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FACTORS INFLUENCING THE EXTENT TO WHICH
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A STUDY FOCUSING ON SMALL FARMERS
IN RURAL SUBANG, WEST JAVA

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FACTORS INFLUENCING THE EXTENT TO WHICH FARMERS PRACTICE NEW FARM INPUTS: A STUDY FOCUSING ON SMALL FARMERS IN RURAL SUBANG, WEST JAVA

By

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ABSTRACT

FACTORS INFLUENCING THE EXTENT TO WHICH
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In principle, food self-sufficiency is still a national goal of the Indonesian country. Major rice programs were launched to increase food self-sufficiency and to increase farmers' welfare. This study, which focuses on small rice farmers in rural Subang, West Java, was conducted with the purpose of better understanding the factors that are associated with the extent to which small farmers practice new farm inputs, i.e., high yielding rice varieties, fertilizers and pesticides.

Study data were collected during 1981 through a multistage cluster sample--180 small farmer respondents were selected who operate on farm lands of .7 hectare or less in six sample villages of northern Subang. Each farmer respondent was interviewed and asked questions that dealt with his: (1) farm setting; (2) social context; (3) economic context; (4) communication context; and (5) extent to which he uses inputs designed to increase rice production (e.g. fertilizer, pesticides).

Attention was focused on eleven independent variables: farm size, degree of commercialization, level of education,

extent of social participation, socio-economic status, economic activities, off-farm employment, extent of contact with change agents, extra-family contact, use of mass media, and ease of obtaining new farm inputs.

Several major hypotheses were tested in this study. The sub-hypotheses of Hypotheses I - IV focus on the relationships between each of these independent variables and the dependent variable of the study. For example, sub-hypothesis I-1 predicted that the larger the size of the farm, the greater the degree to which farmers adopt new farm inputs. Hypothesis V predicted that the farmer's economic context and communication context represent the most important blocks of indicators associated with the degree to which farmers practice new farm inputs. Hypothesis VI predicted that commercialization, economic activities, extent of contact with change agents, and ease of obtaining farm inputs are the most important indicators associated with the degree to which farmers practice new farm inputs. Pearson correlation analysis was employed to test the sub-hypotheses of Hypotheses I - IV; multiple-partial correlation analysis was used to test Hypothesis V; and multiple regression analysis (using stepwise inclusion) was employed to test Hypothesis VI.

The results of data analysis indicate that most of the findings did not support the expectations as stated in the study hypotheses. Only the degree of commercialization and economic activities variables, respectively, were found to

have a positive and statistically significant relationship with the dependent variable at the .05 level. The size of farm, social participation, socio-economic status and extra-family contact variables have a moderate, but inverse, relationship with the extent to which farmers practice new farm inputs. The results of multiple-partial correlation analysis suggest that the blocks of indicators associated with farm setting are the most important blocks of indicators in terms of explaining variance in the dependent variable. The results of multiple regression analysis suggest that only the degree of commercialization and economic activities variables significantly contribute to explaining variation in the dependent variable.

Based on the study findings, various national policy, agricultural extension, and research recommendations were made. For example, it is suggested that the Indonesian government rethink the policy goal of achieving internal rice self-sufficiency. Another recommendation pertains to the need for more direct contact between agricultural extension agents and small farmers.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

The Issue of Food Production.

Achieving an acceptable balance between food and people may be regarded as one of the most difficult problems facing mankind. Borgstrom (1967) has pessimistically pointed out that mankind has largely failed in its effort to adequately feed the billions of people now living on earth; at least one billion people are regarded as being undernourished. If the minimum nutritional requirements of the world's population were to be met, Borgstrom points out, food production would have to be doubled.

In the mid-1960's, optimism surrounding the food production situation in developing countries was generated because of the so-called "Green Revolution." The "Green Revolution" is defined by Stevens (1977) as the period in which modern science and technology began to have major impact on agriculture. The "revolution" resulted in large and continuing increases in land and labor productivity. For example, new seed varieties, which could increase crop production, were introduced. These agricultural breakthroughs caused observers, such as Lester Brown (1970), to conclude:

> The food-production breakthrough demonstrates that man is capable of responding to crises, a fact that many of us, beset with the numerous complex and seemingly insolvable problem of today, were beginning to doubt.

The Consequences of Increasing Food Production:

Implications for Agricultural Policy.

As stated earlier, the application of science and technology to traditional agriculture held promise for producing dramatic increases in crop production. However, technological change neither begins nor ends with the introduction of new varieties alone. The new technology involves other factors--factors such as requirements for fertilizer, water, and pesticides. According to Wharton (1969), the very success of the new technology has concomitantly produced a number of new problems. For example, the "miracle rice," IR-8, was produced at the International Rice Research Institute (IRRI) in the Philippines through the process of crossbreeding a tall, vigorous rice variety from Indonesia, called Peta, with a dwarf rice from Taiwan, called Deo-geo-woo-gen (Brown, 1970). When properly managed, IR-8 could double the yield of most local rices in Asia. IR-8, and increasingly popular new strains of other IR's, have proved quite responsive to fertilizers in a wide range of growing conditions in several countries and without lodging. However, these new seeds require a considerable amount of irrigation. Thus, irrigation now becomes, more than ever before, a critical component of agricultural development.

As might have been expected, the consequences associated with new agricultural technologies have promoted an evolution in agricultural development thought and policy in the decade since the innovation of the "Green Revolution."

During the 1960's, development thought in vogue emphasized that: 1) the growth of agricultural output and productivity could become a major source of growth in the total economy; 2) technology represented the major constraint on agricultural productivity growth; and 3) investment in agricultural research could become the "high-pay off" source of agricultural growth. This perspective was reinforced and confirmed by the development and dissemination of the new, fertilizer-responsive varieties of wheat and rice.

The food crisis of 1972-73, however, put an end to such an unwarranted confidence in the "Green Revolution" as an easy answer to the complex food problem facing the overpopulated countries. Related to this situation, Wong (1979) argues that the "Green Revolution" actually represents a gradual process of developing and diffusing high-yielding varieties; the technological advances in rice, for example, should not be construed as a once-and-for-all change, but should be viewed as evolutionary in nature (Barker, 1971).

The early months of 1973 witnessed a dramatic upsurge in interest in the world food situation--largely in response

to global scarcity and rising food prices. Prices for some of the principal food commodities--wheat, rice, feed-grains, and soybeans--soared to historic highs in international markets. According to Brown (1977), several factors that contributed to the food scarcities of 1973 were the poor rice harvest in Asia and the shortfall in the Soviet wheat crop.

But Brown (1977) has also stated that we should not be permitted to obscure other, more fundamental, long-term trends and forces that are altering the nature and dimensions of the world food problem. During the 1970's, rapid global population growth continued to generate demand for more food, but, in addition, rising affluence emerged as a major new claimant of world food resources. Hence, self-sufficiency in food staples is still a national goal of most major rice-producing countries of south and southeast Asia. It was thought that the introduction of modern rice varieties (MV) or high yielding varieties (HYV) might make it possible to achieve the goal of self-sufficiency. However, importation levels in these countries generally have not declined.

