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ABSTRACT

This report compares the roles and utilization of women in science and technology in the Soviet Union and the United States. Changes in demographic and population data in both countries during this century are examined and compared. Differences in policies and organization of scientific enterprises are also examined and used in comparing the participation of women in scientific and professional occupations in the two countries. Results of the analysis indicate that over the last 30 years, Russian women have been educated and have achieved all but the highest offices equally with men. The authors observe that use of women's capacities is essential to the Soviet economy, and that if any change in women's status should be expected in the USSR, it will be one of declining need for women in the work force. By contrast, the status of women in the United States is changing from one in which their talents have been untapped or underdeveloped. It is conjectured that societal changes in the United States will cause an increase in the proportion of women in the professions. (SD)

WOMEN IN SCIENCE AND TECHNOLOGY:

U.S./USSR COMPARISONS

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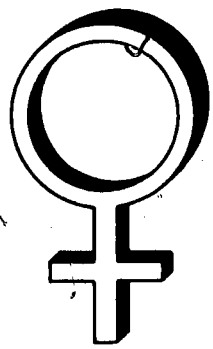
June 1974



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WOMEN IN SCIENCE AND TECHNOLOGY: U.S./USSR COMPARISONS

ABSTRACT

A discussion of the results of an exploratory net assessment of the relative role and degree of utilization of women in science and technology in the Soviet Union and in the United States. Relevant demographic and population dynamics data are shown to indicate substantial differences, and trend analyses are developed to assess the future importance of U.S./USSR disparities. In terms of women representing a national resource in science and technology, the significance of these disparities is assessed -- significance not to men and women individually or as groups, but in the context of science and technology contributions to the future welfare and security of both nations.

The participation of women in all sectors of the national economy is considerably greater in the Soviet Union than in the United States, not only in such professional fields as science, engineering, and medicine, but also in the judiciary, in politics, and in education. But the upper-echelon positions in both countries are still filled disproportionally with men rather than with women, and while an ideological motif underlies Soviet policy toward women, the economic motif and practical necessity are dominant in determining specific Soviet policies.

In the United States and other Western countries, a large reservoir of female talent remains untapped or underdeveloped, and is left largely at the margin of professional life. On the other hand, the United States is in the process of re-assessing many of its past policies with regard to the social and economic status of women, whereas the Soviet Union appears to have approached a nearly steady state situation. On the basis of demographic and socio-economic trends, it is projected that over the next decade a considerable degree of convergence will occur between the different paths followed by the Soviet Union and the United States in the past.

At the present time, the Soviet economy depends on and requires the participation of women in all branches of the labor force. In the United States, in contrast, the participation of a woman in the labor force is primarily a matter of individual choice or of personal economic necessity. But in the not too distant future, the great necessity for participation of women will decline in many sectors of the Soviet economy, whereas societal changes in the United States will bring about considerable increases in the participation rates of women in professional life.

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You have come a long way, baby, but look
where Valentina, Veronika, and Natalya have gone*

INTRODUCTION

We have recently completed an exploratory net assessment of the relative role and degree of utilization of women in science and technology in the Soviet Union and in the United States. As a net assessment, it involved comparative surveys of economic, political, and educational as well as technological factors, was policy-oriented, and concentrated on addressing the fundamental issues revealed by national differences and disparities. In terms of women representing a national resource in science and technology, the significance of such disparities was assessed not so much for men and women as individuals or as groups, but rather in the context of potential contributions to the future welfare and security of both nations.

In world opinion, the Soviet Union has been for many years among the leaders in the evolution of the status of women. The participation of women in all sectors of her national economy is considerably greater than in the United States, and the high percentage of women in professional occupations is one of the major accomplishments of the Soviet regime. In a certain sense, the United States appears to be only slowly catching up. But it would be a mistake to simply deduce that conditions in the United States will eventually approach those we see in the Soviet Union today.

As we shall show, the Soviet regime's attitude toward women is quite different from that of our society which considers the individual's welfare as the basic social goal. While an ideological motif underlies Soviet policy toward women, the economic motif and practical necessity are dominant in determining specific Soviet policies. In our concluding remarks, we will make projections of the probable future course of events and explain why, over the next decade, we expect to experience a considerable degree of convergence between the different paths followed by the Soviet Union and the United States in the past.

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* Valentina Nikolayeva-Tereshkova went into earth-orbit on June 16, 1963 and is currently studying for her doctorate at the Zhukovsky Air Force Engineering Academy; Veronika Dudarova is chief conductor of the Moscow State Symphony Orchestra; Natalya Makarova chairs the Moscow Regional Court of Justice. Not to mention Yadgar Nassriddinova who is Chairwoman of the Council of Nationalities, and Shamama Gasanova who is Vice-Chairwoman of the Council of the Union of the Supreme Soviet.

In this paper, we have attempted to provide an interpretive overview of the substantive results of our analysis. Details of relevant statistical data and examples of the supportive background material are given in the Appendix. Throughout the text, however, we point out and comment on difficulties with regard to obtaining reliable data on the men-women aspects of both the U.S. and the Soviet economy, especially in the areas of science and technology. Nevertheless, available facts and figures speak largely for themselves, and we hope that this exploratory investigation can serve as the basis for more explicit analyses.

DEMOGRAPHIC DATA

Early in our study we found that in spite of the voluminous demographic statistics which abound, there are relatively few reports or analyses at hand which concentrate on the men-women picture. This is true for both the Soviet Union and the United States. The question is why?

The reasons may be quite different. In the Soviet Union, no special attention is given to distinguishing between male-female economic statistics, except perhaps externally for comparison purposes vis-a-vis other countries. On the other hand, we have reason to believe that such statistics are routinely analyzed for internal planning purposes. In the United States, the percentage of women in certain sectors of the labor force may still be so small as to warrant little attention.

In the absence of readily available, relevant men-women data in processed form as from analytical studies, we were often forced to look at raw data such as Census figures, Public Use Samples, Current Population Surveys, and similar data collections, including reports from various commissions and study panels.

But a word of caution is in order with regard to accepting some of the available statistical material on a numerical basis. Much of the U.S. census information, for example, is based on extrapolations from limited samples, and is translated into self-consistent series which give the impression of great accuracy. But at any one instant, we doubt that even such a simple datum as the number of employed women in the United States is actually known to better than an accuracy of perhaps a million or so.

It has been estimated, for example, that the 1950 population census of the United States failed to account for the presence of approximately five million persons. In a more specific example in January 1974, the U.S. Census Bureau revised its 1970 figures of the number of Americans of Spanish-Mexican origin, living in the United States, upwards by 1.5 million. We suspect that similar comments could probably be made about USSR statistics.

See Appendix, Figure 1. All figures are collected together in the Appendix. Tables are in the text.

But fundamental to any comparative study of the role of women is an understanding of the basic demographic situation and the population dynamics which affect the utilization of women in the labor force. This has been of particular significance to the Soviet Union. As discernible from Table 1, the Soviet population suffered severe human casualties, especially young men, during the two World Wars. By 1950, there were only 78 men for every 100 women, compared with a U.S. figure of 99 men per 100 women.

Table 1 -- Population [millions]

	U.S.		USSR	
	Men	Women	Men	Women
1913	49.9	47.3	79.1	80.1
1950	75.5	76.2	79.2	101.1
1970	100.2	104.6	111.4	130.3

The man/woman gap is now shrinking, but it remains impressive enough: the USSR still has some 18 million more women than men. This numerical gap between the sexes will narrow faster and faster every year as the disturbed population cohorts age and as every passing year produces 100,000 more boys than girls. While the ratio of men to women is thus increasing in the Soviet Union, it has been gradually decreasing in the United States.* Hence, these ratios are expected to be nearly the same by the end of this century.

It is sometimes believed that the basic U.S./USSR demographic differences are caused by a difference in life expectancies. But this is not the case. As shown in Table 2, the Soviet Union and the United States have nearly the same life expectancy rates, comparable to those of most developed nations.**

Table 2 -- Life Expectancies [years]

	U.S.	USSR
Men	67	65
Women	74	74

*See Figure 2.

**See Figure 3.

The current population pattern peculiar to the USSR is a combination of a number of factors, including the extensive loss of male lives during wars, the decrease in loss of female lives in connection with childbirth, and changes in the reproduction rates. Birth rates have been declining considerably in both countries.* But most population projections to the year 2000 predict men-women ratios of about 93 to 95 men per 100 women, and total populations of the order of 300 million for both the Soviet Union and the United States. These demographic trends will be of importance when we later theorize about the future role of women of both countries in the professional labor force. Before we get to that, however, there are many other factors to be considered.

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*See Figure 3.

EMPLOYMENT DATA

From various U.S. and Soviet census sources, one would expect to be able to get a clear picture of the comparative employment situation. Yet this is not easily done. Different ways of national compilation and treatment of data by each nation cause difficulties in deriving truly equivalent figures. A summary comparison of the U.S. and USSR labor forces is shown in Table 3.

