

# INSTRAW

United Nations International  
Research and Training Institute  
for the Advancement of Women



## WOMEN'S ACCESS TO TECHNOLOGY: MYTHS AND REALITIES

Research Paper Series

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**WOMEN'S ACCESS TO TECHNOLOGY:  
MYTHS AND REALITIES**

**Research Paper Series**

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## General Introduction

The International Research and Training Institute for the Advancement of Women (INSTRAW) is an autonomous body within the framework of the United Nations. The organization carries out research, training, information, and communication activities and acts as a catalyst to promote the full participation of women in all aspects of development, particularly in developing countries.

Technology plays a key role in the development process. While different technological approaches have been attempted, external and internal constraints have affected the transfer, selection, diffusion and utilization of technologies. Certainly at the international level the discussion of "technological" issues has acquired considerable significance and is leading to an approach which recognizes the need for greater equilibrium between the transfer of technology from abroad and the development of national "technological capabilities". At the national level, discussions have centred on the ways in which technology seriously affects the division of labour, notably male/female relationships of production.

Unfortunately, the international situation has deteriorated since the early years when it was thought that economic growth, international trade, and the transfer of technology would automatically promote women's increased participation in development. World-wide economic recession, unemployment, growing trade protectionism in developed countries, a huge external debt burden in many developing nations have widened the gap between developed and developing countries still further. Rapidly growing populations have caused a shrinkage in farm plots and intensified job competition.

These circumstances have served to impede and curtail women's participation in technological innovations, modern-sector employment, training and education schemes still further. At the same time, the number of female-headed households has increased and women's need for supplementary economic resources has accelerated. Specific measures are therefore needed to facilitate their equal involvement in economic and technological development. Economic, social, educational and legal structures need to be adapted to ensure that women and men participate equally in the overall development process.

INSTRAW has prepared two monographs which are included in this research series under its programme area, "Choice and Assessment of Technology for the Mobilization of Women's Participation in Development". The first monograph, Recent Trends in Women and Technological Development, presents one school of thought on the subject. The United Nations Conference on Science, Technology and Development (UNCSTD) adopted a Resolution in 1979, which took the first important step of defining the urgent problems that needed to be linked to women's issues. Its operative clauses are slowly being implemented by different organizations within and

outside the U.N. system, although no analysis has been undertaken on establishing the nature of the relationship between women and science and women and technology. This paper examines the problem of female inaccessibility to technology and the social costs involved in excluding women from the benefits of the technological change.

The second INSTRAW monograph, "Conceptual Insights from the U.N. Decade," is a 'state of the art' report documenting the linkages of women with technology issues. The two monographs point to an important fact, namely that today women's participation and equal involvement in economic and technological development cannot be separated from mainstream issues.

## Part One

### RECENT TRENDS IN WOMEN AND TECHNOLOGICAL DEVELOPMENT

by

Krishna Ahooja-Patel

#### Introduction

Technology is transforming the lives of peoples around the globe in a variety of ways. New and old and "appropriate" technologies are changing our living patterns and modes of thought. The rapidity with which economic and social upheavals are occurring as a result of the impact of technologies has undermined traditional value systems. Today the influence of technology is so far-reaching that the term "technology" has become a household word.

Unfortunately, the impact of technology, especially as it concerns women, has not always been positive. Over the past decade technology transfer has in fact in many instances, notably in the Third World, reduced the quality of life and created more economic and social problems for women. One major reason for this has been the failure of developers to take the impact of technology upon the social and economic environment in which it is applied into account. One pertinent example is the failure to understand that the introduction of technology must be preceded by a transformation of the use and organization of the labour force at the local level to be successful.

In the process of this global technological revolution, women have been registering some gains, though negative consequences outweigh the latter. Statistics continue to reflect that an increasing number of women worldwide are now in employment, although such jobs are in low-income categories and stressful with meagre social benefits. Yet through such unskilled work women play an important economic role producing goods and services vital to a modern economy. In a sense women are 'forgotten' producers, concentrated in the most low paying unskilled sectors. Their participation in industrial planning is minimal in most countries.

Studies show that the economic and social implications of technological development on women are often negative. Frequently, technologies used by women in formal occupations and in their daily life do not lighten their work burden. The introduction of mechanization, automation and robotics has benefited male workers, with such jobs associated with higher social and economic status. New occupations show gender bias in favour of men. Even in cases where women's work is lightened by new technology, their work burden often remains unchanged because the division of labour within the family continues to be unequal. Given these conditions an important question to be discussed must center on assessing the impact of new and traditional technologies on both different "social groups", as well as on men and women.



Such issues need to be seriously addressed to help understand the role of women in technological progress. A decade of studies has helped assess the impact of the male/female division of labour on employment, education, training and on communication technologies. Some insight has been gained on the type of barriers women face in obtaining wider access to decision-making in technology planning and in its economic application. Some understanding has also been reached as to reasons why women are not fully participating in national technical bodies. But more work is needed to improve the fragmentary information now available on the condition of women in changing economic structures. One important topic that arises here is the reason for the continuation of such gender-based asymmetries.

In coming years human resource development will increasingly provide the competitive edge in industry. Already the emergence of high technologies is rapidly changing conditions in the international economy and the requisite skill-content in manufacturing industries. The significance of these developments for women is obvious for if they are to participate in the production process on an equal footing with men, careful analysis of their present condition is needed to determine the prerequisites for their future participation.

#### I. Women, Technology and International Decision-Making

In response to United Nations General Assembly resolutions and initiatives taken by several United Nations bodies, non-governmental organizations and women's organizations have examined the impact of science and technology in the development of the Third World countries. In August 1979, a United Nations Conference on Science and Technology for Development (UNCSTD) was convened in Vienna. At this conference the Vienna Programme of Action was adopted, which aims at strengthening the technological and scientific capacity of developing countries and at harnessing it to accelerate the development process.

The Conference called for the implementation of science and technology programmes through concentrated action within the United Nations System, as well as at international and multilateral levels. A special feature of this Conference was the singling out, in a separate resolution, of the inter-relationship between scientific and technological advances and the increased participation of women in the development process. This was the first time in the current history of the debate on science and technology at the international level that women were included in the agenda and linked to the general problems of development. The resolution, entitled "Women, Science and Technology",<sup>1/</sup> in its preamble, recalled the earlier General Assembly resolutions (XXIX) of 17 December 1974 and 3524 (XXX) of 15 December 1975 on the "Integration of Women in Development."

These earlier resolutions had urged governments to give sustained attention to the "integration of women" in the planning and implementation of development projects. The Assembly had also recalled the importance of

the improvement of the status and role of women in education and in the economic and social fields for the achievement of the equality of women with men (Resolution 33/184 of 29 January 1979). The operative part of the resolution on women, science, and technology stressed the following:

- a) "The equal distribution of the benefits of scientific and technological development and its application to men and women in society;
- b) The participation of women in the decision-making process related to science and technology, including planning and setting priorities for research and development and in the choice, acquisition, adaptation, innovation, and application of science and technology for development;
- c) The equal access for women and men to scientific and technological training and to respective professional careers."<sup>2/</sup>

This was the first time that an international decision had called for the full and effective participation of women in science and technology. Further progress on the issue would be forthcoming six years later in the Nairobi Forward-looking Strategies (FLS) in 1985 which further spelled out the "agenda for action".<sup>3/</sup>

The FLS emphasized the following: "In the context of the Third United Nations Development Decade and any subsequent decade, the implications for women in international decisions specifically pertaining to international trade and finance, agriculture, and technology transfer should be assessed by the United Nations System..." (Paragraph 351). It further called for increased participation of women in the research and implementation of science and technology programmes, both at the national and international levels, and in the evaluation of the impact of such participation on the development process (italics added by author). The directives of the UN Conference on Science and Technology for Development and the Nairobi Forward-looking Strategies (FLS) together constitute significant landmarks for initiating work on an assessment of the impact of women's participation, or lack thereof, in scientific and technological fields.

#### A. Research Results from the UN Decade

A preliminary review of the work within the United Nations System in implementing the UNCSTD resolution shows that within UN bodies and agencies, a systematic, comprehensive analysis has not yet been undertaken on establishing the nature of the relationship between women and science or between women and technology. The belief held at the outset of the eighties that the benefits of economic development would extend automatically to men and women alike has been disproven. This has underscored the need, for an in-depth analysis of the many factors involved in technology transfer before such a process takes place. This includes



the level, appropriateness and rate of introduction of the technology; the assimilative and adaptive capacity of the target society; the socio-cultural context; the organization of the labour force; educational and training facilities; and global, national and regional trends. However, recent International Labour Office (ILO) studies<sup>4/</sup> and the global survey by INSTRAW have undertaken some positive research steps,<sup>5/</sup> although research results have not as yet been collated globally. To date current concepts underlying development economics and the analysis of different approaches to development "models" have not paid direct and specific attention to the special problems arising out of the impact of technologies on the pattern of employment of women and structural adjustments.

To date, two major misconceptions have distorted the analysis of the impact of new technologies on women. The first misconception is the perception of women as a homogeneous group. For example, rural women alone can be subdivided into several groups: those from landless households, from tenant households and from female-headed households. The second misconception is that a household can be considered a unit of analysis without any distinction between its individual members. This erroneously assumes that each member automatically receives an equal share of goods and services, whereas in fact female household members, including girls and infants, consistently get a smaller share than men of available food, cash, health care and other services.

Several different subject areas on women, science and technology in developed and developing countries which can provide a useful starting point for further research, have been identified in a few selected studies and reports prepared both within and outside the United Nations System.<sup>1/</sup> The lack of female access to scientific and technological "know-how" in developing countries is the focus of such studies. The key points in this analysis concern: (i) unequal participation in scientific and technological training, education, and decision-making; (ii) the differing impact of technological change on occupational distribution between men and women in the modern sector; and (iii) the special problems faced in the rural areas where an overwhelming majority of women continue to work and live.

Recent data indicate that most women in industry, particularly in developing countries are employed mainly in the food and textile sectors. No general statistics on female employment in electronics, chemicals, and communications are available although the number of women employed in these sectors depends on a country's level of development. There is a reluctance to recruit women in "male" occupations such as leather, wood, metal, iron, steel, heavy machinery, and automobile industries. In many countries, women continue to be hired in jobs requiring the least technical skills, such as assembly-line and packaging activities. For example, in the electronics industry, women are concentrated in the least technical jobs such as assembling and sorting out electronic parts for machines, televisions, computers and other devices.

A few studies particularly those focused on Africa, have recently studied rural activities of women and their relationship to basic technology issues. For example, the introduction of mechanization in agriculture and its impact on women's work; the unequal division of labour between men and women; and the desirability of introducing basic technologies to improve working and living conditions of women.

ILO research in fact shows that there are considerable economic advantages in selecting and maintaining simpler equipment for the use of rural women. This includes newly tested tools, such as thin-walled cement tanks, simple hand-pumps, mud brick stoves, and better containers for food storage.

INSTRAW and UNCTAD have been engaged in a joint programme of work on the impact of technological developments on the advancement of women and the policies required to assure greater participation of women in the process of technological transformation. The study "Women, Technology, and Sexual Divisions" by Amartya Sen<sup>8/</sup> makes three major points: (1) it is argued that problems of sexual divisions have to be seen as exercises in "co-operative conflicts", of which wage bargaining problems form a special subclass. The combination of co-operative and conflicting features can be characterised in terms of certain general "qualitative" relations; (2) the issue of "sexual divisions" requires that a broader view of technology be taken than is commonly the case. Both commodity production and social arrangements that sustain commodity production need to be considered. This wider view of technology is particularly crucial for understanding the nature and implications of co-operative conflicts and the division of labour between men and women; (3) the analysis of "entitlements" applied to inter-family and inter-class relations has to be extended to intra-family divisions; and (4) this study shows that, the issues of "legitimacy" raised by social arrangements link technological questions with ideology norms and social behaviour.<sup>9/</sup>

## II. Unequal Access to Technologies: the Core Problem

In developing countries, the main problem facing women is lack of access to technology, training, credit, and decision-making processes which would enable them to make choices and adapt new innovations and tools to their own needs and economic interests. For example, technology introduced into rural communities and cottage industries, has subsequently mainly been transferred from one male member to another. Women are rarely consulted on the choice or use of technology, or subsequently instructed in its use even in an informal manner. As automation, new machinery and equipment, and "high tech" processes transform industrial production, women workers are not included in training or retraining programmes. In the organized sector, women find themselves laid off leading to loss of income, prestige and self-esteem, or relegated to the lower echelons of factories and assembly lines. There are as yet no formal or informal channels granting

credit to women for the purchase of new technologies. Women's only access to credit is generally through informal financial networks, for example, male family members, money-lenders, pawnbrokers or community saving schemes.

Lack of access to technology and its benefits are the main factors responsible for the deterioration of women's living and working conditions in the developing world, rather than the technology itself. Lack of access is closely related to women's continuing inequality in society and is likely to persist as long as gender-related discrimination continues to permeate all spheres of society, regardless of the level of resources involved in the technology transfer. Discrimination hindering women's access to technology in developing societies includes women's inferior social status and economic invisibility; lower education and training; lack of access to credit and extension services; lack of unionization, and absence from decision-making processes.

Women's inequality in society is manifested in several ways. Firstly, women occupy a subordinate place within the family unit. This is largely because the work they perform at home is viewed as "unproductive" and non-economic, despite the fact that it is essential to the survival of the family and to the existence of the labour force. Consequently, women are erroneously perceived as contributing less to economic development than men, although evidence shows that they usually shoulder a larger work burden. Numerous pregnancies and unending household and child-care responsibilities make it difficult for many women to attend school and training courses, to enter the wage labour market, and to accumulate years of uninterrupted work experience. Family planning services which would enable women to control the size and timing of their families, as well as child-care facilities which would release them for greater economic participation, are often still unavailable. In addition, women in developing countries consistently receive less food and health care than men. Evidence from Asia, Africa, and Latin America show that men are frequently given the best diets both in terms of quality and quantity (Ahmed 1985 b:76).