Food Self-Sufficiency as a Policy Goal: The Case of Indonesia.

Indonesia is one country that is faced with the problem of food insufficiency, particularly in rice. Upon achieving its independence after World War II, Indonesia adopted self-sufficiency of food staples,

particularly of rice, as a national policy goal. The continuous population growth in Indonesia, together with its still low productivity of agriculture, has resulted in the lack of national self-sufficiency in food production. There is increasing awareness that one of Indonesia's critical problems is to keep food production growth ahead of population growth and demand growth. In addition, in countries like Indonesia, where national economies had been based on the export of tropical cash crops during the colonial period, the policy of self-sufficiency represents a nationalistic desire to minimize foreign power leverages.

By the mid-1960's, the Indonesian government was determined to reduce rice imports. Thus, the policy goal of food self-sufficiency was sought through the design and implementation of national rice intensification programs. Major rice programs--"Demas," "Bimas," Inmas," "Bimas Gotong-Royong" and "Bimas Yang Disempurnakan"--were launched, especially in Java (Indonesia's "rice bowl") to increase food self-sufficiency and, at the same time, to increase the farmers' welfare.

In general, these rice intensification programs have consisted of three major activities: 1) agricultural extension; 2) distribution of farm supplies (e.g., seed, fertilizer, and pesticides); and 3) provision of credits. Furthermore, the government has made considerable investments in the extension of irrigation facilities and

fertilizer use. To accelerate the achievement of the food self-sufficiency goal, the government has established policies directed toward the support of stabilizing product prices and subsidizing inputs, thus stimulating farm producers to increase food output. The government has also operated a price-policy program for rice that is designed to support a floor price for producers and maintain a ceiling price for consumers. Another policy instrument used by the government to encourage rice self-sufficiency has been the subsidy on inputs for rice production, especially fertilizer. The Indonesian government has supported fertilizer use among rice producers by subsidizing half the going market price.

For the country as a whole, there have been significant increases (i.e., 44 percent) in rice productivity over ten years--resulting in part from the adoption of modern technology (Wong, 1979). For example, Beckman (1981) reported rice production soared to 20 million tons in 1980--more than one million tons above the government's estimate.

The Impact of Rice Intensification Programs on Indonesia's Small Farmers.

A major question can be posed: Does the increased rice productivity, through such extremely high cost, translate into equitable social and economic benefits for the rural population? There is some doubt as to whether the rice intensification programs in Java have reduced poverty,

unemployment, and lowered inequality. From the experiences in other developing countries, it can be shown that when production is increased through new technology, the income of the "well to do" are increased the most (Mellor, 1975). Thus, there is a potential for a severe disequilibrium in economic benefits. This problem seems especially relevant in rural Java because of the large number of small farmers. Indonesia's Agricultural Census reports that the average farm size in Java was 0.71 hectare. Small farmers constitute 4.1 of Java's 7.9 million farmers. Of these small farmers, 2.1 million farm less than 0.1 hectares (Sajogyo, 1973).

The concern for equitable distribution of the benefits of rice intensification is not unique to the Indonesian case. For example, in the early 1970's, development thought had shifted to a new concern about institutional performance. One big question was: How can the institutions that serve rural areas be modernized so that the potential productivity of the new green revolution technology can be realized? (Ruttan, 1978).

More recently, attention has also focused on the rural poor, including the landless and small farmers. However, the focus is now one of "equity," largely because it is becoming increasingly apparent that the advances in agricultural technology often result in disparities between large and small farmers.

The remarks made in 1972 by Robert S. McNamara, then president of the World Bank, illustrate the heightened

concern for small farmers:

> Without rapid progress in small holder agriculture throughout the developing world, there is little hope either of achieving long-term stable economic growth or of significantly reducing the levels of absolute poverty.
>
> The fact is that very little has been done over the past two decades specifically designed to increase the productivity of subsistence agriculture.

In Indonesia, it has been found that small farmers share two interrelated characteristics: 1) The income from a farm size of 0.5 hectare or less is not sufficient to support household needs. (Therefore, many small farmers often live at the subsistence level.); and 2) many small farmers have to engage in off-farm jobs.

But can the rice productivity on small farms be increased simply through the adoption of new technology by small farmers? It has been very difficult to persuade small farmers to adopt recommended new technologies. The reluctance seems to be related to several main reasons: 1) the new technologies require substantial capital for cash inputs; and 2) there is always some risk and uncertainty in the use of new practices.

There is also evidence to support the contention that not all of Java's farmers have gained benefits from participation in the rice intensification programs. Some reports have shown that the new technology of farm practices are still beyond the reach of many small farmers. Records from the government's "People Bank" (Hansen, 1974) indicate that the average landholding for participants in the rice

programs is about 0.75 hectare, a figure that is well above the average farm size of Java.

Study Problem and Approach to the Problem.

Despite an aggregate increase in rice production through successive rice intensification programs, Indonesia remains one of the world's largest importers of rice. In addition, there is some evidence to suggest that all farmers do not equitably benefit from increased production.

A government sponsored "Expert Team" has found that, since 1975, stagnation has been experienced in the expansion rate of the land used as part of the rice intensification programs. It may be expected that one of the main reasons for this "leveling-off" trend comes from Java's small farmers, many of whom do not engage in new agricultural practices as fully as recommended.

The extent to which the improved rice technology can increase rice productivity is determined by the quality and quantity of various resources, including human resources, and the extent to which these can be upgraded and reorganized by improving the distribution system for the required inputs. According to Stevens (1977), many questions can be raised regarding the limitations associated with the technical, social, and economic situations faced by small farmers:

> Is the agricultural technology that is needed to increase production in a particular location actually available for small farmers?

If it is available, is it in sufficient quantities, in the form of fertilizer, new seeds, and pesticides?

Has the available new technology been demonstrated on typical small farms so that farmers know the details and other possible problems related to practicing the new technology?

Are there community and social problems related to agricultural practices?

In addition to these questions, Java's small farmers have been faced with a dilemma: to participate in the rice programs and apply the recommended agricultural technology fully or to work off-farm, if the opportunity is available.

To answer those questions, and to better understand the small farmer's problems related to the new agricultural technology, it is useful to identify factors that may be associated with the farmer's decision to participate fully or not fully in the rice intensification programs. Hypothetically, a number of factors, such as the social context, the economic context, and the extent and type of communication with off-farm actors, can influence the extent to which small farmers practice new agricultural technology.

Accordingly, this study focuses attention on the degree and extent to which these factors impact the agricultural-related decisions made by Java's small farmers.

Overview of the Study.

An introductory discussion on the background of the problem and the study problem were presented in this chapter. The following chapter will provide additional background information by presenting an overview of Indonesia's situation (primarily intended for those who have little or no prior acquaintance with this country). At the end of Chapter 2 the discussion will focus on the importance of rice in agricultural and economic development of Indonesia.

A review of related literature and research to this study will be presented in Chapter 3. This chapter provides an overview on the adoption of new agricultural technology--particularly new rice technology--by small farmers.

