THE CHANGING ROLE OF WOMEN IN AGRICULTURAL PRODUCTION: AN INDONESIAN CASE STUDY

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ABSTRACT

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This study explores the impact of technological change on the agricultural work patterns of rural women in Indonesia. Data initially collected by Sudardja Adiwikarta in three West Java villages were analyzed as an illustrative case.

Prior to the introduction of modern irrigation, the villages represented three different techniques of water use for growing rice: rainfed, flooding, and a local system of irrigation. Retrospective data from male heads of households revealed shifts in the division of labor, and differential socioeconomic impacts. Upper status women are withdrawing from agriculture; lower and middle status women are experiencing increased workloads.

Even with an initial increase in farm work demands on women, the new technology does not appear to have stimulated more skilled work opportunities for women. Over time, poorer households may not be better off: shifts in the division of labor may eventually narrow the range of jobs available to women in rice production.

To my mother, MARIE VITIMA DAWSON
(1919-1985),
who did not see this
work completed,

and,

To my father, HERMAN L. DAWSON, SR.,
who has always encouraged
me, and been an inspiration
in my life

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CHAPTER I

INTRODUCTION

Over the past two decades a considerable amount of literature has been generated on the rapid agricultural transformations taking place in many developing countries, and specifically on the effects of these changes on women's work roles (Boserup, 1970; Timmer, 1973; Tinker, 1976; Rogers, 1980; Dixon, 1982). The shift to newer forms of technology has been known to cause some disruption in the division of labor and the complementarity of the roles of men and women (Stoler, 1977; Staudt, 1978; Cain, 1981). Many times during the process of planned change, there is a tendency toward overlooking women and thereby preventing them from not only benefitting fully from the new technology, but often too of preventing them from contributing fully to the family enterprises. The intensification of cultivation techniques through the introduction of irrigation technology has also been known to alter the traditional division of labor (Sharma, 1980; Dey, 1981; Barnard, 1983; Stanbury, 1984).

My research focuses on the Indonesian situation. It aims to explore and provide information on changes and/or contradictions in the roles of women in three

rural agricultural villages in West Java following the introduction of a modern irrigation system and new rice technology. I want to bring into sharper focus some of the critical problems associated with agricultural modernization and suggest issues for further research. Some of the broader issues will be taken-up through more general discussion of the evidence from available literature relating both to Indonesia and other parts of Asia and the developing world.

In Chapter 2, which follows, I will present an overview of the dominant development perspectives as they pertain to rural women, and consider the formulation of an appropriate framework for studying these changing situations. My review of the literature on the role of women in agriculture in Third World countries will pay particular attention to how the introduction of new techniques has affected rural women's work.

Chapter 3 explores case study data from a complete rice cycle. Part one of this section provides an overview of West Java, and describes the three study villages and the role of women in traditional rice production. Part two will attempt to determine what actually happened to rural women in the three villages following the innovations.

Concluding remarks and suggestions for further research that should be considered in formulating future rural development policies and programs of agricultural modernization are presented in Chapter 4.

By examining in some detail a specific case, my research will attempt to determine:

- what technology has been introduced, and how women's work and participation have been impacted?
- are women of all socioeconomic levels effected equally by these new technologies?
- are there new roles for rural women as new technologies are introduced?

Research Approach

For purposes of my exploratory analysis, I will use data initially collected in 1981 by Sudardja Adiwikarta (1982) to explore the social impacts of the Jatiluhur Irrigation Project on farm family work patterns in three villages in West Java, Indonesia. The Jatiluhur Project was designed for a number of purposes, but one of its main contributions was to stimulate the rapid modernization of agriculture and specifically to enhance rice production in the region.

The three villages are located on the Northern Coastal Plain of West Java in the Subang Regency of Indonesia. They were chosen because prior to Jatiluhur

they represented three different techniques of water use for growing rice. Betok had relied on rain, while Kalencabang used a flooding technique to provide water for the rice paddies. Both of these villages produced one rice crop annually. Kamalsari, on the other hand, enjoyed a local system of irrigation and had been double cropping long before the modern Jatiluhur system was constructed.

Applying national standards, all households in the three villages were grouped into three socioeconomic categories according to the average amount of riceland owned per household member. On the basis of this criterion, which assessed the balance between household needs and land resources, Adiwikarta found that 8 percent of the households had more land than necessary for their minimal subsistence, 22 percent had enough land and 70 percent were land poor. From these groupings, a random sample of 162 households (54 from each village) were selected by Adiwikarta for his study. The sample was stratified to include 30 "more land", 66 "enough land" and 66 "less land" households. A retrospective inquiry approach was utilized to obtain information on patterns of work and the system of farming at two points in time --- before the Jatiluhur project and after. The survey population was defined as

heads of households who had been self-employed farmers in these three villages since 1968.

Information collected in the three selected villages in West Java will be used here for illustrative purposes, and to explore some of the impacts of agricultural modernization on the labor force participation of women.

CHAPTER II

2. WOMEN IN AGRICULTURE IN DEVELOPING COUNTRIES

Throughout the Third World, technological transformations are taking place which affect the lives and work patterns of the rural population. Many of the changes underway in Indonesia relate to issues raised in the literature by a number of social scientist and researchers about the effects of agricultural modernization in rural areas, and specifically concerning the impact of this technology on women's work (Boserup, 1970; Timmer, 1973; Rogers, 1980). It has been noted that many of the recent studies of social change are guided by theories of development originally formulated following World War II (Wilson, 1985). An understanding of these and other approaches will provide useful insights on some of the consequences for rural women.

To begin with, I will overview some of the dominant perspectives in development theory as they relate to rural women. Drawing on the "women in development literature", I will attempt to highlight some of the barriers that prevent women from participating fully when new technology is introduced.

Empirical studies will be used to document the changing conditions of women under the impact of modern technology diffusion.

2.1 WOMEN AND DEVELOPMENT

Following World War II, strategies of development were based on a Western model of growth which perceived social change as a "linear movement from backwardness to modernity." This approach focused on technical solutions for development. A common belief of the advocates of this model was that if you introduced enough technology and removed the obstacles to economic growth (seen in terms of attitudes, beliefs and basic personality characteristics), backward societies would begin to grow (Heyzer, 1986). It should be noted that sectoral participation of people in work, which would lead to considering women's activities, was not differentiated by the early development strategies. Besides, it was assumed that women would benefit from new technology through the "trickle-down" effect (1).

The classical Marxist approach to social change emphasized class analysis and raised questions about the

1. Trickle-down: A theory of development that assumes that economic growth and prosperity in one sector or in one class will spread gradually to all other areas (Simon Smith Kuznets, Towards a Theory of Economic Growth (New York: Norton, 1968).

differentiation of the peasantry. According to Jaquette (1982), the primary assumption of this model was that the issue of women's role should be subsumed under the general critique of capitalism.

Drawing on Marxist concepts, Latin American scholars formulated a model of development based on systemic linkages between the advanced and developing countries. Frank (1966) proposed a model of underdevelopment based on dependency. This school of thought maintains that during the colonial period, the underdeveloped countries were integrated into the world economic system under terms highly favorable to the industrialized center. According to proponents of this model, the cause of underdevelopment was external to the developing society and was created and perpetuated by the expansion of capitalism. The issue of gender was left out entirely (Flora, 1982). According to Jaquette, (1982) the marginalization of women became an example of the marginalization of the periphery. Besides, as Cebotarev (1982) noted, the assumption was that women would automatically take on the class position and interest of their spouses.

The absence of specific concern for women in the earlier development perspectives is clear. Although women account for 40 to 80 percent of the Third World's

agricultural labor, women's productive role in these economies have been virtually ignored by researchers and policy makers (Cain, 1981). Besides, as noted by Tiano (1981), the assumption apparently was that the efforts of development and underdevelopment would be the same for all segments of society.

Ester Boserup's seminal work (1970), challenged the traditional development theories. Boserup focused attention on women's contribution to economic development, and the effects of development on their work. She also drew attention to the cross-cultural diversity in the division of labor by sex in agricultural production. Her comparative study of rural women in developing countries emphasized a number of topics systematically related to the role of women in the economy. Her analysis paid careful attention to such factors as changes in land tenure, type of cultivation, technology, employment, and outside intervention in local processes in bringing about change in men's and women's participation in agricultural production. Also addressed were issues such as the correlations between women's work and factors such as population density and landholdings, the effects of colonialism on women, and the omission of subsistence

activities performed by women in the statistics of production and income in developing nations.