Secondly, women in developing countries have consistently lower education and training levels than men from similar socio-economic groups. Several interesting facts have emerged in the preliminary research on "Technology and Women's Participation in Development". A review of United Nations literature indicates that from an early age, both in school and at home, girls are obliged to learn tasks that will make them good mothers and homemakers. Any academic learning is as a general rule limited to the arts and humanities<sup>10/</sup> while boys enrol in science and technology, most girls are following more limited paths towards a home and family.<sup>11/</sup> This trend is beginning to change in some countries where higher-income families sometimes encourage technical and scientific education for girls.

Traditional attitudes, coupled with the sexual segregation of many schools and training programmes and the sexual stereotyping of curricula contribute to maintaining higher illiteracy rates among females than among



males, and discourage many women from opting for technological and scientific courses. As pointed out earlier the majority of wage-earning women are employed in jobs which resemble their household tasks: low-level, unskilled and monotonous work in industry, agriculture and the services. It is precisely these jobs which become redundant with the introduction of advanced technology because they are the easiest to mechanize.

Thirdly, women are unable to obtain the credit necessary to invest in and use modern technology. Usually, they have no collateral to offer since they are rarely landowners or co-operative members. There are also cultural barriers to women gaining control over money. Employers in some countries for example, might hand over women's wages directly to a male household member or women's income might be taken away from her for traditional reasons. Women also lack experience and training in accounting and financial management practices. In addition, extension services such as child-care facilities and transportation are often lacking in both rural and urban areas.

Fourthly, women lack an essential platform for the defense of their rights as workers and find themselves on the bottom rungs of the wage, training and promotion ladders. Their participation in unions is discouraged both by management seeking to keep a lid on wages and minimize concessions for improved working conditions, and by male union members and leaders who may not support equal pay for equal work. Male union members and leaders might also attempt to preserve male dominance over the labour market, especially during periods of high unemployment and also conclude agreements which exclude women from jobs in the organized sector.

Lastly, women have little control over the choice and implementation of new technologies owing to their widespread absence from international, national, and local policy and decision-making bodies. There are very few countries where women are members of national scientific and technological bodies or members of various industrial boards and committees where key decisions on technology use and application are made.

If the distribution between men and women of tasks, wealth, employment and participation in decision-making is viewed as the outcome of their relative bargaining positions, as suggested by one analyst (Sen 1985: 5), it is clear that, owing to various factors, women will possess less bargaining power and therefore enjoy fewer benefits than men. Moreover, women's disadvantaged position tends to be self-perpetuating continuing from one generation to the next. Thus despite numerous efforts to redistribute tasks between men and women and to equalize access to technology continuing subordination at home and in the community has in the most optimal cases led to some unequal gains for some women, and in the most extreme cases, to greater disadvantages.

### III. Excluding Women from the Technological Revolution: the Cost to Development

Evaluation and monitoring of several international programmes at national and international levels have clearly demonstrated that if, at the formulation stage, provisions for redressing inequalities between men and women are not included, such programmes tend to reinforce those inequalities. At the same time, projects designed exclusively for women tend to perpetuate women's marginalization. Therefore women's needs must be addressed through mainstream development efforts. Specific measures must be taken to ensure that women play an active role in major development projects, and become involved in national and local development policy-making on an equal footing with men. This helps not only to enhance women's integration in technological change, but also to increase their economic and social visibility and to help alter traditional perceptions and belief concerning their role.

The failure of many development plans and programmes can be traced to inappropriate technology choices. Technologies intended to relieve women of burdensome tasks have floundered because too little attention has been paid to the socio-cultural context into which such technology was to be introduced. Examples of this abound. Water pumps and wells in African communities have in many cases fallen into disrepair because instructions for their use and maintenance were given to men rather than women who were traditionally responsible for the water supply. In Latin America, foreign industries have offered women paid work outside the home, thereby trapping female workers in low-skilled monotonous employment offering no future or security. Thus the introduction of capital-intensive, highly sophisticated modern plants in regions with large and unskilled labour forces has tended to exacerbate economic and social difficulties. To reverse this situation, greater attention has been paid in recent years to "appropriate" and improved technologies. In some countries, both capital- and labour-intensive technologies co-exist at different levels in different enterprises, although women have continued to be employed predominantly in labour-intensive jobs.

This has meant that the output of their productive labour has either remained constant or has decreased in contrast to that of men which has increased thanks to access to advanced factors of production. The direct result of this unequal access between women and men is that the work input of women has proportionately increased in various agricultural tasks without giving them any control on their output. As a result, in many countries women have to work longer hours in almost all rural and urban physical tasks.

The international situation has drastically deteriorated since the 1970's when it was thought that economic growth, increased international trade, and the transfer of technology would automatically promote women's increased participation in development. World-wide recession, high levels



of unemployment, growing trade protectionism by developed countries, the huge external debt burden of many developing nations, and the use of national resources for purchase of weapons systems by many countries have caused the gap between developed and developing countries to widen further. Thus a complex interplay of economic and social factors have failed to make women significant beneficiaries of technologies. On the contrary, in many cases the introduction of new technologies into developing countries has served to widen the economic gap between men and women further as men remain the main beneficiaries of such technology transfers. The social costs of excluding women from technological advancements in terms of "unutilized" or "untapped" human resources are considerable and affect national development as a whole. The urgent tasks of planners in the future must be to redress this process to bring women into the mainstream of the development process.

### Footnotes

- 1/ United Nations Conference on "Science and Technology for Development", (1979), Women, Science and Technology (New York, UNCSTD).
- 2/ This resolution was adopted on 31 August 1979 at the 16th plenary meeting of the United Nations Conference on Science and Technology for Development (UNCSTD) held in Vienna, from 20 to 31 August 1979, in conformity with General Assembly Resolution 33/192 of 29 January 1979.
- 3/ The Nairobi Forward-looking Strategies for the Advancement of Women as adopted by the World Conference to Review and Appraise the Achievements of the UN Decade for Women: Equality, Development, and Peace, Nairobi, Kenya, 15-26 July 1985.
- 4/ E. Date-Bah, and Y. Stevens, "Rural Women in Africa and Technological Change: Some Issues," Labour and Society, (Geneva, ILO), (Vol. 6, No. 2) pp. 149-160.
- 5/ United Nations International Research and Training Institute for the Advancement of Women (INSTRAW), Choice of Technology for Women: Theories and Realities (monograph in preparation).
- 6/ International Labour Office (ILO), Women Technology and the Development Process, (Geneva: ILO, 1978).
- 7/ See for example the Asian and Pacific Centre for Women and Development (1979) Participation of Women and their Emancipation through the Application of Science and Technology to Development (Bangalore, APC WD/ESCAP), Report of the Round-Table Discussion; oho P. D'Onofrio-Flores. and S.M. Pfafflin, S.M., eds., Scientific Technological Change and the Role of Women in Development (Boulder: UNITAR 1982)
- 8/ United Nations International Research and Training Institute for the Advancement of Women (INSTRAW), United Nations Conference on Trade and Development (UNCTAD). Women, Technology and Sexual Divisions by Amartya K. Sen, 1985.
- 9/ As part of its programme on women and technology and to accomplish the most appropriate types and levels of training needed to upgrade the technical knowledge and skills of women, INSTRAW has established contacts with international, regional, and national experts in the field of technology and women. Also within its programme, INSTRAW has been developing co-operative relationships with other United Nations bodies and agencies, particularly the United Nations Centre for Science and Technology for Development (UNCSTAD) and the United

Nations University/World Institute for Development Economic Research (UNU/WIDER). As well as with UNCTAD and the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Labour Organisation (ILO), the United Nations Development Programme (UNDP), and other pertinent bodies.

- 10/ D.F.Bryceson, Women and Technology in Developing Countries: Technological Change and Women's Capabilities and Bargaining Positions (Havana, UNCTAD/INSTRAW), (1985).
- 11/ G. Borcelle. Jobs for Women, (Geneva: UNESCO 1985), monograph 165.

### Bibliography

Ahmed, Iftikhar. Technology and Rural Women in Asia: Some Issues. Geneva: International Labor Organization, 1982.

Ahooja-Patel, Krishna. "Women, Technology and Development". Economic and Political Weekly (Bombay) XIV (36), 1979.

Bergom-Larsson, Maria. "Women and Technology in the Industrialized Countries" in Pamela M. D'Onofrio-Flores and Sheila M. Pfafflin (eds.), Scientific Technological Change and the Role of Women in Development. Boulder: Westview Press, 1982.

Bleier, Ruth. Science and Gender: A Critique of Biology and its Theories on Women. New York: Pergamon Press, 1986.

Bourque, Susan C. "Experiments with Equality: Complexities in Peruvian Public Policy," Journal of Asian and African Studies, XX (3-4, July-October), 1985.

Bourque, Susan C. and Kay B. Warren. Women of the Andes: Patriarchy and Social Change in Rural Peru. Ann Arbor: University of Michigan Press, 1981.

Bryceson, Deborah A. Women and Technology in Developing Countries: Technological Change and Women's Capabilities and Bargaining Positions. Santo Domingo: UN/INSTRAW, 1985.

Carr, Marilyn. "Technologies Appropriate for Women: Theory, Practice and Policy" in Roslyn Dauber and Melinda L. Cain (eds.), Women and Technological Change in Developing Countries. AAAS Selected Symposium 53. Boulder: Westview Press, 1982.

Date-Bah, Eugenia. Rural Women, their Activities and Technology in Ghana: An Overview. Geneva: ILO/WEP, 1981.

Deere, Carmen Diana and Magdalena Leon de Leal. Women in Andean Agriculture. Geneva: ILO, 1982.

D'Onofrio-Flores, Pamela. "Technology, Economic Development, and the Division of Labour by Sex". Pamela M. D'Onofrio-Flores and Sheila M. Pfafflin (eds.), Scientific-Technological Change and the Role of Women in Development. Boulder: Westview Press, 1982.

Fuentes, Annette and Barbara Ehrenreich. Women in the Global Factory. Boston: South End Press, 1983.

Jahan, Rounaq. "Participation of Women Scientists and Engineers in Endogenous Research and Development" in Shirley Malcom et al., Science, Technology and Women: A World Perspective. Washington, D.C.: AAAS and Centre for Science and Technology for Development, United Nations, 1985.

Kalpagam, U., "Women, Technology and Forms of Production", Samya Shakti, Vol. 2, No. 1, 1983.

Scott, Joan. "The Mechanization of Women's Work". Scientific American, July, 1982

Sen, Amartya. "Women, Technology and Sexual Divisions", 1984.

United Nations. INSTRAW/UNIDO. Women and Industrialization in Developing Countries. Report of the Preparatory Meeting on the Role of Women in Industrialization in Developing Countries. New York, 1981.

Zimmerman, Jan. "Technology and the Future of Women: Haven't We Met Somewhere Before?" in Joan Rothschild (ed.) Women, Technology and Innovation. New York: Pergamon Press, 1982.



## Part Two

### CONCEPTUAL INSIGHTS FROM THE U.N. DECADE FOR WOMEN(1975-1985)<sup>1/</sup>

by

Susan C. Bourque and Kay B. Warren

#### Introduction

Technology and its transfer to the developing world have been difficult and contested subjects for policy-makers and scholars alike. For some, technology is a primary mechanism for promoting economic modernization and enhancing standards of living in newly industrializing states. For others, technology transfer from the industrialized nations has been a misstep for the developing world, leading these nations to misdirect their limited resources in futile attempts to adopt Western patterns, which are inappropriate to their needs (Stewart: 1977). Obviously very different policy choices follow from these two positions.

These conflicting strains of thought are also found in current analyses of women and technology. The wealth growth of scholarship during the United Nations Decade for Women (1975-1985) added gender as a category of analysis for understanding the consequences of technological change. Social scientists pursued the following questions: firstly, the extent to which technology transfers from industrial to developing countries affected women's lives, the sexual division of labour, and gender relationships at home and at work. Secondly, the extent to which more sophisticated technology improved women's lives, lessened their work loads, increased employment opportunities, and enhanced their authority. Thirdly, the level of women's contribution to the process of more technological change and the social and economic obstacles to the acquisition of more technological training. Fourthly, the question as to how women may gain greater access to new technologies and play a greater role in their development and dissemination.

This paper, initiated by INSTRAW as part of its research series on women and technology, deals with the distinctive schools of thought that address the impact of technological change on the status of women. The paper's main concern has been a theoretical one: to assess the conceptual contributions that a decade of research has made towards formulating and answering questions about the impact of technology on women and women's role in technological development. This is an important task because the concepts and theoretical models that inform current research shape the direction and scope of future empirical studies. To accomplish this task, the study first examines the logic of explanation inherent in five major schools of thought: (1) The Luddite School; (2) the school of thought,

dealing with the feminization of technology; (3) the school dealing with appropriate technology; (4) the school concerned with the global economy; and (5) the school concerned with perspectives of cultural-political integration.

In the second part of this analysis, this study pursues research findings on education and employment to show how feminist analyses complicate the policy recommendations that development planners are currently advocating: that higher levels of education will resolve the problem of women's limited access to technologies. The final section of the paper examines women in multinational high technology production. Case studies of research on Hong Kong and Mexico allows the examination of debates about the cultural implications of new employment patterns for women and their families.

Doubts about the impact of technology transfer on the Third World began in the sixties with the reassessment of international development programmes and their impact on women. Feminist critiques<sup>2/</sup> of such programmes started with the observation that women were absent from the calculations of most development planners. As a result women's economic contributions were ignored or underestimated, and the negative effects of induced change on women's lives were not considered (Boserup 1970; Rogers 1980; Chaney and Schmink 1976).

These critics argued that contemporary patterns were reflections of a long history in which Western technology, particularly agricultural technology, was differentially available to men and women. European colonial administrators, applying their own notions of appropriate gender roles, made men the preferred recipients of training by Western technicians, even in areas where women were the primary agriculturalists. As a result of the differential access of each sex to new technology women's status declined. Moreover, local cultural values reflecting male dominance in community affairs, rather than female involvement in productive activities, were often transferred to the new tools and crops (Boserup 1970: 53-54; Etienne and Leacock 1980).