The study methodology is presented in Chapter 4. This chapter provides the procedures or approach employed in this study and includes a discussion of: the operationalization of the theory, study hypotheses, the data collection methods, and the data analysis approach.

Study findings are presented in Chapter 5. The first section of Chapter 5 deals with a general description--based on the results of the items in the survey questionnaire. In the second section of this chapter, the results of testing the study hypotheses will be discussed.

The final chapter is devoted to a summary, conclusions, and recommendation. In Chapter 6, an attempt is made to

identify the key findings of the study, draw conclusions and explain the key findings, and relate the study findings to policy, extension and further research recommendations.

CHAPTER 2

A DESCRIPTION OF INDONESIA'S SITUATION: FOCUS ON THE IMPORTANCE OF RICE IN AGRICULTURAL AND ECONOMIC DEVELOPMENT

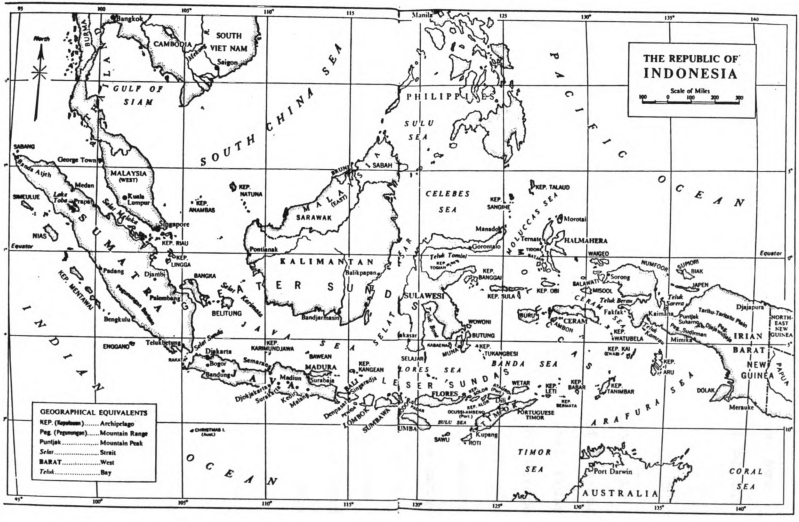
The purpose of Chapter 2 is to provide an overview of Indonesia's situation. This will provide additional background to the problem presented in Chapter 1.

The early parts of this chapter are intended to introduce the Republic of Indonesia to those who have no prior acquaintance with this island nation. These parts will present the locality, the physical setting, history, and the government of the country. The remaining parts of the chapter will focus on the role of agriculture in the national economy, the importance of rice in the agricultural sector, and the government policy on agricultural development through the rice intensification programs.

Location.

Where the Indian (or Indonesian) Ocean merges with the tropical Pacific, some 3,000 inhabited islands are strung out in a broad belt across the equator. Most of these islands, along with perhaps 7,000 tiny islets and the nearby waters, make up the Republic of Indonesia (Neill, 1973).

Figure 2-1. Map of the Republic of Indonesia



Source: Neill (1973)

This country is located between the mainland of Southeast Asia and Australia (see Figure 2-1). Five of the main islands, i.e., Kalimantan, Sumatra, Irian Jaya (West New Guinea), Sulawesi and Java, contribute 92 percent of the total land area.

Terrain.

Indonesia, with its islands and seas together, is almost as large as the United States; but much of its territory is water. Its actual land area, about 735,865 square miles, is a little less than half the land area of Europe and less than a quarter that of the United States.

In general, rugged areas exceeding 2,000 feet in height might conveniently be described as mountains, those between 500 and 2,000 feet as hills, and flatter areas below 500 feet as plains (Neill, 1973). By this definition, most of the country consists of plains. Extensive plains exist in eastern Sumatra, southern Kalimantan and southern Irian Jaya, with those of Sumatra and Kalimantan being low and swampy in many places. The mountainous portions of Indonesia include western Sumatra, east-central Irian Jaya, most of inland Java, a large part of inland Kalimantan, and practically Sulawesi. The rest of Indonesia is hilly for the most part. Besides these three terrains, the country has many scattered and small plateaus: areas above 500 feet in height, steep-sided, but comparatively flat on top.

Excluding Irian Jaya, the highest elevations of Indonesia are provided by volcanos. In the stretch of

islands from Sumatra and Java eastward through the Bali-Wetar chain, and thence northward through Sulawesi and the Mollacas (Maluku), more than 400 volcanos exist. About 77 of them are regarded as still active. On Sumatra, Mount Kerinci is 12,484 feet high. On Lombok Island, just east of Bali, Rinjani is almost as high, at 12,224 feet. Semeru, in eastern Java, reaches 12,060 feet. Irian Jaya is nonvolcanic even though mountainous. The highest mountain, Puncak Jaya, on Irian Jaya, rises to 16,500 feet high.

Climate.

There are only two seasons: the dry season between April and October, and wet or rainy season between November and March. Rainfall is most prevalent during December and January. It varies from island to island with an average precipitation of 3,300 mm in Kalimantan and 2,000 mm in the eastern part of Nusa Tenggara.

Indonesia straddles the equator, so the country has generally a hot, tropical climate with little difference in temperature the year round. In Bandung, for example, the mean minimum temperature was 18.6°C in February, 1978; the mean maximum temperature was 28.8°C in May, 1978 (Indonesia's Statistic Bureau, 1979/80).

Population.

Indonesia has the fifth largest population in the world. Only China, India, the Soviet Union and the United States possess larger populations. According to the 1971

Table 2-1. Population Statistics for Indonesia by Province and Major Islands: Population in 1971, 1980, and Average Growth Per Year (1971-80).

	Population In: 1971	1980	Population Growth Per Year 1971-80 (%)
Aceh	2,008,918	2,607,737	2.94
North Sumatra	6,622,693	8,357,018	2.62
West Sumatra	2,793,196	3,401,564	2.21
Riau	1,641,591	2,163,088	3.11
Jambi	1,006,084	1,439,787	4.06
South Sumatra	3,443,749	4,621,155	3.32
Bengkulu	519,366	767,672	4.44
Lampung	2,777,085	4,622,247	5.82
Sumatra	20,812,682	27,980,268	3.34
Jakarta	4,576,009	6,506,470	3.99
West Java	21,632,684	27,490,210	2.70
Central Java	21,877,081	25,365,053	1.66
Yogyakarta	2,489,998	2,745,470	1.09
East Java	25,526,714	29,175,269	1.50
Java	76,102,486	91,282,462	2.04
Bali	2,120,338	2,469,853	1.71
West Nusa Tenggara	2,202,333	2,724,065	2.39
East Nusa Tenggara	2,294,945	2,721,909	1.91
East Timor	-	552,954	-
Nusa Tenggara	6,617,616	8,468,781	2.0o
West Kalimantan	2,019,936	2,482,809	2.32
Central Kalimantan	699,589	949,819	3.46
South Kalimantan	1,699,105	2,069,423	2.21
East Kalimantan	733,536	1,218,785	5.80
Kalimantan	5,152,166	6,720,836	3.00
North Sulawesi	1,718,155	2,091,279	2.21
Central Sulawesi	931,662	1,289,226	3.90
South Sulawesi	5,189,227	6,053,633	1.73
Southeast Sulawesi	714,120	943,386	3.14
Sulawesi	8,535,164	10,377,524	2.20
Maluku	1,088,945	1,407,016	2.90
Irian Jaya	923,440	1,146,178	2.43
Maluku & Iran Jaya	2,012,385	2,553,194	2.68
Indonesia	119,232,499	147,383,075	2.34

Source: "Biro Pusat Statistik" (Center Bureau of Statistics), 1981.

census, the population of Indonesia was 119 million inhabitants; 78.2 million live in the islandsof Java, Madura, and Bali. The population density is 560 persons per square kilometer for the country--one of the highest in southeast Asia. The islands of Kalimantan, Sulawesi and Sumatra have densities of 9, 37 and 39 persons per square kilometers, respectively.