The scholarly work of Boserup generated a considerable portion of the empirical and theoretical work that followed. In an attempt to formulate an appropriate model for studying rural women in agriculture, researchers and social scientists have revised, expanded, and modified the earlier modernization and dependency assumptions and focused on the uneven costs and benefits of social and cultural changes on different groups within a region. Other researchers have examined issues such as the impact of national dependency on women and the impact of colonialism on their position. Recently, female scholars in Latin America are developing theoretical frameworks for viewing the sexual division of labor under changing modes of production. They have also expanded the definition of crop production and are systematically attempting to describe and analyze the role and status of women within the larger social, political and economic structure (Deere and Leon de Leal, 1981). Research is also being conducted to develop an appropriate framework for studying women and technological change (Dauber and Cain, 1981; D'Onofrio-Flores and Pfafflin, 1982; Whitehead, 1985).

As a result of the research being carried out on rural women, attention is being directed to questions previously ignored that take account of women's lives and interests along with those of men (Heyzer, 1986).

It is not my intention to provide an exhaustive review of the women in development literature. However, a precursory examination of the perspectives guiding research in the field of social change is relevant to an understanding of the effects on rural women. It also provides meaningful insights to the intellectual transformations taking place in the literature which are creating new knowledge that focuses on women in their own right. A number of the issues raised in the women in development literature will be taken up in the Indonesian case study. In the next section, I will explore some of the constraints which prevent women from participating fully in the development process.

2.2 BARRIERS TO WOMEN'S PARTICIPATION IN AGRICULTURAL DEVELOPMENT

It has been noted that historical processes have played an important role in defining women's role in subsistence agriculture. Boserup (1970) and Tinker (1976) analyze the erosion of the role played by women in subsistence economies from a historical perspective,

demonstrating that women's deteriorating position in rural economies began under colonial rule.

Ward (1984, 1986) points out that during periods of classical economic dependence, and when women were subsistence agricultural providers, men received greater preference for cash or commodity crops introduced by colonial officials. The redistribution of land also benefitted men, and women often lost their rights to land (Hahn, 1984). These reforms, Boserup explains, were based on the European belief that cultivation was properly men's work. Boserup (1970), Staudt (1978) and Dey (1981) argue that modern technology and cash crops benefitted men rather than women by creating productivity gaps between them. Women were relegated to the subsistence sector of food production using traditional methods of cultivation. Where training for rural women was offered, the homemaker and domestic roles received priority.

This invisibility of women's contribution in agricultural production has been cited as one of the leading causes of the underestimation of women's role and involvement in agriculture. Palmer (1977) maintains that discussions of employment effects of agricultural modernization took place mainly in terms of male

employment because female labor in the crop cycle was invisible.

Boserup (1970), Rogers (1980), Papanek (1982), and others have noted that the prevailing stereotyping embedded in data collection methods often gives credit to male heads of households, while the work is actually done by women and other household members.

Safilios-Rothchild (1981) notes that many studies yield no information on the important role played by women in modernizing agriculture because data collected on labor and household income are not disaggregated by age and sex. Census data, as well as those collected by international agencies and organizations, consistently underestimate women as agricultural laborers when they contribute their labor as unpaid family labor (Rogers, 1980; Safilios-Rothchild, 1981). According to Dixon (1982), female unpaid family helpers in agriculture are systematically excluded, resulting in a consistent undercount of the agricultural labor force, and an underestimation of the proportion female. She continues by pointing out that not only has domestic labor been excluded from census and national accounts, such as the gross national product, but even women's work in the fields has eluded the collectors of rural labor force statistics.

It has also been noted that definitions of economic activity in agriculture used by most censuses consistently underestimate the percentage of the female population active in agriculture (Palmer, 1977; Safilios-Rothchild, 1981; Deere, 1982). In line with this observation, Irene Tinker (1976) argues that there is a continued perception of a dichotomy between the modern and the traditional sectors. Work is performed for money and work is located in the modern sector. Similarly, Beneria (1982) points out that covering only measurable commoditized activity in the definition of economic activity is a reflection of Western economic models, where most economic work is translated into monetary terms.

This point was made concrete by Rogers (1980) when she stated "women who are not paid for their work are defined as non-productive". Therefore, only those activities in the modern monetary sector are reflected in statistical counts. Furthermore, women's work was regarded as economically insignificant in relation to the total income and budget of families.

Dixon (1982) acknowledges that the collection of labor force statistics are a problem in most countries, but women in farm work are disproportionately under-counted in most population census.

The foregoing discussion indicates quite clearly that the roles of rural women in agriculture have been undergoing change for many decades. In the next section, I will examine more closely recent evidence from empirical studies which demonstrate the effects of the modernization of agriculture on the work patterns of rural women.

2.3 WOMEN AND NEW TECHNOLOGY

The point has often been made that the introduction of modernized methods into agriculture causes women to lose existing employment (Tinker, 1981; Staudt, 1978; Boserup, 1970). Boserup (1970) hypothesized that "as agriculture becomes less dependent upon human muscular power, the difference in labor productivity between the two sexes might be expected to narrow". She concluded, however, that this does not happen because it is usually the men who learn to apply modern methods in the cultivation of cash crops, while the women continue to cultivate food crops utilizing traditional methods.

Manderson (1983) and O'Brien (1983) have noted that agricultural development programs in Malaysia are directed primarily at males, a situation not uncommon elsewhere in the developing world (Palmer, 1977; Rogers,

1980). Similarly, Staudt's (1978) findings in East Africa document how the government perpetuates this situation by systematically chanelling agricultural resources that benefit men at the expense of women.

The impact of new technologies on the labor force participation of women has varied according to the type of technology introduced. Agarwal (1984, 1985) distinguishes between biochemical technology in the form of high yielding variety seeds and chemical fertilizers with an assured water supply, and mechanized equipment, such as tractors, combine harvesters, and threshers. She points out that these two components need to be separated because their effects on labor use are often contradictory. The former is generally associated with an increase in the demand for labor time, and the latter with a decrease. However, the evidence indicates that the effects for women have been varied.

Agarwal (1985) provides an example from her research in India. Her findings demonstrated an increased demand for labor with the introduction of the HYV-irrigation package for both men and women in transplanting, weeding, and harvesting. However, there was a decrease in the use of hired labor in ploughing, including threshing and transportation. According to Agarwal, it is these very operations that, in a number

of areas, have been mechanized through the use of tractors and threshers. This suggests, therefore, that the decline in overall terms, for all operations taken together, is likely to be due largely to such mechanization, even though mechanization did not imply a decrease in women's workload.

Barnard (1981) notes that the increasing capitalization of agriculture has limited the number of female workers. McCarthy (1985), commenting on the situation in Bangladesh, reported that when rice milling technology was introduced, it represented a serious reduction in the availability of employment for rural women and a commensurate reduction in their income.

Cain (1981) provides similar evidence from Indonesia, and documents the effect of mechanized rice hullers on work traditionally performed by women. According to Timmer (1973) and Collier (1973), estimates of job loss ranged as high as 1.2 million in Java alone, and as high as 7.7 million in all of Indonesia. It was noted that women not only lost a lucrative source of income, but no alternative sources of income or training were provided for the displaced workers.

Palmer (1977) points out that when mechanization is introduced, many times female tasks become male

tasks. Rice milling employing male labor in Sri Lanka, South India, Bangladesh and Java, are decreasing opportunities for landless women.

The introduction of new irrigation schemes have been reported to have wide ranging effects on women's labor force participation. Sharma (1980) observed that in Punjab, India, increased prosperity since the Green Revolution has been marked by a withdrawal of upper class women from production. A similar tendency was noted in Malaysia (Barnard, 1983) where upper income women now concentrate on work in the home, which is a role highly valued in Malay rural society.

According to Epstein's (1962) research in India women achieved greater independence with irrigation through increased income from livestock raising.

Stanbury (1984) reports that following the introduction of irrigation in North India, the changes varied by class. Agricultural work increased for women from landed families during the harvesting season mainly as a result of cropping intensity. On the other hand, women from landless households were provided with a source of cash income. Prior to irrigation little agricultural wage work was available. Thus irrigation brought about both a demand for, and tapped into, a reserve of female laborers. Stanbury noted that

landless female workers made up a relatively small percentage of hired agricultural wage laborers. She surmised that this may have been due to land owners' preference for male laborers, and also the prestige of not working outside the home also appears to have entered into the relationships. She found that harvesting wage work has reinforced class distinctions between land owners and landless.

It has been noted that women's work load increases with the introduction of new technology. Ingrid Palmer (1977) notes that the modernization of agriculture has meant more hours worked in the fields by women. Referring specifically to Africa, Palmer points out that a common factor leading to longer hours for women is that where modernization involves both additional labor intensive work and high productivity work, women usually find they are left with the former. She argues that since women are allocated the labor intensive, poorly paid or totally unremunerated work, they become "marginalized" (or pushed out) to the periphery of the modernized sector.