Because access was defined as the major issue, the logical solution for women and development critics was to equalize it. Women needed the ability to use tools and machines, as well as literacy and education. The message was explicitly pro-technology: women had lost ground because of restricted access. The solution to inequities was to open the restricted channels of education and training.<sup>3/</sup>

Early analyses of development and modernization also assumed that the process was positive and unproblematic. Like wider access, development might be difficult to achieve, but it was unquestionably the goal. Development, however, was to come under closer scrutiny. In the late sixties and early seventies, critics of development theories pointed out that industrialization and modernization policies were not producing the expected social and economic improvement in Third World countries. They

argued that conditions in the Third World were deteriorating due to the dependence of these economies on the capital credits, technology, training, and markets of the developed nations. This troubled dependency led many scholars to the conclusion that the wide-ranging adoption of Western models and technologies might not be the solution to the problems of developing nations.<sup>4/</sup>

Women and development, as a field of inquiry, and technology transfer to developing societies, as a strategy for change, have been criticized for reflecting the ethnocentrism of Western feminism. Many Third World feminist scholars argue that the concept of development is an invention of the industrialized states intended to serve their own interests. Similarly, they argue that Western feminism as a political movement and a scholarly tradition has paid too little attention to imperialism, colonialism and racism. Moreover, they contend that Western priorities are very different from those appropriate to the Third World (D'Onofrio-Flores 1982; Tadesse 1982; Srinivasan 1982). Specifically they find that Western feminist strategies have been insensitive to cross-cultural differences in terms of the significance of the family and kinship groups, the value of children, and the economic realities of impoverished dependent economies. Since technology transfer touches upon these issues, debates between feminists about potential strategies and policies are likely to be affected by such concerns and charges.

The eighties have witnessed the recognition of women's economic contributions to urban and rural households in developing countries, growing concerns about the feminization of poverty, and questions about the costs, in terms of productivity, of discrimination against them (Charlton 1984: 63). At the same time as Third World women's productive roles have been acknowledged and patterns of change that reinforce gender inequality studied, feminist assessments have been characterized by a strategic retreat from the wholesale embrace of technology.

### I. Alternative Perspectives in Technology

Distinctive lines of argument have been developed to conceptualize the impact of international development on women during the U.N. Decade. A recent review of the literature suggests that these diverse approaches have coalesced into major schools of thought (cf. Warren and Bourque, in press). Each school of thought elaborates a social critique and appropriate strategies and policies to enhance women's position in the face of technological change.<sup>5/</sup>

These approaches may be termed as follows:

- A. the Luddite (or rejector of technology) perspective;
- B. the feminization of technology perspective;
- C. the appropriate technology perspective;
- D. the global economy perspective;
- E. the cultural-political integration perspective.



A. The Luddites<sup>6/</sup>

Very few researchers advocate a wholesale Luddite rejection and destruction of technology.<sup>7/</sup> In fact, most women and development scholars associate a Luddite strategy with naive escapism. The modern Luddite is pictured by her feminist critics as seeking to halt technological development by returning to an idyllic low-tech existence closer to nature, even as the world order overwhelms her. Luddite attempts to halt further technological development are dismissed and discredited by market-driven societies which are economically dependent on continued technological growth. Nationalistic Luddites in developing countries, who reject industrialization on the grounds that it destroys jobs in labour-intensive economies, are also fated to be marginalized by a world order that demands the acceptance of new technologies to maintain low costs for export production (Zimmerman 1982; Arnold et al. 1982).

B. The Feminization of Technology

The feminization of technology perspective calls for a radical reordering of economic and political orders and argues that special female values should play a central role in international development. As technological innovation is now organized, according to this school of thought, masculine values determine its development and application. The result is the continual reinforcement of values emphasizing hierarchy, competition, immediate measurable results, material accumulation, depersonalization, and economic and political expansionism. It is not that bearers of masculinist views are ignorant of other values; rather they have been forced by the economic order to suppress their "needs for subjectivity, feeling, intimacy, and humanity" and "project them onto the realm of private life and of women" (Bergom-Larsson 1982: 35).

The feminization of technology position holds that technology must be redirected to serve new values, including human rather than economic growth, conservation, decentralization, self-reliance, self sufficiency and caring. This view postulates a distinctive women's culture and sees it as a critical tool for transforming the social order toward a more humanistic, egalitarian one, concerned with relationships and welfare rather than individual success and profit. The primary source of this utopian vision is women's involvement in the family, where this perspective idealistically holds that hierarchy is deemphasized, nonviolent persuasion is stressed, and investment is directed toward the nurturing of future generations. Women learn a wider lesson from their familial vantage point, namely that hierarchy inevitably subordinates the weaker (Boulding 1981; Bergom-Larsson 1982).<sup>8/</sup>

A common theme in this literature is the connection between technological innovation and military objectives. Those arguing for the feminization of technology voice the belief that women will be less violent than men and will offer an alternative to what many of these writers feel is the imminent danger of war (Bryceson 1985).

Unfortunately, according to these authors, women's values are currently imprisoned by the separation of spheres of home and work. Effective change requires an expansion of women's sphere and a new political procedure for evaluating technology, one which involves women in policy-making roles and includes questions about the impact of new technologies on women and women's culture. As female values successfully inform the public world, hierarchical distinctions between "productive paid" work and "non-productive unpaid" work will be challenged; women and men will share a personal commitment to responding to the needs of the community; and unnecessary divisions of labour will be rejected (H. Scott 1982; Bergom-Larsson 1982).

This perspective argues that women should not necessarily pursue integration into Western-directed development efforts. If they do so they are likely to lose the decentralized, relatively egalitarian social order of traditional society which was long ago lost by Western women. For those with the option of experimenting outside Western patriarchies, the best strategy is to strengthen women's networks and expand women's sphere as a source of new economic and political organizations (Boulding 1981). Western women must cope with a more pervasive patriarchy, a sharp division of public and private realms, and an economic system devoted to masculine values.

#### C. Appropriate Technology

Appropriate technology directly attacks Third World poverty and underdevelopment by attempting to increase local production without reinforcing patterns of dependence on the industrial nations. The strategy has been to move away from capital-intensive solutions toward a less costly intermediate technology emphasizing local resources. For women appropriate technology should increase their productivity and give them more time for other obligations and community development efforts. For example, in rural societies where women spend hours every day gathering fuel for their kitchen fires, women and development planners worked on new designs for low-tech mud brick stoves that would significantly cut fuel consumption. In the very common cases where rodents, insects, or rot destroy more than a third of family harvests during the early months of storage, design projects concentrated on low-cost storage practices that would increase available food. Hand-operated grinding machines for corn, wheat and millet as well as rice hullers and palm-oil presses, can free women from hours of daily drudgery without displacing workers. Solar energy, wind power, and biogas are forms of energy that would cut dependence on expensive commercial fuels (Tinker 1981; Carr 1981, 1984).

While in conception, appropriate technology makes sense, in practice it has brought new dilemmas. Foremost is the fear of increased unemployment with new technologies. For women the cost of innovation is often too high, and they find themselves caught in a circular trap. Limited resources and cash generally restrict women's use of technologies



that might increase their productivity and give them access to credit, education, and land (Ahmed 1985). Furthermore, women's economically marginal position makes it very difficult to experiment with their family's welfare. For new technologies to convince women of their values, they must substantially increase women's productivity to pay for the new technology and to compensate women for the time lost from other work to learn and experiment with new techniques (Tinker 1981: 58).

Leading exponents of appropriate technology self-consciously criticize top-down decision-making in the development of new technologies, noting that although they may appear to be obviously appropriate in the eyes of engineers and development workers, the people who expect to use the new techniques may not find them at all appropriate (Carr 1981b: 1983). Certainly, African women who experimented with solar cookers found serious drawbacks in such a fuel-saving technology (Carr 1981). For example, cooking at midday involved continually having to move the stove in the direction of the sun's rays, while the family-sized cooking pots did not properly fit into the stoves.

Even if full consultation with the "end users" takes place and designs are consistent with local needs and use patterns, the concept of "appropriate" technology to lighten women's work may have fundamental pitfalls. A sexual division of technology may be created in which women gain appropriate technology for domestic work while men become the focus of wider technology training generating new employment opportunities (Leet 1981). The issue is of particular significance in societies in which women are expected to be the financiers of the traditional domestic economy with their own earnings, as well as in cases where social change has multiplied the number of female-headed households.

Critical advocates of appropriate technology call for women to be involved in high-tech policy planning in order to influence the use of technology, the agenda of research priorities, the choice of government subsidies and the discussion of needs (Leet 1982). They conclude it is not the form of technology that determines gender use rather gender control of its development, dissemination and product. These issues parallel those found in the global economy approach which attempt to integrate examinations of the household with wider concerns about the state and the international division of labour.

#### D. The Global Economy

The global economy perspective would question the use of the term "technology" in its narrow sense as the focal point of an investigation, arguing that, in an interdependent world system, the primary issues are economics and power relations. This view is often phrased in neo-Marxist terms and stresses the importance of the historical forces that shape national economies and developing countries' capacities to compete in international markets. Of central concern is the way that economies have shaped in international markets by a division of labour in which developing

countries are sources of cheap labour and raw materials for technologically sophisticated industrialized countries where capital is accumulated.<sup>9/</sup> From the global economy perspective, one cannot consider technology without studying the issues of its production application and use in the context of changing class relations, state policy and international economics. Feminist scholars have made major contributions to materialist analysis by pursuing the study of class relations and sexual divisions of labour both within the workforce and in the household.

This perspective has been very influential in women and development circles. For many it links a needed critique of capitalism and imperialism with gender stratification (cf. Reiter 1975; Khun and Wolpe 1978; Etienne and Leacock 1980; Young et al 1981; Nash and Fernández Kelly 1983; Nash and Safa 1985; Leacock and Safa 1986). As Beneria and Sen conclude:

The problem for women is not only the lack of participation in this process (of development) with men; it is a system (of international capital accumulation) that generates and intensifies inequalities, making use of existing gender hierarchies to place women in subordinate positions at each different level of interaction between class and gender. This is not to deny the possibility that capitalist development might break down certain social rigidities oppressive to women. But these liberating tendencies are accompanied by new forms of subordination.<sup>10/</sup>

Stolcke, representing another current of neo-Marxist thought, stresses the function of women's forced subordination in the household in perpetuating wider inequalities:

The perpetuation of class relations and domination -- mediated directly by the institutions of marriage, the family and inheritance ...determines both women's primary assignment to domestic labour and the undervaluation of this function. In a class society, in other words, the sexual division of labour -- women's domestication -- is ultimately the product of man's control over women's reproductive capacity in the interests of perpetuating unequal access to the means of production.<sup>11/</sup>

Both socialists who seek redistributive alternatives to free market economies and nationalists who reject Western influence in their politics and economics find these perspectives useful. While liberal researchers do not share the utopian socialist vision, it is clear that materialist analyses have influenced their thinking about the importance of an international perspective that sees various forms of inequality as interactive and central to explanations for current patterns of development.

The insights from the global economy perspective also allow us to focus on a neglected element in many feminist analyses of technology: the interplay of national governments and international markets in shaping national planning, policy development and the allocation of resources. Of

particular concern is the state's creation of labour force policy in areas such as employment, migration, education, housing, agriculture, and industrial development. How does the state formulate priorities for its own development? For the agrarian sector, how does it balance the need to produce food crops for domestic consumption with the need to encourage the production of commodities for export? What alternatives does it see for increasing domestic production, for dealing with shifts in subsistence agriculture and wage labour, and for reducing dependency on the international market for basic food supplies?

For the industrial sector, does the state encourage multinational production, and how does it respond to the resulting patterns of centralized and decentralized production? For instance, as workers are pulled toward export processing zones and assembly work, it is common for new patterns of decentralized outputting assembly, information processing and service work to emerge. This spin-off work from multinational plants is often organized outside government regulation as part of the informal sector, where work is done in the home or in unregulated sweatshops.

The global economy perspective gives the issue of decentralized, small-scale work a much more complex shape than does the feminization of technology analysis. The latter analysts place a positive value on decentralization and tend to view it as a counterpoint to hierarchical, centralized systems. The global economy perspective helps us see that decentralization is not inherently positive or negative, nor is it always an exclusive alternative to centralized modes of production. As in the case of multinational assembly plants, contemporary industrialization can foster decentralized modes, such as subcontracting to domestic outworkers, to produce at a lower cost. The issues center on how these work patterns influence the household, whether women will be able to gain greater control of work processes in the smaller units; and whether companies will exploit a fragmented labour force by raising production quotas for constant wages.

The global economy perspective questions the common tendency to treat women as a category with uniform interests and concerns. To overcome the conceptual simplification of other feminist frameworks, this view argues that, rather than studying individual women, household units should be examined according to their class position in mixed subsistence, cash crop, and urban economies. Women's domestic responsibilities vary by class and involve intricate balances of monetized and non-monetized activities, rapidly responding to changing market conditions (Ahmed 1985; Agarwal 1985; Bryceson 1985; Bourque and Warren 1981a, 1981b). However socially valued or devalued, women's household roles are critical for the physical and social reproduction of the labour force. The central analytic project is to study women's reproductive and productive roles as they are mediated by their class position in the wider economy. Thus another important contribution of this perspective is to help restore concrete social contexts to women's work and perceptions.



It must be noted, however, that there are potential political drawbacks when policy-makers focus their concerns about women on the household and the family. Men are seldom viewed as members of households except as "heads" or "breadwinners". The focus on women's domestic and reproductive roles has tended to limit policymakers' concerns to those roles, thereby establishing constraints on national policy directed towards women (cf. Jaquette and Staudt 1985, Beneria and Sen 1982, Buvinic 1983 and 1984, Evans 1985). As a result, women have become the targets of population programmes and welfare projects or have been integrated into the lowest levels of production as part-time workers. Little thought is given to providing women access to the full range of skills that would allow them to control and direct development activities.<sup>12/</sup> As long as women are primarily viewed as members of households, there may be a tendency to leave unquestioned their absence from society's significant political, social and economic institutions.