Preliminary results from the 1980 census reveal a national population of more than 147 million people. The annual population growth rate is 2.34%.

As shown in Table 2-1, the population growth rate in Java is still high despite ten years of intensive family planning efforts. Java's population growth is often noted as one of the country's major problems. Estimates of projected population growth indicate that, by the year 2000, from 110 to 120 million people will inhabit Java (Hansen, 1974).

History.

Indonesia's history can be divided into the following periods: early history, the period of Dutch colonization, and the period after movement toward independence.

Early History

Scholars appear to generally agree that ethnically and culturally the Indonesians are composed of two strains (Sievers, 1974). The Neolithic, Austronesian-speaking Proto-Malays drifted into this area from the Asian mainland

over the period between 2500 to 1000 B.C. One or two centuries before the Christian era, the Proto-Malays were joined by more purely Mongoloid people that may be called, Deutro-Malays. In general, the two strains merged, and this synthesis has produced the distinctively Malay ethnic type and cultural pattern (of whom the Indonesians are the major part), which is characterized by tribal-village life, with its "adat" (traditional custom), including wet-rice agriculture with irrigation.

During this period, Indian cultural influence was dominant. Early Indonesian contact with India had consisted largely of travel by merchants of both regions. Because of this contact, Hindu-Buddhist culture began a rapid penetration of Indonesia. The great Shriwjaya empire with its capital in Southern Sumatra, was a reknowned center of Buddhist learning. In about A.D. 800, the Saelendra dynasty built the great Buddhist temple, Borobudur, in Central Java. In the 1200's, Hinduism was ascendant in the powerful, Java-based, Majapahit empire.

From the 1100's, Arab traders spread the Islamic religion. Like Buddhism and Hinduism, Islam was first adopted by the kings and nobles of the local dynasties and by the merchant princes, who were a powerful force in these communities.

The kingdom of Majapahit, its power already weakened, was conquered in 1478 by a coalition of the Moslem states that had been established on the north coast of Java. By

the dawn of the sixteenth century, a majority of the Indonesian people were Moslems.

Western dominance began in 1511 when the Portuguese landed at Malacca, on the Malayan peninsula, in search of spices. Traces of the Portuguese influence can still be found in the many Indonesian words derived from Portuguese and in some of the music of the eastern part of the archipelago.

Dutch Colonization

A new and more vigorous group of European traders dropped anchor off the west of Sumatra, in 1596. The Dutch were previously interested in quick and substantial profits. Within five years, the Dutch merchants had formed no fewer than ten companies to carry on trade with the islands. The Indonesian rulers welcomed the opportunity to use the Dutch to drive out not only the Portuguese, but also the considerably smaller British and French trading groups.

In 1602, the existing trading firms were amalgamated into a single unit, the Dutch East India Company. By the 1630's, this Dutch company had effectively driven out rival European traders from the archipelago.

In Java, the net effect of the Company's policy was negative. The Dutch regulated the production of various crops and imposed a system of forced cultivation of certain crops and the delivery of the stipulated quotas to the Company. Thus, although agricultural production, in general, increased considerably under the Company's regime--and

despite the fact that the Dutch introduced the cultivation of new crops, principally coffee--the position of the individual Javanese farmers deteriorated (Mintz, 1961). Javanese merchants also were soon forced out of business. The Dutch preferred to use Chinese as their middlemen. The Company leased large tracts of land to the Chinese, and also granted them certain monopolies, among them the right to collect tolls and taxes. The Chinese soon came to control the internal commerce of the island; their number increased and the Javanese merchant class gradually disappeared.

Although coffee, sugar, indigo and tea from Java, and spices from the Moluccas (Maluku), were bringing the Dutch enormous profits, the Dutch East India Company was disastrously in debt by the end of the eighteenth century. The Company collapsed in 1798 and the areas it had controlled were taken over by the Netherlands government.

In 1811, following Napoleon's conquest of the Netherlands and his subsequent attempt to establish French rule in Java, the British seized the Indonesia archipelago. The Dutch came back to Java in 1816, after the close of the Napoleonic Wars. Once again they found themselves back in the familiar situation: running a highly profitable colonial enterprise.

Movement Toward Independence

Discontent at the way things were going was protested by the local people in the form of local wars and other

anti-government actions from time to time. These struggles against the colonial power gradually produced a feeling of nationalism among Indonesians, which lead to movements toward independence from the Dutch colonial string. During World War II, the Japanese occupied the islands for more than three years. The sufferings during Japanese occupation had accelerated the desire for independence. With Japan's defeat, two Indonesian leaders, Sukarno and Hatta, declared the independence of the Republic of Indonesia, on August 17, 1945. For the next four years, Indonesia struggled to keep the Dutch from resuming colonial rule. The U.N. succeeded in getting both sides to end the conflict. In December 1949, the Netherlands formally recognized Indonesia's independence. However, conflict against the Netherlands still existed and increased as Indonesia sought control of its territory that still was controlled by the Netherlands--West New Guinea (Irian Jaya). In 1960 diplomatic relations with the Netherlands were severed and Indonesian troops began infiltration of Irian Jaya. The Netherlands subsequently turned the region over to the United Nations in 1962. The U.N. placed the territory under Indonesia's jurisdiction in May 1963.

Government.

Form of Government

At the present time, Indonesia is a unitary republic with a president as the national head of the central

government; just after the Agreement with the Dutch the country was a Federation of several regional states. In accordance with the Agreement, on December 27, 1949, the "Republik Indonesia Serikat" (Republic of the United States of Indonesia") became a sovereign and independent state--under a new constitution and under Sukarno as president and Hatta as prime minister. However, by the end of March,1950, twelve of the sixteen states voluntarily submerged their identity, through unitary movement, in the first Republic (which was proclaimed by Sukarno-Hatta on August 17, 1945).

In May 1950, it was decided by all concerned to establish a new unitary state, terminating the Federation. The new Republic chose Sukarno for president and Hatta for vice-president.