Bukh (1979) demonstrates in a study in Ghana how the concentration of men in commercial crops and male migration to urban areas in search of work forced women to take up additional tasks in subsistence agricultural production, lengthening and intensifying their work day.

Spencer (1976), reporting on a study conducted in Sierra Leone, shows that modernization brought a change from roughly equal field work for both men and women to longer hours for both, but disporportionately more for men. However, as Palmer (1977) points out, if household tasks and childcare had been included, the results would have shown that women worked longer hours. Similar findings of women working longer hours was also reported by Mukhopadhyay (1987).

Hanger and Moris (1973) document the increased workload for women in the Mwea Irrigation Settlement project in Kenya. This project was designed to raise household income through cultivation of rice, both as a cash crop and a food crop. Women had their own plots and were responsible primarily for the cultivation of food crops. They also worked on the plots of their husbands. Prior to the Mwea project, the womens' plots had been sufficient for subsistence and at times even for producing a surplus for sale. Women's workload increased because the men would not consume the new rice varieties and the women had to continue growing the traditional foodstuffs. Additionally, when labor was hired by men, the laborers worked only on the men's fields, while meals had to be cooked for the workers by the women.

With irrigation and high yielding variety seeds, two crops can be harvested from the same field in one year. Although fertilizer application is a male task, additional weeding of fertilized crops by women and children becomes necessary, thereby increasing their workload. One might ask, does this increase in women's work load result in significant changes in economic rewards? The literature describing different forms of work patterns provide an answer.

Rapid population increases combined with technological innovations in agriculture have lead to radical changes in the traditional harvesting system which affect predominantely female labor. In Java, traditionally farmers exchanged family labor on the basis of reciprocity. This meant that all community members could participate in rice harvesting and receive a share of the harvest. However, as noted by Stoler (1977) in order to cut harvesting costs and escape traditional obligations, farmers have replaced this system. Under the new system the prospect for work is confined to a small group of men who are hired by middlemen and paid in cash (Collier, 1973; Palmer, 1977; Kikuchi, et al., 1980; White, 1981).

Similar findings have been reported in Thailand (Hara, 1981) and the Philippines (Kikuchi, 1981). This mutual exchange of labor involved predominantly female

members of households as the tasks performed were traditionally female activities.

Contractual arrangements in hiring practices which operate to reduce and/or eliminate female labor, as well as the wages paid, have been reported by Husken (1979), Kikuchi (1981), and Whythe and Whythe (1982). Under this system, payment to labor for weeding and harvesting (predominantely female) is now tied to other tasks. Only those who do weeding can participate in harvesting and thereby gain a right to a share of the harvest (which becomes a joint payment for both tasks). In effect, the laborers employed receive no payment for the additional tasks. In addition, there is also a restriction placed on the number who can get such employment.

The Indonesian and Malaysian literature provide similar evidence of payment for transplanting and harvesting (female labor) being tied in the post irrigation/high yielding variety period.

I would be remiss to conclude this chapter without considering the impact of internal factors which contribute to changes in the role and status of women as indicated in the following discussion. Some of these factors are tied to the social organization existing in the countries.

Safilios-Rothchild (1981, 1985) and others emphasize sex stratification and sexual inequality as factors which contribute to the changing role of women in agriculture. She argues that men and women do not benefit equally because "women lack access to land ownership, credit and agricultural information within the context of an unusually all male agricultural extension service". She notes that women's position deteriorates because rural development schemes, which benefit men by increasing their agricultural income, increase sexual inequalities by eliminating employment opportunities for women.

Hull's (1982) study of women in Java's rural middle class demonstrated the importance of class differences in understanding women's employment patterns and decision-making within the household. In her comparison of middle and lower class women, she demonstrates how differences in class are important variables in understanding women's status, even in a rural context where it is generally assumed that women form a homogeneous undifferentiated group.

Stoler (1977) illustrates the importance of class, as defined by the amount of land owned in her research in Kali Loro, Indonesia. She found that women in landless households harvest for the greatest number

of woman days, but receive the lowest returns to labor. On the other hand, women from large landholding families receive the highest average returns to labor and harvest the least number of woman days. Stoler explains that women from landless households have nothing to exchange but their labor, and they can only earn the right to harvest by obligating themselves to a patron household. Women from large landholdings are self-sufficient in rice and have various options available to them to acquire income.

Deere and Leon de Leal (1981) found in their research in three Andean regions of Latin America that there was considerable variation in women's productive roles in agriculture according to the social class of the household and the level of capitalist development.

Similarly, Deere (1982) found in Cajamarca, Peru that there was a significant difference in the agricultural division of labor by the socio-economic class of the household. Her data revealed that in poorer households, women's participation in agriculture was greater. Gibbons (1980) also reported comparable findings.

Beneria and Sen (1981) attribute the changing role of women to the process of capital accumulation which results from the innerweaving of class and gender relations. They argue that class differentiation, which

accompanies the capitalist transformation of a region, simply provides a new basis for differentiation between women.

Stoler (1977) found when analyzing the impact of agricultural change on labor force participation of Javanese women in Indonesia, that for the poorer majority of village society, both men and women suffer as more and more land is concentrated in the hands of the wealthier households. However, the decline in female employment opportunities is more heavily observable. Similarly, Beneria and Sen (1981) concur that agricultural modernization obeys the dictates of capitalist accumulation and profit making. They point out that it is a system 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 gender.

Finally, various scholars have cited the introduction of technology as a causal factor in women's changing role in agricutural production (Boserup, 1970; Staudt, 1978; Tinker, 1981). They point out that economic productivity has an important effect on the position of women within a society. According to Mattiasson (1974), in societies in which the main economic unit of production is the household, the

amount of productive work contributed by the wife is a significant factor in determining her position relative to men in peasant villages. She contends that male dominance is strong where there is little female participation in agriculture, and when agriculture is the primary economic activity. Therefore, as women lose their productive role in agriculture and their ability to contribute to the household economy, their economic value is reduced.

2.4 GENERAL PERSPECTIVE

This overview of the dominant approaches to social change reflected in the literature, reveals in particular the absence of gender analysis and the lack of regard for women's contributions to economic development in the earlier frameworks. The review also indicates that women's labor force participation, especially in predominantly agricultural areas, is often underestimated and overlooked. This omission, which is reflected in policies and attitudes regarding women's proper place, continues to influence options available to many rural women today.

The studies cited demonstrate the impact of new agricultural technologies on women's work in many developing countries. Some researchers have stressed

the negative effects on women, and raised issues regarding women's loss of traditional employment, their withdrawal from agriculture, the intensification of their work, as well as the channeling of modern technology to men only.

Similarly, it is repeatedly observed that men take over responsibility for women's tasks as soon as those tasks are mechanized, and that there is a consequent decline in women's productivity. Other writers have emphasized particularly that agricultural modernization does not affect all sectors of a society equally, and that for some sectors the effects of the process have been less than favorable. On the other hand, some authors suggest that women have benefitted from new technology and gained a source of income and/or leisure time.

The literature reviewed demonstrates some of the contradictory effects of agricultural modernization. The studies cited support the notion that development is a complex and varied process whose effect on women's labor is mediated by a number of factors. Nonetheless, since women form a major segment of groups that are most vulnerable to labor displacement and cost reducing practices, greater attention should be focused on gender analysis, for it has been shown that in some cases,

women lose economic opportunities when capital intensive methods are introduced.

In Indonesia, and in particular Java, the most populous of the Indonesian islands, many observers have noted that the position of women is viewed as being relatively equal to that of men in the household, and similarly in the society at large (Vreede de Stuers, 1960; Geertz, 1961). In addition, the contribution of women to the household economy is recognized in the adat (customary) law, and all goods acquired by a couple after marriage are considered joint property (Geertz, 1961).

At present, the agricultural sector of Indonesia is undergoing major changes, which implies a significant restructuring of women's roles. Will the introduction of new technology in agriculture (the leading occupation of the majority of rural women) change the position of women? In this highly stratified society, the division of labor is fairly well defined along sexual lines (Stoler, 1977). Changes in agricultural technology may affect the traditional role of women and the division of labor. The transformations may also affect women differently than men.

My review of the literature suggests a number of areas to which an analysis of the impact of agricultural

technology on women's work and employment should focus. The introduction of high yielding varieties of rice immediately following the completion of the Jatiluhur Irrigation system, and the technology that accompanied it, provides a good case study for exploring more closely some of the issues raised.

In the next chapter, I will examine some of the queries related to the changing work patterns of rural women in agriculture in three villages in West Java. Will women in these villages be displaced by modern technology? Will irrigation make women's work easier or does it increase their work load? Will men take over activities traditionally performed by women? Do women of all socioeconomic levels benefit equally from the introduction of modern irrigation systems?