#### E. Cultural-Political Integration

Thus far missing from our discussion of the array of perspectives on women and technology is a position that is neither neo-Marxist nor dependent upon the premises of the feminization of technology. The cultural-political integration framework is such a perspective. Its adherents are concerned about the limited number of women trained as scientists and engineers, and the absence of women from positions of scientific leadership. They share a belief in the possible benefits of technology and a desire to see women participate in its development. This perspective argues that the "integration" of women will result in the transformation of basic institutions because comprehensive female participation would challenge existing sexual divisions of labour and authority, as well as differential male-female earnings. While this view does not assume that wider female participation would result in a political feminization of technology and industry, it does hold that women would introduce distinctive values and concerns to the work-place (Malcom 1985; Jahan 1985).

If one's faith does not reside in a socialist government to end the inequities of capitalism, or in a burst of technological invention following the replacement of men by women who advocate a feminization of technology, what are the possible avenues for change? Women's expanded participation in non-traditional jobs and professions resulting from higher levels of scientific education is one answer, and clearing away the obstacles to that education and subsequent employment an essential part of the solution (Hall 1979; Anderson 1985). Thus the cultural-political integration perspective seeks to account for women's low enrolment in fields directly related to technology, to identify obstacles to women's educational and employment achievements, and to devise programmes to reverse gender asymmetries (Briscoe and Pfafflin 1979).

Researchers taking this position have focused attention on the ideologies that surround the acquisition of technical competence and the structural arrangements that reinforce stereotypes ascribing scientific fields and expertise as "masculine" fields. Such researchers view the key to change in the culture and politics of education and the workplace (A. Sen 1984; Namboze 1985). To change gender stereotypes and widen opportunities, the processes that reproduce existing patterns must be understood. This implies the following: (1) an understanding that sexual hierarchy as a product of culturally created social ideologies and of material conditions of women's and men's lives and, (2) an appreciation that sexual divisions of learning and work are not immutable behavioural divisions. Rather both school and the workplace are cultural and political environments where rules and norms are perpetuated and legitimated by contemporary ideologies of exclusion, segregation and avoidance. Fundamental to this perspective is an understanding of how institutions shape meaning and values, as well as how individuals can both internalize and challenge social norms (Bourque and Warren 1981; Keller 1984). With respect to technology, these analyses extend to the fields in which women have been poorly represented, exploring ways to increase women's enrolment in science and engineering, or developing methods to deal stereotypes of women categoring them as belonging to non-scientific fields (Briscoe and Pfafflin 1979).

This viewpoint does not make the mistake of assuming that individuals are autonomous decision-makers who choose whether or not to participate in technological development. Nor does it reduce education to the status of a "variable" which mechanically accounts for higher rates of technology adoption. Rather these analysts see education as a process of structural and ideological tracking. As a result, they have had to readdress the question of wider access as a solution to gender inequality and to take on institutional change as necessary for structures that have constrained choice and equity.

The challenge for the cultural-political integration perspective is that the arenas that need to be transformed have been remarkably resistant to change. Substantial reform in education or the workplace requires the intervention of political forces that must be convinced of the reasons for and rewards ensuing from pursuing substantial reform (cf. Buvinic 1983). Moreover, transformation must take place at a variety of levels: in the highest reaches of the national political system, as well as in daily household relations. Since many of the changes sought can be affected by executive or bureaucratic action, it is possible to imagine a political plan of action to influence ministers of education and labour, as opposed to the broad electorate. Yet for the types of change envisioned it is often individuals, mothers, fathers, teachers, coworkers, and employers who will be the primary instruments for affecting meaningful change. Effective policies must receive approval at both levels.



Amartya Sen's (1984) insightful analysis of intra-household power dimensions of gender relations makes an important contribution to this perspective. Sen's work emphasizes the perceptual elements in women's contributions to the household. He notes the generalized reluctance to face the powerful conflicts of interest which exist within households and, for the Indian case, identifies a pattern of "adapted perception" which involves "systematic failures to see intrafamily inequalities and perceiving extraordinary asymmetries as normal and legitimate". Sen notes that:

Problems of conflict within the family tend to get hidden by adapted perceptions both of "mutuality" of interests (going well beyond the actual elements of congruence that do, of course, importantly exist) and of "legitimacy" of inequalities of treatment. As a result no policy analysis in this area can be complete without taking up the question of political education and understanding.... This is an area in which social illusions nestle closely to reality, and terrible inequities are cloaked firmly in perceived legitimacy. The importance of information and analysis in breaking the grip of traditional arrangements is hard to exaggerate. The technology of mass communication offers great opportunities as well as powerful resistance (1984).<sup>13/</sup>

In addition to familial and political issues, there are staggering difficulties at the national level to the reforms proposed by the cultural-political integration perspective. Firstly, in many developing countries it is increasingly difficult to make a case for a general expansion in educational opportunities in which case the plea to give attention to women has a small chance to receive priority. The experience of the past twenty years has demonstrated that the rapid expansion of education does not solve and may not even lessen development problems. While most leaders must publicly declare themselves in favour of greater educational opportunity, privately they may fear that expanded education is creating problems. Policymakers in the developing world find themselves unable to meet the demand for jobs from those currently educated, thus the desire to expand these numbers by special attention to women, particularly in the face of potential opposition, limited funds, and overwhelming debt burdens makes this a less attractive policy option (Jahan 1985).

Secondly, employment opportunities appear to be shrinking in much of the developing world, due, to some degree, to technology transfer and the mechanization of labour intensive processes. As a result, one of the catalysts for the nineteenth century expansion of public education in the United States, the desire for a well trained and docile workforce (Katz 1968), may not be as compelling an argument for leaders in the developing world.<sup>14/</sup> Constructing a political agenda to expand women's employment opportunities will be even more difficult where employment opportunities are limited. Given this, recent research on the impact of women's education in developing countries takes on special importance, because it is from such material that a political agenda supporting change must be constructed.

## II. Education and Employment: Policy Dilemmas

Women's education is an especially complex issue for scholars, and like technology the debate has proceeded along several lines. Echoes of the concerns of neo-Marxists, radical feminists, and integrationists can be found in the discussions of educational transformation. While there are no educational Luddites, one does find great cynicism and penetrating critiques of existing educational institutions expressed by the entire range of feminist analysts.

Among their most serious charges is that schools perpetuate gender inequalities and class differences by regulating access to knowledge and by teaching world views that justify the status quo. Critics observe that the expansion of educational opportunity for women in the developed world has not eroded unemployment or closed the earning gap between men and women. Nor have expanded educational opportunities ended the underrepresentation of women in science and technology, though there have been important changes in these fields (Hacker 1986). Significantly, they note that as women have entered the science-based professions two-tiered systems have often emerged, with the less prestigious and less remunerated tier having the highest proportion of women. This pattern is reported for both capitalist and socialist societies (Carter and Carter 1981; Rudolph 1985; Lapidus 1978; H. Scott 1974; Zimmerman 1982). In addition some feminist scholars have serious doubts about the integration of women into established scientific fields, arguing that the problem is the structure and ideology of science which is dependent on the research priorities of competitive capitalism, rather than meeting wider social needs and challenging the status quo. From this point of view the process of training women scientists calls for the wider agenda of criticising biases -- such as the uncritical extension of biological explanations to social and political phenomena -- in existing science as well as creating a new and better science (Fausto-Sterling 1985; Bleier 1984, 1986; Keller 1985).

These critiques have led some scholars to conclude that conventional education is a mistaken focus for changing women's relation to technology because educational systems are bound to reflect the cultural biases and values of the societies that establish and support them. Consequently they are unlikely to be the locus of a radical restructuring of gender roles or power relations. Institutions must be transformed, education decentralized, and new curricula and modes of teaching developed for the system to carry another message. While there is great validity to these critiques, it is clear that Third World women will have very little impact on national development priorities, political ideologies, and development planning until they are literate and have acquired basic arithmetic skills with which to analyze their political and economic systems. Furthermore, if the political obstacles to narrowing gaps are substantial, as we have suggested, then there are even greater difficulties standing in the way of wholesale transformations.

Nevertheless, scholars of all perspectives must continue to address the question of access and how to increase women's opportunities at all levels of the educational system while stripping the system of its sexism. Comparative rates of literacy, school attendance, educational achievement, and faculty composition continue to help measure gender gaps and areas where improvements have been made.

There are three areas in which research has shed new light on the complex interplay of factors affecting women's education: (a) constraints on getting women into schools; (b) obstacles to providing educational equity once women are in schools; and (c) significant correlates that might be used to construct political agendas in support of women's education.

The initial problem in women's education is getting girls into schools. Studies continue to find marked differences in school attendance between boys and girls at all levels, much higher female dropout rates, and much greater illiteracy. In accounting for the persistence of these trends Bowman and Anderson point out:

Analysis of the spread of education among females must be closely tied to evidence concerning how education affects their subsequent roles and behaviour. Parental expectations of these effects, along with parental estimates of foregone production and foregone learning of schooled girls, are crucial not only in initial access of a daughter to schooling, but also in performance of girls in school.<sup>15/</sup>

Schooling does not necessarily offer the same direct economic payoff for women as it does for men. This is due, in part, to cultural and family expectations that domestic and reproductive work will be undertaken by women. Parental and familial assessments about short and long term returns on their children's education help explain continuing gaps in school attendance, achievement, and literacy between men and women. Cultural patterns that take girls out of the house at marriage while tying sons to extended households may weaken parental investment in daughters. But the wider economy is also influential. For instance, in the case of urban industrial employment, there are conflicting signals from the market which both promote female education and limit its duration so daughters can contribute to the family economy before marriage.

These findings have implications for development policy -- if women's time invested in education leads to remuneration in the cash economy then it would appear to justify a reevaluation of their other contributions to the family. This conclusion echoes Sen's findings on the importance of cash earnings in the evaluation of women's work and family perceptions of their contribution to its welfare (1984). Both factors affect the family's decisions about who is "entitled" to investments in



such resources as education and nutrition. In this, as in so many areas, the issues of education and employment are linked to one another and to the larger questions of how gender hierarchies are constructed and perceived within a society.

A CEPAL study (1983) of Latin America found that women have higher rates of illiteracy and are less likely than men to complete primary school. This gender difference is greatest in the rural areas and most notable in Peru, Mexico, Paraguay, El Salvador, Guatemala, Bolivia, and Ecuador, all countries in which gender intersects with marked class and ethnic disparities. The study argues that gender disparities will persist and become greater without special programmes focused on women. The problem is exacerbated by the tendency of governments to put more financial resources into secondary and higher education, thus leaving the initial imbalance between men and women unaddressed (CEPAL 1983). Recent findings on literacy suggest that while women show considerable interest in such programmes there is little governmental effort to direct programmes toward them (Stromquist 1985). One study concludes that even a new sex blind policy would not change the situation.

It is difficult to equalize opportunity once some groups have established an initial lead, and even more so with current constraints on increasing educational investment and government employment. After actively discriminatory policies have set inequalities in motion, sex-neutral policies are sufficient to maintain established patterns. Thus the educational gap continues, as does the clustering of women in low-paid service occupations.<sup>16/</sup>

Moreover, literacy and the completion of primary school no longer assure a place in the labour force as in the past. Ironically, equality of opportunity is not necessarily fostered by similar levels of education, because as large numbers of students completed primary school, employers begin to require still higher levels of attainment for the same jobs. This points to an important function of educational systems: they can be used as flexible sorters of the national labour force responding to changing national and international market conditions (CEPAL 1983; Lim 1985).

Once girls are in the school system, a second series of obstacles emerge. In those nations where equal rates of educational participation exist (including the Philippines, Western Europe, Eastern Europe, Chile, the United States) sexual segregation in tracking and curriculum creates totally different educational experiences for boys and girls in coeducational settings. Smock found this archetypal pattern in Mexico: streaming at the lower secondary stage effectively filters a majority of young women into terminal courses, preparing them for traditionally female vocations (1981).



The problem of the "hidden" curriculum is very much a part of the experience of the industrialized and developing nations. Elliot points out that the issues go beyond the classroom to the very structures of institutions:

It is important to know how the messages implicit in the formal curriculum of textbooks may be reinforced by other messages in the "hidden" curriculum of schools -- authority structures, staffing patterns, and regularities of classroom interaction by gender. This hidden curriculum of schools may be as significant, or even more so, than the formal curriculum in moulding educational outcomes.<sup>17/</sup>

As a result of "hidden" curriculum, girls may see achievement as "masculine" and may receive little encouragement in striving for superior academic performance (Finn, Reis and Dulberg 1982).

What are the chances of altering educational systems and women's education in particular? The types of changes that feminists have identified as necessary require new curricular materials, non-sexist textbooks, science laboratories and mathematics instruction for girls in situations where the limited facilities and instruction have previously been provided for males. Most of the research on education singles out the importance of teachers and the learning environment to push the horizons of young girls. But a strategy based on such people may require new personnel, new values, and a rethinking of the reasons for educating youths. Extraordinary political skill and commitment will be a prerequisite for garnering support for such a programme. Expenditures for this course of action are not among the priorities of hard-pressed government economies, and there is a reluctance among development agencies to press for such changes (Stromquist 1985).

The consequences of sex stereotyping become most apparent when the traditional responsibilities of women are in conflict with enrolments in specialized schools of study. The case of India is instructive:

In higher education, India has a relatively strong ratio of girls to boys and a good stock of well-educated women... However, the sex stereotyping of fields is marked, with consequences both for individual career choices and for development programmes. Women's enrolment for an agricultural degree are still miniscule, and nonexistent in forestry. This means that development programmes in critical areas of women's work -- agriculture, fuel and fodder -- are designed, directed and evaluated by male experts who, because of customary practices prevalent in most of India, can have no direct access to village women.<sup>18/</sup>

If development planners can be convinced that scarce training resources are being squandered on the wrong population, or that investment in training women would yield a better return, then one essential component in a viable agenda for change would be secure. But for policymakers to

accept such proportions they would have to be convinced that women are technologically capable and educable. This means renewed attention to learning environments.