After the failure of an attempted communist coup on October 1, 1965, a power struggle erupted. Gen. Suharto emerged as the strong man of a new regime. On February 23, 1967, he was nominated as acting president. On March 12, 1968, he was appointed full president by the "Majelis Permusyawaratan Rakyat" (MPR, People Consultative Assembly--the highest authority of the state, the embodiment of the sovereign people). Suharto was reelected to a third five-year term as president in 1977.

Levels of Government

The central government, located in Jakarta, controls and coordinates the lower levels of government. The lower levels consist of: provinces ("propinsi"), regencies

("kabupaten"), sub-districts ("kecamatan"), and villages ("desa"). The country consists of 27 provinces that cover major islands and regions: Sumatra, Kalimantan (Borneo), Sulawesi (Celebes), Java, Irian Jaya (West New Guinea), Nusa Tenggara and Maluku (Moluccas). The central government gives "first order" autonomy to provincial governors and "second order" autonomy to the regencies or "kabupaten" and to town municipalities. Each level has its legislative council, personnel, and budget. The village, particularly in Java, is seen as the "third order" autonomy level of government, but usually functions without any legislative body.

Government Planning

General Suharto became full president in March, 1968. In June, 1968, he named his first cabinet the "Development Cabinet." He gave this name special meaning by appointing members of his brain trust to it. For the first time, the generals were outnumbered by civilians--about half of whom were technocrats (Sievers, 1974).

The first Five-year Development Plan, "REPELITAI," was inaugurated at the beginning of fiscal year 1969/70, that is, April 1, 1969. It is the National Development Planning Board, BAPPENAS ("Badan Perancang Pembangunan Nasional"), which develops the five-year plans, makes annual adjustments in the plans, and generally supervises the development program.

Each province government has a Regional Development Board. This board is responsible for the planning

coordination among department offices at the province level to meet the central government policy guidelines for development program. The regency government has a Regency Development Board. The purpose of this board is to decide the priority of development projects for a particular regency.

The regency or "kabupaten" is usually known as the county level with population of one or more hundred thousands. Other similar levels are changwat in Thailand, counties in China, Korea and Taiwan (Uphoff and Esman, 1975).

In the sub-district level, the head man ("Camat") has the responsibility of reporting to the higher level of government. The "Camat" has the responsibility for coordinating the technicians, who are stationed in the sub-district area. According to Uphoff and Esman (1975), the sub-district is equivalent to the U.S. township level with a population generally in the range of 20,000 to 50,000. Similar to sub-districts are amphoe in Thailand, blocks in India, divisions in Sri Langka, mukim in Malaysia, mura in Japan, and unions in Bangladesh and Pakistan.

The "desa" or village is the bottom administrative unit of the government, although generally it consists of several sub-villages or "kampung," i.e., a cluster of family houses. As a comparison, Indonesia's village is the same level as barrio in the Philippines, brigade and production-team in China, hamlet in Japan and Korea,

kampong in Malaysia, local community in Yugoslavia, and panchayat in India (Uphoff and Esman, 1975).

The Role of Agriculture in the National Economy.

Agriculture plays an important role in the Indonesian economy. More than 60 percent of the economically active population of the country is in agriculture, as can be seen in Table 2-2.

Table 2-2: Agricultural Population in Indonesia.

Year	Total Economically Active Population (million)	Active Population in Agriculture (million)	Percentage in Agriculture
1960	32.9	24.6	74.5
1970	42.2	27.9	66.3
1978	50.3	30.4	60.4

Source: FAO (1978).

Approximately 80 percent of the agricultural population is concentrated in Java.

Prior to 1968, agriculture's contribution to the gross domestic product (GDP) fluctuated between 51.3 to 53.9 percent (USDA, 1977). In 1976, the agricultural sector represented 40 percent of the GDP. Since 1974, the percentage has decreased as a result of the relatively increasing contributions made by other sectors, particularly oil. However, the absolute value of the agricultural sector has increased. It is estimated that, as a portion GDP, agriculture remains at about 35 percent. Major agricultural

products are rice, rubber, cassava, corn, palm oil, and tobacco.

Agricultural exports in 1979/80 reached $4,628 million as compared to $2,744 million in 1977. In both cases, the agricultural exports represented roughly about one quarter of total exports. To some extent, the high proportion of the agricultural export value is a result of increasing prices for agricultural products on the international market.

Coffee is Indonesia's largest food-product earner. Exports of lumber, rubber, palm oil, along with coffee, represented 85 percent of the agricultural export value in 1979/80.

The Importance of Rice in the Agricultural Sector.

One of Indonesia's major problems is the insufficiency in food production, particularly of rice. Actually, rice production in the last decade has expanded rapidly, but still not rapidly enough to keep up with the demand.

The increase of rice consumption per capita of almost two percent annually, coupled with population growth of more than two percent, should continue to aggravate the problem of food supply. The growing deficit of rice is evidenced by rapidly increasing rice imports--from an average of only half a million tons in 1968 to almost

2 million tons in 1977. With high productions of rice in 1979 and 1980, rice imports were still high--approximately 1.9 million tons and 1.3 million tons, respectively ("Tempo," Nov. 1981).

Components of the Rice Production System in Indonesia

Indonesia's agricultural production is basically composed of two components: the plantation sector, which produces cash crops mainly for exports, and the subsistence sector of small holders (peasants), who produce rice and other secondary food crops. While the cash crops have long been a prime factor in the growth of the economy, the importance of the subsistence sector is even more far-reaching; it directly concerns the livelihood of about 70 percent of the rural population (Wong, 1979). Within the subsistence sector, rice is the most important crop for the peasants in the country, as it provides not only the bulk of their incomes, but also a major source of their daily caloric intake. It is not surprising, therefore, that the government has given high priority to rice production in economic development plans.

Indonesia's Rice Intensification Programs

The government has focused production efforts through several rice intensification programs. "Intensification" generally means the use of a recommended package of inputs involving new high-yielding variety seed, fertilizer, pesticides, irrigation, and improved cultural practices.

Upon achieving its independence, the government of Indonesia immediately set about preparing plans for increasing the domestic production of rice. In discussing Indonesia's economic developments, it is relevant to refer to 1960-65 as the "Sukarno period" and 1966 to present as the "Suharto" or "new order" regime. In general, the Sukarno period was a time of slow economic growth and high inflation rates. Conversely, the Suharto government brought stability to the country by reducing inflation and accelerating economic growth.

Overview of rice intensification period

Historically, the Indonesia's rice programs can also be differentiated into two periods: those carried out prior to 1966 and those carried out after 1966. Four of the early programs were: (1) The first sustained program to increase rice production, which was initiated in 1952; (2) "PadiCentra" (Paddy Center) program that was initiated in 1959; (3) "Demas" (Mass demonstration) that was carried out in 1964-65. The second period's rice program are: (1) "Bimas" (Mass guidance) that was initiated in 1965-66; (2) "Inmas" (Mass intensification) that was initiated in 1967-68; (3) "Bimas Gotong-Royong" (Cooperative Bimas) conducted in 1969-70; and (4) Improved Bimas that was initiated in 1970-71 and continues to the present time.

