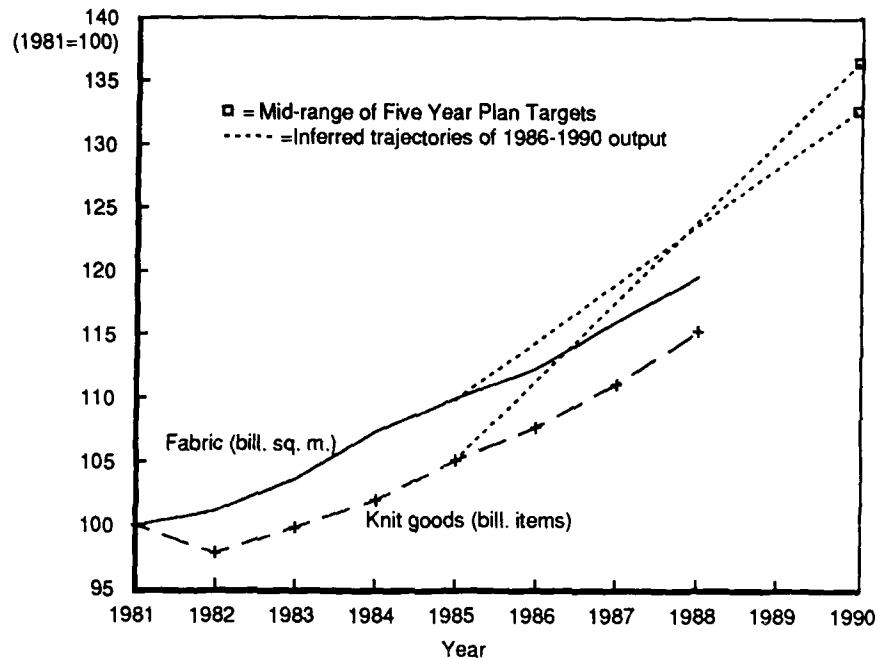


Fig. 3—Annual textile output compared with trajectories toward 1990 production targets

existing enterprises. The latest figures are presented in Table 1. It is not clear what these figures actually convey. When compared with the total increase in output of fabric, the increase ascribed to reequipping appears to be very large indeed. The most charitable interpretation is that the increases stemming from reequipping, plus those accruing from a general increase in productivity and construction of new plant, are partially offset by capacity being taken off line or by enterprise closings, if any have occurred. Another explanation is that the theoretical increase in capacity did not translate into actual output because of inefficient operation, input bottlenecks, or other causes. Alternatively, the figures from the two statistical series may not be reconcilable because of differing means of collection and definition; or the reported figures may not tell us very much because they are considerable overstatements. At any rate, the figures cited in Table 1 do not speak to questions of quality or increased assortment. They do portray a continuing emphasis on quantity as the prime indicator of success and

Table 1

CAPACITY INCREASES FROM REEQUIPPING EXISTING ENTERPRISES

Year	Cotton Fabric		Wool Fabric	
	Million m ²	Fraction of Increase in Production (percent)	Million m ²	Fraction of Increase in Production (percent)
1986	192	192	14	350
1987	269	160	8.9	45
Annual Average 1981-1985	130	107	14	NA ^a

SOURCES: *Narkhoz*, 1985, 1987.^aProduction declined 12.6 percent over the period.

suggest that the orientation of branch authorities, hence the cues picked up by enterprise personnel, have not changed that greatly.

Mechanism of Economic Management

The modernization drive was intended to differ from previous investment campaigns because of the different system of economic relations prevailing. It was to be accompanied and partly guided by a greater responsiveness of machine designers and builders to the needs and contributions of the users. The expected result was a more efficient allocation of resources.

The Soviet press does contain references to phenomena that might be considered breaks with past practice. In the early days of the program, *gospriemka* also appeared as a force that not only passed upon the quality of output⁴ but also occasionally acted in the manner of an outside management consultant. Stories appeared of quality inspectors who would take a comprehensive view of production activities and suggest ways in which the process could be improved by using existing equipment more efficiently.⁵ Yet there are signs that the intrusions of *gospriemka* may have been moderated after seriously deleterious effects on production figures were observed. Further, the *gospriemka* system

⁴E.g., at the Sibirskii Tekstil'mash in Novosibirsk almost all the parts used to assemble looms, previously awarded the Quality emblem, were rejected (Migachev, 1987).

⁵See Sadykov and Parfirova, 1987, and Mgeladze, 1987 for examples.

applies only at the end of the production process as it exists in a target enterprise. It cannot affect the quality of work done by the design bureaus, planning authorities, or research institutes. Finally, *gospriemka* is not integral to the workings of enterprises nor to their interaction. It is an intrusion of outside authority that is in itself an admission that no self-regulating means currently serve the same function. And *gospriemka* officials go "by the book" of state standards; if output meets these standards, even if judged inadequate for its purposes by the recipient enterprise, it will be passed by the inspectorate. Any changes would have to be wrought by the enterprise petitioning higher authority, not approaching its supplier directly.

There are also press reports of the distress caused machine builders by enterprises refusing to purchase the textile machinery they produce. This trend could cause a realignment in business practices in the branch if it were to continue, but it must be balanced against other reports of persistent shortages of equipment and lack of adequate alternatives. Refusal by textile enterprises to place orders will not have as immediate an effect on the outlook of the machine builders if present sole-source practices continue and the ministry, playing its role of technology policy planning staff, does not allow for multiple solutions to manufacturing problems. Textile enterprises will have to choose between accepting the less satisfactory equipment while hoping for the eventual production of equipment better suited to their needs, or creaking along with continual repairs to their present stock. These factors, taken with the incomplete evidence in Sec. V, on the provision of spare parts, suggest that elements of a meaningful system of direct, horizontal links mediated by binding contracts are not yet in full evidence.

More Abundant and Productive Machinery

Providing the domestic market with a greater assortment, quality, and amount of textile products is the ultimate goal of modernization. Introducing alterations in the fundamental system of economic relations is to be one of the mechanisms employed. What of providing textile enterprises with the means for exchanging machinery with more desirable productivity characteristics for the existing capital stock?

The secondary sources, especially the sector journal *Tekstil'naya Promyshlennost'*, carry stories of apparently successful modernization efforts in individual enterprises.⁶ The prevalence of stories of the other sort raises questions about the generality of these positive experiences and the criteria according to which they are being judged. Here, too,

⁶See, for example, Garber, 1988.

an assessment should consider several questions. What is the quality of the new machinery being provided to textile manufacturers? Are the machine builders producing a sufficient amount of equipment to reduce the shortage perceived by their customers?