In recent research, inadequate attention has been given to the impact of single-sex versus coeducation settings on women's classroom experience and subsequent employment. Some reports recommend coeducation without considering the possible limits or drawbacks of such a strategy (CEPAL 1983: 137). Significantly, in the wider field of women and development there has been a healthy exchange of ideas on the advisability of "women-only" as opposed to "integrated" development projects. Analysts have decried the tendency of policymakers to stereotype and undervalue women-only projects as welfare projects when, in fact, they increasingly focus on training and income generation for poor women. Analysts have also found that women often become marginalized from the critical aspects of leadership and control in integrated projects. Women appear to have a better chance of gaining and maintaining control in women-only projects (Buvinic 1984, Crandon 1985, Stromquist 1985). A similar attempt to assess the impact of different learning environments for women and girls is necessary. The wholesale adoption of coeducation may be an example of a form of technology transfer from the United States, without the benefit of recent reassessments of sex stereotypes built into the American coeducation. Of course single sex schools may perpetuate traditional roles or track girls for stereotyped futures through their formal and hidden curricula. On the other hand, they may also provide an environment for educational innovation. Clearly research in this area needs to distinguish between gender-stereotypes about single-sex education and the actual positive alternative this form represents for girls.

One avenue for policy innovation would be the reconsideration of single sex programmes with the goal of conveying new authority patterns and eliminating gender stereotyping with respect to scientific disciplines. In the case of technology and science, the duplication of scarce laboratories, equipment, and specialized instructors may make single sex education seem an unnecessary expense where resources are shrinking for the population as a whole. But it also seems mistaken to assume that coeducation will naturally address the problems of sex role stereotyping. At coeducational institutions strong Women's Studies Programmes may serve a similar purpose by supporting women in technical fields and causing institutions to be more self-conscious about gender assumptions.

How can programmes of political support be developed to promote expanded opportunity for women given the economic, political, and cultural obstacles to their education? New findings on fertility, child welfare, and infant mortality may provide grounds to capture the attention of national development experts. The impact of women's education on fertility has been examined in a variety of contexts and the results appear mixed, and at times contradictory. While more research needs to be done to clarify these patterns, Leslie et.al. (1986) conclude from their review of

the literature that in general increased female education is associated with lower fertility. This finding is also related to the positive effect of maternal education on child health and survival.

Research done in the late 1970's in developing countries found a surprisingly consistent positive effect of maternal education on infant and child mortality rates and on child nutritional status usually associated with both higher levels of paternal education and higher levels of household income, most research has found a positive effect of maternal education on child survival and health separate from its association with other socioeconomic variables.<sup>19/</sup>

While these results are encouraging and can serve as the basis for additional research and policy planning, it is clear that studies of correlations and associations need to be complemented by research on institutional arrangements and social ideologies in order to explain how systems perpetuate the status quo and how they might be transformed. Furthermore, the use of the traditional sexual division of childcare and nurturance to mobilize political support for change must be recognized as a problematic strategy. Reliance upon this strategy -- while politically appealing -- could ultimately limit women's opportunities in other areas where their work is just as important for family welfare.

One of the central messages from the Decade is the importance of the construction of viable political agendas for the changes that reformers seek in education, employment, and women's relation to technology. The research of the past decade has begun to identify potential sources for such an agenda, which can be found in careful assessments of the changing relationship between educational opportunity and perceived return on that opportunity, or the link between education and increased child welfare and lower fertility, or the costs of failures to introduce women to technological innovations in agriculture or other areas of the economy.

Any sustained analysis of gender, technology, education, and work must deal with the diversities and complexities of culture, state, labour market and family. Two illustrative case studies of women and the work-place in Hong Kong and Mexico will show the extent to which specific realities challenge theoretical models.

### III. Multinationals: A Technological Case Study

In assessing the impact of technology transfer and employment changes on women's roles a number of issues must be considered. First has been the impact of technology on agricultural production and women's role in that production. As subsistence agriculture has given way to commercial agriculture for national and international markets, women's traditional roles in agriculture have often been eroded and wage labour and migration have transformed rural communities. This classic pattern was identified by Boserup in 1970 and has been explored in many subsequent studies, including



studies on the Peruvian Andes.<sup>20/</sup> Because most women in developing countries live in rural settlements and are engaged in agricultural work, food processing, and local commerce this will remain an essential focus for research (Ahooja-Patel 1986). For this conceptual overview, however, the urban problem of women's employment in multinationals in developing countries has been selected leaving rural issues to be the focal point of other papers in the INSTRAW series. Multinationals are an important arena of technology transfer where the paradoxes of the women's education, family roles, and new options in the labour force are highlighted. The past decade has produced a number of inciteful studies on multinational employment.

In the last 15 years there has been an explosion of industrial production in the Third World as multinational companies have searched for cheap labour to assemble high-technology products, to manufacture clothing, and to grow and process food. Recent relocations of manufacturing plants to Third World countries has been spurred by Japanese successes in capturing Western markets for consumer goods and the transformation of national firms into multinationals in Hong Kong, South Korea, and Singapore. Faced with new competition, European and U.S. companies have looked to the Third World to cut their labour costs and retain international competitiveness. In the case of the U.S., this process was encouraged by new tariff regulations in the 1960s and 1970s. These allowed goods sent to other countries for further processing to be reimported with duty payable only on the value added as a result of labour (Lim 1983: 71-72; Nash 1983: 10).

These developments build on a long history of transnational involvement in the world, with a new twist, as women are now being recruited in large numbers for bench-assembly production work. "Heavy" multinational industries such as mining, petrochemicals, iron and steel, and shipbuilding continue to employ many more men than women,<sup>21/</sup> while "light" industries like clothing manufacture, food processing, pharmaceuticals, and electronics assembly tend to have mixed labour forces, where women may predominate on the assembly line. In 1980, over four million people in developing countries worked in multinational enterprises: 63% in Latin America, 31% in Asia, and 6% in Africa. Of this total it is estimated that over one million worked in national firms doing subcontracting work for multinationals (Lim 1985: 7-9, 28).

For their part, national governments have often competed to attract multinational investment to deal with high unemployment and lack of capital. Multinational companies involved in microelectronic assembly, clothing manufacture, and food processing have built production plants dispersed at great distances from their corporate headquarters in the United States, Europe, or Japan (cf. Chapkis and Enloe 1983 and Arizpe and Aranda 1981). New products are developed in the industrial countries and sent along with the appropriate production machinery to factories in the developing world. Local labour, which is labeled semi-skilled or unskilled, is recruited for production, and the plants' output is sold in



external markets, such as the United States and Europe. Manual assembly is preferred in rapidly changing industries because it successfully competes at this point with the higher cost of continually retooling automated systems to keep pace with technological, stylistic, and market-driven changes.

Two contrasting views of the impact of multinationals on women are found in the literature. Authors such as Lim (1981, 1983, 1985) and Salaff (1981) argue that the new industrial employment is providing young women with important options and financial resources which may coexist with traditional family forms and values. While multinationals pay low wages by industrial countries' standards, Lim points out that multinational wages are generally higher and working conditions better and safer than national companies which tend to be smaller in size and, thus, subject to greater economic pressures. The contrast is starker for women who face the exploitative and marginally-paying alternatives of work as farm labourers, domestic servants, and market vendors, all typical alternatives to assembly work. The reasons for the disparity between multinationals and national firms is not due to better intentions on one side than the other, but rather to the multinationals' larger size, greater productivity, and profitability. Furthermore, multinationals tend to conform to national standards in their sexual divisions of labour (Lim 1985: 24-25, 60-61).

Lim argues that without multinationals women would have fewer employment opportunities, would be forced to work for more exploitative national enterprises, and have less say in the face of a traditional patriarchal system:

Although the multinational does take advantage of national and sexual wage differentials and sometimes reinforces them, it is not responsible for creating them and cannot by its own actions eliminate them. National wage differentials are the result of differences in the development of capitalist relations of production between nations, whereas sex wage differentials originate in indigenous patriarchy.<sup>22/</sup>

Many of the problems women face result from cultural expectations that they are temporary workers who will later turn their attention and time to marriage and children. As a result national economies pay women less than men and more young unmarried women are available for work. Young unmarried women tend to have other advantages: they can work various shifts, are more highly educated, are mobile, and will not use pregnancy benefits. For Lim cultural expectations about women's marriage and job commitments as well as family investment patterns which favour sons over daughters for education explain most of the earning and promotion differentials between women and men.<sup>23/</sup> She concludes that these factors are more important than employers' gender biases in explaining female/male earning differentials in any particular country (Lim 1980: 59).

Lim questions the finding that multinationals are footloose and that they use the threat of relocation to avoid unionization. She finds that in countries like Indonesia, the Philippines, and Thailand, where multinationals have been in place for long periods of time, their rates of unionization are higher than those of domestic industries. In these cases women may benefit by being brought together in large groups for the first time and having the opportunity to organize politically. For their part, multinationals may not fight unionization if it gives them a structure through which to negotiate efficiently with workers. Factories are more interested in political stability than they are fearful of unions; their departures are more commonly caused by business reverses, takeovers, and reorganizations. Lim argues that multinational factories have a life cycle, with countries having longer histories of multinational operations more likely to have assembly plants with unions, higher wages, greater job security and higher investment in capital-intensive production. They are also likely to have exported unskilled production work to countries like Bangladesh or Sri Lanka which have still lower wages. The tendency is for multinationals to upgrade their work environments over time, especially if national governments urge these developments and the labour market is tight. The spinoffs from mature multinational operations developments may support the growth of national industries and an entrepreneurial middle class (Lim 1983: 75-76, 83; 1985: 64-68).

Salaff's in-depth study in Hong Kong reinforces many of Lim's findings while adding an important cultural dimension to the analysis of women's industrial work (1981). Since 1949 Hong Kong, under British rule, has been a centre of textile and assembly work promoted by local Chinese capitalists who tapped a growing international market. The political and economic situation of Hong Kong is unique; a British colony facing an uncertain future when it becomes part of China after the British mandate expires in 1997. Lacking sufficient land for large-scale agriculture while experiencing waves of migration from the mainland, the colony has become particularly hospitable to multinational industrial production. Young women have played an important role in this industrialization, and by the early 1970s they had become more than one-half the factory labour force.

State policy promotes a profit-driven commercial sector over participatory politics; in addition, it reinforces an individual's dependence on his or her family for subsistence and welfare. Basic household expenses are so high in Hong Kong that multiple wage earners are necessary in every family. The state offers very few social services beyond subsidized housing and education; there are few welfare provisions, no unemployment insurance or social security. As a colony, political officials are appointed from abroad, and there are few political forums and no legal parties. Unions are discouraged and have only token membership.

Typically young women from poorer families begin working at the age of 12-14. Until marriage, they enjoy a varied life of commitment to their families, industrial work and a peer culture of friends. Their earnings are most often used to pay for a higher standard of living and for the

education of sons in the family, something that Salaff argues the young women do not resent because these contributions represent a valued contribution to collective family welfare.

This situation is compatible with the Chinese value placed on the family as joint endeavour for social survival and continuity. Chinese culture stresses a religious commitment to a male-centered conception of family ancestors. Sons are particularly valued; daughters less so since marriage will inevitably take them to their husband's family. In the past family inheritance was equally divided among the sons; now working families invest in the future by educating their sons for higher paying skilled jobs. According to this world view, members of the family are asked to subordinate their personal goals to their family's needs. Daughters do this by remitting three-quarters of their wages to their parents "to repay the cost of their upbringing". In return daughters gain the right to more personal freedom: reduced demands for household work, an allowance for their own purchases, the right to choose their own husband, and higher levels of education than in past generations. As Salaff points out, the frame of reference for these women workers is their mothers and grandmothers, rather than their brothers. As a result, while they would like more education for themselves, they do not resent the family's greater investment in sons. Women see themselves as gaining social freedom while maintaining strong family ties.

A second line of analysis is much more critical of multinationals and the opportunities they have offered women for new forms of work. This view, articulated by researchers like June Nash and Pat Fernández-Kelly (1983), emphasizes the failure of industrial work in the Third World to provide women with new options or long-term employment possibilities. Multinationals have not introduced changes that make a real difference because the recruitment of women into high-tech assembly work has not challenged the idea of a sexually segregated work force or the tacit understanding that women can be paid lower wages than men. Their analyses describe a situation in which multinationals are taking advantage and reinforcing gender, ethnic, and class based inequities in industrialized and developing societies.<sup>24/</sup> In this respect their analysis overlaps with that of Lim and Salaff. As Nash concludes:

Sectors of the labour force based on gender, ethnicity, age and education within both industrial core and peripheral nations are differentially rewarded and these differences, along with wage differences between nations, determine the long-run movement of capital.<sup>25/</sup>

Where the two schools of thought differ is that Nash and Fernández-Kelly argue that the labour practices of multinationals are challenging rather than complementing cultural practices in ways that leave women particularly disadvantaged and with less social support than they had in traditional society.



Studies of high-tech assembly plants in Mexico, Hong Kong, Taiwan, Indonesia, Malaysia, Thailand, the Philippines, Brazil, and the Caribbean illustrate the widely accepted policies of recruiting young single women, maintaining paternalistic modes of plant organization, encouraging turnover after several years of employment, and providing virtually no opportunities for advancement or job security if the market sags (Fernández-Kelly 1983a, 1983b; Nash and Fernández-Kelly 1983; Ehrenreich and Fuentes 1983; Lim 1981). Employers reinforce the idea that assembly work draws on inherent female skills, such as manual dexterity, attentiveness, docility and the capacity to do repetitive work. Thus, such work is regarded as an extension of women's conventional roles. Srinivasan notes the high cost to women of this sex role stereotyping:

The reasons for employing (women) in modern high technology companies are the same reasons for which they are excluded from training, technical responsibilities, and high-paying jobs.<sup>26/</sup>

By defining high-tech assembly as young women's work, plants are able to maintain low wages, favourably competing with U.S. labour despite the cost of transporting goods internationally for assembly.