Programs of the early periods (1952-66). The rice program initiated in 1952 was inaugurated with the purpose of achieving rice self-sufficiency by 1956. The basic

thrust of this campaign involved the increased distibution of fertilizer, the dissemination of improved seeds, and restoration of irrigation facilities; whereas in the outer islands efforts had been conducted through an expansion of new agricultural land areas. The results of this program appear to have been considerable; rice production rose by a margin of 30 percent between 1950 to 1954. However, the momentum achieved in this program came to a sudden halt in 1955 when major floods destroyed a significant portion of the rice crop. The plan was then abandoned.

In 1959, a national policy for reaching self-sufficiency in rice within a period of three years was established in the "Paddy Center" program. The target was to establish 250 paddy centers to cover 1.5 million hectares by 1961-62. A special authority, the "Pertani," was created to implement an integrated program to deliver a better technology package to rice farmers. The package included intensive extension sources and credit in kind (fertilizer, local improved seeds, pesticides) and in cash, to be repaid in rice procurement for a national rice stock. According to Sajogyo (1973), the program had pushed a chemical fertilizer "revolution" in Indonesia's rice fields. In a short time, the annual imports of fertilizer had reached two to three times the pre-war volume. Despite the result of increased fertilizer consumption, the lack of trained extension agents and the weakness of the administrative performance of the "Pertani," made the program unsuccessful.

The hoped for surplus of 390,000 metric tons in 1962 turned out to be a record deficit of one million tons (Palmer, 1978). Another failure of the program was the low repayment rates. In the wet season of 1959-60, the repayment rate in West Java was the lowest at 56 percent (Birowo, 1975).

During the 1964-65 wet season, a "Mass demonstration" program was conducted. The program encouraged farmers to practice "panca usaha" ("five principles" of rice intensification): 1) use of high-yielding seed; 2) use of fertilizer; 3) use of pesticides; 4) better irrigation; and 5) improved cultural practices. Four hundred forty students from nine Colleges of Agriculture of all parts of the country were sent to 220 villages in an area of almost 10,000 hectares. The tasks of the students were to undertake intensive extension work and work together with farmers in practicing rice intensification efforts. This program was successful in terms of the national effort to increase production. However, with the growing of the size of rice areas faced by each student, problem inputs delays becoming serious, and this program was terminated.

Newer program (1966 to date). The second "wave" of rice programs was the "Bimas" rice intensification program that was initiated during the wet season of 1965-66. Bimas is an acronym for "BImbingan MASaal," which means mass guidance. It involved the mass guidance, or education, of farmers in using their resources for production,

i.e., to use more and proper fertilizer, better rice varieties, and pesticides, besides improving their cultural practices and irrigation facilities.

The Bimas program was rapidly expanded and it has been modified substantially. Program areas were selected on the basis of: 1) the availability of irrigation; and 2) the adequacy of road network. These areas were heavily concentrated in Java.

The predominant feature of this Bimas program was its group-credit approach. Farmers received credit accommodations through their village cooperatives. These cooperatives were loosely registered organizations as they served as channels for loans, but they do not meet cooperative standards of education and financial management. "Bank Rakyat Indonesia" (Indonesia's People Bank") was the major source of loans. Other sources were "BULOG" (Food Logistic Board) and "Pertani." Bimas loans consisted of farm supplies and cost of living allowance; the size of loan packages varied from time to time.

In mid-1967, some alterations were made to these rice programs. The programs were divided into "Inmas" and "Bimas." "Inmas" (mass intensification) embraced farmers who were self-financing and voluntary participants. It was assumed that farmers, who had been assisted under the Bimas program, would have increased their production and income substantially. Further, it was assumed that they no longer needed credit and would only need technical

advice. In fact, there was no evidence that the extension service had been intensified under the Inmas program.

During the wet season of 1968-69, "Bimas Gotong Royong" was introduced. "Gotong Royong" means cooperation; the cooperation was arranged among Indonesian government, farmers, and foreign companies. The government entered into a contract with seven foreign companies, mostly manufacturers, for the supply of fertilizer, pesticides, and some equipment on a one-year deferred payment basis. It was designed to have a dramatic impact on rice production. For West Java, this program covered 343 thousand hectares in 1969 and 318 thousand hectares in 1970. The size of loan packages under this program were larger than under the earlier programs. Farmers were advanced supplies of fertilizers and pesticides through the village head and were committed to pay for these inputs by delivering one-sixth of their crop to the government. By the second year of implementation (1970), the terms of repayment were changed to a fixed value; repayment was to be made in cash or in kind. Those foreign companies were to be paid a fixed price for every hectare that was supplied with production inputs.

Despite some benefits of the mandatory introduction of new inputs to the farmers through the Bimas Gotong Royong program, repayment rates were very low--even lower than in Paddy Center program in 1959-62. Thus, in light of the high cost of the program, low repayment rates, wastage of

farm supplies, and alternative investment opportunities, this Bimas program was not considered successful. This program lasted only two years before it was terminated.

A new Bimas program was then developed during the wet season of 1970-71. It was named the "Improved National Bimas" program. The funds for the new program were put in the national development budget. The "Bank Rakyat Indonesia" was the single institution called on to take care of the credit services. Under this program, farmers received loans individually--not as collective credit--from the "village unit," which was organized by Bank Rakyat Indonesia.

In structure, the "village unit" consisted of a representative of the government bank with two assistants recruited from local villages--an extension workers, and a fertilizer retailer. A "village unit" usually covered an area of 600 to 1,000 hectares of rice fields (called "Wilud, Wilayah unit desa) and a population of 1,800 to 3,000 farmers living in about five adjoining villages (Birowo, 1975). Supplies of fertilizer and pesticides go through the usual marketing channels instead of direct government's distribution ones. Farmers are given more freedom to choose the combination of inputs they need.

A "Wilud" is also provided by a village unit administrative (BUUD, "Badan Usaha Unit Desa") whose officials are appointed from local villages. It is hoped that, in the future, when local administrative resources were strong

enough, the BUUD would turn into Village Unit Cooperative (KUD, "Koperasi Unit Desa"). It is also hoped that this KUD would form the basis of a new village development unit. Since 1973, BUUD's and KUD's have been grown in many areas. They serve both the Bimas and Inmas programs.

Observations About Indonesia's Rice Intensification Efforts.

From studying Indonesia's rice intensificaton programs, it can be generalized that basically those programs consist of four major activities. The activities differ in the manner in which they are carried out. They involve: 1) agricultural extension to encourage farmers to adopt new agricultural inputs; 2) steps to properly distribute supplies of new inputs; 3) provision of credit to enable farmers to secure farm supplies and pay for them after harvest; and 4) improvement of irrigation facilities.

Two other measures on price policy are conducted by the government in connection with the rice programs to accelerate the achievement of the programs. They are: 1) the fertilizer price subsidy to encourage greater use of fertilizer by farmers; and 2) the rice price stabilization to encourage farmers to adopt improved technology and to increase their production so that consumers can benefit by reduced prices.

C 'R 3

THE ADOPTIO' 'AL TECHNOLOGY
BY S 'VIEW

The Smal mer.