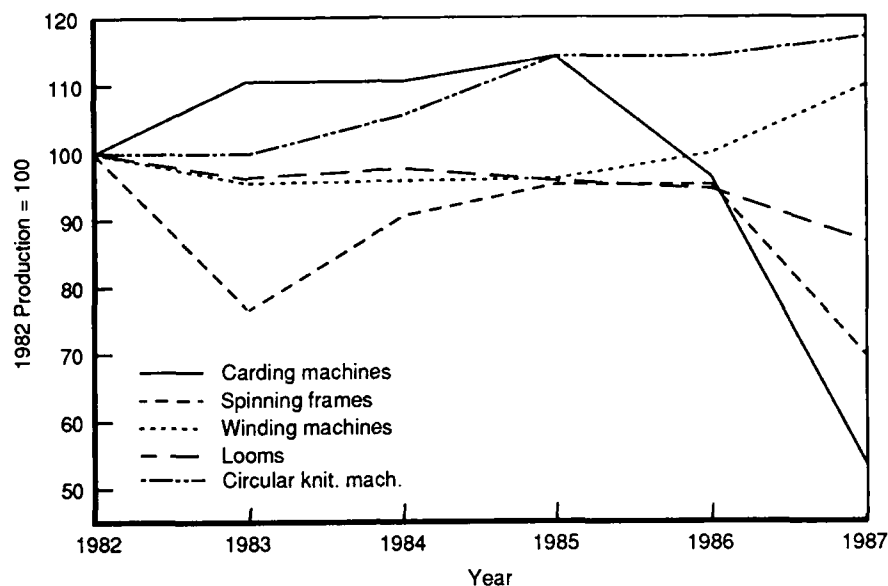
Considering the second aspect of modernization first, there again does not appear to be a large break with past performance in basic machine production.⁷ Whereas the value of equipment and spares produced for the textile industry increased by 12.7 percent in the three years preceding 1985, it actually declined by 2.6 percent in the 1985-1987 period. The physical series also show slowing production rates. Figure 4 shows changes in output for the last five years for which data are available. Circular knitting machines for hosiery and winding machines have shown an increase.⁸ The numbers of carding machines, spinning machines, and looms have decreased, the output being 54, 70, and 87 percent, respectively, of 1982 production levels. The Soviets also publish a series showing the number of spinning spindles and looms established as a result of new construction, expansion, and reconstruction of existing enterprises. During the period 1981-1985, spinning capacity received an average incremental increase of 300,000 spindles a year by all three means. The rate was maintained in 1986 but fell to 200,000 in 1987. Similarly, while the number of new looms set in place increased an average 6,000 a year in 1981-1985, this number fell to 4,200 in 1986 and 3,600 in 1987.

A decrease in the gross numbers of equipment produced need not mean that modernization has failed to take hold; the phenomenon could stem from several positive factors. Principally, the decrease could be because of greater quality control as exercised by *gospriemka* directly, because of fewer orders by enterprises that are now more financially responsible for such decisions, or because the machinery that is produced is fundamentally different in character. For example, a shift from traditional looms to more productive shuttleless types may well appear as a decrease in total loom production.

Yet none of these phenomena are strongly supported by the secondary source material. *Gospriemka* certainly took a bite in 1987. However, it remains to be seen whether the process of state inspection becomes self-sustaining. The inspectors may have been reined in after

⁷Use of aggregate data has been made more difficult since the breakup of the Ministry for Machine Building for the Light and Food Industries has placed its former enterprises under the heading of several other ministries. Further, the textile branch productivity series, disaggregated by subbranch and activity, have been dropped by the latest *Narkhoz* (1987), making it difficult to determine if any change has occurred as a result of modernization.

⁸The increase in winding machines is odd since the deemphasis of ring spinning should reduce the need for this equipment.



Source: Narkhoz., 1985, 1987

Fig. 4—Production of selected machine types
in physical units

1987. Even if it does become a permanent and meaningful fixture, that will not necessarily insure that the machinery passed by the inspectors will be that sought by the users.

Lack of orders by textile manufacturers might explain the slowdown even though the Law on the State Enterprise came into full effect only in the beginning of 1988. But this would be taken as a signal that modernization proper had not yet taken hold; the negative message from machine users was still being sent. A realignment of production by the machine builders had not yet occurred. Similarly, the decreased rates of production could stem from dislocations and disruptions caused by a shift to unfamiliar and underdeveloped mechanisms for economic interaction. This was clearly not the intention of the architects of reform and modernization.

There is little indication that the machinery is now fundamentally different from that produced previously. Indeed, as discussed above, a strong current of opinion in the branch believes the new machinery is of lower or indifferent quality compared with the old, especially considering the differences in price and other characteristics. Even in

Tekstil'naya Promyshlennost', the organ of the ministry, recent articles have suggested that it is now necessary to look to the period extending through 1995 for serious improvement in standards of equipment.⁹ The increasing proximity of the year 1990 has caused branch administrators to shift their millenarian aspirations to the later year.

PROSPECTS FOR FUTURE DEVELOPMENT

Placing the branch on a different footing by 1990 is no longer a reasonable prospect. The current period is now viewed as one of continuing transition. What are the prospects for the branch to support self-sustained growth in the future?

As much as we might wish it to be, this is not a question that lends itself to quantitative analysis. There is an insufficiency of data and what data we possess are of dubious quality if only because of the problems Soviet enterprises themselves face in accurately gauging the factors that are most important. Further, in the extrapolation of current trends we are again faced with the fundamental problem of determining whether the ills plaguing modernization are transitory teething problems or not. Is there reason to believe they will persist, undercutting modernization well into the next decade? This suggests the need for a less quantitative approach, one that seeks to detect systemic obstacles to the full realization of the branch goals.

Such obstacles are present and will endure in the absence of more fundamental economic reform. Pursuing this line of argument brings the discussion full circle once again to the main problem addressed by this study: the implications that the experience of modernization in the textile industry hold for other, more crucial sectors of Soviet industry. Outlining a theoretical construct that explains the phenomena noted in connection with the development of this branch suggests that these problems will persist throughout industry. Further, they are likely to be especially troublesome the more advanced and novel the technological change is being sought.

⁹See for example Kotova, 1988; and Razumeyev, 1988.

VIII. A PARADIGM FOR ASSESSING SOVIET MODERNIZATION POLICIES

The information presented in the earlier sections is consistent with an analysis suggesting that a fundamental weakness exists in the process of modernization as carried forward in the Soviet Union. This interpretation arises directly from the experience of modernization that unfolds from the evidence that has been cited, and the analysis also lends the preceding discussion more coherence and gives it a more generalizable framework than would be provided by a mere collection of anecdotes. The following discussion will depart from the narrow focus on the textile industry. Though it springs from an inductive analysis of phenomena appearing in that single sector, what follows is applicable to the general program of modernizing Soviet industry.