Within the plants, these authors argue that employers further reinforce, manipulate, and distort cultural values by bringing their own culture to bear on workers to foster control. For instance, in Japanese-managed firms there is a tendency to stress family commitments and self-discipline, while in U.S. managed firms Western aspirations are encouraged through factory beauty contests, cooking classes, and make-up instruction, which emphasize the importance of cash incomes for competitive, consumer success and modern marriage (Grossman 1978/79; Elson and Pearson 1981; di Leonardo on Ong 1985).<sup>27/</sup>

Pat Fernández-Kelly's ethnography of Mexican border industries in Ciudad Juárez (1983a, 1983b, 1983c) argues for this critical analysis. Like Hong Kong, Mexico has witnessed a growth in women's employment in multinational assembly plants. In contrast, however, Mexico's severe unemployment problems, growing population, stagnation of its agrarian base, dependence on an uncertain international petroleum market, and different cultural system mean that new work has very different implications for women, men, and their families.

Industrialization along the Mexican border has been shaped by the overshadowing presence of the U.S. economy. Assembly plants (called maquiladoras) are the result of the Border Industrialization Programme (BIP) which was jointly developed by Mexico and the U.S. in 1965<sup>28/</sup>. The Programme was designed in part to generate local employment to counterbalance the effects of the U.S. termination of the Bracero Program, which left over 200,000 migratory agricultural workers, many of whom settled along the border, out of work. The BIP employed classical strategies learned from the Asian experience to foster multinational investment: Mexico had a rapidly growing labour force, unemployment and



underemployment of about 20% in key border cities, high birth rates and internal migration to the region, and a populace willing to work for one-sixth of U.S. wages. Firms were allowed to import machinery, equipment, and raw materials free of duty into Mexico, providing all production was exported. Multinational subsidiaries were permitted to be totally foreign-owned in contrast to the limitation of 49% foreign ownership for domestic firms. For its part the U.S. tariff policy taxed only the value added for reimported goods including clothing and electronics. A final selling point was that U.S. managers would be able to commute to these plants from their homes across the border.

The growth in assembly plants has been impressive: in 1965 there were 12 assembly plants employing 3,087 workers; by 1979 there were 531 plants employing 156,000 persons. Between 75% and 90% of the workers in these plants are women. In 1978 these factories were the third largest foreign exchange contributor to Mexico, just behind tourism, and petroleum. One-third of the multinationals' expenditures went for workers' salaries; the rest entered the Mexican economy through rents, taxes, material and miscellaneous costs (Fernández-Kelly 1983: 21, 34-35). With the devaluations of the peso and the decline in the world price of petroleum, Mexico's economy has experienced serious reverses, with increasing unemployment and great pressure on workers to seek employment in the United States as undocumented workers. While the Mexican government sees multinational assembly plants as a fundamental development strategy, it is clear that they will not solve unemployment problems of the present scope.

Because the factories recruit many more women than men, Fernández-Kelly concludes that they have helped foster contradictory pressures on women and men in a situation where 80% of the border unemployment and underemployment is male. The companies prefer women because of their perceived greater docility, manual dexterity, and the fact that they are viewed as temporary workers who can receive the lowest possible wages. This is important because these labour-intensive industries are intensely competitive, quick to lay off workers if demand for their products weakens, and subject to collapse during U.S. recessions. One half of the assembly plants in Ciudad Juarez closed during the 1974-75 recession in the U.S. Fernández-Kelly argues that factories have not reduced unemployment rates, but rather have introduced formerly unemployed women into the labour force. What is clear is that women see assembly work as a step up from work as maids across the border, and they especially value the access to state medical care that they receive as a job benefit. Other women, who have worked as local secretaries, receptionists, and clerks, move to multinational jobs because the pay is higher than office positions. On the other hand, high male unemployment forces men across the border, dividing families, resulting in abandonments, and creating pressures for wives to join husbands. The fact that this migration is illegal clearly subjects the participants to great anxieties.

Most female assembly line workers are between 17 and 25. Electronics plants recruit younger single, childless women with an average of eight years of education. Companies test women for pregnancy when they are recruited because they do not want to be subject to the eighty-two day paid leave women are legally entitled to with the birth of a new child. Electronic workers most often live with one or both of their parents, and their income is pooled with fathers who are often marginally employed at very low paying positions in fields like construction. Generally they give about half their wages to the family, where the money is used for domestic expenses or higher education for a younger brother. Mothers in these households are less often members of the paid labour force, concentrating instead on domestic duties. On the other hand older women, women with children, and less educated women, who must enter the work force, find work in apparel factories where wages are lower and working conditions less desirable. One third of the women working in clothing assembly are single mothers who have been forced into the labour market to support their families after the death of their husbands or the latter's desertion.

Women's job tenure averages three years as they experience pressures to leave positions from companies trying to avoid payments required under the Mexican labour law for vacations, yearly bonuses, and indemnity in the event of layoffs. Factories also note a drop in women's productivity over time as they become bored of highly monotonous work. For their part, women leave positions to marry, take care of their children, rest and change jobs, to regain their health, and to avoid tensions with factory personnel. Women do not see themselves as permanent workers and describe pressures from men to leave paid work to take on full time domestic duties. Later economic need may force them back into the labour force and into less desirable positions or illegal migration.

As a result of multinational employment, older women see a shift in the value of educating daughters, noting that in their generation fathers dismissed female education as a waste of time for women who would devote their lives to their children and domestic work. Now mothers seek to persuade fathers to educate daughters to meet the minimum educational requirements for electronic assembly employment. Yet they worry that fathers will take advantage of daughters, reducing their own financial contribution to the family.

Fernández-Kelly feels very strongly that multinational industrialization has not solved existing problems, particularly male unemployment after the end of the Bracero Programme, nor has it created new options for women. Rather the border industries have reinforced the magnetic attraction of the Mexican-U.S. border resulting in continuing migration from other regions of the country and growing unemployment. Women are caught in complex counter currents: they are actively recruited for work, yet thought of as supplementary and temporary by companies and themselves; they are major wage earners in families fighting for subsistence, yet pressured to retire from the labour force by husbands who seek submissive wives; they are often abandoned by men discouraged by

poverty and unemployment on the Mexican side of the border. Young women have been recruited as a vulnerable and docile labour force stereotyped as supplementary and temporary workers at plants and as submissive wives and mothers at home by patriarchal traditions. While neither stereotype is accurate, they are used by institutions and individuals to shape women's lives in important ways.

Comparing two societies as different as Hong Kong and Mexico demands caution as the histories, cultures, state politics, international contexts, and development problems of the two are vastly different. Yet both societies have been touched in important ways by the new wave of multinational expansion which has recruited young women as a first generation of female industrial workers in their families. Lim would account for the differences between the countries' multinational experiences in part by noting that multinationals have a more mature profile in Hong Kong, where women workers find the experience a more positive one economically and personally, families have adapted old cultural patterns to new modes of economic participation, and wages are higher and working conditions better. Fernández-Kelly would respond with an argument that the issues are structural, and that the basic asymmetry of the U.S. and Mexican economies has been intensified through the Border Industrialization Programme. As a result, cultural patterns have been distorted, populations relocated, development priorities skewed, and families put under unbearable pressures thereby intensifying male-female tensions. Both would agree that the chronically high rates of unemployment in Mexico and the full employment in Hong Kong create different options for individuals, families, and multinationals expanding production in these countries.

In Hong Kong there is still a strong cultural consensus about family economic strategies as in utilizing extra earnings of daughters to finance the education and upward mobility of the sons. This is a successful reconciliation of traditional Chinese values and new industrial sexual divisions of labour. It allows poor families to amass funds and place their hopes on one or two individuals, who with better schooling and high test scores might gain entrance into university and the professions. The fact that such decisions do not provoke tensions between daughters and sons at this point is due to the fact that daughters' frame of reference is still their mother's. However, it is not clear that this strategy for mobility bears fruit for the working class in the long run given an educational system that favours upper middle-class rather than working-class children in terms of access to the very few university positions available.

Along the Mexican border there are cross currents and multiple family strategies which reflect the mixture of cues families are receiving from the economy. On the one hand traditional values call for a greater educational investment in sons. Some families report saving daughters' assembly earnings to do this, although it is unclear how this might translate into upward mobility since most men focus on crossing the border



for higher earnings as manual labourers in the U.S. On the other hand, the economy is demanding that daughters receive higher educational investments than formerly in order to qualify for what is considered high status, well-paying work. This situation appears to translate into some intergenerational tensions, but, more importantly, into increased tension between young spouses when husbands put traditional patriarchal pressures on wives to leave work, to join them in the U.S. in very uncertain circumstances, or to face being abandoned. What is not clear is if these tensions are greater than they might be in areas of Mexico where multinationals have not dominated local economies, but internal migration for work is common.<sup>29/</sup>

A given frame of reference shapes women's consciousness in Hong Kong and Mexico; it is also an issue for the analyst. Both studies acknowledge structural inequalities in the economic system and view individual actions as shaped by wider economics and politics. Each finds areas of creative choice and challenge. They find gender dimensions in international economics and in the traditional patriarchies of developing societies. What distinguishes them is one group's sense that national labour markets operate with a certain level of independence and that integration into the world order will benefit women and workers, even as it brings new problems and inequities. The other side of this debate finds that capitalism has a long history of shaping both local and international markets and economic opportunities. This point of view seriously questions the benefits of increased economic integration on developing societies which have different needs and dilemmas than industrialized countries. This difference parallels the tendency of analysts who focus their work on the domestic domain to stress traditional patriarchy as shaping women's subordination, while those who examine the public domain more commonly emphasize capitalist economics as the primary shaper of gender inequality (cf. Leacock and Safa 1986: x).

Research on multinationals has produced important findings on gender, employment and education. Educational levels, which may vary dramatically from country to country for the same work, serve as screening devices for multinationals, just as gender, ethnicity and class are used to shape flexible labour pools in segmented labour forces. Very often multinationals require educational levels that have very little to do with the work required in "unskilled" or "semiskilled" positions. Once established, however, educational levels determine the kinds of work women have access to, often in relation to the standards set by the companies in a local labour market. Multinationals encourage parents to invest in their daughters' educations. In Mexico the average educational level for all workers is 3.8 years, while the average for young women in electronics firms is 8 years (Fernández-Kelly 1983b, 1983c). Yet because education is really being used to regulate numbers of applicants in the labour force, when demand for products is down and there are fewer positions available, educational requirements may well be increased as they have in other countries. Lim argues that this is because education is regarded by



multinationals as "a proxy for other desired workforce characteristics such as hard work, perseverance, ability to perform repetitive tasks, tolerance of authority and discipline" (1985:34-35). Thus education is felt by multinationals to prepare workers for the regimentation of an industrial setting.

#### IV. Conclusions

The U.N. Decade of 1975-85 has brought forth not just a single feminist voice but a range of positions, politics and policies. The conflicts existing among the different feminist perspectives -- the Luddite perspective, the feminization of technology perspective, the appropriate technology perspective, the global economy perspective, and the cultural-political integrationist perspective -- are important and unlikely to result in a grand conceptual synthesis for Third World and Western feminists. But this is not the point: the debates that these perspectives have uncovered reveal important contours of reality.

It is clear that these frameworks have grown more sophisticated over time. The feminization of technology viewpoint has taken on the major task of analysing social ideologies implicit in Western science. The appropriate technology perspective has become increasingly attuned to the power relations inscribed in the transfer of tools and skills to solve concrete development problems. The global economy framework has moved beyond economic reductionism with attempts to integrate the cultural construction of ideology into its materialist analysis. The cultural-political integrationists have taken their work beyond merely stressing individual achievement toward the wider consideration of institutional and cultural constraints. As researchers from these perspectives contemplate the policy implications of their analyses, each is faced with the challenge of showing the greater cost of not incorporating gender as a major dimension for national development programmes.

A decade of cross-national research has led to a greater fount of knowledge on the questions initially posed in this overview concerning the impact of technology transfers on women's lives, sexual divisions of labour, gender relations, employment and patterns of authority. More is also known about the obstacles to women's wider participation in technology development, dissemination and its use. Access is not enough to change gendered asymmetries, though it is clearly crucial to the process of change in education, science, industry and other major institutions.

Clearly neither technology nor education are independent forces for modernization. Rather both may be better understood as clusters of economic, institutional, and ideological relations which shape and are shaped by power relations in national and international spheres. Thus neither technology nor education is a unilateral solution to the problems of underdevelopment or women's continued marginalization in processes of change. In both cases -- as attention is paid to the contexts of the production of ideas, skills, tools and commodities -- one realizes how much technology and education are bearers of social relations marked by gender. Just as there is a "hidden" curriculum in the schools there is a "hidden" organization of production in technology.

Ten years of research have contributed very useful critiques of modern societies and a renewed sense of the interconnections among technology, economy, science, the military, development, education, local communities, and the world system. The costs of sexism for individuals, for men and women, for

their families, and for nations are becoming clearer. In the two case studies of contemporary industrialization considered in this paper, women appear to have internalized wider social ideologies, working full-time at home and in the labour force for much of their lives, yet seeing their work as temporary and their rights as secondary to those of others. In these instances women may feel that they are entitled to less and may be depoliticized in terms of making demands for change in their own work situations. Yet such patterns are hardly universal. More work is needed to understand the factors that shape female solidarity and divisions, as well as those that influence varying ideologies of state and worker control.<sup>30/</sup>

Women have little option but to participate in the labour force as cheap labour as they are drawn from families and rural communities into urban economies. Changes in the economic evaluation of women's work and in the implication of women's education for financial rewards are clearly important, as Sen points out (1984). Yet this overview of the multinational literature shows that income for women may not change their self-evaluation as much as it changes family incentives to slightly increase girls' years of schooling.

Research has uncovered a series of dilemmas for those concerned with striving to change policy. Just as appropriate technology may be a solution to important problems for women, it has drawbacks as a dominant strategy for change. Over-reliance on it may ghettoize women in the midst of wider technological changes involving the use of high-technologies. Similarly, a truly "appropriate education" might involve Hong Kong, Mexican, and U.S. workers in developing concepts they could use to analyse their own work situations and make longer term plans and collective demands on their workplaces and political systems. Yet women in these countries also need access to "higher education" to participate in the formulation of national policy in economics, health and technological development.<sup>31/</sup>

A major unresolved problem lies in the arena of policy in a world of fluctuating international markets, dependent economies, high rates of inflation, falling commodity prices and state policies that make change an exceedingly complex process. It is clear from this research that any effective policy must deal with workplace and educational issues, as well as with household dynamics. In the current literature on gender and development, there is a new interplay of what were formerly two separate discourses: one dealing with self-esteem, family-work dilemmas, sexuality and sexism and the other with class relations, poverty, exploitation and survival strategies. What is most interesting is that this decade of research has brought these distinctive discourses closer together to explore the dilemmas of women's roles in social change.