Rural poverty of flicts most developing countries. The onsists of landless laborers, the unemployed, and stence farmers (Berry and Cline, 1979). Subsistence farmers may be defined as farmers who use most of what they grow to meet the needs of their families (Wharton, 1970). A subsistence farmer generally operates a small farm; he almost always works close to the edge of poverty. Many small farmers cannot support their families from the income generated by their tiny holdings. Thus, many small farmers are forced to seek employment as agricultural labors.

In the developing countries, agricultural per capita income is typically below the national average. Even worse, the distribution of income within the agricultural sector is highly skewed. In Mexico, for example, more than 40 percent of the agricultural population in 1962 belonged to the lowest income group. Yet, persons in this group received only 15 percent of the income generated in agriculture. By contrast, the highest income group, which

constitutes 1.4 percent of the agricultural population, received 14 percent of the income. Therefore, the per capita income of the highest income group was nearly one hundred times higher than that of the lowest group (Biggs, 1974).

Enhancing the Development of the Small Farmer: Strategies.

Since an estimated 40 percent of the land under cultivation in the developing countries is subsistence, rather than commercially farmed (Wharton, 1970), an increase in the output of subsistence farms would have an important affect on the overall agriculture yield. Recently, policy makers have turned, in earnest, to the present and potential small farm sector in the search for a feasible means of achieving the objectives of increasing agricultural production, growth of income, and enhancing rural equity. In the last decades, many countries have embarked upon a variety of projects that are aimed at increasing food production as a means to enhance the standard of living of rural people (Crouch and Chamala, 1981). Through those projects, technological change has been either guided, managed, or induced in different parts of the world. However, there is a greater need to define or redefine development and to understand the process and dynamic factors that are related to technological change and rural development. In this connection, Seers (1981) in his attempt to define development, points out that a "plan that

includes no targets for reducing poverty, unemployment, and inequality can hardly be considered a "development plan." The questions to ask about a country's development, according to Seers (1981), are therefore: What has been happening to poverty? What has been happening to unemployment? What has been happening to inequality? If all three of these have declined, then--beyond doubt--there has been a period of development for the country concerned.

According to Berry and Cline (1979), two general policies warrant particular, considerations: (1) land reform, i.e., redistributing land from existing large farms into new small-scale family farms; and (2) the channeling of improved inputs and credits to existing small-farm sector. For Java, where land redistribution is not a feasible option, only the latter policy is relevant.

Mosher (1966) has presented a classification system for small farmer development strategies. Essentially, there are three types of programs: (1) the integrated approach; (2) the non-integrated approach; and (3) the filter-down approach. The integrated approach calls for the simultaneous provision of a number of sources or activities for small farmers located in a specific geographic region. The non-integrated approach stresses the delivery of a small number of sources or activities (e.g. credit programs and cooperatives). The filter-down approach includes a national development policy that is aimed at overall agricultural development, such as: price support, extension efforts, trade policy, and research.

Enhancing Small Farmer Development: Results of Strategies.

Deficiences are associated with these approaches in terms of their ffect on small farmers. For example, filter-down programs typically benefit large commercial farmers who have access to information and/or already actively participate in the exchange economy.

The rice intensification programs in Java may be categorized as an example of the integrated approach. Through these programs, new agricultural technology (i.e., "Green Revolution" technology), is introduced to farmer participants. However, the reality (at least from the experiences in the developing world) is that the new technology is still beyond the reach of many small farmers. Some analysts also feel that the impact of the "Green Revolution" has been minimized because of: 1) soil erosion; 2) the costs of the adoption package (improved seed varieties often demand irrigation and intensive application of fertilizers and pesticides); 3) the cost of storage, distribution, and marketing; and 4) the lack of awareness of the technology by some low-income farmers (Wharton, 1969). According to Havens (1975), the "Green Revolution" technology was often available only to the large landowner. This situation could lead to further concentration of agricultural incomes. In essence, those who may not benefit fully from the fruits of the "Green Revolution" may be small farmers, sharecroppers, renters, and agricultural laborers.

Lele and Mellor (1972) have noted that larger farmers are in a position to afford these innovations. They also wield more political power over the development agencies that provide access to credit and crucial supplies, such as: fertilizers, seeds, and pesticides. Thus, the introduction of new technology seems generally to fall under the predominant control of those who own most of the land and capital. Consequently, while new technology may increase production and incomes, these benefits may not automatically "trickle down" to the rural majority.

The problem of inequality is further compounded by the use of a "progressive farmer" strategy by national governments to diffuse new innovations. The reasons why most rural development agencies in developing nations follow the "progressive farmer" strategy have been delineated by Roling (1970):

1. Progressive farmers have large-size farms; the extension worker's direct effect on total agricultural production is greater if he works with more progressive farmers;

2. Progressive farmers are those who can be expected to form the future core of commercial farmers who will provide the nation with food and export earnings;

3. Progressive farmers have a high sense of efficacy; thus, they are eager for information;

4. Progressive farmers demand assistance; they have the economic means to try out new ideas;

5. Progressive farmers are usually homophillous with the agricultural extension workers;

6. Progressive farmers provide an intellectual challenge to the local extension service official--they keep him "on his toes" with their questions and problems;

7. Extension workers learn from progressive farmers what to tell others.

An example of the "progressive farmer" approach is described in a report authored by the Republic of Indonesia (1973). After having said that "ideal domonstrator farmers should be progressive, influential, sufficiently educated, representative, and of sufficient economic means," the authors continue:

> ...it will not be easy to find the ideal demonstrator farmer, ...but it must be considered quite possible to find always a farmer who is willing to follow advice and to play a leading part in farmers' meeting without insisting on being paid for that.

However, diffusion processes are "imperfect equalizers," in fact, because of the following reasons:

1. Innovations do not typically arrive in rural communities one by one; instead, innovations come in rapid succession. While some members of the system are still adopting an earlier innovation, other individuals are already reaping benefits from those more recently introduced.

2. Innovations take time to diffuse. So, those who plant it earlier receive an extra income over additional years that puts them ahead of others. The later adopters may find it impossible to "catch up."

3. Farmers with a small resource base run a proportionately greater risk in venturing into new endeavors. Conversely, those with larger farms benefit proportionately more, given the same yield increase per hectare.

4. Progressive farmers tend to become a fixed clientele over time. Consequently, new

information is always channelled to the same farmers--further strengthening their advantages through early adoption of innovation.

The Diffusion of New Agricultural Technology to Small Farmers in Java.