MODERNIZATION QUESTIONS AND POLICY RESPONSES

A policy to change the technological basis of an industry or an economy has to address a series of issues. The first is to determine that the program is feasible, that the material resources necessary to implement the proposed program will be available. These resources may come from either domestic or foreign sources. The Soviet program for modernizing the domestic textile industry as originally conceived emphasized the need to ensure adequate domestic sources of machinery.¹ Therefore, the present program of front-loading investment in machine building may be scrutinized from this perspective. It is certainly an aspect of Soviet development planning that has received a great deal of attention from policymakers within the Soviet Union and from analysts without.

A second issue is whether the resulting output will be of sufficient quality to adequately support the requirements of the technological

¹All the same, the period of modernization has been marked by an upswing in the import of textile machinery. The volume of import commodities designated as "equipment for the textile industry" has increased from 48.8 percent of the total of the sector's machinery investments in 1980 to 57.7 percent in 1987. A definition of "textile equipment" and breakdowns by country of origin are not available. Neither does the fact that this aggregate is expressed in actual machine units inspire confidence. The import share of two of the most important textile machines are by no means as great as the aggregate although the rate at which these shares are growing has been rapid. In 1980, 14 percent of spinning machines were imported, 28.8 percent in 1987. Similarly, 14.1 percent of looms came from abroad in 1980, 18 percent in 1987 (*Goskomstat*, 1988).

development scheme. This question has grown in prominence in recent years. Since 1985 it certainly has become the central question posed by the political leadership, which might be characterized by its commitment to emphasizing, at least in theory, the primacy of quality over the more familiar preoccupation with quantity.

Two other issues remain that receive less attention from Soviet policy spokesmen and yet are perhaps the most crucial aspects for determining the likely success of a program of this sort. Setting appropriate targets for quantity and quality appear, at first, to determine the direction development should take. Neither of these, however, speaks directly to the question of policy. They define ends, not means. To illustrate the first of these issues, suppose for the purpose of argument that the Soviets somehow are granted the ability to produce the quantity of textile machinery they desire at a chosen level of quality, assuming, of course, that the appropriate costs are paid; and there is good reason to believe that the costs to the Soviets might be quite high. By what means is the desired level of quality to be chosen? How is the required level of sophistication to be determined, and who is to make the decision?

It is by no means clear that current institutions, even after introducing changes in the mechanisms of economic management, are sufficient to guarantee adequate technology choices. In the absence of such means, the direction of modernization will not be well-informed and will yield disappointing results as resources continue to be allocated inefficiently. Indeed, the serious consequences for the economy may be magnified the more that modernization is pursued. The standards used to judge the adequacy of domestic equipment will introduce a bias against producing least-cost solutions to manufacturing problems.

A further policy issue directly affects the potential result of a modernization program. A modernization effort that is primarily directed to putting the most modern technical means in the hands of manufacturers could well miss the most crucial point. If the recipients do not use these means efficiently or appropriately, the modernization will not meet its intended purpose. In this analysis, the apparent problem of lagging technological level in Soviet industry comes from two sources. The most obvious is that the industrial capital stock, taken in aggregate, is old both in terms of technological vintage and in years of service. This fact has most strongly drawn the attention of the present leadership and has given the present program of modernization its bias in favor of emphasizing the production of hardware that embodies leading edge technologies.

A second detriment to the technological level that is largely masked by the first is that the Soviet Union, or any other nation, does not need high technology; what it needs is to have the capital it possesses,

whatever its technological level, achieve its potential. The Soviet capital stock of whatever vintage is not used efficiently. This raises the conjecture that utilizing the current stock of capital in a more efficient manner will yield substantial productivity gains without an extraordinary investment drive. Further, a campaign emphasizing the hardware aspects of modernization will result in great costs to the economy that are unlikely to realize adequate payoff in increased quantity and quality of output. Indeed, a campaign of this type might be dangerous to the longer-term prospects of the economy, because it would entail large-scale expenditures that could not be recouped at a later date as well as a diversion of authoritative attention from industry's most pressing problems. The longer time passes before these problems are made the primary target of action, the more serious will be the consequences for the Soviets. Further, the actions required to address the problems of efficient utilization will of necessity require a more radical approach to economic reform than has been put in place heretofore.

THE NAVIGATION OF TECHNOLOGY POLICY

The first policy issue is the need for a mechanism that will allow informed choices to be made between alternative approaches to industrial problem-solving. The design of the modernization program leaves this question unresolved. On the one hand, the intent of the Law on the State Enterprise is to give greater scope to the enterprises for making the decisions that will affect their production and development. On the other, one of the roles explicitly granted to the ministries in the new milieu is to serve as the planning staff for their branches. The result is that the actual sphere for action by the enterprise is circumscribed by decisions already taken and preferences imposed by the ministry in discharging its legal responsibility. It can be argued that this is a role that the ministry is ill-suited to play.

This would be less a problem if there were an unambiguous definition of "quality" or if the characteristics to be desired in a machine could be arranged along a one-dimensional axis and agreed upon. In practice, the concept of "quality" is multi-dimensional. The term may be applied to indicate the technological level of the apparatus; the more advanced, the higher the quality. Quality also carries the connotation of discrimination on the bases of reliability, ease of maintenance, and time between service. Further, there is also an aspect of suitability to a specific production program. By what algorithm, and by whom, are these various attributes to be reconciled in choosing between alternative designs for a given machine?

In a market economy, this problem is resolved ideally by giving the machine user sovereignty over purchasing decisions. The customer is judged to be the most likely to possess the information required to choose between alternative machines offered by competing vendors.² The drafters of the Soviet legislation had at least the first part of this model in mind for the operation of the new system of industrial economic management.

Several factors inhibit realization of the model. The true economic independence of enterprises is limited. This in turn limits the ability to make decisions over technology choice meaningful. This is surely true in the textile industry where underinvestment has left enterprises ill-equipped to accept the sole burden of undoing decades of neglect, but it also obtains in other branches where individually tailored norms for taxation and profit retention redistribute net revenues from the stronger enterprises to the weaker. It is also not clear that the enterprise possesses the necessary information and incentive to be authoritative in these matters, a question treated more fully below. Further, a great deal of machinery is produced under conditions of quasi-monopoly. Because it is difficult for machine users to turn to other sources, it is difficult to make their voices heard by the machine builders or to make the concept of "direct link" contracting work to their advantage except through the negative action of delivery refusals.