### Footnotes

- 1/ This is one of a series of papers on gender, technology and international development. This analysis has been inspired by discussions with colleagues at the Rockefeller Foundation and the International Center for Research on Women (ICRW). In particular thanks are due to Joyce Moock, Alberta Arthurs, Shirley Malcom, Micaela di Leonardo, Mayra Buvinic, Susan Joeques, and Joanne Leslie for probing questions. Anna Vigh and Elissa Adair assisted with the bibliography and Kathleen Thayer with word processing. The authors would like to add that, as always, this joint project has been benefited from strong collaborative efforts at all stages.
- 2/ This study's notion of feminist research includes scholarship by women and men who have taken gender as a central category of analysis, and are interested in understanding the diversities of experience both within and between genders.
- 3/ Boserup's pioneering work has sparked insightful critiques by Beneria and Sen (1986) and Huntington (1975).
- 4/ See Bourque and Warren's Women of the Andes (Chapter 8) for a fuller discussion of the relation between the critique of "development" and the reconsideration of development's impact on women. Ahooja-Patel (1979:1550) makes the important point that the mid-1970's marked an important historical conjunction "when almost simultaneously women and the developing countries made new demands for restructuring economies and societies. Both the Declaration and the Plans of Action of the New International Economic Order and the Mexico Conference emphasized somewhat similar goals, the core of which was the urgent need to create new equitable relationships between the industrialised and developing countries in international economic relationships and between men and women in internal relationships."
- 5/ In the initial review four schools of thought were presented: the Luddite school, feminization of technology school, the appropriate technology school and the global economy school. This study has added another perspective, that of cultural and political integration, analysed hereunder.
- 6/ Luddites were nineteenth century militants who responded to industrialization by smashing machinery.
- 7/ Gearhart (1983) is an often cited exception to this generalization.
- 8/ Much of this discussion is reminiscent of psychoanalytic claims that women engage in a gender-distinctive form of maternal thinking (cf. Dinnerstein 1976; Chodorow 1978; and Gilligan 1982).



- 9/ Benería and Sen summarize these interrelations in the following terms: "The capital-accumulation approach analyzes the growth of interconnected processes of production -- both quantitative and qualitative -- motivated by profits, extension of the market, growing social division of labour and modes of production, and the proletarianization of the labour force. Private ownership of resources, and hence of the surplus generated in production (profits, rent, and interest), leads to class differentiation between owners and nonowners of the means of production. Private ownership also signals the private appropriation of productive wealth, and growing inequalities in the distribution of income and power" (1987: 157).
- 10/ Lourdes Benería and Gita Sen, "Accumulation, Reproduction and Women's Role in Economic Development: Boserup Revisited" in Eleanor Leacock and Helen I. Saga (eds.), Women's Work; Development and the Division of Labour by Gender (South Hadley, Ma: Bergin and Harvey, 1986), p. 150.
- 11/ Verena Stolcke, "Women's Labours: The Naturalisation of Social Inequality and Women's Subordination" in Kate Young et al (eds.) Of Marriage and the Market; Women's Subordination in International Perspective (London: CSE Books, 1981), p. 34.
- 12/ Buvinic (1984) provides an illuminating discussion of the practical consequences of this process in development projects specifically directed at women. See, as well, Sen's wide-ranging discussion (1985).
- 13/ See Amartya Sen, "Women, Technology and Sexual Divisions" (Santo Domingo: INSTRAW, 1984)
- 14/ For an excellent review of the literature on women's education in 19th century America see Conway (1982: 82-90).
- 15/ Mary Bowman and C. Arnold Anderson, "The Participation of Women in Education in the Third World," Comparative Education Review 24 (June 2, 1980), p. 32.
- 16/ "New Directions for Research" in Gail Kelly and Carolyn Elliott (eds), Women's Education in the Third World: Comparative Perspectives (Albany: SUNY Press, 1982), p. 336.
- 17/ Ibid., p.336
- 18/ Ibid., p.342

- 19/ Joanne Leslie et al., "Weathering Economic Crises: The Critical Role of Women in Health". Paper prepared for the Second Takemi Symposium on International Health, School of Public Health, Harvard University, 1986, p.8
- 20/ There is now an extensive literature on this process, (see, for example, Ahmed 1985, Bourque and Warren 1981a and 1981b, Deere and León de Leal 1982).
- 21/ Accounts such as that of Barrios de Chungara, however, demonstrate, the vital, though unpaid role, played by women in reproducing and sustaining this labour force (1978).
- 22/ Linda Y.C. Lim, "Capitalism, Imperialism and Patriarchy: The Dilemma of Third World Women Workers in Multinational Factories," in June Nash and M.P. Fernández Kelly (eds), Women, New and the International Division of Labour (Albany: SUNY Press, 1983), p.85
- 23/ In addition, women's chance for promotion from the floor is unusual because of the structure of the workplace. But Lim notes that this would be true for plants in industrialized countries, as well as in the developing world (Lim 1985: 56-57).
- 24/ For a critique of wider cultural transformations with multinational expansion, see Mattelart (1983).
- 25/ June Nash, "The Impact of the Changing International Division of Labour on Different Sectors of the Labour Force" in June Nash and M.P. Fernández-Kelly (eds), Women, Men and the International Division of Labour (Albany, New York: SUNY Press, 1983). p.3
- 26/ Mangalam Srinivasan, Technology Assessment and Development (New York: Praeger, 1982), p.139 (author's emphasis).
- 27/ At this point very little data is available on the extent to which the cultural values women bring to assembly plants give them a distinctive perspective with which to question consumerism and their employer's thinly disguised attempts to deflect women from organizing over poor work conditions.
- 28/ Fernández-Kelly notes that this development was part of a longer historical trend of Mexican industrialization through free-trade privileges begun in the 1930's in response to the depression and the end of prohibition, which hurt Mexican liquor production along the border (1983: 25).

29/ In addition more research is required to know how multinational investment has influenced the frequency of women headed households. In other parts of Latin America, in both rural and urban settings, the rates are high. For instance, in rural Peru 20% of women are single parents at some point in their lives (Bourque and Warren 1981a; Warren and Bourque 1985).

30/ For instance, according to Salaff, women in Hong Kong have little sense of the destination of their production, blaming calls for speedups and low wages on the personalities of their supervisors. They appear to be much less aware of the role of multinational corporations and the wider market in dictating production quotas and the value of their earnings. In Mexico, Fernández-Kelly's account reveals similar problems: women seek to please supervisors whom they see as patrons, rather than holding a more sophisticated view point which views U.S. economy as having cyclic consumer needs and recessions. In contrast, for Singapore, Elson and Pearson report patterns of self-repression and subservience while supervisors are around and intense anger and ridicule when they are not on the scene (1981). See Caplan and Bujra for studies of solidarity and division (1979) and Morgen and Bookman (in press) for comparative U.S. case studies of empowerment.

31/ For parallel case studies on the West, see Nash and Fernández-Kelly 1983; Morgen and Bookman; and di Leonardo. J. Scott (1982) charts important conceptual issues in her historical case study of early Western industrialization.

## Bibliography

Agarwal, Bina. "Women and Technological Change in Agriculture: The Asian and African Experience." In, Iftikhar Ahmed (ed.), Technology and Rural Women: Conceptual and Empirical Issues. London: George Allen and Unwin, 1985.

Ahmed, Iftikhar (ed.). Technology and Rural Women: Conceptual and Empirical Issues. London: George Allen and Unwin, 1985.

Ahooja-Patel, Krishna. "Women, Technology and Development", Economic and Political Weekly (Bombay) XIV (36), 1979.

Ahooja-Patel, Krishna. "Economic and Social Status of Women in Asia Today" INSTRAW Working Paper No. 101. Santo Domingo: UN/INSTRAW, 1986.

Anderson, Mary B. "Technology Transfer: Implications for Women". In Catherine Overholt et. al. (eds.), Gender Roles in Development Projects. West Hartford: Kumarian Press, 1985.

Arizpe, Lourdes and Josefina Aranda. "The 'Comparative Advantages' of Women's Disadvantages; Women Workers in the Strawberry Export Agribusiness in Mexico." SIGNS 7, 1981.

Arnold, Erik, Lynda Birke, and Wendy Faulkner. "Women and Microelectronics: the Case of Word Processors" in Joan Rothschild (ed.), Women, Technology and Innovation. New York: Pergamon Press, 1982.

Barrios de Chungara, Domitila. Let Me Speak! Testimony of Domitila, A Woman of the Bolivian Mines. New York: Monthly Review Press, 1978.

Benería, Lourdes and Gita Sen. "Class and Gender Inequalities and Women's Role in Economic Development -- Theoretical Practical Implications." Feminist Studies, 8:1., 1982

-----, "Accumulation, Reproduction, and Women's Role in Economic Development: Boserup Revisited" in Eleanor Leacock and Helen I. Safa (eds.), Women's Work; Development and the Division of Labour by Gender. South Hadley, MA: Bergin and Garvey, 1986.

Bergom-Larsson, Maria "Women and Technology in the Industrialized Countries" in Pamela M. D'Onofrio-Flores and Sheila M. Pfafflin (eds.), Scientific Technological Change and the Role of Women in Development. Boulder: Westview Press, 1982.

Bleier, Ruth. Science and Gender: A Critique of Biology and Its Theories on Women. New York: Pergamon Press, 1984.

-----, editor. Feminist Approaches to Science. New York: Pergamon Press, 1986.



- Boserup, Ester. Women's Role in Economic Development. New York: St. Martin's Press.
- Boulding, Elise. "Integration into What? Reflections on Development Planning for Women." in Roslyn Dauber and Melinda L. Cain (eds.), Women and Technological Change in Developing Countries. AAAS Selected Symposium 53. Boulder: Westview Press 1981.
- Bourque, Susan C. "Experiments with Equality: Complexities in Peruvian Public Policy," Journal of Asian and African Studies, XX (3-4, July-October); 1985.
- Bourque, Susan C. and Kay B. Warren. Women of the Andes: Patriarchy and Social Change in Rural Peru. Ann Arbor: University of Michigan Press, 1981a.
- ". "Rural Women and Development Planning in Peru". In, Naomi Black and Ann Cottrell (eds.), Women and World Change: Equity Issues in Development. Beverly Hills: Sage, 1981b.
- Bowman, Mary and C. Arnold Anderson. "The Participation of Women in Education in the Third World," Comparative Education Review 24, 2, June, 1980.
- Briscoe, Anne and Sheila Pfafflin (eds.). Expanding the Role of Women in the Sciences. Annals of the New York Academy of Sciences, Vol. 323. 1979.
- Bryceson, Deborah A. Women and Technology in Developing Countries: Technological Change and Women's Capabilities and Bargaining Positions. Santo Domingo: UN/INSTRAW, 1985.
- Buvinic, Mayra. "Women's Issues in Third World Poverty: A Policy Analysis." In, Mayra Buvinic et al. (eds), Women and Poverty in the Third World. Baltimore: Johns Hopkins University Press, pp. 14-31.
- ". "Projects for Women in the Third World; Explaining Their Misbehaviour." Washington, D.C.: ICRW.
- Carr, Marilyn. "Technologies Appropriate for Women: Theory, Practice and Policy" in Roslyn Dauber and Melinda L. Cain (eds.), Women and Technological Change in Developing Countries. AAAS Selected Symposium 53. Boulder: Westview Press, 1981.
- ". Blacksmith, Baker, Roofing-Sheetmaker. London: Intermediate Technology Publications, 1984.
- Susan and Michael Carter. "Women's Recent Progress in the Professions Or Women Get a Ticket to Ride After the Gravy Train Has Left the Station." Feminist Studies 7 (3); 1981.

CEPAL. Five Studies on the Situation of Women in Latin America. Santiago: UN/ECLA, 1983.

Chaney, Elsa M. and Marianne Schmink. "Women and Modernization: Access to Tools" in June C. Nash and Helen Safa (eds.), Sex and Class in Latin America. New York: Praeger, 1976.

Chapkis, Wendy and Cynthia Enloe. Of Common Cloth: Women in the Global Textile Industry. Washington: Transnational Institute, 1983.

Charlton, Sue Ellen. Women in Third World Development. Boulder: Westview Press, 1984

Chodorow, Nancy. The Reproduction of Mothering. Berkeley: University of California Press, 1978.

Conway, Jill. The Female Experience in Eighteenth- and Nineteenth- Century America. New York: Garland, 1982.

Crandon, Libbet. Women, Enterprise and Development. Chestnut Hill, Mass.: The Pathfinder Fund, 1985.

Deere, Carmen Diana and Magdalena León de Leal. Women in Andean Agriculture. Geneva: ILO, 1982.

di Leonardo, Micaela. "Women, High Technology, and Society Conference." International Labor and Working Class History No. 28: 1985.

----- "Clericals, Computers and Culture: Two Discourses in Search of a Subject" in Women's Work and High Technology. Silicon Valley Research Group (n.d.).

Dinnerstein, Dorothy. The Mermaid and the Minotaur. New York: Harper and Row, 1976.

D'Onofrio-Flores, Pamela. "Technology, Economic Development, and the Division of Labor by Sex" in Pamela M. D'Onofrio-Flores and Sheila M. Pfafflin (eds.), Scientific-Technological Change and the Role of Women in Development. Boulder: Westview Press, 1982.

Elson, Diane and Ruth Pierson. "The Subordination of Women and the Internationalisation of Factory Production." in Kate Young et al. (eds.), Of Marriage and the Market; Women's Subordination in International Perspective. London: CSE Books, 1981.

Elliot, Carolyn and Gail P. Kelly. "New Directions for Research." in Gail P. Kelly and Carolyn Elliot (eds.), Women's Education in the Third World: Comparative Perspectives. Albany, New York: SUNY Press, 1982.