Table 3 -- Labor Force Comparison in 1970 [millions]

	U.S.	USSR
Total Population	204.8	241.7
16 Years and Over	140.2	168.4
Able-bodied	108.8	130.6
Labor Force	85.9	121.9
Civilian Labor Force	82.7	118.6

A more detailed comparison of different population categories is shown in Figure 4. U.S. labor figures are often based on the "16 and over" group, while the Soviets invariably deal with the "able-bodied," by definition men from 16 to 59 years of age and women from 16 to 54 (but excluding any groups not counted). "Able-bodied" does not refer to physical capability, but strictly to age groups. Retirement age with pension rights in the USSR is 60 for men and 55 for women.

Also, the U.S. "labor force" and "civilian labor force" include unemployed persons who wish to work but have not found jobs (the Soviet Union has no unemployment) and part-time employees who may or may not be double-counted in some way. The potentially available primary work force is therefore generally given by the "16 years and older" group for the United States, and the "able-bodied" for the USSR.

About 54% of the total Soviet population in 1970 fell into the so-called able-bodied age group,* and some 90% of this able-bodied population is employed in the labor force. As far as this most productive group of the working population is concerned, the Soviet gap in numbers between men and women has already changed significantly as shown in Table 4.

*See Figure 5.

Table 4 -- Soviet Able-Bodied Population [millions]

	Males	Females	Difference
1950	44.4	58.2	13.8
1960	55.2	64.2	9.0
1970	64.1	66.5	2.4
1980	Numerical equality nearly obtained		

The more or less official figures for the percentage of women employed in relation to the total employed non-agricultural labor force show a striking difference: 39% for the United States versus 51% for the Soviet Union.

Let us compare these latter figures with those of other countries.

A glimpse of the world-wide picture can be obtained from reports of the United Nations Commission on the Status of Women. A recent U.N. analysis of replies to a U.N. questionnaire from 77 countries and 26 non-governmental organizations shows a wide diversity. "From the current trends in many countries it would appear that measures taken to increase the participation of women are prompted not so much by the desire to bring about a fundamental change in the role of men and women in society, but rather by the realization that over-all development requires a greater utilization of the potential labor force."

The percentage of women gainfully employed outside the home in relation to the total employed labor force varies widely, from 28% of the labor force in Israel to 80% (??) in Bulgaria. Examples of the UN figures for a number of countries are shown in Figure 6.

In general, levels of responsibility for women are comparatively low throughout the world, ascribed in part to the younger age structure of the female work force. (This can also be correlated with salaries.) But an important determinant of the level of responsibility is the sector of the economy in which women work. They are generally in higher positions in such sectors as social welfare and education, and in lower positions in commerce or government. There seems to be an important exception in several Republics of the USSR, explained as being partly due to the educational system "which prepares boys and girls equally for specialization in the technical and scientific fields."

"A few countries* emphasized that the real influence of women within a country should not be gauged by their activities in gainful occupations, but through the very important role they play at home as wives and mothers."

In response to a request for guidelines for the establishment of a long-term U.N. program for the advancement of women, the U.S. government observed that "since customs and attitudes regarding the role of women in society tended to lag behind technological advance, a first objective was to find ways to change underlying attitudes, and to anticipate the new possibilities and relationships which would liberate women and their families for a wider participation in national life."

Next, we look in more detail at employment figures for the United States.** In 1970, the "Civilian Labor Force" of 82.7 million included some 4 million unemployed and more than 11 million part-time employees, some of whom may have been counted more than once. The degree of participation by women is characterized in Table 6 below.

Table 6 -- Women in U.S. Labor Force [millions]

	Employed	Population 16 Years & Over
Single	6.9	13.1
Married	19.8	47.8
Widowed/Divorced	4.5	12.3

Thus, about 43% of the female population of the United States, over 16 years of age, are employed in the labor force. This contrasts with 79% of the male population. In sum, some 55% of the U.S. population over 16 years of age is gainfully employed.

In the Soviet Union, some 69% of the population over 16 years of age is gainfully employed.

There are many interesting details to be observed in the U.S. employment situation.** As expected, for example, single women of all age groups are more likely to be employed than married women. Single men, on

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*Ivory Coast, Rwanda, United States of America.

**See Figures 7 and 8.

the other hand, are considerably less likely to be employed than married men.

After the single woman, the woman most likely to be employed, in any specific age group, is widowed or divorced or with an absent spouse. But as a group, they constitute only 14% of all women, and contribute only some 5% of the total labor force.

Some 37% of the U.S. total labor force are women, and 63% are men. For reasons mentioned earlier, it is difficult to derive completely equivalent USSR numbers. Approximately corresponding figures are that 51% of the Soviet civilian labor force are women, and 49% are men.

We want to note that all the detailed Appendix data in Figures 7 and 8 were calculated from official U.S. Census information sources. But there are noticeable discrepancies, especially when comparing totals and breakdowns from different source material.

We run into similar difficulties and discrepancies when trying to understand USSR statistics.

From the most recent Soviet census of 1970, we learn that 48% of the total population were gainfully employed, 14% were pensioners, 36% were dependents and workers engaged in ancillary husbandries, i.e., private raising of livestock, and close to 2% were students.*

Of specific interest is that 95 million persons in the USSR had higher (college) or secondary (high school) education. This represents a remarkable increase during the past decade, and the trend distribution among gainfully employed men and women with such education runs as follows:

Table 7 -- Soviet Employees with Advanced Education
[Expressed per Thousand Employed]

	Men	Women
With Higher Education		
1959	34	32
1970	68	62
With Secondary Education		
1959	400	399
1970	586	589

The data are almost identical for both sexes, but note the doubling of employees with higher education between 1959 and 1970.

*See Figure 9.

WOMEN IN THE ECONOMY

The most obvious disparities between the degree of participation by women in the national economies of the United States and of the Soviet Union are reflected in Table 8 below:

Table 8 -- Women Participation in Percent of Totals by Employment Category

	U.S.	USSR
Population	51%	54%
High School	50	54
College	41	53
Employed	38	51
Life and Physical Scientists	14	38
Engineers	2	28
Doctorates	7	26
Physicians and Dentists	9	72
Lawyers	3	
Judges		32
Congress	3	
Supreme Soviet		31

But the most important disparity is between large differences from category to category in the U.S. participation rates and a generally more even distribution in the USSR. In the United States, certain fields are dominated by women and a number of areas have very minor participation by women; in the USSR, women are well represented in all sectors of the national economy.

This is illustrated in Figure 10, where participation rates of women in various types of employment categories have been extracted from U.S. and Soviet census data. The arrangement shown there is in descending order of percentage participation, and while the divisions are not closely equivalent between the U.S. and the USSR categories, they do indicate the way the two countries break down their labor force.

In much of the following discussion, we will be focusing on the categories of professional, technical, and scientific employment. But it is not enough to note, for example, that the Soviet Union has 343,200 women research workers, or that in the matter of recognition of the quality of work, 24% of the awards of the Order of Lenin have gone to women between 1918 and 1970. Thus, before taking a closer look at census data, let us pause for a moment and consider the general picture.*

The high percentage of women in semi-professional and professional occupations (i.e., "mental work" or "white collar," as opposed to "physical labor" or "blue collar") is clearly one of the major accomplishments of the Soviet regime. In world opinion, the Soviet Union has been among the leaders in the evolution of the status of women. Why?

The policies of the Communist Party regarding women workers have been embodied in labor legislation from the early years of Soviet power (1917). With certain exceptions and advantages dictated by their role as mothers, women have been treated as economically equal to men. Their equal rights to education and employment and their basic legal equality are well established in the USSR. On the other hand, the equality they have attained in socialized work is not by any means always combined with real equality in home life. Soviet women seem to have two careers: One at home and one in the national economy.

What may have been originally an ideological concept became a practical necessity after World War II with the heavy loss of male lives. (January 1946: 75 million males, 101 million females; in the age group 16-59: 66 males per 100 females.) Many aspects of the picture we see today can be illuminated by understanding Soviet population dynamics over the past decades and the intricate relations to Soviet economic development and associated demographic policies. Thus, we find a high percentage of women in science and technology as in all other fields. While the percentage in the managerial class and among academic leaders is not as high as 50-50, it is considerably higher than in other countries.

There is no doubt that the disparities between the United States and the Soviet Union with respect to the utilization of women are large from a quantitative point of view. But we must consider significance; we will have to look critically at trends and at the future. The current numerical

*See Figure II.

superiority of women is rapidly diminishing, and the picture by 1980 and 1990 will be governed by the generation now in school; so, we must also look at current trends in education.