CHAPTER III

3. CASE STUDY: WOMEN AND THE MODERNIZATION OF RICE PRODUCTION IN THREE VILLAGES

Some of the transformations taking place in women's work patterns, and that have been associated with new technology, were highlighted in the previous chapter. Attention is now focused on a specific case study. I will begin with a brief overview of West Java in order to place this case study in context. Then I will describe the villages, and specify the division of labor in traditional rice production. Finally, I will attempt to determine changes in the work patterns of rural women by exploring (i) the technology introduced and the impact on women in these villages, (ii) the differential impacts associated with household socioeconomic status, and (iii) perceptions of male heads of households about the changing work roles of women.

3.1 OVERVIEW OF WEST JAVA

Indonesia, with a population of 158 million inhabitants (1983), is spread over nearly 3,000 miles along the equator in Southeast Asia (World Bank, 1985). It is a predominantly Muslim country with over 300

ethnic groups (Birowo and Hansen, 1981). The Northern Coastal Plain of West Java has been known for hundreds of years as a rice producing area (Soedjatmiko, 1981). With a population density of 690 persons per square kilometer, Java is the most densely populated island in the world (Rose, 1982). It covers only 6 percent of Indonesia's total land area (about the size of New York State), but contains two-thirds of the country's total population (Cain, 1981).

Java has been referred to as the bread basket of Indonesia, and assumes a dominant role in accounting for a very high proportion of the country's total agricultural production (Rose, 1982). Nearly eighty percent of the population live in rural areas (World Bank, 1985), and 31 million persons or 61 percent of the total labor force is directly employed by agriculture (Rose, 1982).

The structure of agriculture in Java is characterized by small scale producers. Landholdings tend to be of limited scale. Birowo and Hansen (1981) report that 58 percent of Java's landholders have less than 0.5 hectares (2.39 acres), and 40 to 60 percent of the households are landless or near landless. Thus, a sizeable proportion of Java's rural households have little or no access to agricultural land, and many

families must seek employment in a diverse range of income producing activities. This great shortage of land has given rise to a considerable degree of rural underemployment, and the standard of living in the crowded villages is very low.

Rural women in Indonesia play a dominant role in agricultural production. In 1980, of the total 73.8 million women recorded, 57.4 million lived in rural areas, and 70 percent of them were engaged in agriculture (Republic of Indonesia, 1986). Over the last two decades, the agricultural sector in rural Java has undergone considerable transformation. The expanded diffusion of modern agricultural technology has resulted in rapid improvements in productivity, but at the same time it has been reported to affect employment opportunities for women. Stoler (1977) in her analysis of women's economic activities in Java found that women in landless and near landless households earn one-third of the household's total income, and that these families are dependent on women's earnings. Therefore, if women are deprived of their income earning opportunities, this has serious implications for the survival of the family.

In the following section, I will explore several innovations introduced by the Jatiluhur Irrigation scheme and try to assess how women's work in the three

villages was affected. Before proceeding, however, a description of the villages and the role of women in traditional rice cultivation is necessary.

3.2 CHARACTERISTICS OF VILLAGES STUDIED

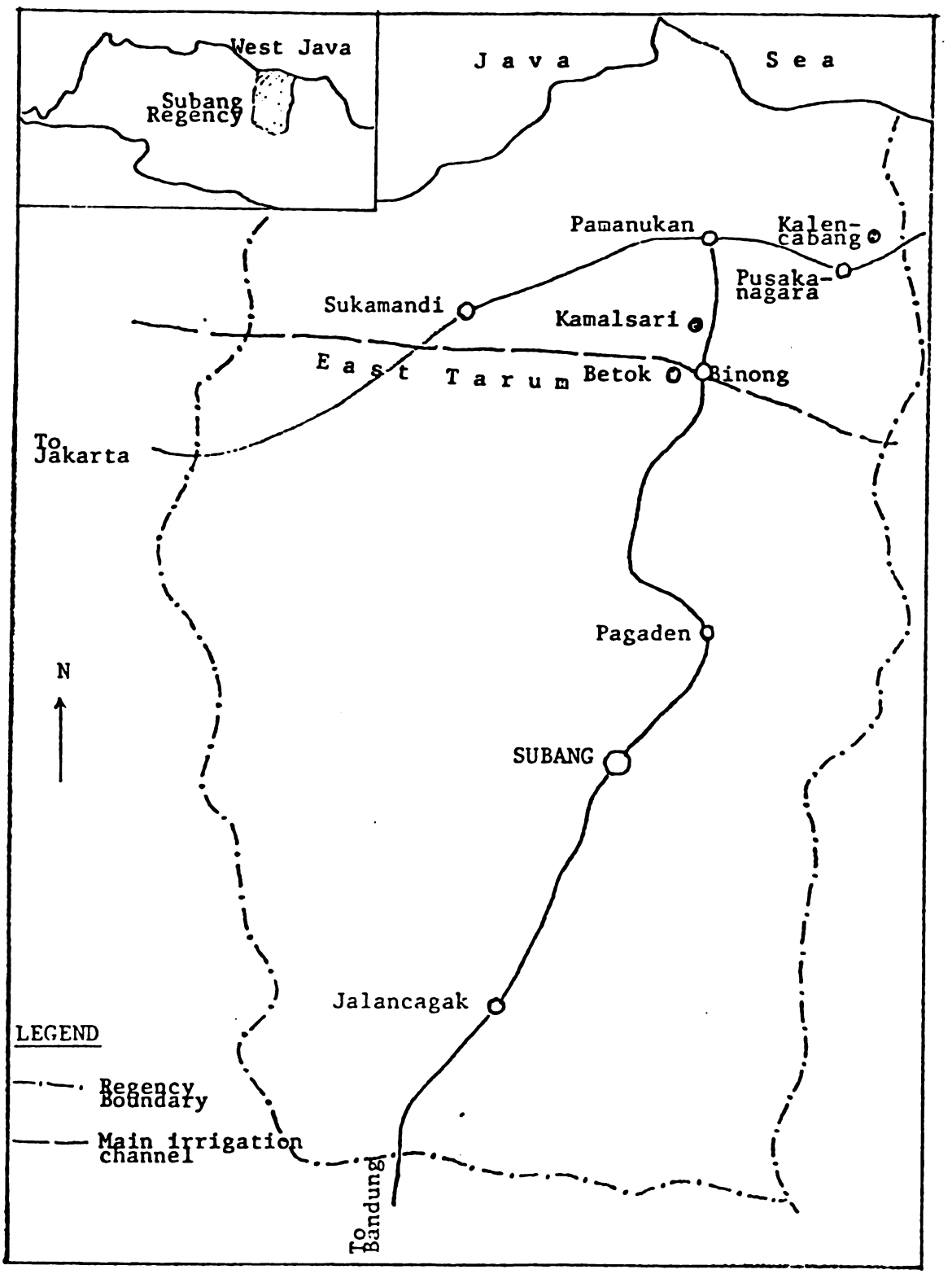
The three villages, --- Betok, Kalencabang and Kamalsari --- were researched by Sudardja Adiwikarta (1982). Adiwikarta's study aimed to explore the social impacts of the Jatiluhur Irrigation Project on farm family work patterns. The Jatiluhur Project serves a total of 260,000 hectares on the Northern Coastal Plain of West Java, and guarantees the availability of water for two rice crops each year (Soedjatmiko, 1981). It is a multipurpose project designed mainly to increase rice production through irrigation, provide Djarkata with a reliable source of water and electricity, and to generally improve the overall quality of life of the rural people in the region.

The villages are located on the Northern Coastal Plain of West Java in the Subang Regency of Indonesia (See Figure 1). All of the villages are in the transitional stage of development (1), and were selected

(1) The Indonesian Government divides regions for administrative and program aid purposes into three categories: traditional, transitional and developed, based on their developmental level and potential (Adiwikarta, 1982).

Figure 1. The three villages in the Subang regency

1 : 100,000



because prior to the Jatiluhur System they represented three different ways of managing water for growing rice. The cultivation of rice and work related to rice agriculture was and continues to be the main subsistence and income producing occupation in these villages. The villages, as described by Adiwikarta (1982), are very similar in terms of regional location, proximity to a paved road, level of development, basic cropping practices, and sociocultural heritage. A demographic characterization of the villages is presented in Table 1.

Table 1. Demographic Characteristics of the Three West Java Villages

Demographic Characteristic	Descriptive Unit	Villages		
		Betok	Kalen-cabang	Kamal-sari
Population	Persons	1258	980	586
Households	Number	356	255	170
Household Size	Average Number Persons	3.53	3.84	3.45
Age Group < 15	Percent	34	41	34
15-49		58	48	51
> 50		9	11	15
Sex Ratio	100M/F	104	101	92
Growth Rate (1) 1976-80	Percent	12.1	13.2	6.4

(1) Equation used to calculate growth rate:

$$\frac{P1980 - P1976}{P1976} \times 100 = \text{Growth Rate}$$

Source: Computed by author based on Adiwikarta data compiled from census data and village documents.