As a tacit admission of the lack of sufficient enterprise authority, the state effectively makes and enforces the decisions of machine choice through the ministry planning bodies and the organs of *gospriemka*. The ministry sets the standards and the state quality inspectors enforce them. This is a source of weakness for the modernization program. A system of state-enforced standards need not, and most likely will not, equate to a system that guarantees the output so judged will have optimal economic utility for the users. In addition to the problem of determining what characteristics are to receive emphasis, there are also the problems of data collection, timely analysis, conflicting local interests, and bounded rationality that so bedevil bureaucracies. These problems are magnified during a time when, as appears to be currently the case, older technical approaches are being challenged by a proliferation of newer technological applications. Manufacturing processes are being redesigned world wide. It is not at all certain which path leads most directly to the future.

The Soviets believe they have found a way out of this quandary. Since the leadership perceives an increasing gap between the

²This is not to gainsay the considerable exertions of the vendors' sales staffs to bring this information to the attention of their potential customers.

technological bases of Soviet industry and that of the West, the "world technology level" should be identified and then used as a yardstick for measuring progress on the road to increasing the quality of Soviet output.³ This would appear to solve both the problems of defining specific end goals and of circumventing the lack of information that prevents Soviet institutions from generating adequate approaches to the needs of industry. And it suits Gorbachev's agenda. In his address at the 1987 Party Central Committee conference he reiterated:

I would like to emphasize again and again that the goal of reaching the highest world level of machinery, equipment, and instruments that are being manufactured is the primary task of machine building. . . . Machine builders will receive any kind of aid they need from the state. But their responsibility for the fulfillment of all the decisions adopted will also be increased.⁴

The problem is that when this strategy is allied to a campaign for investment and modernization, the message becomes oversimplified or results in entirely inappropriate decisions over technology choice. In most cases there is a continuum of technologies of different degrees of sophistication that could be applied in an industrial setting. It is not always the most advanced technology that is appropriate. Neither does the appearance of a new technology render earlier approaches obsolete. An assortment of technological solutions are applied in the United States, Japan, and other Western advanced industrial economies. The rule of thumb currently applied to technology choice in the Soviet Union does not look to the full range of the West's machine stock but rather to what is emerging on the margin, and then only selectively.

As a result, the line of machinery chosen to effect the modernization program has been skewed. The example of the shuttleless looms cited in Sec. IV gives an example of how using a sharply defined world technology "frontier" as a guide resulted in increased costs to society on two counts. The equipment produced was more costly than required, and it failed to aid, or perhaps even inhibited, the user from achieving higher productivity.

The case for the world technical standard approach to quality (as well as a sense of a certain unreality that appears to pervade the upper reaches of the branch administration) may be found in a statement by the deputy chief of the Ministry for Light Industry's Technical Administration.

³This approach is similar to that used in CMEA to generate something approaching efficiency prices for hard goods. Here as well the problem is that there is no mechanism organic to the institutions of that organization that is adequate to perform this function.

⁴*Pravda*, July 26, 1987, p. 2.

The crucial tasks facing the sector can be resolved only through technical models embodying revolutionary principles and that will ultimately yield labor productivity growth and improvement in the quality of the manufactured product. Therefore, an important principle has been set down for today—to develop and accept for series production those models of equipment that meaningfully surpass the existing counterparts. Designers must not simply orient themselves toward the best world achievements and copy them. Rather, they must exceed the current level of technology by 5–10 years (Loginov, 1988).

What this means in practice may be found in an extended excerpt from a piece by a deputy director of the All-Union Textile Machinery Research Institute.

The branch research institutes of light industry send out to the machine builders demands for new equipment with an overriding concern [*ozabocheny v pervuyu ochered'*] for the technical level of the forthcoming machine. [The technological level] is determined by a concatenation of numerical indicators (productivity, weight, power consumption, etc.). The price of the item is not included in the number of indicators; that is, today the technological level appears as a noneconomic category (Khavkin, 1987).

He then provides insight into the technique employed to reconcile the various indicators of technological level. The set of indicators is made equal to those characteristics applying to the best foreign analogues (the best are chosen among those having the highest indicators), and if the machine does not lag in any parameter it is considered to correspond to the "world level." If it lags in any single indicator, it is considered not to correspond to the world technological level. "It is forbidden to produce such an item."⁵ The article's author contrasts this practice with the Western system where firms produce a wide range of machines from the simple and inexpensive to complicated, automated varieties with microprocessors requiring large outlays and highly qualified staff. Through competition each type finds its buyers. The machines with the highest technological level by no means dominate the market. The buyer determines which is most suitable based upon his own technological level, price, and many other factors. Most important, the correspondence between technological level and price is clear. "However, it would seem, life has taught our customer—the USSR Ministry of Light Industry—a stern lesson" (Khavkin, 1987).

The domination of technology choice by the ministry coupled with the singularity of its determination to permit only a narrow range of

⁵It is possible that this is not literally the system that is used, but rather a reification for didactic purposes. Nevertheless, even if the example is extreme, it indicates the context within which decisions of this type are made.

acceptable applications imposes costs on the economy and undercuts the purpose of the modernization campaign. The inefficiency of the resulting reequipping is noted by the director of a cotton combine.

The orientation toward the output of [rigorously standardized] (*metrogonnoi*) equipment works to the detriment (*obernylas' poteryami*) of both consumers and enterprises. One enterprise, after reequipping, dumps into the warehouse unneeded coarse calicos—since it doesn't have the means to produce more complicated fabrics. Another, which continues to produce a useful and demanded assortment [using old equipment], is also in a bind. People don't want to work on obsolescent machinery and looms, but there are no equivalent replacements (Molodtsov, 1987).

But the machine builder receives a powerful and unambiguous message from the ministry. The planning documents from the machine builders' own ministry also inform them of the criteria by which they shall be judged. The intention for the five year period to 1990 was to achieve a "renewal rate" of output types of 12 percent while assuring that the fraction of output achieving the world level definition of quality was to rise from the 20 percent current at the plan's inception to 30 percent by 1987. The incorporation of new output was to increase one and one half times over the 1987 level, the rate of modernizing equipment 1.7 times, and the removal of obsolete machinery 1.3 times (Yegorshev, 1987). This speaks little to the question of actually modernizing the textile industry and much to the need to push an ever greater rate of "new" equipment out the door of the machine building plant. Little wonder, then, that it appears to the same director of a cotton combine that

today machine builders are not interested in the production and modernization of the technology we need. For them this is only a headache. The price of equipment, and together with this the financial condition of the [machine building] enterprise, does not depend upon the consumer's characterization of the machinery produced, but rather on the amount of money expended upon a machine. And as a result we receive more complicated and more bulky machinery whose productivity is less than its predecessor's, but whose price is incomparably higher (Molodtsov, 1987).