Let us recall that the Soviet economy is a planned system. Detailed and comprehensive perspective plans guide the development of each sector in a manner quite unlike the U.S. style. For example, when we talk about the possible advantages and disadvantages of Zero Population Growth in the United States, we talk about it on TV shows, the lecture circuit, and the editorial pages. If and when population growth is determined to be either beneficial or not to the Soviet State, official plans are made and implemented, and responding action follows on all levels -- whether the plans are successfully met is another story.

In Figure 12, we contrast the major forces that are acting towards greater participation by women in the labor force in the United States and in the Soviet Union, respectively. While U.S. forcing functions can be characterized by such terms as Family Needs or Social Desirability, the contrasting USSR terms are National Labor Scarcity and Economic Necessity. The plain facts are that U.S. women want participation in the economy whereas the USSR economy needs women participation.

In Figure 12, we also compare the means of implementing greater participation of women in the national economies. Such forces and means of implementation have been active in the Soviet Union since World War I. Except for a relatively brief period during World War II, most of the driving forces and some steps towards implementation in the United States have only become active during recent years.

In a certain sense, the United States appears to be on the road of slowly catching up with the USSR with regard to employment equality of men and women. However, it would be a mistake to deduce simply that conditions in the United States will eventually approach those we see in the Soviet Union today. The basic situations are completely different. Further, barring catastrophe, the numbers of men and women in the USSR will reach numerical equality again by the end of the century, and the economic necessity for the employment of women will therefore diminish.

We shall have more to say on this subject in our closing remarks.

SCIENCE AND TECHNOLOGY

We will now turn to the situation in science and technology. First, we must emphasize again that diverse data sources can often give completely different results. This is true both for the United States and the Soviet Union, especially when attempting to compare the number of persons involved in S&T (science and technology).

Another nontrivial problem concerns the use of equivalent terms and data sets. Just a few examples are:

Table 9 -- Differences in U.S./USSR Terminology and Data Sets

U.S.		USSR
Doctoral Degree	=	Candidate Degree
Post Graduate Achievements	≈	Doctoral Degree
?	=	Scientific Worker
Engineer (engaged in engineering work)	≠	Engineer (trained in engineering)
National Acadmey of Sciences	≠	USSR Academy of Science
no equivalent		Ministries
no equivalent		Five-Year Plan
Congress	≈	Supreme Soviet
NSF + ARPA + NAS (plus other functions)	≈	State Committee on Science and Technology

When such differences in meaning are neglected, misleading comparison data are easily obtained. Figure 13 is typical of information that is often quoted to the effect that the USSR has many more "engineers" than the United States (viz.: 2.5 million versus 1.1 million), but that American "natural scientists" outnumber Soviet scientists by large numbers (viz.: 610,000 versus 284,000).* The UN data do not help much either.

*From Soviet Economic Prospects for the Seventies, A Compendium of Papers submitted to the Joint Economic Committee, Congress of the United States, U.S. Government Printing Office, Washington, D.C., June 27, 1973 (776 pages).

But a much more meaningful picture is given in Figure 14. These data are based on a very recent and -- in our judgment -- one of the most accurate comparisons of U.S. and Soviet workers engaged in research and development (Conlin, 1973).

By taking into account employment practices, he derives the following numbers for full-time-equivalent scientists and engineers in research and development:

Table 10 -- R&D Scientists and Engineers

	U.S.	USSR
1960	415,000	244,900
1965	496,500	443,700
1970	535,400	600,300
1971	536,000	641,100

Also of special relevance are the numbers for so-called "Scientific Workers" in the USSR: 927,700 in 1970. By Soviet definition, they consist of academicians, members and corresponding members of all academies, all persons having the academic degree of doctor or candidate of science or the academic title of professor, docent, senior scientific associate, junior scientific associate and assistant, without regard to the place or character of their work; persons carrying out scientific-pedagogical work at higher educational institutions, even if they do not hold an academic degree or title; and also those specialists not having academic degrees and titles, carrying out scientific work at industrial enterprises and project organizations.

38.8 percent of these "Scientific Workers" in 1970 were women, and among those scientific workers with doctorates, 25.7% were women.

In Figure 15, we have assembled data on scientists and engineers from various sources. Soviet data are from the statistical yearbooks. U.S. data are estimates by the National Science Foundation (NSF), and U.S. numbers in parentheses are for scientists listed in the U.S. National Register of Scientific and Technical Personnel. As explained, the numbers are not strictly equivalent between the U.S. and the USSR, but give a picture of long-term trends.

The striking differences between U.S. and USSR numbers of women with science doctorate degrees (in 1970: 9,400 vs. 63,700), as well as the high percentage of women engineers (28%) in the USSR, reflect the most immediate disparity between U.S. and Soviet utilization of women in S&T. Women are well represented in Soviet S&T, and this has been maintained as the total numbers of scientists and engineers has risen over the years.

In comparison, U.S. women participation fares poorly, expecially in the hard sciences; from a low of 1.6% (engineering) to a peak of 13.7% (life and physical sciences).

Also of interest would be the ratio of doctorates relative to the total S&T work force: About 1 in 4 in the Soviet Union; about 1 in 10 in the United States. This, however, may be due to peculiarities in the U.S. data sets and needs elaboration:

The lower part of Figure 15 gives some breakdowns of 1970 data. But comparison of the U.S. estimates by NSF with data in the U.S. National Register shows very significant differences. For example, NSF estimated that there are 253,000 Physical Scientists and 76,000 Mathematicians in the United States, but only 60,700 scientists are actually registered in Physics and Mathematics. We believe that this is primarily a problem of definition and, especially, of who calls himself or herself a "scientist" in census questionnaires against registrations by scientific societies. We commented earlier that the most meaningful quantitative comparison of U.S. and Soviet scientists and engineers in R&D is probably contained in Figure 14, based on a Defense Intelligence Agency analysis (Conlin, 1973).

[Our qualms with some of the NSF estimates are based, in part, on the contents of a recent NSF report on the state of science in the United States, entitled Science Indicators 1972 (National Science Board, 1973). This report contains no data whatsoever on women scientists, and in some 145 pages of text and numerous tables and figures, the word women occurs twice, and the word sexes once; and that only in connection with results from opinion surveys. We mention it here as a specific example of the persistent difficulties we encountered in obtaining reliable men-women data for our analysis.]

In Figure 16, we attempt to compare the number of U.S. and Soviet scientists by specific fields in 1970. The U.S. data on some 312,000 scientists are quite selective as indicated by the fact that 40% of all the scientists listed in the National Register have Ph.D.'s, and that 32% of the 30,000 women scientists registered are holders of a Ph.D. The data are tabulated according to descending numbers of U.S. scientists in various fields, with some corresponding Soviet categories. Note that 518,000 of the 927,000 Soviet scientific workers are classified as scientists by Soviet sources; the rest as technical.

Consistent with findings displayed earlier, the percentage of women listed in the USSR (38.8%) was some four times those in the United States (9.4%). Also, as indicated in earlier discussions, the Soviet women are more evenly distributed throughout the fields. We do not have precise figures on these breakdowns, but we believe the percent women participation in different categories ranges upwards from a minimum of about 25% in every field. By contrast, U.S. women are much more likely to be concentrated in only a few scientific areas. Their degree of participation in various fields is characterized in Table II.

But we believe that on the one hand, Soviet listings include more junior scientific personnel than the U.S. listings. On the other hand, the U.S. Register is very likely incomplete, with totals too low by as much as 30%. In absolute numbers for 1970, we therefore estimate that there were probably some 200,000 active women scientists in the USSR, and about 40,000 in the United States.

Of these latter, about three-fourths are concentrated in psychology, chemistry, the biological sciences, mathematics, and in the computer sciences.

Table 11 -- Distribution of Registered Women Scientists in the United States (1970)

	Percent Women	Numbers
Fields of Low Participation		
Atmospheric and Space Sciences	1.5%	100
Agricultural Sciences	3.4	540
Earth and Marine Sciences	3.6	860
Meteorology	4.5	250
Economics	6.1	820
Physics and Mathematics	6.8	4,130
Chemistry	7.1	6,200
Astronomy	7.9	220
Political Science	9.9	640
Fields of Higher Participation		
Statistics	11.1%	330
Computer Sciences	11.5	1,300
Biological Sciences	12.9	6,130
Anthropology	22.3	300
Sociology	22.6	1,730
Linguistics	23.5	450
Psychology	24.2	6,330
All Fields		
United States	9.4%	
Soviet Union	38.8	

About scientists in faculty positions, we were able to collect only rather incomplete data. As Figure 17 indicates, women during the 1960s filled about one-fifth of the academic teaching and research positions in the United States, and about one-third of such positions in the Soviet Union. There is some evidence that in both countries, the percentage of women increases as one goes down the academic ladder, viz.:

Table 12 -- Women in Faculty Positions

U.S. 1967	% Women	USSR 1961	% Women
Dean, Professor, Associate Professor	12%	Professor, Dozent, Senior Research Associate	19%
Assistant Professor, Instructor	26%	Assistant, Junior Research Associate	51%

The single datum which seems to come to everybody's mind when talking about professional women in the Soviet Union concerns physicians. Let us look at the long-term trend as shown in Fig. 18.