Betok, the largest of the three villages with 356 households, had relied exclusively on natural rainfall for rice cultivation prior to the Jatiluhur Project. Hence, only a single crop annually could be produced. The fields were left fallow during the dry season. The sources of income were relatively diverse, and included rice growing, wage work in rice fields elsewhere, collecting and peddling firewood, fishing in nearby rivers, and off-farm jobs.

Kalencabang, on the other hand, with 255 households, is located in a flood plain. Prior to the Jatiluhur Project, this village experienced considerable difficulty from regular and dangerous flooding during the rainy season. Farmers had to replant several times just to get one harvest of rice. Sources of income were scarce, and families depended heavily on rice growing and wage work in the rice fields.

Kamalsari, the smallest of the three villages with 170 households, had benefitted from a localized system of irrigation prior to Jatiluhur, and had been producing a double rice crop since early 1960. However, sources of income were limited to rice production; few alternative job opportunities existed. The Jatiluhur Project complemented and improved upon the existing system.

As mentioned earlier, the mode of production in these villages consists predominately of small scale landholders, a characteristic of the region and the country as a whole. Consequently, Adiwikarta was correct in basing his selection of households on landholdings. Three categories of land holdings were identified:

Households with "more land" (upper status) had an average of two or less persons per hectare of riceland. They produce a surplus of rice for cash sale and rent out land to others. These households are also financially secure and have capital available for investment.

Those households with "enough land" (middle status) have an average of two to six persons per hectare and produce just enough for their own use. The quality of their lives depends to a large extent on the success of the seasonal harvests. They must work off-farm for wages, and when possible, rent land from others to expand their farming operation.

The "less land" and "landless" households (lower status) average more than six persons per hectare and constitute the vast majority in these villages. They cannot produce enough from their land to provide the basic needs of their households. This group depends on outside work in the form of wage labor, and non-farm work to maintain their households. The lives of these

people are precarious, and in essence they operate at the edge of poverty (Adiwikarta, 1982).

The land tenure situation illustrated in Table 2 shows the total distribution of households in each village according to socioeconomic status and the amount of rice land owned per household member. In general, it is noteworthy that only 8 percent of the households in all three villages are classified as belonging to the upper status group, while 70 percent form the great majority of less land and landless households.

Table 2. Land Ownership Class of Farm Households by Village (percent)

Land Ownership-Class/(persons per hectare)	Villages			
	Betok	Kalen-cabang	Kamal-sari	Total
"More land" (Upper Status) ≤ 2 persons/ha	(25) 7%	(24) 9%	(13) 8%	(62) 8%
"Enough land" (Middle Status) 2 ≤ ≤ 6 persons/ha	(87) 24	(52) 21	(31) 18	(170) 22
"Less land/Landless" (Lower Status) > 6 persons/ha	(244) 69	(179) 70	(126) 74	(549) 70
(N=781) Total percent	(356) 100%	(255) 100%	(170) 100%	(781) 100%

*Number of households in paretheses.

Source: Computed by author based on Adiwikarta data.

From the foregoing description, it becomes apparent that prior to Jatiluhur the three villages reflected the variable situations throughout West Java in terms of land tenure and crop production. As such, it was expected that the Jatiluhur Irrigation system would affect the villages differently according to their initial water utilization practices, and the socioeconomic positions of the impacted households.

As previously mentioned, a retrospective inquiry approach was used to compare farm work patterns at two points in time, before and after the Jatiluhur Irrigation Project. The data were obtained by direct interviews with 162 heads of households, plus focused interviews with key informants and information gleaned from official documents.

A sample of 162 households (54 from each village), stratified according to the average amount of rice land owned per household member, was selected. The sample included 30 households classified as having "more land" (18.6%), 66 households with "enough land" (40.7%), and 66 households with "less land" (40.7%).

3.3 WOMEN AND TRADITIONAL RICE PRODUCTION

To analyze the role of women from the perspective of agricultural work, a description of the division of

labor in rice production is important because it facilitates an understanding of the crucial role played by rural women. When considered in addition to the other tasks they perform, it becomes clear that rural women "work from early in the morning til late in the afternoon, and that their working hours exceed those of men" (Republic of Indonesia, 1986).

The household, as the unit of production, is responsible for consumption and accumulation, which is dependent upon family labor for survival. As the cultivation of rice is highly labor intensive, men, women, and children have always been active in rice growing activities. Rice has been grown throughout Indonesia for many centuries, and has been a staple food along with cassava and later corn. It is the traditional food crop and provides more than one-half of the total calories and protein in the Indonesian diet. It is therefore appropriate at this point to provide a brief description of a rice cycle which will also be helpful in understanding the analysis of change which follows.

The rice growing cycle begins as soon as water becomes available in the field. The first step involves soaking the rice seeds which is typically done by men. The land and seedbeds are also prepared by men with the

aid of animals. Men too have the responsibility of making parallel lines lengthwise and across the width of the area in order to facilitate weeding and other cultivation activities.

The seedlings are soaked for approximately three weeks before they are ready for distribution. Men take advantage of this slack time to seek short term work in other areas. When the seedlings have matured, women lift them out of the seedbed individually by hand, and tie them into bundles. Men transport the bundles to the field and distribute them over the entire area. Women do the actual planting (see Appendix 1). Thereafter, water levels are maintained by men who ensure that the plants are always covered by at least two inches of water. Both men and women provide daily care.

By the third week after transplanting, women perform a first weeding, which includes replanting (see Appendix 2) those plants which have not survived. Men apply the manure fertilizers. When the plants are about six weeks old, a second weeding is performed by women and children, followed by a second application of fertilizer. While waiting for the harvest, men, women and children protect the rice plants from birds and other rice pests.

Harvesting, the most labor intensive operation of rice production is performed by women, and occurs when about 90 percent of the rice heads change from a green to a yellow color. Traditional harvesting involves large numbers of women who use small hand knives, called the ani-ani (see Appendix 3) to cut the rice stalks. The process is tedious and time consuming; local rice varieties mature in a scattered way within the paddy field, so ripe stalks must be cut individually.

The rice sheaves are then transported by men on their shoulders to the home of the owners where the threshing is done.

Threshing is performed by women who handpound or shake the ripe rice from the stalks. This task is quite strenuous and time consuming, as the rice stalks are beaten against a bamboo rack until the rice is dislodged from the stem (see Appendix 4). Drying the harvest, as well as storage and removal from storage, is done jointly by both men and women.

In addition to working in the rice fields, which is essentially seasonal, women are also responsible for childcare, cooking, shopping, housework, and food preparation (including the drying and cleaning of rice and other crops for home consumption). For households

with gardens, it is the women who tend to grow fruit crops (bananas, mangoes, coconuts), and plant secondary crops such as cassava and sweet potatoes. Women too are often involved in raising and feeding farm animals, such as cows, goats, rabbit, poultry, and in fish farming. Also, women generally make handicrafts, (such as pottery, kitchen utensils and plaitwork) for sale in the market, exchange labor with other households, and perform ceremonial duties (weddings, rites of birth and passage, harvests), as well as midwife services (2).

From my overview of a rice growing cycle, it is clear that women traditionally play a major role in rice cultivation, and are involved in a wide range of activities, including processing and storage. However, it is noteable that the use of female labor is not evenly distributed over all operations. Except for tasks which require a certain amount of physical strength (land preparation and transporting), the significant contribution of female labor appears to be limited to the more labor-intensive, rather time-consuming activities, which may also require manual dexterity (pulling out small plants, transplanting and threshing).

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(2) The description for the traditional division of labor in the rice cycle, as well as the activities performed by women were compiled from a variety of sources but focused specifically on rural Java. Adiwikarta (1982); Stoler (1977); Soedjatmiko (1981); White, (1981); Mangkuprawira (1981); Sajogyo (1983).

In view of the differences in tasks designated for men and women, which may be based on biological factors, it will be interesting to see if the innovations introduced by the Jatiluhur Project alter this situation. I will begin by asking the following questions in an attempt to determine the impact on women's work:

- What were the innovations introduced by the Jatiluhur Irrigation Project?
- To what extent are the work patterns of women in these villages affected by the new technology?
- Are women of differing socioeconomic levels affected equally?

Considering the situation of women in terms of these different foci of inquiry is important because it not only helps us to better understand the evolution of women's participation in rice production activities, but it also makes it possible to compare strategies of development according to socioeconomic groups.