This statement explicitly links the problem of technology choice to the nature of the price system.

The world technological level strategy is a symptom of a systemic inability to determine users' true needs, or indeed, of users themselves developing a clear picture of their requirements. The unreformed price system and the lack of competition between vendors makes it difficult for the Soviet economy to generate and act upon sufficient information

when choosing between alternative technologies. The world technological level expedient will mean that choices will be made routinely in favor of approaches that provide more costly means than would be sufficient to meet the needs of the users, means that may even be ill-suited for their intended purpose. The ministry and its decisionmaking organs are thus forced to serve a function for which they are not prepared. The result of carrying forth a program of modernization through front-loaded investment under these conditions will be inefficient utilization of national resources, precisely the problem the modernization campaign is intended to address.

FUNDAMENTAL SOURCES OF INEFFICIENCY

A modernization program will do little to change the productivity characteristics of an industry if the equipment that results from investment efforts is used in an inefficient or inappropriate fashion. If the new machinery uses new technology or novel applications of existing technologies, modernizing a factory's production equipment often requires redrafting the fundamental production process to take full advantage of the greater capabilities embodied in that equipment.⁶ The act of adopting new equipment is not enough. Successful adoption often requires conscious adaptation of the environment in which it is to be set.

In this sense, although the Soviet machine users may complain about the way the machine builders and design bureaus design manufacturing equipment for them, the latter might complain in turn about the way their new machinery is used.

There were shortcomings on the part of the textile operators themselves [in using pneumatic spinning frames]. The more speedy machine has a greater demand for material of higher quality in the sense of meeting more exact tolerances for consistency. This implied the need for redesign of the preparation part of the spinning process. The majority of textile plants didn't do this. In nurturing innovation they operate on the principle, "swallow everything that they give you." But this is not the same as the other [plant equipment]. Speed and tempo is its portion. But they swallowed—where did it all go!—and choked. The result is that the spinners had higher rates of thread breakage on the new machines. Of course, it was not themselves but the new machines that they blamed (Biryukova, 1987a).

⁶The introduction of numerical control in Western metal working industries, for example, often required a redesign of prevailing production and job scheduling techniques for the new equipment to succeed (Popper, 1988).

Information

In this light, the example of the shuttleless looms offered in Sec. IV becomes more complicated and its lesson less obvious. The point of the anecdote appeared to be that the machine builders were impervious to signals from textile manufacturers. Instead, taking their cue from the ministry to improve the technological level of their output, they produced newer shuttleless looms that were inappropriate to the needs of the users. The weavers, in turn, complained that the looms were not suited to the raw material inputs they received and the conditions for weaving in their plants. However, textile manufacture is, in fact, an instance where it is possible to produce a superior product from inferior raw materials.⁷ In this instance, it would require adding several preparatory steps, operating the spinning and weaving machinery more slowly to reduce breakage rates, and generally adjusting the output profile of the enterprise to suit the means at its disposal. In other words, there is a need to adjust the production process to the change in the technology of production. Why do the Soviet enterprise managers not do this, or do so only slowly and under duress?

One problem may be simple ignorance. The Soviet textile industry has had an overwhelmingly domestic orientation for decades. Soviet enterprise managers are by no means well-versed in the variety of options available for improving product quality that have been developed elsewhere. Scholars and specialists rarely visit work collectives, few give talks to production workers, and the propaganda effort in promoting knowledge of new ideas is poor (Chayanov, 1988). Further, enterprises lack accurate and regular information on equipment available both domestically and from abroad and do not receive adequate instruction in the operation of new technology (Garber, 1988).

How is an enterprise to determine when it is operating new equipment incorrectly? If technical-economic performance indicators do improve to some extent, will it be clear that the new machinery may yet be far from achieving its potential? A firm in a market type of economy often receives a painful lesson if it is operating machinery in a less efficient fashion than its competitors. Soviet textile enterprises have been largely insulated from learning of this type. With protection from import competition, high levels of concentration, restrictions on output profiles, and individually tailored fund formation norms, not to mention the isolation imposed by underdeveloped transportation and retail infrastructures, enterprises are kept effectively ignorant of accepted best practice with new equipment. They certainly are

⁷Technical insights were obtained by discussing this example with the staff of the Institute of Textile Technology, Charlottesville, Virginia.

protected from receiving the "invisible foot" from their performance in the market that would be an early harbinger of ill-adjusted production practice to a Western textile firm.

This also means that there is little prospect of learning from other enterprises in the sector and that there will be wide variation in the results achieved with different types of machinery. Losses of over 5.5 million square meters of nonwoven fabrics per year, along with 1.5 million pieces of knit undergarments, have been specifically attributed to unsatisfactory use of capacity. The textile enterprises in Kirgiziia and Turkmenia are said to be especially remarkable for low use of capacity (Chayanov, 1988). Union-wide, the difference in results between plants stemming from different patterns of use for similar equipment may be as much as 25 percent for spinning frames, 30 percent for looms, and 40 percent on circular knitting machines (Vilenskii, 1987). The result, in the aggregate, is loss to the national economy in the form of increasing capital-output ratios and spreading phenomena of stagnation.

Enterprise Sovereignty and Incentive

Beyond the lack of information is a lack of sovereignty (and hence incentive) for using the information available. Returning once more to the problem of yarn breakage with newer types of processing equipment, which of the expedients that might be available to a Western textile producer are available as a practical matter to the Soviet textile producer? If there are only episodic deliveries from unresponsive raw material suppliers, producers may not have the luxury of allowing fibers to equilibrate to plant humidity levels to reduce breakage. Operating machines more slowly and taking extra steps would lengthen the time of production runs. The quantity indicators of the enterprise would then suffer.⁸ Similarly, changing the production recipe by altering the preparation process, and incidentally modifying the technical characteristics of the ensuing output, would place the plant in technical violation of quality norms and lead to problems with state inspection.⁹

⁸The director of a cotton combine says that his enterprise possesses the technical means for producing an assortment of high quality fabrics, but not the economic ones. To do so, the labor intensity of production would need to increase, roughly by a third on average. This would lead to a reduction in the quantity of fabric produced, which would in turn cause a reduction in the important indicators for enterprise fund formation. They are still awaiting a resolution of this problem from the ministry whose directors don't appear to want to deal with it (Molodtsov, 1987).