In comparison to women representing some 70% of all physicians and dentists in the USSR, the U.S. figure of 9% is obviously quite low; in fact, it seems to be the lowest in the world. But there is an illuminating aspect to these USSR statistics. We can quote Soviet statements:

> Medicine is attractive to girls because:
>
> a. It is close to the nature of women; it appeals to the maternal instinct.
>
> b. It is possible to choose working hours; women with children therefore can adjust or limit their schedule.

Current Soviet policy is however, to somewhat discourage women from studying medicine. Among the reasons given is an attempt to balance the male-female ratio among physicians because male surgeons are better (more detached, less emotional; also, needed for the military).

There is a strange statistical sidelight. Women medical students have a strong tendency to get married on or about graduation time. The explanation concerns location assignments upon graduation. By getting married, urban girls avoid being stuck alone in some remote village in the middle of nowhere.

We can look deeper into the comparative data on physicians, although we have to mix 1967 and 1970 figures.* It seems to be one of the few scientific fields where such detailed information is available. But men-women ratios are hard to find even among these data.

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*See Figure 19.

There is approximately one physician for every 613 persons in the United States, and one for every 452 Soviet citizens. But U.S. data include a sizeable number of retired M.D.'s, and some 7% are of age 70 or older. The Soviet ratio of dentists to physicians is about half the U.S. ratio, there are twice as many Soviet surgeons, some five times as many pediatricians, but only half as many psychiatrists as in the United States. Noteworthy are the high percentages of foreign graduates among U.S. M.D.'s -- fully one-third of all women physicians in 1967, for example. As we have mentioned before, national figures show the U.S. to be the lowest in the world in the employment of women in medicine.

Universal military service is the law in the Soviet Union, and all men are obliged to do active duty in the USSR Armed Forces of from one to three years, depending on education and on area of service. Women can be drafted only in wartime, but women 19 to 40 years of age who have medical or other specialized training can be taken into military service in peacetime.

By law, the medical examination of all draftees is performed by physicians drawn from the best medical institutions: a surgeon, an internist, an ophthalmologist, an otolaryngologist, and, when necessary, doctors in other specialties.

In concluding our discussion about employment in science and technology, it may be instructive to take a look at Soviet views on where they stand in S&T. Figure 20 contains excerpts from a recent discussion by S. Mikulinsky (1973) in the context of implementing the directives of the 24th CPSU. Congress towards increasing the effectiveness of scientific research, and "accelerating the utilization of the achievements in S&T in production," i.e., the practical application of S&T.

He states that in spite of the high increase in the number of scientific personnel since 1950 (9% per year), there are still too few scientists in several important disciplines. But he criticizes comparisons between U.S. and USSR utilization rates of S&T personnel for applied R&D, which found that 70% of all American R&D scientists and engineers are in industry, and that only 6% of Soviet R&D personnel are employed in industrial enterprises. He explains that, in the USSR, applied R&D is conducted largely in governmental institutes. Hence, the true figure of the percentage of Soviet

scientists and engineers conducting applied R&D is really 50%. In addition, he emphasizes that industrial R&D in the USA is inefficient because of proprietary secrets and resultant duplications.

His final points refer to ways and means of implementing the CPSU directives, including closer cooperation among CMEA* countries (to a certain degree, the eastern equivalent to NATO) and better planning.

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*Council of Mutual Economic Assistance countries are: Bulgaria, Hungary, German Democratic Republic, Cuba, Mongolia, Poland, Romania, Czechoslovakia, and the Soviet Union.

EDUCATION

We stressed earlier that the situation during the 1980s and beyond will be governed by the generation now in school. Let us therefore take a look now at educational trends. Again, it is extremely difficult to obtain relevant men-women data.

There are 794 Soviet higher educational institutions (VUZy), of which about 60 are universities and the remainder are institutes.* Admission is regulated by strict rules, and a student is admitted to a particular field of study or specialty. Length of study is about five years. The majority of students are assigned to specific jobs upon graduation, where they must serve a minimum of three years.

The 4,129 specialized secondary schools (tekhnikumy) consist of various types, including industrial, technical, medical, agricultural, and pedagogical schools. The changing specialities available reflect the demands of the economy and, particularly, new and developing technologies. The average length of training is two and one-half years.

Figure 21 indicates the upward trends in Soviet education and the general destination of high school graduates. (In the USSR students are assigned to jobs upon graduation, rather than being free to look for jobs of their preference. In practice, of course, teachers and acquaintances do have some means of influencing work assignments.)

The educational level of the Soviet population has been rising steadily. Some illustrative figures are shown below; note the change for women.

Table 13 -- Percentage of Literate People in the USSR (Age 9-49)

	Both Sexes	Men	Women
1926	55.6%	71.5%	42.7%
1939	87.4	93.5	81.6
1959	98.5	99.3	97.8
1970	99.7	99.8	99.7

*In May 1974, it was reported that the 60th university has opened in Tyumen, one of the regional centers of Siberia, with 5,000 students and a faculty of 300 professors and researchers.

We were able to assemble only incomplete data about Soviet graduate student enrollment, but we show them in Figure 22 because they give some indication of sex distribution. The Soviet graduate student enrollment of 99,400 in 1970 compares very roughly to a U.S. enrollment of graduate students in S&T of 138,000 in the same year. In terms of general student enrollment in the USSR, in both higher educational institutions and in specialized secondary educational establishments, the percentage of women was about 53% in 1970/71. [The percentage of women in the general population age group 16-28 years was only 49% during this period.] It is noteworthy, however, that the percentage of women declines throughout school -- from over 50% in specialized secondary to a significantly smaller percentage in graduate schools.

There are, of course, many incentives in the Soviet Union to undergo advanced education. A lesser known one is the provision that soldiers and sergeants who have a higher or a secondary education, receive, upon completing active duty and passing prescribed examinations, officer rank with their discharge into the reserves.

As we have stressed, there is often found a considerable amount of confusion with regard to the equivalence of U.S. and Soviet terms and data sets. The situation is similar with regard to academic degrees, and some illustrative examples are shown in Figure 23. We believe that, in general, the Soviet candidate degree can be taken as corresponding to the American doctor's degree in the field of S&T, viz.:

Table 14 -- Equivalent Academic Degrees

U.S.	USSR
Ph.D., D.Sc.	Candidate of Science
Post-doctoral achievements	Doctor of Science

There is no Soviet equivalent to the American bachelor and master's degrees. This situation is also found in some countries in Central Europe, where sometimes an American bachelor degree is considered equivalent to graduation from a European specialized high school such as a "Realgymnasium."

On the other hand, there is no American equivalent to the Soviet doctorate. The Soviet doctor of science degree is conferred upon mature scientists who have made a significant contribution in their field. It can be equated more nearly to the designation of Dozent or Dr.h.c. at several European universities, and perhaps the achievement of post-doctoral honors or awards in the United States.

In accord with our conclusions about the equivalence of degrees, we compare in Figure 24 the number of doctorate and candidate degrees awarded annually. Both magnitude and trend are similar in the United States and the Soviet Union, as indicated in Table 15 below.

Table 15 -- Doctorate and Candidate Degrees Awarded Annually

	U.S.	USSR
1960	9,829	7,500
1970	29,872	26,300
1972	34,607	28,700

In the United States, the percentage of doctorates awarded to women has been slowly but steadily increasing and is now near 16%. For the Soviet Union, we have indirect evidence that at least 25% of the doctoral degrees awarded annually are to women. Among Soviet scientific workers in 1970, for example, women held 27.3% of the candidate of science degrees and 13.4% of the doctor of science degrees.

In the United States, a phenomenon of potentially considerable significance to S&T concerns the percentage of holders and recipients of advanced degrees, who are either naturalized or foreign citizens. For example, it was shown in Figure 19 that 32% of practicing women physicians and dentists in 1967 were foreign graduates. In Figure 24 we note that 14% of U.S. doctorate degrees awarded in 1970 went to foreign citizens. In a recent survey of U.S. women in meteorology, Simpson and LeMone (1974) state that "A surprising result of our survey was the high fraction of foreign born women in the advanced degree categories." [33% of women Ph.D.'s; 47% of women Ph.D. candidates.]

Viable data are practically non-existent in this area, but we have come across similar information often enough in our survey to speculate on various reasons for this obvious preponderance of foreign backgrounds

and/or foreign education among women scientists in the United States. The subject clearly requires serious consideration.

For the United States we have sufficient U.S. data to conduct some long-term trend analyses about the progress of women in education. Figure 25 expresses the number of persons receiving earned degrees annually (i.e., bachelor's, 1st professional, master's, and doctor's) as percentages of the total population. In 1970, for example, 1,072,581 earned degrees were awarded, or 0.5% of the U.S. population of all ages received an academic degree during this year. Of them, 639,000 went to men, and 433,600 went to women.