It is within a setting of small landholdings, large numbers of landless laborers, and the emergence of commercially oriented agriculture, all of which contribute to serious problems of income distribution and nutritional inadequacies, that an attempt will be made to determine what changes have occurred in rice

farming and how rural women's participation in agricultural work was affected by the Jatiluhur Irrigation Project and the simultaneous introduction of new technology.

3.4 WOMEN AND MODERNIZED RICE PRODUCTION IN THREE VILLAGES

Having described the division of labor for men and women in traditional rice production, I will now attempt to determine what changes have occurred in the work patterns of rural women as a result of the new technology. I will identify (i) the technology introduced and the effect on women's work in general, (ii) the perceptions of male heads of households about the changes in women's work, and (iii) the differential impacts by socioeconomic status of the household.

3.4 (a) New Technology

The implementation of the Jatiluhur Irrigation scheme resulted in several changes. The technologies introduced by the Project were identified as: a modern irrigation system, high yielding varieties of rice, sickles, tractors, chemical fertilizers and pesticides. In order to facilitate the discussion and to focus on the specific effects upon women's work, the new innovations will be discussed separately, even though it

is recognized that in reality the various components are often interrelated, and parts of a stream of new technologies.

It was noted that variations in the way the new techniques were introduced also involved changes in the persons performing certain tasks. The new technologies, in addition to affecting the work load, may also have affected work oportunities for women. Consequently, an examination of the technology introduced by the Jatiluhur Project, and of the effect on work performed by women, will permit identification of changes in the work patterns of rural women within these villages.

1. Irrigation

The acquisition of water is one of the most important factors contributing to increased rice production. The introduction of the Jatiluhur Irrigation system, particularly for the villages of Betok and Kalencabang, which previously relied only on rain or flooding for rice production, stimulated significant social and economic changes. Indeed, a regular and assured supply of water enables these two villages to produce two crops of rice annually, instead of just one, which was the situation before the project, while the

village of Kamalsari had a local irrigation system, and already produced a double crop annually.

Two rice cycles a year means there will be an increased demand for labor, particularly manual labor, and eventually more opportunities for wage work for both men and women at various stages of rice production. Irrigation also makes water control less difficult to perform and less dangerous for women to manage. As a consequence, and as noted by Adiwikarta, there is an increase in women's participation in water maintenance, which was not the case prior to the Jatiluhur Project. This is especially so in Kalencabang which was flooded regularly.

Even though the available data do not permit measurement of the extent of women's involvement in water control, it can be viewed as somewhat of a breakthrough for women into a new area of work which was previously dominated by men. This observation implies more work for women, but at the same time it may eventually provide a new opportunity for paid employment.

2. High Yielding Varieties of Rice

The Jatiluhur Project introduced new varieties of rice. These high yielding varieties are characterized

by a shorter growth period, and the crop is significantly increased. This innovation transformed rice cultivation in all three villages, but especially in Betok and Kalencabang. Indeed, the use of high yielding varieties, and the availability of water through irrigation, permits multiple rice crops in a single year. As a result, changes were observed not only in the work load of women, but also in the work pattern. With multiple cropping, indeed, more time is needed in operations where female labor is dominant, such as transplanting, weeding, harvesting and threshing. This increased need for female labor implies an increase in the work responsibilities of women on the family farm.

The transformations observed in the work patterns concern the involvement of men in activities previously performed by women, namely, weeding and harvesting. According to Adiwikarta, men more often participate in traditional women's work because there is a shortage of wage work for men during slack periods in the rice growing cycle. This new development appears to have generated new job opportunities for men. In the long run, what does this imply for women? Will men eventually take over the operations of weeding and harvesting?

3. Sickle

The data reveal that both men and women now participate in harvesting using the sickle, which replaced the ani ani, a small hand knife previously used by women to cut the rice stalks. The ani ani, a traditional instrument, was highly labor intensive. Harvesting was also one of the most lucrative sources of income for rural women. How does the involvement of male labor in harvesting affect this female task? One possible explanation could be that the increased yields may be so abundant that women alone cannot handle them. It could also imply that both men and women are fully employed, or perhaps that both are underemployed? Are women devoting less time to harvesting because men also participate? Does this mean women are being marginalized, as noted in the literature when new technology is introduced (Timmer, 1973; Cain, 1981; White, 1981)? If this is true, women are losing another source of income which is crucial for land poor and landless households.

4. Tractor

Traditional land preparation requires a certain amount of physical strength, and for this reason was

reserved for men. However, despite the fact that land preparation has been made easier by the tractor, women still are not directly involved. Nonetheless, the use of the new technology affects the work of women in two distinct ways. Extending the land under cultivation reduces the possibility of collecting firewood, which, in addition to being used for cooking, had also provided a source of income for women from landpoor households. Now, women must expend more cash money for fuel for cooking. Consequently, as Adiwikarta (1982) points out, this decreased the contribution women and children, particularly those from landless households, were able to make to the household economy. In the literature reviewed, it was noted that as women lose their ability to contribute to the household economy, their economic position is reduced (Boserup, 1970; Tinker, 1976; Staudt, 1978; Rogers, 1980).

But the expansion of land under cultivation also provides some new work opportunities for women. This can be viewed as a kind of compensation for the lost income from the sale of firewood. Yet, another question can be raised --- are the new income-generating opportunities provided by the tractor equivalent to the income lost from the collection of firewood for sale and home use, especially since the participation of men in

activities previously performed by women, may curtail the opportunities available for women?

5. Fertilizer / Pesticides Application

The application of fertilizer, whether organic manure, or inorganic chemicals, remains a male task. However, chemical fertilizers have a tendency to increase the growth rate of weeds, thereby causing a need for weeding to be performed more frequently (Prabowo and Sajogyo, 1975). Weeding tends to be women's work.

These observations indicate increases in work traditionally performed by women, and, therefore, a greater demand for female labor, even though men are getting involved in work traditionally carried out by women. To better appreciate how women's work is affected, the next section will report on the perceptions expressed by male heads of households about changes in the level of women's participation in farm work.

3.4 (b) Changes in Women's Farm Work

What are the implications of these new technologies on women's participation in farm work, especially rice production? The perceptions of the heads of household in the three villages provide some

insights on what the changes imply for rural women's work. Only male heads of households were interviewed by Adiwikarta, and this should be taken into account when evaluating the change or lack of change in women's work in rice production. Certain biases may be present in the information obtained. Nonetheless, useful indications of change in the work load of rural women can be obtained, particularly when the situation in each village is considered.

At first glance, we note that in general 36 percent of household heads in Adiwikarta's three village sample perceive women to be working to the same degree as before Jatiluhur, 36 percent see women as working less than before Jatiluhur, while 28 percent perceive an increase in women's participation in farm work. From this general situation it is difficult to distinguish any trend. But each village was considered separately to obtain more context-specific insights.

Table 3. Changes in Levels of Female Participation in Farm Work as Perceived by Heads of Households, by Village
(percent)

Perceived Changes in Work Load	Betok	Kalencabang	Kamalsari	Total
More Now	46	26	11	28
Same	28	54	28	36
Less	26	20	61	36
Total Percent (N=162)	100 (54)	100 (54)	100 (54)	100 (162)

Source: S. Adiwikarta, 1982.

In Betok, household heads report that women are now more involved in farm work, which includes rice production. Indeed, 46 percent of the household heads interviewed reported an increase in women's participation in farm work. This increase could imply a greater demand for farm wage labor, and women may now have more opportunities for employment. One explanation for the increase in women's participation in farm work is related to the use of high yielding varieties, which require more care, and as a result utilize more labor than the local varieties. The new varieties also increase the frequency of certain activities, such as weeding, transplanting and harvesting.

In the village of Betok, the practice of men seeking non-farm work outside the village during the slow period of the rice growing cycle contributed to an increase in the work performed by women, especially weeding and daily control of irrigation. Adiwikarta reported that the expansion of rooftile factories also absorbed a lot of male labor, thereby leaving the work performed by men to be done by women. Can this situation be interpreted as a benefit for women, and a means of providing them with new skills? When the men return, will they resume the tasks they were previously

performing or do women continue performing their traditional tasks, as well as the male activities?

In Kalencabang, 54 percent of household heads reported that women were working the same as before. Prior to the Project, this village was plagued by floods and the rice fields had to be replanted several times to get one good crop. Adiwikarta (1982) reported that job opportunities for women increased, nonetheless, because new ricefields were created and work in the field had to be done more quickly, as the new varieties matured much faster. Therefore, the full impact of the new work opportunities for women resulting from irrigation and the use of high yielding varieties could have been offset somewhat by the fact that the rice fields only had to be planted once. The extra energy exerted to replant the crops was merely diverted to the new work.

In Kamalsari, where a local irrigation system existed, 61 percent of household heads reported women to be participating less in farm work. There may have been increased income from the use of new rice varieties, and this may have caused women to withdraw from "menial" farm work in the fields. That interpretation is consistent with the view that women tend to withdraw from manual work in the fields when

there is a rise in the economic status of the household (Sharma, 1980; Stanbury, 1984; Agarwal, 1984).