Etienne, Mona and Eleanor Leacock (eds.). Women and Colonialization. New York: Praeger, 1980.

Evans, Judith. Improving Program Actions to Meet the Intersecting Needs of Women and Children in Developing Countries: A Consultative Group on Early Childhood Care and Development. High/Scope Educational Research Foundation, 1985.

Fausto-Sterling, Anne. Myths of Gender: Biological Theories About Men and Women. New York: Basic Books, 1985.

Fernández-Kelly, María Patricia. "Gender and Industry on Mexico's New Frontier" in Jan Zimmerman (ed.), The Technological Woman: Interfacing with Tomorrow. Albany, New York: Praeger, 1983a.

----- . For We Are Sold, I and My People: Women and Industry in Mexico's Frontier. Albany, New York: SUNY, 1983b.

----- . "Mexican Border Industrialization, Female Labour Force Participation, and Migration" in June Nash and María Patricia Fernández-Kelly (eds.), Women, Men, and the International Division of Labor. Albany, New York: SUNY, 1983c.

Finn, Jeremy, Janet Reis, and Loretta Dulberg. "Sex Differences in Educational Attainment: The Process." In, Kelly and Elliot (eds.), Women's Education in the Third World. Albany, New York: SUNY Press, 1982.

Fuentes, Annette and Barbara Ehrenreich. Women in the Global Factory. Boston: South End Press, 1983.

Gearhart, Sally M. "An End to Technology: A Modest Proposal" in Joan Rothschild (ed.), Machina Ex Dea. New York: Pergamon Press, 1983.

Gilligan, Carol. In a Different Voice. Cambridge: Cambridge University Press, 1982.

Grossman, Rachael. "Women's Place in the Integrated Circuit" in Changing Role of South-East Asian Women. Joint issue of Southeast Asia Chronicle No. 66 and Pacific Research 9 (5-6), 1978/79.

Hacker, Andrew. "Women and Work," The New York Review of Books, August 14, 1986.

Hall, Diana Long. "Academics, Bluestockings, and Biologists: Women at the University of Chicago, 1892-1932" in Briscoe and Pfafflin (eds.), Expanding the Role of Women in the Sciences. Annals of the New York Academy of Sciences, 1979.

Huntington, Sue Ellen. "Issues in Woman's Role in Economic Development: Critique and Alternatives." Journal of Marriage and the Family, 37(4), 1975.

Jahan, Rounaq. "Participation of Women Scientists and Engineers in Endogenous Research and Development." in Shirley Malcom et al., Science, Technology and Women: A World Perspective. Washington, D.C.: AAAS and Centre for Science and Technology for Development, United Nations, 1985.

Jaquette, Jane and Kathleen Staudt. "Women 'At Risk' Reproducers: Biology, Science, and Population in U.S. Foreign Policy" in Virginia Shapiro (ed.), Women, Biology and Public Policy. Beverly Hills: Sage, 1985.

Katz, Michael. The Irony of Early School Reform: Educational Innovation in Mid-Nineteenth Century Massachusetts. Cambridge, Ma.: Harvard University Press, 1968.

Keller, Evelyn Fox. Reflections on Gender and Science. New Have: Yale University Press, 1985.

Kuhn, Annette and Ann Marie Wolpe (eds.). Feminism and Materialism. London: Routledge and Kegan Paul, 1978.

Lapidus, Gail. Women in Soviet Society. Berkeley: University of California Press, 1978.

Leacock, Eleanor and Helen I. Safa (eds.). Women's Work; Development and the Division of Labour by Gender. South Hadley, MA: Bergin and Garvey, 1986.

Leet, Mildred Robbins. "Roles of Women: UNCSTD Background Discussion Paper" in Roslyn Dauber and Melina L. Cain (eds.), Women and Technological Change in Developing Countries. AAAS Selected Symposium 53. Boulder: Westview Press, 1981.

Leslie, Joanne, Margaret Lycette, and Mayra Buvinic (ICRW). "Weathering Economic Crises: The Crucial Role of Women in Health". Paper prepared for the Second Takemi Symposium on International Health. School of Public Health, Harvard University, 1986.

Lim, Linda Y.C. "Women's Work in Multinational Electronics Factories". In, Roslyn Dauber and Melinda L. Cain (eds.), Women and Technology Change in Developing Countries. AAAS Selected Symposium 53. Boulder: Westview Press, 1981.

-----, "Capitalism, Imperialism, and Patriarchy: The Dilemma of Third-World Women Workers in Multinational Factories" in June Nash and María Patricia Fernández-Kelly (eds.), Women, Men, and the International Division of Labor. Albany, New York: SUNY, 1983.



- . Women Workers in Multinational Enterprises in Developing Countries. Geneva: ILO, 1985.
- MacCormack, Carol and Marilyn Strathern (eds.). Nature, Culture and Gender. Cambridge: Cambridge University Press, 1980.
- Malcom, Shirley. "The Participation of Women in Policy and Decision-Making Regarding the Use and Development of Technologies" in Shirley Malcom et al. (eds.), Science, Technology and Women: A World Perspective. Washington, D.C.: AAAS and Centre for Science and Technology for Development, United Nations, 1985.
- . et al, editors. Science, Technology and Women: A World Perspective. Washington, D.C.: American Association for the Advancement of Science and Centre for Science and Technology for Development, United Nations, 1985.
- Mattelart, Armand. Transnationals and the Third World; The Struggle for Culture. South Hadley, Mass.: Bergin and Garvey, 1983.
- Morgen, Sandra and Ann Bookman (eds.). Women and the Politics of Empowerment; Perspectives from Workplaces and Communities. Philadelphia: Temple University Press. (In press).
- Namboze, Josephine. "Participation of Women in Education and Communications in the Fields of Science and Technology: A National Perspective", in Shirley Malcom et al. (eds.), Science, Technology and Women: A World Perspective. Washington, D.C.: AAAS and Centre for Science and Technology for Development, United Nations, 1985.
- Nash, June. "The Impact of the Changing International Division of Labour on Different Sectors of the Labour Force" in June Nash and María Patricia Fernández-Kelly (eds.), Women, Men, and the International Division of Labour. Albany, New York: SUNY, 1983.
- and María Patricia Fernández-Kelly (eds.). Women, Men, and the International Division of Labor. Albany, New York: SUNY, 1983.
- and Helen Safa (eds.). Women and Change in Latin America. South Hadley, MA: Bergin and Garvey, 1985.
- Ortner, Sherry B. and Harriet Whitehead (eds.). Sexual Meanings: The Cultural Construction of Gender and Sexuality. Cambridge: Cambridge University Press, 1981.
- Reiter, Rayna (ed.). Toward an Anthropology of Women. New York: Monthly Review Press, 1975.
- Rogers, Barbara. The Domestication of Women: Discrimination in Developing Societies. New York: St. Martin's Press, 1980.

Rudolph, Hedwig. "Educating Women for the Engineering Profession". Paper presented at the International Conference on Gender, Education and Technology, Rockefeller Center, Bellagio, Italy, October 7-11, 1985.

Salaff, Janet. Working Daughters of Hong Kong: Filial Piety or Power in the Family? New York: Cambridge University Press, 1981.

Schwartz, Vanessa. "Gender and Technology: Women, the International Division of Labour, and High-Tech Production. A Selected and Annotated Bibliography". Princeton University Program in Women's Studies Bibliography No. 3, 1985

Scott, Hilda. Does Socialism Liberate Women? Boston: Beacon Press, 1974.

----- Working Your Way to the Bottom: The Feminization of Poverty. Boston: Pandora Press, 1984.

Scott, Joan. "The Mechanization of Women's Work". Scientific American, July, 1982

Sen, Amartya. "Women, Technology and Sexual Divisions". Santo Domingo: UN/INSTRAW, 1984.

Sen, Gita and Caren Grown. Development, Crisis, and Alternative Visions: Third World Women's Perspectives. DAWN (Development Alternatives for Women for a New Era). Norway: A.S. Verbum, 1985.

Smock, Audrey. Women's Education in Developing Countries. New York: Praeger, 1981.

Srinivasan, Mangalam. "The Impact of Science and Technology and the Role of Women in Science in Mexico" in Pamela M. D'Onofrio-Flores and Sheila M. Pfafflin (eds.), Scientific-Technological Change and the Role of Women in Development. Boulder: Westview Press, 1982.

----- Technology Assessment and Development. New York: Praeger, 1982.

Stewart, Frances. Technology and Underdevelopment. New York: Macmillan, 1977.

Stolcke, Verena. "Women's Labours: The Naturalisation of Social Inequality and Women's Subordination" in Kate Young et al. (eds.), Of Marriage and the Market; Women's Subordination in International Perspective. London: CSE Books, 1981.

Stromquist, Nelly. "Empowering Women through Knowledge: Politics and Practices in International Cooperation in Basic Education." (Manuscript submitted to UNICEF, 1985).

Tadesse, Zenebeworke. "Women and Technology in Peripheral Countries: An Overview" in Pamela M. D'Onofrio-Flores and Sheila M. Pfafflin (eds.), Scientific-Technological Change and the Role of Women in Development. Boulder: Westview Press, 1982.

Tinker, Irene. "New Technologies for Food-Related Activities: An Equity Strategy" in Roslyn Dauber and Melinda L. Cain (eds.), Women and Technological Change in Developing Countries. AAAS Selected Symposium 53. Boulder: Westview Press, 1981.

Warren, Kay B. "Capitalist Expansion and the Moral Order: Anthropological Perspectives" in David Krueger and Bruce Gruelle (eds.) Christianity and Capitalism: Perspectives on Religion, Liberalism and the Economy. Chicago: Center for the Scientific Study of Religion, 1986.

----- and Susan C. Bourque. "Gender, Power, and Communication: Women's Responses to Political Muting in the Andes" in Susan C. Bourque and Donna Robinson Divine (eds.), Women Living Change. Philadelphia: Temple University Press, 1985.

----- "Gender, Technology, and International Development: Appraising Feminist Frameworks." (n.d.).

Whitehead, Ann. "Effects of Technological Change on Rural Women: A Review of Analysis and Concepts" in Iftikhar Ahmed (ed.) Technology and Rural Women: Conceptual and Empirical Issues. London: George Allen and Unwin, 1985.

Young, Kate, Carol Wolkowitz, and Roslyn McCullagh (eds.). Of Marriage and the Market; Women's Subordination in International Perspective. London: CSE Books, 1981.

Zimmerman, Jan. "Technology and the Future of Women: Haven't We Met Somewhere Before?" in Joan Rothschild (ed.), Women, Technology and Innovation. New York: Pergamon Press, 1982.

## ANNEX

### I. UN DOCUMENT: RESOLUTION ON WOMEN, SCIENCE AND TECHNOLOGY

#### The United Nations Conference on Science and Technology for Development

Mindful that the United Nations Decade for Women was proclaimed in order to draw attention to the problems faced by women in their daily lives and to stimulate recognition at the national and international levels of the loss experienced where women, accounting for half of the world's adult population, are not given equal opportunity to contribute fully to national development.

Recalling General Assembly resolutions 3342 (XXIX) of 17 December 1974 and 3524 (XXX) of 15 December 1975 on the integration of women in development, in which the Assembly urged Governments to give sustained attention to the integration of women in the planning, formulation, design and implementation of development projects and programmes, as well as Assembly resolution 33/184 of 29 January 1979 on the importance of the improvement of the status and role of women in education and the economic and social fields for the achievement of the equality of women with men,

Recalling the relevant proposals of the World Plan of Action for the Implementation of the Objectives of the International Women's Year adopted at the Conference of the International Women's Year held in Mexico City,<sup>1/</sup> the World Population Plan of Action<sup>2/</sup> and the World Food Conference,<sup>3/</sup> as well as the World Conference on Agrarian Reform and Rural Development<sup>4/</sup> on the integration of women in development,

Noting the importance accorded to the integration of women in development by the Governing Council of the United Nations Development Programme at its nineteenth session and by the Industrial Development Board of the United Nations Industrial Development Organization at its ninth session,

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- 1/ See Report of the World Conference of the International Women's Year (United Nations publication, Sales No. E.76.IV.1).  
2/ See E/CONF. 60/19.  
3/ See E/CONF. 65/20.  
4/ A/34/485.



Mindful that the Training and Research Centre for Women of the Economic Commission for Africa, the Economic and Social Commission for Asia and the Pacific, the United Nations Conference on Trade and Development, the United Nations Children's Fund, the International Labour Organisation, the United Nations Development Programme, the Food and Agriculture Organization of the United Nations, the United Nations Educational, Scientific and Cultural Organization and the World Bank have planned activities and studies concerning technological development in order to enhance women's contribution to economic life,

Recalling Economic and Social Council resolution 1987/34 of 5 May 1978 on women in development and the international conferences, in which the Council urged all Governments to ensure that the topic of women and development be included within the substantive discussions of international conferences, including the United Nations Conference on Science and Technology for Development,

Recognizing the importance of the present quantity and quality of the contribution of women, and its potential value where fully and appropriately utilized and developed, for the well-being and wealth of their families and societies as a whole,

1. Invites Member States to facilitate:

(a) The equal distribution of the benefits of scientific and technological development and its application to men and women in society;

(b) The participation of women in the decision-making process related to science and technology, including planning and setting priorities for research and development and in the choice, acquisition, adaptation, innovation, and application of science and technology for development;

(c) The equal access for women and men to scientific and technological training and to the respective professional careers;

2. Recommends that all organs, organizations and other bodies of the United Nations system related to science and technology should:

(a) Continually review the impact of their programmes and activities on women;

(b) Promote the full participation of women in the planning and implementation of their programmes;

3. Invites the proposed Intergovernmental Committee on Science and Technology for Development:

- (a) To give due regard to the perspectives and interests of women in all its recommendations, programmes and actions;
- (b) To include in its annual reports a review on the progress made concerning the implementation of the tenets of the present resolution;

4. Recommends to the forthcoming World Conference of the United Nations Decade for Women: Equality, Development and Peace, to be held in 1980, to give due consideration to the relationships between women, science, technology and development.

16th plenary meeting  
31 August 1979

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