Between 1948 and 1970, the percentage of the U.S. population receiving degrees annually increased by a factor of 2.4, and a substantial portion of this increase was due to women receiving an increasing proportion of the degrees.

We can see this in more detail in Figure 26. As shown in the upper part of Figure 26, the number of all degrees awarded annually to women increased from 35% in 1948 to 40% in 1970. For bachelor and first professional degrees, this percentage decreased from 35% to 33%, but it increased for master's degrees from 32% to 40%, and for doctor's degrees from 12% to 13%.

In the lower part of Figure 26, certain selected trends are of interest. These numbers are expressed as percentages of all degrees awarded annually. Significant changes from 1948 to 1970 are shown for four major categories. The relative numbers of degrees conferred in physical science, in engineering, and in medicine has decreased substantially for both men and women, while mathematical and computer sciences have increased. The major relative increases were in the fields of social sciences and education for both men and women, and in the arts and humanities for men. Fields not discussed remained relatively stable.

Together, Figures 25 and 26 show clearly that while there has been a large increase in the number of recipients of academic degrees in the United States from 1948 to 1970, the trend is away from the hard sciences. Importantly, however, this applies to both sexes and is not due to more women receiving degrees in the softer sciences.

In the Soviet Union, in contrast, while there has been an equally large increase in the number of academic graduates, the emphasis on scientific and technical education of both sexes has, if anything, continued to increase.

POLITICS AND LEGISLATURE

The systems of government in the United States and the Soviet Union are so different, of course, that it is difficult to find parameters that would permit valid comparisons in the context of the present study. But we can display in Figure 27 one aspect that is (a) somewhat comparable, (b) significant with regard to the status of women in authoritative positions, and (c) influential, at least in the United States, regarding decisions on R&D.

The data in Figure 27 need no elaboration concerning the numerical disparity between the United States and the Soviet Union: 30.5% of the deputies to the eighth USSR Supreme Soviet were women, while the average number of women in the U.S. Congress for years has only been about 13 out of some 530 senators and representatives.

The emphasis is, however, on the elective process, and we do not wish to imply that there is much similarity between the functional operations of the U.S. Congress and the USSR Supreme Soviet. The election process, on the other hand, is conducted in a somewhat similar vein, and does indicate that a Soviet woman in a popular election is some 13 times more likely to be nominated and to receive a majority of votes from her political district than is an American woman.

Whether or not the presence of more women in decisionmaking bodies is the direct cause, there are very significant differences between important legislation affecting the employment of women in the Soviet Union and the United States. A specific example concerns pregnant women and working mothers.

A recently modified Soviet law (1973) now provides 112 calendar days of maternity leave at full wages, including bonuses: 56 days before, and 56 days after childbirth. Further, if a child is sick, a married mother may take up to seven days of paid leave; an unmarried mother, a widow, or a divorced woman may take up to 10 days. All medical care is, of course, free in the Soviet Union.

In the United States, legislative details vary from state to state. But it is generally true that a pregnant women is not allowed unemployment

benefits, because she is not considered available for employment, nor is she allowed disability benefits, because she is not considered disabled. Only recently, efforts are being made to persuade states to abandon such pregnancy clauses.

In passing, we may note that as of January 1970, 31.6% of the judges in the Soviet Union were women.

ASSESSMENT

In this exploratory study of women as an S&T resource, we have been able to conduct only preliminary analyses and assessments. In Figure 28, we reflect on the meaning and utilization of S&T resources in general. They can be classified in three major categories:

- The S&T base which consists of knowledge of the nature of physical phenomena as well as the ability and knowhow to convert this knowledge into practical applications.
- The S&T institutions and facilities which make it possible to acquire and apply new knowledge.
- The S&T labor force to actually do so. Our study, of course, was concerned with only this last category.

Given the potential availability of S&T resources in a nation, its utilization is primarily influenced by societal expectations and objectives -- in practice, carried out through planning and budgetary processes.

The problem here is the time lag between the initiation of a plan and the resultant payoff. Such time lags between initial investment and eventual practical application can be as much as 20 years or more in R&D. Similarly, there are obvious time lags in the response of educational systems to new demands and directions. Hence, when we talk about the utilization of women in S&T, we must be aware of the problems of time lags in effecting greater use of this resource.

We have summarized the principal findings of our exploratory study in Table 16 below.

Table 16 -- Women as a National Resource in S&T

U.S./USSR disparities are very large; the U.S. lags the USSR considerably; but there will be important changes in the future.

The effective utilization of women is of major significance to the USSR.	It is of minor significance to the U.S. economy and national security.
The predominant effects in the USSR have been of a quantitative nature.	The predominant effects in the U.S. will be of a qualitative nature.
The USSR needs may decline because of demographic changes.	The U.S. degree of women participation will increase.

It would appear that the most direct benefit from a greater participation of women in U.S. science and technology could be realized in research and research administration as distinguished from development and production. There are several reasons for this, but the dominant one can be stated succinctly, if somewhat brusquely:

It is the additional high-quality brainpower that merits utilization and exploitation, rather than any purely quantitative increase of the U.S. labor force in science and technology.

As we mentioned before, however, to effectively implement greater utilization of women in S&T, the problems of time lag will necessitate long-range planning, both in the field of education and in the area of societal, governmental, and industrial motivation.

In view of already existing trends towards the greater participation of women in the professions and in politics in the United States, some realistic projections can be made with regard to possible future effects in the area of science and technology. As summarized in Table 17, a variety

Table 17 -- Projected Effects of Greater Utilization of Women on S&T in the U.S.

R&D Wages	Downward pressure on average wages.
R&D Productivity	Research -- Increase in diversity and imagination in approach to scientific problems. Increase in competition. Decline in low-quality contributions.
	Technology -- Dexterity and inclination issues.
	Military Services -- Raising of qualification standards.
R&D Employment	Surplus of educated labor resources.
S&T Labor Pool	Decline in relative birth rates -- unless special provisions are enacted.
Congressional Attitudes	Will reflect strongly the greater participation of women in management, politics, leadership groups.
National Security	Structure of Military Life -- Liberalization, less regimentation.
	Public Support -- Increasingly unsympathetic audience; decreasing willingness to support heavy defense expenditures.
	Politico-Military -- Shifts in interactions between military, political, economic, moral, and societal aspects.
National Economy	Principally changes of socio-economic nature.

of changes can be expected to occur in specific aspects of the national conduct of R&D. With regard to the national economy as a whole, however, the principal effects will be primarily of a socio-economic nature. Any effects in individual sectors of the economy are likely going to be minor in comparison to the societal results.

REFLECTIONS AND CONCLUSIONS

Our survey has shown that the Soviet Union is clearly ahead of the United States with regard to the official status and degree of utilization of women in the labor force. The current situation can perhaps be characterized best by our earlier statement that American women desire to participate in the national economy, whereas the Soviet economy requires the participation of women. However, a number of reflections are in order.

First, it is fairly obvious that the participation of women in all sectors of the national economy is considerably greater in the Soviet Union than in the United States. This U.S./USSR disparity is especially noticeable in such traditionally "male" fields as science and engineering, medicine, and even heavy industry. But the upper-echelon positions in both countries are still filled disproportionally with men rather than with women.

Secondly, with regard to what one might call the quality of life, we confront a debatable issue fraught with emotionalism and subject to often erroneous generalizations. Nevertheless, it does seem that the majority of women in the United States are in many respects in an enviable, if not advantageous position relative to women in other countries, be they developed or developing nations. This, however, does not mean that the position of women relative to men in any country could be considered advantageous. Nor does any comparative advantage apply to members of minority races in the United States, or, for that matter, to several non-slavic ethnic groups in the Soviet Union.

Thirdly, we confirm several conclusions reached by Norton Dodge from his survey of women in the Soviet economy some ten years ago. It is still true that a large reservoir of female talent in the United States and other Western countries remains untapped or underdeveloped, and is left largely at the margin of economic life. It is obvious that the Soviet regime has a very different attitude toward women from that of a largely unplanned, individualistic society such as our own, which considers the individual's welfare as the basic social goal. But while an ideological motif underlies Soviet policy toward women, the economic motif and practical necessity are dominant in determining specific Soviet policies.

Finally, it appears to us that the course of events during the last decade has shown the Soviet Union, while pursuing economic advantages, to have approached a nearly steady state situation with only marginal improvements for women. The United States, on the other hand, is in the process of reassessing its past policies with regard to the social and economic status of women, and is embarking on a new path.