⁹The same problem occurs in the design of new machinery. The output derived from the use of a new technology may be different from the traditional output but the ministry wants it to be the same. It is then easier to account for it within the traditional assortment guidelines. This created great problems for the designers of the new spinning technology who had to redesign their apparatus many times to ensure that the yarn produced was not only as good as the old, but identical (Biryukova, 1987a).

Finally, using what the enterprise has available to it in a flexible fashion to produce what is best suited to its means would require altering the enterprise output profile. This remains the prerogative of the supervising ministry.¹⁰

Generally speaking, enterprises lack the sovereignty to make fundamental decisions to readjust production or to modify existing enterprise organizations. One of the curiosities of the reform effort accompanying the modernization campaign is that while enterprises are being asked to behave in a new manner consistent with a changed milieu of economic information and control, the enterprises themselves retain the same form as under the previous system. They are still the rigidly stratified organizations that were specifically designed to operate within a hierarchic system of command control. Activities are organized by functional department rather than production tasking. Information and decision authority still move in a pronouncedly vertical direction and answer less well the needs of a self-sufficient, entrepreneurial economic agent than they do a controlling regime of higher management outside the enterprise itself. Authority for redrafting enterprise internal organization remains with the ministry if only because of the supervisory and data collection roles it retains. To be sure, the intent is to gradually reduce the number of reporting requirements incumbent upon enterprises.¹¹ But the actual fact of formal reporting may be less injurious to enterprise initiative than the implicit lesson that reporting requirements teach: Enterprise personnel learn that most decisions ultimately rest with higher authority. And the job of these authorities becomes more difficult if the enterprise is left to chart its own course.¹²

¹⁰Further, according to the decree designed to improve the performance of the system of state orders, enterprise rights to contract freely for sale of the remainder of the output not covered by state orders "shall not, without justification, permit the unilateral cessation of [previous] ties." This is another check to self-generated changes in output profiles. See the "Temporary Statute on Formulation of State Orders for 1989 and 1990," *Ekonomicheskaya Gazeta*, No. 31, July 1988, pp. 18-20, in *FBIS Soviet Union Daily Report*, August 26, 1988.

¹¹Following agreement with the USSR TsSU the number of indicators in operational reporting [in the Ministry of Machine Building for the Light and Food Industries] in 1985 was reduced by 7,200 (from 21,000 to 13,900) and in 1986 another 1,500 will be eliminated" (Yegorshev, 1987).

¹²The chief engineer of a textile mill found that he was answerable to 39 different organizations. During the most recent summer, nine separate commissions required participation and responses. They explored the use of raw materials and equipment, the quality of output, and the financial situation of the enterprise. What is the point, asks the engineer, when under conditions of *khozraschet* enterprise workers are more interested than anybody in avoiding loss; and who else would know more about the facts of the matter than those who work in production day by day? This ties up the time not only of the chief engineer but of dozens of enterprise specialists (Mel'nikov, 1988).

The Concept of Modernization

In part, the continuing lack of enterprise sovereignty over the use of information available to it and the way in which it organizes itself to use this information is a signal that there was failure by the leadership in the conception of the modernization drive. To understand this point, we may idealize any manufacturing process as a means for transforming raw or semi-finished inputs into final goods. But there are three additional inputs not transformed by the production process itself that also must be drawn upon. These must be suited to each other for the process to be efficient. The most obvious is the physical capital stock at the disposal of the manufacturing enterprise.¹³ But there is also the input that comes from management. Management's control leads to constant readjustment of the manufacturing process, in line with evolving needs, allowing the capital to realize its potential. Finally, management efforts in turn are based upon information inputs providing the knowledge upon which managers act.

The Soviet modernization effort is overwhelmingly addressed to changing the character of the first of these three nondegraded input categories. The conception is that if the material and technological base of manufacturing, narrowly confined to refer to the capital stock of the enterprise, is improved, then the efficiency of production will be affected and productivity increased accordingly. The experience of the West, however, has been that to pay excessive attention to this sphere without assuring the efficacy of operation of the other two, making certain that advances in the capital base are matched by a concomitant redrafting of the systems for utilizing information and applying management, means that a substantial investment in capital will not help realize a substantial, commensurate change in productivity.¹⁴ Defining the technological base to apply only to the hardware of production and pushing forward a campaign to improve it will almost certainly undermine the success of that campaign.

The Soviets have a history of assimilating the machinery used in the West without paying sufficient attention to mastering the methods and conditions under which they are applied. The introduction of machine harvesting, for example, led to a marked decline in the quality of

¹³As a matter of practice, of course, the second law of thermodynamics may not be waived; capital becomes depreciated. But here we are considering an idealized process.

¹⁴This receives corroboration in a Soviet article suggesting that many problems in achieving acceptable standards are not attributable to low technology per se. Rather they are caused by lack of adequate documentation of technical norms and technical models, lack of measurement devices of a rudimentary nature, low proficiency level of machine operators, lack of appropriate inputs to perform finishing process according to specifications, etc. (Sadykov and Parfirova, 1987).

cotton produced in the Soviet Union (Lysaya, 1984). "Veteran cloth makers recall how highly our native cotton fabrics used to be regarded on the international market. . . . Were the varieties and methods of harvesting different?" (Bystrova, 1986). According to Western observers this was indeed the case. The Soviets assumed that the secret of the yields found in the United States lay in mechanization. Purchasing and copying U.S. equipment without adequate attention being paid to the means of management has led to spiraling costs with declining yields and poor quality fiber.¹⁵ Modernization of textile production could be the occasion for a recapitulation of this experience.

The hardware approach also tends to increase the demand for even more hardware, deepening the deficit of capital goods. One result of a concentration upon the capital aspects of manufacturing is an increase in the complexity of the techniques of quality control, engineering, etc. This is not necessarily the only path that may be followed. One could also concentrate on the spheres of management and information to simplify various functions for controlling production. The hardware approach leads to creating a group of functional specialists for support of production who are not directly involved in production decisions. The alternative approach makes it possible for those with primary production responsibility to also have under their control these functional aspects of production. This has been the course adopted in East Asian textile mills. It confers the advantages of increased process controllability and a reduction in the staff needed to operate plants.

The Soviet approach will only further stratify production hierarchies in the enterprise, increasing problems of communication and effective use of information. This runs counter to world manufacturing trends, which have increasingly come to be shaped by the flexibility characteristic of advanced manufacturing machinery. This again suggests that there was a flaw in drafting the present Soviet modernization campaign. With attention drawn to the world technology frontier, the tendency is to pay inordinate attention to new developments in machinery design while ignoring many of the changes in management that make the best use of this equipment possible. In other words, to focus attention on the machinery may be to pay undue emphasis to the appurtenances of modernity without noting its true wellsprings.