Kamalsari was more highly mechanized initially than Betok and Kalencabang. Can the high level of mechanization found in this village also account for the greatly reduced female participation in farm work? As noted earlier, Kamalsari is the smaller of the three villages, and a greater percentage of the population is 50 years of age and older. Thus, the age structure in this village may also be a factor in explaining women's reduced participation in agricultural work in the rice fields.

In terms of the general situation in these villages, there appears to be a tendency toward less participation of women in farm work. Upon closer inspection, however, we find that the perceptions of change in women's work varies according to the initial hydrological and socioeconomic circumstances. In the next section I will take into account the socioeconomic status of households.

3.4 (c) Change in Farm Work Load of Women by Socioeconomic Status

Since these villages are mainly agricultural, landownership was utilized to determine the economic

status of households. My analysis is based on the categories of households which Adiwikarta (1982) used to draw a sample for the study. The data in Tables 4, 5, and 6 present changes in women's work load as perceived by heads of households, according to their socioeconomic status.

Table 4: BETOK: Changes in the Farm Work Load of Women as Perceived by Household Heads: Before Modern Irrigation and Now, by Socioeconomic Status of Household Head

Are Women Working More or Less Now?	Socioeconomic Status of Household Heads (percent) Upper	Middle	Lower
More	20 (02)	50 (11)	55 (12)
Same	30 (03)	23 (05)	32 (07)
Less	50 (05)	27 (06)	14 (03)
Total Percent (N=54)	100% (10)	100% (22)	100% (22)

(Numbers in parenthesis represent Household Heads)

Source: Adapted by author based on Adiwikarta (1982) data.

In Betok, it is noteable that 55 percent of the household heads belonging to the lower status group perceived women to be working more now than before the

Jatiluhur Project; only 14 percent think they are working less. Similarly, 50 percent of the household heads in the middle status group considered women to be working more now. Only 27 percent thought women to be working less now. The difference, though tenuous, suggests that as status increases, women's farm work load decreases as a result of the new technologies.

Across socioeconomic levels, the increase in the farm work load for women reported by heads of households, varied from 20 percent for the upper status group to 55 percent for the lower status. Thus, while there appeared to have been a reduction in the work load of women as perceived by household heads from the upper stratum, household heads in the lower and middle strata perceived an increase. These findings indicate a relationship between the socioeconomic status of the household head, and the way he perceives the work load of women.

Adiwikarta noted several factors which may have affected changes in women's level of participation in farm work for the different socioeconomic groups. With the increased prosperity resulting from the new technology, women of the upper status are now able to withdraw from work in the fields, and concentrate on managing their homes. This conclusion is supported by

other studies which document the upper class view that work in the fields lowers the prestige of the family (Sharma, 1980; Barnard, 1981).

Another factor which may have contributed to the increased work load for women, as perceived by heads of households of the middle and lower status groups, is their participation now in water management and irrigation control, which was considered too perilous for them prior to Jatiluhur. In addition, Adiwikarta noted that the expansion of the rooftile industry in this village drew male labor into the factories, leaving additional farm work to be performed by women. Similar findings have been reported by Hanger and Moris (1973) and Bukh (1979).

Table 5: KALENCABANG: Changes in the Farm Work Load of Women as Perceived by Household Heads: Before Modern Irrigation and Now, by Socioeconomic Status of Household Head

Are Women Working More or Less Now?	Socioeconomic Status of Household Heads (percent) Upper	Middle	Lower
More	20 (02)	14 (03)	41 (09)
Same	40 (04)	59 (13)	55 (12)
Less	40 (04)	27 (06)	5 (01)
Total Percent (N=54)	100% (10)	100% (22)	100% (22)

(Numbers in parenthesis represent Household Heads)

Source: Adapted by author based on Adiwikarta (1982) data.

The situation in Kalencabang differs from that observed in Betok. Indeed, most household heads perceive women to be working the same now as before Jatiluhur, especially household heads from the middle and lower status groups, which represent 59 and 55 percent, respectively. Only 40 percent of household heads of the upper status group consider women to be working the same now. In contrast to Betok, however, very few household heads of the lower status group consider women to be working less, noting 5 percent, compared to 41 percent who viewed women as working more.

Prior to the Project, Kalencabang was plagued by serious flooding which damaged the rice crop, and women participated actively in the replanting process. The implementation of the Project eliminated the periodic necessity for women to replant, but the creation of new rice fields provided additional job possibilities and tasks.

Unlike Betok, there were few prospects for male wage work in Kalencabang, so men were likely to be working in the fields with women and performing tasks traditionally considered female activities. This explains why these two groups of women experienced no change in their work load, and were considered to be working the same as before. It is noteable that although there were no substantial changes in the amount

of work performed by the groups reported to be working the same as before, the reduction in work load as perceived by upper class heads of households (40%) is equivalent to the increase in work as perceived by household heads of the lower status (41%) group. This observation was also noted in Betok and appears to hold for this village as well.

Table 6: KAMALSARI: Changes in the Farm Work Load of Women as Perceived by Household Heads: Before Modern Irrigation and Now, by Socioeconomic Status of Household Head

Are Women Working More or Less Now?	Socioeconomic Status of Household Heads (percent) Upper	Middle	Lower
More	20 (02)	0 -	18 (04)
Same	20 (02)	32 (07)	27 (06)
Less	60 (06)	68 (15)	55 (12)
Total Percent (N=54)	100% (10)	100% (22)	100% (22)

(Numbers in parenthesis represent Household Heads)

Source: Adapted by author based on Adiwikarta (1982) data.

Unlike the situation in Betok and Kalencabang, where farmers were able to benefit from the irrigation Project by double cropping for the first time, household

heads from all socioeconomic groups in Kamalsari observed that women are working less. Indeed, according to the household heads interviewed: 60 percent from the upper status, 68 percent from the middle class, and 55 percent from the lower strata, women experienced a decrease in their work load.

As previously mentioned, this village benefitted from a local system of irrigation for many years before Jatiluhur, and the improvements provided by the Project enhanced the system which was already in place. Similar to Kalencabang, this village offered few nonfarming job opportunities during slow periods of the rice cycle. Consequently, men were found to be participating in all stages of the rice cycle, including tasks traditionally reserved for women, such as weeding and pulling seedlings. This tends to explain the reduction in women's work load. What are the consequences of this situation for women?

Since this village was more highly mechanized, and had a local system of irrigation before the Jatiluhur Project, are the villages of Betok and Kalencang following the same path, and will they also experience the same type of mass reduction in female participation in farm work?

Since women are devoting less time to rice production, what are they directing their energies to now -- what opportunities are available to them? It was noted that Betok experienced an increase in cottage industries and in the service sector. It is interesting to note that Kamalsari, the village that experienced the greatest reduction in women's participation in farm work, also witnessed a substantial increase in the service sector. What does the increase in these areas of work represent for rural women? Are women seeking alternate sources of income to replace the income lost from agricultural wage work? Both Stoler (1977) and Hull (1982) document increases in the trade and service industries as women participate less in agricultural farm work. If this is the case, and since the service sector, which includes trade, is reported to already be overcrowded, the question becomes how much longer can these subsectors continue to absorb female labor?

The foregoing observations raise several questions, among which three seem most relevant:

Since men readily move into areas of work traditionally performed by women (pulling seedlings, weeding, harvesting), why is the reverse not true in work performed by men (irrigation, land preparation, fertilizer/insecticide application)? Can rural women's lower educational levels account for their absence in

areas of work which may require some type of training? Why aren't women taught how to utilize modern equipment? Are these considered dangerous for them? It can be argued that attitudes and beliefs intervene, or, as the literature points out, that men tend to ignore the needs and capacities of women, as well as the important role played by women in sustaining poor households. Further research could provide a more accurate response to this important issue.

The same question can be raised regarding the application of pesticides. In this case there may be some type of cultural explanation, since pesticides eliminate a form of life and certain female tasks can be associated with the giving of life and related to the biological function of reproduction. In terms of rice cultivation, transplanting rice could be viewed as giving life, and anything associated with the taking of any form of life could be considered inappropriate for women.

This section has focused on the technology introduced by the Jatiluhur Project, and the perceptions of change as reported by male heads of households on women's work in general, and according to the socioeconomic status of the household. I have attempted to demonstrate the importance of taking into account the

significance of class differences in studying the implications of changes in agriculture on women's work participation. This is particularly important given that a considerable proportion of the population in these villages are landless or near landless, and therefore the impact of technology will affect them differently according to their socioeconomic status. The limitations of agricultural employment may be forcing women into the trade and service sectors, where they are reported to work long hours and receive low returns to labor.