In consequence, we project that over the next decade, we will experience a considerable degree of convergence between the different paths followed by the Soviet Union and the United States in the past. The great necessity for participation by women in the Soviet manufacturing section of the economy will decline because of the narrowing of the men-women gap in the population figures and because of the trend towards automation; an emphasis on consumer goods and a striving towards the good life for the individual will gain momentum. In the United States, passage of the Equal Rights Amendment and the various effects of women's liberation movements will cause de facto changes with regard to the true equality of men and women in the American economy.

Barring a major military or economic catastrophe, we foresee that the United States and the Soviet Union may enter an era where they will actively compete in world opinion for being the leader in advancing the cause of women not only in their own country but in all other countries around the world.

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APPENDIX

Figure 1

STUDY APPROACH

DATA ACQUISITION

- Census
- Labor and Manpower
- Education

DATA EVALUATION

- Statistics, Estimates, Projections
- Population Dynamics, Economics, Sociological
- Commissions -- (Presidential, Carnegie, U.N., Vatican)

ANALYSES AND ASSESSMENTS

- Trends
- Disparities -- U.S./USSR -- Men/Women
- Issues and Significance

POSSIBLE EFFECTS

RECOMMENDATIONS

Figure 2

POPULATION HISTORY

U.S.			USSR	
Total [millions]	Men Per 100 Women	Year	Men Per 100 Women	Total [millions]
97.2	105.7	1913	98.8	159.2
117.4	103.1	1926	93.4	147.0
130.9	100.1	1939	91.9	170.6
151.7	99.2	1950	78.3	180.3
		1959	81.8	208.8
180.7	97.8	1960	82.4	214.3
194.2	96.9	1965	84.2	230.9
204.8	95.8	1970	85.5	241.7
		1973	86.1	248.6
(222 - 237)	(95-96)	(1980)		
		(1981)	(88)	(264 - 275)
(251 - 322)	(95-97)	(2000)		
		(2001)	(91-93)	(293 - 352)

Figure 3

LIFE EXPECTANCY (about 1967-1969)

	Men	Women		Men	Women
U.S.	67	74	Hungary	67	72
USSR	65	74	France	67	75
West Germany	68	74	Italy	68	73
East Germany	69	74	England and Wales	69	75
Poland	67	73	Albania	65	67

MARITAL FERTILITY RATES*

	U.S.	USSR
1958-59	15.6	17.4
1969-70	12.1	11.6

MATERNAL GROSS REPRODUCTION RATES**

U.S. (1967)	126	USSR (1971)	120
West Germany (1968)	116	East Germany (1971)	103
Italy (1967)	122	Hungary (1971)	93
U.K. (1967)	128	Poland (1971)	109
France (1967)	129	Albania (1971)	272

*Number of births per 100 married women in age group 15-44 years. (In 1968 in the USSR, the number of births was 4 million, the estimated number of abortions was 6 million.)

**Number of female children who will be born per 100 women and who will survive through the reproduction age, if a constant set of age-specific birth rates prevails throughout the period. Age-specific birth rates are the ratios of the number of children born to women of a specific age to the number of women in that age group.

Figure 4

COMPARATIVE POPULATION PICTURES IN 1970 [millions]

	U.S.		USSR	
TOTAL POPULATION	204.8		241.7	
Men		100.2		111.4
Women		104.6		130.3
16 YEARS AND OVER	140.2		168.4	
Men		67.4		74.1
Women		72.8		94.3
ABLE-BODIED [Soviet Definition]	108.8		130.6	
Men		56.3		64.1
Women		52.5		66.5
LABOR FORCE	85.9		121.9	
Men		54.3		
Women		31.6		
Armed Forces	3.2		3.3	
CIVILIAN LABOR FORCE	82.7		118.6	
Employed-Non Agriculture	75.2		90.2	
Men		46.1		44.4
Women		29.1		45.8
Employed-Agriculture, Etc.	3.5		25.3 ?	
Men		2.9		
Women		.6		
Unemployed	4.1		-0-	

Figure 5

AVAILABLE PRIMARY WORK FORCE [millions]

	U.S. Able-Bodied (M:16-59, W:16-54)			USSR (Able-Bodied (M:16-59, W:16-54)		
	M	W	M+W as % of Total Pop.	M	W	M+W as % of Total Pop.
1950				44.4	58.2	57.5
55				50.8	62.7	58.3
1960	48.5	45.2	52	55.2	64.2	56.3
65				58.6	64.7	53.7
1970	56.3	52.5	53	64.1	66.5	54
75				70.6	72.4	56
2001				85-95	81-91	52-56
NON-AGRICULTURAL EMPLOYMENT (1970)						
	46.1	29.1		44.4	45.8	
	631 women per 1000 men			1,032 women per 1000 men		

Figure 6

EMPLOYED WOMEN AS PERCENTAGE OF TOTAL EMPLOYMENT (UN Data)

USSR	50%
U.S.	33.3
Israel	28
Bulgaria	80.06 [??]
China	33
Austria	40.4
U.K.	51.8

Figure 7

U.S. EMPLOYMENT DETAILS -- 1970 [thousands]

TOTAL LABOR FORCE	85,903	
CIVILIAN LABOR FORCE	82,715	
Full Time		71,019
Part Time		11,696
Employed		78,627
Unemployed		4,088
NOT IN LABOR FORCE	54,280	
Keeping House		35,118
In Schools		7,033

U.S. WOMEN PARTICIPATION IN LABOR FORCE (16 YEARS OR OLDER)

	Median Age	Numbers	Percent of Women Population Groups
Single	22.3 Yrs	6,965,000	53.0% of 13.1 million women
Married	40.7	19,799,000	41.4% of 47.8 million women
Widowed/Divorced	52.6	4,469,000	36.2% of 12.3 million women
TOTAL	38.2	31,233,000	42.6% of 73.1 million women

Figure 8

U.S. LABOR FORCE PARTICIPATION -- 1970

[in percent of civilian, noninstitutional population group in given category]

		16-19	20-24	25-44	45-64	65 yrs and older	% Distribution W
Single	M	54.6%	73.8%	87.4%	75.7%	25.3%	
	W	44.7	73.0	80.5	73.0	19.7	22.7%
Married	M	92.3	94.7	98.0	91.2	29.9	
	W	37.8	47.9	42.7	44.0	7.3	63.1%
Widowed, Divorced, Spouse Absent	M	68.8	90.4	92.3	78.5	18.3	
	W	48.6	60.3	67.2	61.9	10.0	14.2%
All 16 Years and Over	M	57.5	85.1	95.3	87.9	25.8	
	W	43.7	57.5	47.7	48.9	9.2	
% Distribution	W	10.3	15.5	37.0	33.9	3.3	
Numbers [mill]	W	3.3 mill	4.9 mill	11.7 mill	10.7 mill	1.1 mill	

Women constitute 37% of Total Labor Force of 85.9 million.
Women constitute 51% of Total Resident Population of 203.8 million.

43% of Female Population over 16 years of age (73.7 million) are employed.
79% of Male Population over 16 years of age (68.6 million) are employed.

Figure 9

USSR EMPLOYMENT FIGURES -- 1970 CENSUS

	Thousands	% of Total Population
Entire Population	241,720	100.0%
Gainfully Employed	115,493	47.8
Pensioners	33,107	13.7
Grant-Aided Students	3,547	1.5
Dependents and Workers Engaged in Ancillary Husbandries	89,108	36.8
Not specified	465	.2

Figure 10

PERCENTAGE OF WOMEN EMPLOYEES

U.S. (1970)	
Private Household Workers	97%
Clerical	74
Service Workers	56
Professional, Technical	40
Sales	39
Operatives	38
Managers, Administrators	17
Farm Laborers	16
Laborers	8
Farmers	5
Craftsmen	5
Transport Equipment Operatives	4
TOTAL EMPLOYMENT	38%

USSR (1970)	
Health	85%
Credit and Insurance	78
Trade, Eating, Supply	75
Education	72
Communications	68
Government (full- and part-time)	61
Industry	48
Science	47
Agriculture	45
Construction	26
Transportation	24
IN NATIONAL ECONOMY	51%

Figure 11

SOVIET COMMENTS

"The census gives society a mirror in which each one of us will look. One may cast a cursory glance at the figures, or one may take a close look."

Leo Tolstoy

The Soviet Union has 343,200 women research workers. 34 percent of all people in positions of authority are women. There are 463 women (31 percent of the whole) in the USSR Supreme Soviet.

Sputnik, December 1971

OUR IMPRESSION

A predominant factor that made it possible for the Soviet Union to reach her present position as a major world power has been the effective utilization of women in all sectors of the labor force.