¹⁵The yield from the cotton crop has been in decline from 8.75 m tons in 1985 to 8.23 in 1986 and 8.09 in 1987. This has been attributed to outmoded farming methods and slow introduction of change in Uzbekistan, which produces over half of the Soviet crop (*New York Times*, August 30, 1988, p. D2).

ECONOMIC REFORM: SINE QUA NON OF MODERNIZATION

The topics raised are too broad to be fully explored in this study. They arise naturally from observing the textile industry and appear to be so general as to have profound implications for any large-scale program of modernization under current conditions in the Soviet Union. The validity of these speculations can only be borne out by further research and the passage of time. However, a preliminary conclusion is certainly that the major ills attending the implementation of the modernization process will not be adequately resolved without a more radical implementation of economic reform.

This is nowhere clearer than in the area of pricing policy. The lack of a system of prices and price formation that endows prices with sufficient information on true costs and scarcities is a theme that underlies many of the phenomena presented in this study. The ministerial preoccupation with increasing the assessed, if not actual, quality of textile output stems from a price system that will then accordingly inflate the gross value of output.¹⁶ At the same time, according to the director of Lenkhlopprom, the Leningrad Cotton Association, the wholesale pricing policies in textiles leave no possibility for encouraging the output of truly fine and stylish fabrics (Biryukova, 1987b). A large, now somewhat extra-legal role will remain for the ministry to direct the production schedules of manufacturers, because prices cannot be regarded as appropriate guides for action by enterprises. Similarly, the present system of pricing raises the interest of machine builders in improving the "quality" of their output. The result is a machine that can be offered at a higher price even if the user finds it less satisfactory than its predecessor, which contained less metal and fewer electronic systems.

The systemic problems raised in this section are unlikely to be ameliorated in the absence of more fundamental reform than has been put into practice so far. A system of efficiency prices accompanied by increased competition are both necessary to the search for least-cost solutions to manufacturing problems. They would provide the means for management to gain a better understanding of the tradeoffs in the production process within the enterprise, as well as a comparable scale for measuring relative performance in the efficient utilization of capacity across enterprises. Not incidentally, a less administratively

¹⁶"Every new index for an article means an automatic . . . price for it even if the improvement of consumer qualities is not very noticeable. . . . The ineradicable shortage makes it possible to legitimately twist the customers' arms, leaving them no freedom of choice" (Rytov, 1988)

constrained system for setting prices could affect the machine users' willingness to accept more demanding machinery and to expend the effort required to master its use if this would, in turn, mean greater rewards for learning to produce superior products at reduced cost.

These considerations become paramount as more complex technologies are incorporated into machinery design. A principal hallmark of the manufacturing equipment being designed today is, on the one hand, rapid evolution, with several solutions to manufacturing problems being available at the same time; it is by no means certain that one approach dominates the other in all instances in which they may be applied. The problem of deciding which technological solution is appropriate is increasingly complex. On the other, what is fundamentally new in today's vintage of manufacturing equipment is the flexibility inherent in its design. This means that the bulk of this equipment's advantages will be gained by manufacturers who have access to a wide range of information that they can use efficiently to realize the inherent flexibility of their capital. The corollary suggests that to place such costly equipment in an environment without the incentive or possibility to make adequate use of the greater flexibility that such machinery confers is to incur substantial losses.

It may be inferred from the form of Soviet modernization efforts that the leadership is willing, or constrained, to perceive restructuring of the economy as operating along two separate tracks, economic reform on the one hand, and modernization on the other. They are certainly not oblivious to the realization that the economic system requires fundamental restructuring. At the same time, there is a sense that pursuing a dual-track approach is an attractive option: If reform is going slower than intended or has run into snags, if price reform will have to be postponed until some future date, then at least the nation can go forward with the serious business of modernizing industry. The pressure that compels this strategy originates in the perception of stagnation in the Soviet economy and of a widening gap between the technological level of Soviet industry and that of the economies against which it competes. The analysis of modernization in the textile sector carries a strong implication for Soviet industry as a whole. To pursue modernization without taking the necessary steps to prepare the economic milieu in which it is to take root will be to impose large costs on the economy and perhaps even leave it farther behind in its race to the future.

BIBLIOGRAPHY

- Berliner, Joseph, *The Innovation Decision in Soviet Industry*, MIT Press, Cambridge, Mass., 1976.
- Biryukova, L., "Mutual Claims Barred the Way to Technological Innovation," *Sotsialisticheskaya Industriya*, February, 5, 1987a, p. 2.
- Biryukova, L., "Otkroet li koshelek pokupatel'?" *Sotsialisticheskaya Industriya*, December, 26, 1987b, p. 2.
- Bunich, P., "Compass of the Economy: To Where Does the Needle Point?" *Ogonek*, No. 26, June 25, 1988, pp. 6-7, 29, in *JPRS Soviet Union: Economic Affairs*, December 12, 1988.
- Bystrova, Z., "With Old Guidelines: Why Chintz Has Faded," *Pravda*, November 26, 1986, p. 3.
- Chayanov R. A., "Tasks of the NTO 'Legprom' for Carrying Out the Decisions of the XXVII Party Congress," *Tekstil'naya Promyshlennost'*, No. 4, April 1988, pp. 3-8.
- Evgen'ev, A., and I. Zhagel', "Vedomstva v Okopakh," *Sotsialisticheskaya Industriya*, April 12, 1988, p. 2.
- Fal'tsman, V. K., "Mashinostroyeniye: Puti Peremen," *EKO*, December 1985, pp. 3-20.)
- Garber, M. I., "Accelerating Reconstruction and Technical Reequipping: Problems, Searches, Solutions," *Tekstil'naya Promyshlennost'*, No. 3, March 1988, pp. 3-5.
- Goskomstat, Promyshlennost' SSSR: Kratkii statisticheskii sbornik, Informatsionno-izdatel'skii tsentr, Moscow, 1988.*
- Ivanova, T., "Brat' noshu na sebya," *Leningradskay Pravda*, March 13, 1987, p. 2.
- Keiretbaev, Ye. A., "The Kzyl-Ordinskaya Factory of Non-woven Materials," *Tekstil'naya Promyshlennost'*, No. 6, June 1988, pp. 25-26.
- Kalinin, N., "Usloviya Novye, Metody Starye," *Pravda*, December 1987, p. 1.
- Khavkin, V., "Karandash s kompyuterom, ili Pochemu zashlo v tupik tekstilnoye mashinostroyeniye," *Sotsialisticheskaya Industriya*, October 22, 1987, p. 2.
- Kochetkov, M., "Million—za kopeiky?" *Sotsialisticheskaya Industriya*, October 28, 1986, p. 2.
- Kotova, A. A. et al., "Ways to Restructure the Work of Industry to Produce Output that has Increased Demand," *Tekstil'naya Promyshlennost'*, No. 11, November 1987, pp. 17-20.