In order to determine the overall impact of the newly introduced technologies on the employment of women, one must also look at institutional changes, such as methods of labor recruitment and wages, which are reported to be associated with the new technology. In this way a more accurate measure can be obtained of the changes for rural women.

CHAPTER IV

CONCLUDING REMARKS AND SUGGESTIONS FOR FURTHER RESEARCH

This study was undertaken to explore the impact of technological change on the agricultural work patterns of rural women in Indonesia. Data initially collected by Sudardja Adiwikarta in three West Java villages were analyzed as an illustrative case.

Traditionally, throughout Indonesia and in the three villages studied, women played a major role in rice production. Prior to the Jatiluhur Project, the three villages were characterized by different methods of water utilization for rice growing. Betok relied on natural rainfall, Kalencabang grew rice under flooded conditions, and Kamalsari had a local system of irrigation and had been able to produce two crops long before the Project.

The Jatiluhur Project stimulated a stream of new technologies which brought about profound changes in all three villages. A dependable water supply enabled Betok and Kalencabang to utilize modern varieties of rice and produce two crops per year, instead of just one. Kamalsari's system was enhanced and improved. Throughout the region, the Jatiluhur Project made

significant impacts, directly and indirectly, on the agricultural work of women.

My analysis of this case, and my review of the relevant literature focused on the following questions:

(1) What technologies were introduced in the three villages, and how did they effect work performed by women?

(2) Are women of all socioeconomic levels impacted equally by the technologies introduced?

(3) Are new roles being shaped for women utilizing the new technology?

The literature relevant to this topic indicates that historical processes are significant in defining the roles of women. Earlier development strategies neglected women's work and their contributions to the household and to the community. Even after well documented studies reported considerable contributions by women in agricultural work, women continue to be underestimated by agricultural labor force statistics.

More recently, several writers have noted the relationship between newly introduced technologies and the work performed by women. These innovations appear to have a negative impact on women's work, leading in some instances to a loss of traditional employment, the intensification of work loads, and, in some cases, the withdrawal of women from agriculture. On the other

hand, positive effects have been noted which suggests that modern technology improves the position of women and affords them greater opportunities. My study attempted to address some of these issues.

MAJOR FINDINGS

The main points which emerged from the study can be summarized as follows: The new technology introduced by the Project resulted in changes in the sexual division of labor, an increase in work opportunities for women, and changes according to household socioeconomic status.

With regard to the division of labor, very distinct transformations were evident. The sharp differences characteristic of the traditional system were found to have shifted to one of greater male participation in areas of work previously dominated by female labor. These changes were especially noteable in the operations of weeding and harvesting, where male labor is now present. With the new technology, wet rice cultivation appears to be moving towards tasks becoming less gender specific and more heterogeneous.

Another finding of the study is that rural women now participate in rice cultivation utilizing some of the technology introduced by the Project. Women in

these villages were found to be harvesting with the sickle, which replaced the ani ani (small hand knife) previously used by women for harvesting.

It was also noted that women in the village of Kalencabang are now actively involved in water management and control. Before Jatiluhur, women's participation in this area was minimal due to the dangerous nature of the task caused by flooding. Now that flooding is no longer a problem, women are likely to participate in the performance of this task.

The data reveal that the new technology had class specific effects for women. According to male heads of households from the lower and middle status groups, women now work more in the fields than before. They also reported that women are experiencing an overall increase in their work load, as well as a loss of a source of income as a result of the expansion of land under cultivation. The lost income may have affected the economic position of these women which is reported to be related to their ability to contribute to the household economy.

According to upper status heads of households, women tend to withdraw from agricultural work in the field. This withdrawal is related to the prestige

associated with managing their households, instead of "menial" farm work in the fields.

In summary, it appears that the Jatiluhur Project had varying effects on women's work; the effect varied according to the socioeconomic status of the head of household interviewed. Since men are now participating in activities which were formerly carried out by women, what effect will this situation eventually have for work performed by women? This is especially important since the great majority of women in these villages are landless or landpoor. If less labor is required for agriculture, what opportunities are available to them? This is particularly important since there was a marked increase in trades and services, occupations which are already reported to be saturated. The question then becomes how much longer can trades and services absorb surplus labor from agriculture?

SUGGESTIONS FOR FURTHER RESEARCH

My exploratory research points to several areas which require further investigation. The data available did not permit an in-depth analysis of the impact of the Jatiluhur Irrigation Project on women as a specific group, and as members of households. It is important to collect more detailed information on the full range of activities performed by women, both agricultural and non-agricultural. This information should include the amount of time devoted to various activities, as well as the remuneration involved, whether in cash or kind, and generational differences. The availability of this type of information would permit a more accurate assessment of the impact of the new technologies on women's work.

If, as a result of new technologies, women have a wider range of possible opportunities, better working conditions and earn higher incomes, for themselves and their families, their aspirations and life goals may be enhanced. With regard to women as members of households, if they have more job opportunities, they may be in a position to contribute more financially to the household, and this in turn may translate into a higher economic position, and greater influence in decision making within the household.

As the study in the three villages demonstrated, women do not form a homogeneous group, even in rural areas. Therefore, the introduction of new technology may have a differential effect on women's work, depending on the socioeconomic status of the household. There is a need for in-depth studies of the uneven impact of technological change on women of various socioeconomic groups. Information of this type would be useful in aiding development planners and policy makers to formulate alternative strategies to compensate for any negative or unfavorable consequences.

Further investigation should be done to determine the extent of women's involvement in water management and control. The Jatiluhur Irrigation Scheme is a very large and important project for the region, and other comparable projects are being constructed or planned. If women are extensively involved in irrigation, it is important for them to acquire any specialized formal training associated with irrigation control and water management. This will not only provide women with technical skills, valuable in the labor market, but it will also enable them to perform the tasks more efficiently.

In designing impact studies of this kind, interviewing only the male heads of households may not

provide sufficiently accurate data relative to women's participation in agricultural work. A need exists for a more appropriate methodology which includes interviewing women directly concerning activities they are involved in.

Finally, this exploratory study attempted to address a number of issues also raised in the literature. Micro level impact studies of this kind are crucial building blocks in the quest for knowledge and information on the impact of new technology on women and their families. The research completed here suggests the need for further follow up studies to provide more in-depth information on the impact of new innovations on women's work. The retrospective inquiry approach utilized for this study provided an opportunity to obtain some preliminary baseline data.

But there is a great need for longitudinal studies, that, over time, can monitor villages and households in order to more precisely determine both the social and economic impacts associated with the introduction of new technologies.

If future research builds on the insights and suggestions provided by this Case Study of women in three villages, a better understanding of the

consequences of new technologies for the work performed by rural women and their families may be achieved.

It is my sincere hope that a follow-up study be conducted of these three villages, focusing specifically on the changing work patterns of women in the labor force.

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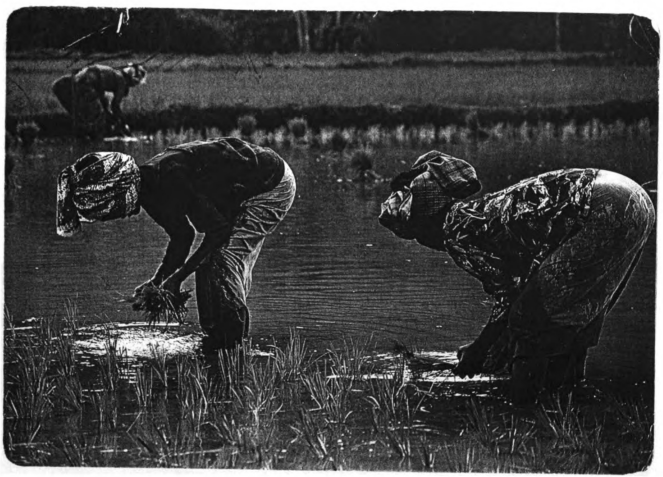
APPENDIX 1



RURAL WOMEN PLANTING RICE

The planting and harvesting of rice is traditionally a woman's job. It is believed that they have the delicate touch which will not frighten the spirit of the rice plant. According to ancient fertility rites, women are the source of life, and it is believed that this power will be transferred to the rice plant.

APPENDIX 2

CHILDREN REPLANTING RICE

Rice is the staple of the Indonesian diet. These children are replanting rice seedlings.

APPENDIX 3

WOMEN HARVESTING RICE WITH THE ANI ANI

Rural women in Indonesia stand knee-deep in paddy mud harvesting rice. In the woman's hand is the ani ani, a small blade with a wooden handle. So that the spirit of the rice (the Goddess Dewi Sri) is not offended by the blade, the ani ani must be concealed.

APPENDIX 4

WOMAN THRESHING RICE