Figure 12

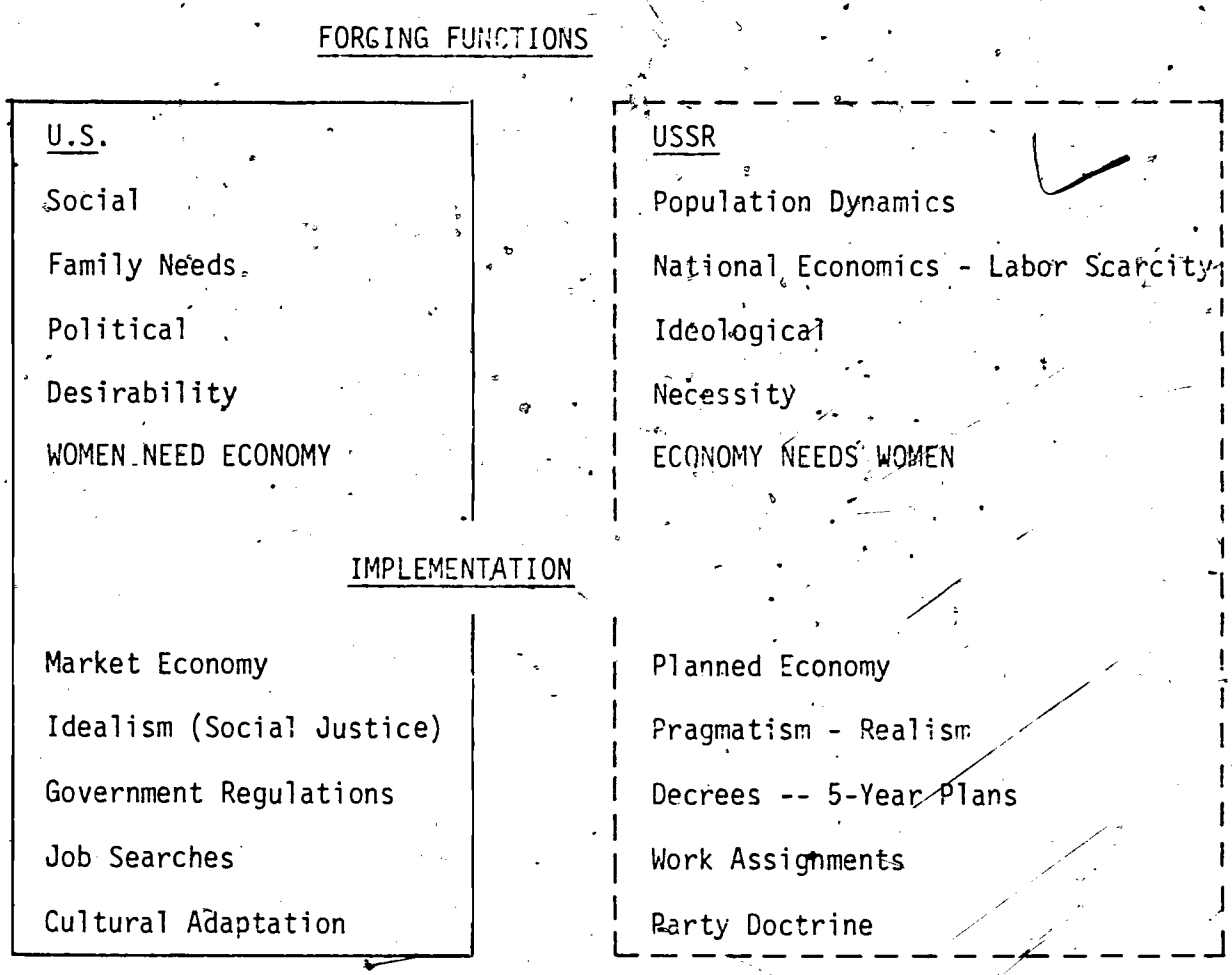
FORGING FUNCTIONS
U.S.
Social
Family Needs
Political
Desirability
WOMEN NEED ECONOMY
USSR
Population Dynamics
National Economics - Labor Scarcity
Ideological
Necessity
ECONOMY NEEDS WOMEN
IMPLEMENTATION
Market Economy
Idealism (Social Justice)
Government Regulations
Job Searches
Cultural Adaptation
Planned Economy
Pragmatism - Realism
Decrees -- 5-Year Plans
Work Assignments
Party Doctrine

Figure 13

EXAMPLES OF PROBABLY INVALID COMPARISONS

U.S./USSR SCIENTISTS AND ENGINEERS [thousands]*

(employed in economy)

	U.S.		USSR	
	Natural Scientists	"Engineers"	Natural Scientists	"Engineers"
1950	146.3	404.6	70.9	400.2
55	208.5	597.8	93.5	597.8 ??
1960	300.5	796.7	134.4	1,135.0
65	395.5	965.8	208.2	1,630.8
1970	610.0	1,100.0	284.1	2,486.5

*From Soviet Economic Prospects for the Seventies, Washington, D.C., 1973.

U.S./USSR SCIENTISTS AND TECHNICIANS [thousands]**

(about 1970 or 1971)

	U.S.		USSR	
	Total	Female	Total	Female
Scientists and Engineers	1,735	- - -	7,300 (!)	3,800
Technicians	1,000	- - -	10,600	6,700
R&D Scientists and Engineers	525.9	- - -	1,002.9[a]	388.5
R&D Technicians	226.6	- - -	- - -	- - -

**From Statistical Yearbook 1972, UNESCO, Paris, 1973.

[a]This exact number appears in Soviet sources with the label Scientific Workers in 1971 (cf. p. 14 and Fig. 15).

Figure 14

R&D WORK FORCE [Thousands]

	1960	1965	1970	71/72(est.)
Science and Science Service Work Force -- USSR	1793	2625	3238	3500
SCIENTIFIC WORKERS -- USSR	354.2	564.6	927.7	1002.9
% Women	36.3%	38.3%	38.8%	
OF THESE, Candidates and Doctors of Science	109.2	149.2	248.1	
% Women	27.4%	24.3%	25.7%	
FTE* R&D Scientists and Engineers -- USSR	244.9	443.7	600.3	641.1
FTE* R&D Scientists and Engineers -- U.S.	415.0	496.5	535.4	536.0

*FTE = Full-Time-Equivalent

Figure 15

NUMBERS OF SCIENTISTS AND ENGINEERS (End of Year)

U.S.

TOTAL	% Women	Doctorates	% Women
1,167,000		89,200	
(242,763)	(8.3)	(90,304)	(7.3)
(297,942)			
1,731,000*		171,800	
(312,644)	(9.4)	(125,370)	(7.5)

U.S. (1970) % Women: Engineers: 1.6%
Life & Physical Scientists: 13.7%

USSR

Year	TOTAL	% Women	Science Candidates and Doctorates	% Women
1950	162,500	36.3	53,800	22.3
1955	223,900	36.4	87,500	
1960	354,200	36.3	109,200	27.4
1965	664,600	38.3	149,200	24.3
1966	712,400	38.4	169,000	25.4
1967	770,013	38.3	187,585	25.4
1968	822,900		206,433	
1969	883,400	38.8	227,247	25.7
1970**	927,700	38.8	248,106	25.7
1971	1,002,900	38.7	275,300	26.0

USSR (1963) % Women: Engineers: 28%
Life & Physical Scientists: 38%

*NSF Estimates:

Breakdown		Employment	
Engineers	1,100,000	Private Industry	70%
Physical Scientists	253,000	Federal Government	15%
Life Scientists	180,000	Universities & Colleges	14%
Social Scientists	126,000	Nonprofit	1%
Mathematicians	76,000		

Of these, about 2% to 3% unemployed

**USSR Statistics:

	% Women
Doctors of Science	13.4
Candidates of Science	27.3
Academicians, Professors	9.7
Docents	21.3
Senior Scientific Associates	24.5
Juniors and Assistants	50.2

Figure 16

DISTRIBUTION OF SCIENTISTS BY FIELD (1970)

U.S. Rank	U.S. Field	U.S. Number	U.S. % W		USSR Rank	USSR Field	USSR Number	USSR % W
1.	Chemistry	86,980	7.1	>>	5.	Chemical	45,815	
2.	Physics and Mathematics	60,736	6.8	<	1.	Physical and Mathematical	95,272	
3.	Biological Sciences	47,493	12.9	>	6.	Biological	37,312	
4.	Psychology	26,271	24.1	>>	16.	Psychological	1,924	
5.	Earth and Marine Sciences	23,756	3.6	>	11.	Geological and Mineralogical	20,342	
6.	Agricultural Sciences	15,730	3.4	<	8.	Agricultural and Veterinary	35,446	
7.	Economics	13,386	6.1	<<	3.	Economic	57,518	
8.	Computer Sciences	11,374	11.5					
9.	Sociology	7,658	22.6					
10.	Atmospheric and Space Sciences	6,637	1.5					
11.	Political Science	6,493	9.9	<<	7.	Historical and Philosophical	37,177	
12.	Statistics	2,953	11.1					
13.	Linguistics	1,902	23.5	<<	4.	Philological	48,721	
14.	Anthropology	1,375	22.3					
					2.	Medical and Pharmaceutical	49,957	
					9.	Pedagogical	31,283	
					12.	Art	12,182	
					13.	Geographic	7,242	
					14.	Juridical	4,765	
					15.	Architecture	2,590	
					10.	Others	30,663	
	TOTAL	312,644	9.4%	<		TOTAL	518,239	
						Technical	409,470	
						TOTAL	927,709	38.8%