- Kotova, A. A., "Work of Enterprises in Conditions of Full Economic Calculations and Self-financing," *Tekstil'naya Promyshlennost'*, No. 6, June 1988, pp. 3-6.
- Kovshova, Z., "Prishel, uvidel i . . . zabyt," *Sotsialisticheskaya Industriya*, April 22, 1988, p. 2.
- Lavrentyev, G. A., "Enterprise Work under Gospriemka Conditions," *Tekstil'naya Promyshlennost'*, No. 8, August 1987, pp. 31-32.
- Lavrovskii, I., "What Lies Behind the Figures," *Sotsialisticheskaya Industriya*, January 5, 1989, p. 1.
- Lev, S., "Story of a Machine," *Pravda*, January 19, 1987, p. 3.
- Loginov, O. G., "Prospects for Retooling in Light Industry," *Shveytnaya Promyshlennost'*, No. 2, March-April 1988, pp. 5-8.
- Lysaya, Ye., "Textile Production: A Time of Changes," *EKO*, No. 4, April 1984, pp. 53-80.
- Mann, Julia De L., "Part I. The Textile Industry: Machinery for Cotton, Flax, Wool, 1760-1850," in Singer et al., 1958.
- Mel'nikov, V., "Ne Doversyaete—Snimaite! Pochemu ya otkazalsya byt glavnym inzhenerom," *Sotsialisticheskaya Industriya*, February 21, 1988, p. 2.
- Mgeladze, Amiran, "State Acceptance: The Criterion is the Quality of Output," *Zarya Vostoka*, February 5, 1987, p. 2, in *JPRS Soviet Union: Economic Affairs*, July 13, 1987.
- Migachev, Boris S., "The Quality Commissioners," *Chelovek i Zakon*, No. 3, March 1987, pp. 19-24, in *JPRS Soviet Union: Economic Affairs*, June 3, 1987.
- Molodtsov, B., "Vernut' byluyu slavy," *Sotsialisticheskaya Industriya*, April 8, 1987, p. 1.
- (Narkhoz.) *Narodnoye Khozyaistvo SSSR, Finansy i Statistika*, Moscow, various years.
- Nikitenko, G. G., "Our Interviews," *Tekstil'naya Promyshlennost'*, No. 10, October 1987, pp. 4-31.
- Nikitin, A., and A. Shabashkevich, "Imennye krecla," *Pravda*, February 22, 1988, p. 2.
- Ol'shanskaya, O. M., I. I. Dukovskaya, N. I. Khrabrova, and A. N. Matytsin, "Conception of the Development of Assortment and the Creation of New Technology in the Flax Industry," *Tekstil'naya Promyshlennost'*, No. 2, February 1988, pp. 13-16.
- Popper, Steven W., "Hungarian Management in Transition: Enterprise Guidance in an Era of Economic Reform," The RAND Corporation, P-7285, December 1986.
- Popper, Steven W., "The Diffusion of Numerically Controlled Machine Tools in Hungary," in Josef C. Brada and Istvan Dobozi (eds.), *The Hungarian Economy in the 1980s: Reforming the System and*

- Adjusting to External Shocks*, JAI Press, Greenwich, Connecticut, 1988.
- Razumeyev, E. I., "Tekhnicheskoye perevooruzheniye legkoi promyshlennost'," *Tekstil'naya Promyshlennost'*, No. 7, July 1988, pp. 3-8.
- Romanyuk, V., "Today a Shortage, But Tomorrow . . . ?" *Izvestiya*, October 18, 1988, p. 2, in *FBIS Soviet Union Daily Report*, October 21, 1988, pp. 82-85.
- Rytov, Yu., "'N' Index Dictates Prices," *Izvestiya*, September 10, 1988, p. 1, in *FBIS Soviet Union: Daily Report*, September 14, 1988, pp. 68-70.
- Sadykov, R., and S. Parfirova, "State Acceptance: The Struggle for Quality," *Tashkent Part. Zhizn*, No. 2, February 1987, pp. 38-43, in *JPRS Soviet Union: Economic Affairs*, July 9, 1987.
- Savinov, A., "General'naya priemka," *Komsomolskaya Pravda*, December 28, 1987.
- Shagun, A., "Gde rvetsya nit' batista?" *Sotsialisticheskaya Industriya*, January 3, 1986, p. 2.
- Singer, Charles, E. J. Holmyard, A. R. Hall, and Trevor J. Williams (eds.), *A History of Technology: Volume IV, The Industrial Revolution*, Oxford University Press, London, 1958.
- Smirnov, M., "Samofinansirovaniye: Pervye shagi," *Vechernaya Moskva*, December 10, 1987.
- Telen', Ludmila, "V teni rekorda," *Sotsialisticheskaya Industriya*, July 9, 1987, p. 2.
- Telen', Ludmila, "Kakaya zhe ona, zhenskaya dolya," *Sotsialisticheskaya Industriya*, April 22, 1988, pp. 2-3.
- Tell', R., "V starom klyuche," *Sotsialisticheskaya Industriya*, January 10, 1986, p. 2.
- Tell', R., "Fabrika y polya," *Sotsialisticheskaya Industriya*, September 23, 1987, p. 2.
- Tolstov, V., "Goods and Scarcity," *Izvestiya*, January 3, 1987, p. 2, as translated in *FBIS Soviet Union: Daily Report*, January 7, 1987.
- Valavoi, D., "The Pyramid," *Pravda*, September 19, 1988, p. 2, in *FBIS: Soviet Union Daily Report*, September 22, 1988, p. 51.
- Vilenskii, M. A., *Economic Problems of the Technical Re-equipping of Production*, Nauka, Moscow, 1987.
- Yegorshev, M., "The 1st Year of Work by the Sector in the New Conditions of Econ Activity," *Planovoye Khozyaystvo*, No. 3, 1987, pp. 20-25.
- Yelshina, V. V., and L. V. Ponomarenko, "Analysis of Work of Enterprises in New Economic Conditions," *Tekstil'naya Promyshlennost'*, No. 4, April 1988, p. 20.

- Zaichenko, A., "Risk and Independence of Innovative Activity," *Voprosy Ekonomiki*, No. 1, January 1988, pp. 41-51, in *JPRS: Soviet Union Economic Affairs*, May 12, 1988, pp. 27-33.
- Zenkovskii, V., "Zigzagi progressa," *Sotsialisticheskaya Industriya*, July 16, 1986, p. 2.