U.S. data from National Register:
Ph.D.s: 40.1% of all scientists registered
32.2% of the women scientists

USSR data from Statistical Yearbook:
Cand. & Doct.: 25.7% of TOTAL, including Technical
17.7% of the women listed

Figure 17

U.S./USSR SCIENTISTS IN ACADEMIC POSITIONS

U.S. Faculty and Professional Staff						USSR In Higher Education Establishments			
	TOTAL	M	W	W/T		TOTAL	M	W	W/T
1950-51					1950	86,542	58,230	28,312	33%
55-56					55	119,000	79,604	39,396	33%
59-60	382,666	297,974	84,690	22%	1960	146,915	97,513	49,402	34%
61-62	427,833	333,830	94,003	22%					
63-64	498,359	387,765	110,594	22%	64	206,308			
1967	330,565*	264,001	66,564	20%	1965	221,800			

*Full-time Instructors and Research Staff

Figure 18

PHYSICIANS AND DENTISTS

U.S.		USSR	
Total	% Women	Total	% Women
410,000	7%		
466,503*	9%		
	1967	598,200	71%
	1970	666,100	72

USSR TRENDS

1913	28,000	10
1940	155,300	62
1950	265,000	77
1960	431,700	76
1965	554,200	74
1966	577,700	73
1967	598,200	71
1968		
1969	642,000	72
1970	668,400	72
1971	697,800	72

*M.D.'s: 334,000

Figure 19

PHYSICIANS (DETAILS)

U.S. (1970)

DENTISTS	118,175
OSTEOPATHS	14,300
MD's	334,028*
GP	57,900
Internal	41,900
Pediatrics	17,900
Surgery	29,800
Ob-Gyn	18,900
Psychiatry	21,100
Other	68,500

*Includes 22,825 retired or address unknown

1967

		% Foreign Graduates
Totals	309,483	17%
Men	287,731	16%
Women	21,752	32%

USSR (1967)

DENTISTS	47,800
STOMATOLOGISTS	30,900
PHYSICIANS	519,500
Therapists	121,200
Epidemiology, etc.	38,100
Pediatricians	74,900
Surgeons	58,000
Ob-Gyn**	37,400
Psychiatrists	11,600
Others	178,300

**1973: 45,800 Ob-Gyn, plus 300,000 midwife-medical assistants

1967

Totals	598,200
Men	172,900
Women	425,300

Figure 20

SOVIET VIEWS OF UTILIZATION OF SCIENTISTS (1973)

1. Average annual increase in S&T personnel (1950-70): 9.1%

   Needed are more: Mathematicians, Statisticians, Geophysicists, Oceanographers, Biochemists

2. Industrial R & D:

   6% of Scientific Personnel are in Industrial Enterprises and Technological Design Organizations;

   46% of Scientific Personnel are in Research Institutes in Ministries and Departments and are conducting R&D;

   THUS, 50% in USSR compares with 70% in U.S. (inefficient because of competition).

3. Needed: Utilization of CMEA scientific potential and scholars.

   Detailed planning of what scientific cadres to be trained in schools.

4. Stress in Future: Interdisciplinary Research

   New area research -- especially important because of time lag between research and application.

   Introduction of the achievements of science and technology into production.

Figure 21

USSR STUDENT ADMISSIONS [thousands]

	Higher Education		Specialized Secondary	
	Total	(Full Time)	Total	(Full Time)
1965	846.9	(337)	1,097.6	(579.7)
1970	904.4	(499)	1,336.1	(834.7)
1975 Plan	977	(582.5)	1,453.2	(932.9)

DESTINATION OF SECONDARY SCHOOL GRADUATES

USSR - 1966

To Study	40%
Higher Education	18%
Specialized Secondary	12%
Vocational and Technical	5%
Other	5%
To Work	50-55%
Other (drafted, unknown)	8%

Figure 22

USSR GRADUATE STUDENT ENROLLMENT.

	TOTAL	M	W	Physics Mathematics	Engineering
1950	21,905	13,312	8,588	972	5,809
55	29,362	20,200	9,200	2,855	9,358
1960	36,754	28,349	8,405	3,435	13,936
65	90,296			10,066	35,733
1970	99,427			11,729	39,979

USSR 1970/71

Percentage of Women in Higher Educational Institutions: 53%

Percentage of Women in Specialized Secondary Educational Institutions: 54%

U.S. 1970

Percentage of Women in College: 40.6% (Among undergraduates: 42.1%)

Percentage of Women in High School: 49.6%

Figure 23

QUALITY OF DEGREES

"Perhaps one-third of all engineering graduates in the Soviet Union have received abbreviated, below-standard instruction. Such graduates would not be considered to be professionally trained engineers in the United States." (Soviet Economic Prospects for the Seventies, Compendium of Papers Submitted to the Joint Economic Committee, Congress of the United States, 27 June 1973, p. 567.)

"Because of strong requirements in mathematics and science, as well as highly competitive entrance examinations, the Russian engineering schools can teach the fundamental sciences, such as mathematics, mechanics, physics, and chemistry, on a higher level than can be done in the USA." (Science Policy in the USSR, OECD, Paris, 1969, p. 135.)

"The lowest-quality Soviet candidate degree does not amount to more than the U.S. master's degree or even the Ph.D. of a third-rate American University. The better quality of candidate degrees would doubtless rank with U.S. Ph.D.'s and D.Sc.'s. (Education and Professional Employment in the USSR, NSF 61-40, 1961.)

"The Candidate of Science degree is the counterpart of the U.S. Ph.D. It is awarded after 3 years of graduate study and the defense of a dissertation." (Soviet Professional Scientific and Technical Manpower, ST-CS-01-49-74, DIA, 17 October 1973, p. 63.)

Figure 24

DOCTORATE AND CANDIDATE DEGREES AWARDED ANNUALLY

U.S.					USSR		
Total	M	W	%	Year	Total	M	W
9,829	8,801	1,028	10	1960	7,500		
16,467	14,692	1,775		1965	15,100		
18,239	16,121	2,118	12	1966	19,600		
26,000				1967	21,200		
23,091	20,185	2,906	13	1968	23,100		
26,200				1969	23,800		5,500***
29,872*	25,892	3,980	13	1970	26,300		7,700***
31,772**	27,165	4,575	14	1971	26,800		
34,607	29,070	5,537	16	1972	28,700		

*Foreign Citizens: 14.4%

**Of these, about 18,000 in science and engineering

***Our estimates, based on annual increase data

Figure 25

U.S. DEGREES AWARDED ANNUALLY AS PERCENTAGE OF POPULATION

	1948	1970	Increase (times)
TOTAL	.22%	.52%	2.4
M	.14	.31	2.2
W	.08	.21	2.8

Figure 26

U.S. DEGREES AWARDED ANNUALLY

		Total	Bachelor and First Professional	Masters	Doctors
1948	M	208,600	176,000	28,900	3,700
	W	110,200	96,200	13,500	500
1970	M	639,000	486,900	126,200	25,892
	W	433,600	246,400	83,200	3,980

U.S. DEGREES AWARDED IN PHYSICAL SCIENCES AND ENGINEERING

[% of Total]

		Mathematical and Computer Sciences	Physical Sciences	Engineering	Medical
1948	M	1.6	5.6	16.9	3.1
	W	1.6	2.5	.2	.7
1970	M	3.9	4.3	9.9	1.2
	W	2.9	.9	.1	.2

% Increases: Social Sciences (M & W), Education (M & W); Arts and Humanities (M).

Figure 27

POLITICAL ELECTIONS

30.5% of the deputies elected to the eighth USSR Supreme Soviet were women (1971):

Men: 1,054

Women: 463

Council of the Union: 767 deputies — Council of Nationalities: 750 deputies

Vice-Chairwoman: Shamama Gasanova — Chairwoman: Yadgar Nasriddinova

The average number of women in the U.S. Congress between 1947 and 1972 was 2.4:

	Average	Maximum	Minimum
Senate	1	3 (83rd)	0 (93rd)
House	12	17 (87th)	7 (80th)

(1971 Members of the Senate: 100 — Members of the House: 433)

Figure 28

S&T RESOURCES

- o KNOWLEDGE
  - Natural Phenomena
  - Applications
- o INSTITUTIONS
  - R&D Facilities
  - Universities
- o LABOR FORCE
  - Scientists and Engineers
  - Managers and Planners

Allocations are determined by societal expectations and objectives:

(i) relative importance of activity to society

(ii) payoff -- perceived marginal utility

PROBLEM: Delay times -- investment to innovation -- R&D application option to commercial/military availability.