This process of diffusing new technology from the progressive farmers ("upper stratum") to the peasants ("lower stratum") also occurs in rural Java. For example, Soewardi (1972) has studied the Javanese farmer's response to the modernization process. He has viewed Java's "Green Revolution" from a sociological viewpoint with the area's history serving as an important frame of reference. The focus of interest of his study is the "cure" of Javanese village society after one-and-a-half centuries of an institutional non-linkage problem with its far-reaching consequences. Soewardi found that the rural population was generally responsive to the adoption of new technology. This conclusion means that both the upper and lower strata of the village population appeared to participate in the new farm practice opportunities that were available to them. The findings of the study also revealed that it is the upper stratum that is in the position to pioneer the new technology. This upper stratum is usually in direct contact with the extension workers so that those people are the first to be persuaded by the extension workers to attend agricultural courses and practice the new practices. Through these people, somewhat indirectly, the new technology has been diffused to the lower stratum over a span

of approximately ten years. The diffusion to the lower stratum happens--not because the upper stratum has extended its knowledge--but because of contacts with the "marginal" upper stratum, who are visually not distinguishable from the lower stratum, and who maintain daily contact with the lower stratum people.

However, an important change has transpired since Soewardi's 1972 study: a "leveling off" of the land area of intensification and of the increasing rate of rice yield has occurred. This suggests that many farmers, who had previously participated in the programs, have decided to decrease or withdraw their participation in the rice intensification program.

A Theory of Adoption Behavior.

What type or kind of adoption behavior appears to be most applicable to Javanese small farmers?

Types of Adoption Behavior.

Innovations, such as new farm practices, can be adopted or rejected by individual members of a system or by the entire social system. Rogers and Shoemaker (1971) have suggested four kinds of adoption behavior: (1) contingent; (2) collective; (3) authority; and (4) optional or individual.

Contingent adoption is defined as a social system adoption in which individual members have the option to adopt the innovation after a prior adoption decision by the system. An example of a contingent adoption is the adoption

by a teacher of audio-visual aids in teaching after the school authorities have purchased audio-visual equipment for use in the school.

Collective adoption may be defined as a social system adoption in which the individual members are involved in decision-making process. The individual members are obliged to act jointly to adopt the innovation. An example of a collective adoption is a well for irrigation by a farmer's cooperative. The adoption decision is made jointly by the farmers. The use of the well for irrigation involves joint action by the farmers.

Authority adoption is defined as a social system adoption in which the individual members are not involved in decision-making. The individual members must, individually or jointly, adopt or reject the innovation. An example of an authority adoption is the adoption of a new technological process by the management of a factory. The individual members are bound to use the new process.

These three types of adoption behavior can be classified as types of social system adoption; cases where the decision to adopt an innovation is made by a subsystem of the social system. This subsystem may consist of all the members of the social system or may consist of one or more members authorized to make decisions for the social system.

Individual adoption is defined as the case where the individual makes a decision for himself and implements the decision to use the innovation. In this process, the

individual adopter is likely to be influenced by the other members of his social system. But the final responsibility for decision-making and acting is his own. The adoption of a new farm practice by a farmer is an example of individual adoption. Only individual adoption will be considered in this study.

Impediments to Adoption

Scientists and planners are aware of the need for deliberate efforts to persuade farmers to adopt new ideas and practices. However, there are a number of problems or obstacles to extending new production-technologies to a large number of farmers. Although it is recognized that these problems are quite complex and interrelated, Biggs (1974) has identified three broad categories of problems: (1) technical-production problems; (2) organizational and institutional problems; and (3) problems related to farmer's decision-making.

Lack of rainfall is an example of a technical-production problem. The new technologies, which employ heavy doses of fertilizer and require more plantings per unit of area, are particularly sensitive to rainfall. New technologies, which are often developed under field-tested, moisture-adequate conditions, often perform worse than the local technologies when subjected to rainfall deficiencies.

An example of organizational/institutional problem is the process of obtaining credit. Many farmers often complain that bank credit is difficult to obtain through Java's rice

program. Particularly the small farmer who could not get credit did not have an opportunity to practice new technologies at earlier time; whereas new technologies need additional cost to practice. The third problem will be elaborated on in the following sub-section.

Factors influencing adoption

From the experience of the Pueblo Project in Mexico, Biggs (1974) indicates that one of the most important factors influencing the decision to participate or not in the problem is the degree of economic risk implied by the new technology. Even under the possibility of doubling family income, many small farmers may be deterred from participation by their perception of the risk accompanying the technology. Another factor that has been found to influence the decision to participate in the rice program is the availability of off-farm job opportunities. The other possible reason for dropping out of the program is the accumulation of debts from previous years. The major reason for loan defaults is low level of production, which may be due to many factors such as the participant's failure to precisely follow farm practice recommendations. From the experiences in some villages of Java, farmers often buy the recommended quantities of fertilizers, but often do not apply the entire amount. These farmers see the fertilizer purchase as a form of savings--to be sold at a later time--when cash is needed. Other farmers sell part of the total fertilizer to a neighbor or family member who may not be able to obtain credit from the program.

In addition, there are a number of other possible reasons for farmers to behave at variance with farm practice recommendations. Among these are: late receipt of fertilizer due to late loan applications (and the associated difficulty in bank processing); participants not being fully informed on the recommendations; and credit constraints in purchasing fertilizer. All of these factors may inhibit the use of optimal farm practices.

Roy (1968) has concluded from his research in rural India that the following variables affect the farmers' decision-making process: (1) socio-economic status; (2) size of farm; (3) the use that a farmer makes of communication in terms of his extension service contact and his reliance on mass media; and (4) the farmer's linkage with outside world in terms of his urban contact, political knowledge, and secular orientation.

Rochin (1972) also found that both mass media and interpersonal communication channels have important roles to play in introducing dwarf wheat varieties to smallholders in Pakistan. Mass media channels are those means of transmitting messages that involve a mass medium such as radio, television, film, newspaper, fairs and the like which enable a source to reach a large audience. (A source is an individual or an institution that originates a message.) Interpersonal channels are those that involve a face-to-face exchange between two or more individuals. Adoption research has shown that people become aware of new ideas

from the mass media, but they usually do not adopt these ideas themselves before they have been able to use personal sources of information; the mass media does not bring about important changes in human behavior unless they are combined with interpersonal communication (Rogers, 1962; Luthe, 1968). Van den Ban (1981) argues that farmers are readily convinced by results and performances--not by claims and suggestions. These influences are likely to come from other farmers who have similar problems and are in the same situation. One of the methods that takes advantage of this premise is the result demonstration farm system that has been used in several countries as an extension technique. Demonstration (both method and result) were supposed to help facilitate communication among illiterates.

In addition, the attributes of innovations, as perceived by receivers, can also influence the rate of adoption. The five attributes of innovation as observed by Rogers and Shoemaker (1971) are: (1) relative advantage, i.e., the degree to which an innovation is perceived as better than the idea it supersedes; (2) compatibility, i.e., the degree to which an innovation is perceived as consistent with existing values, past experience and needs of the receiver; (3) complexity, i.e., the degree to which an innovation is perceived as relatively difficult to understand and use; (4) triability, i.e., the degree to which an innovation could be tried on a limited basis; and (5) observability, i.e., the degree to which the results of innovation are visible or could be felt by others.

Scholars and researchers of the adoption process have recognized that an individual's decision about adopting or rejecting an innovation is not usually an instantaneous act. Rather, it is a process that occurs over a period of time and consists of a series of actions and decision. According to Singh(1965), who has studied the Indian situation, this process has been depicted in terms of seven stages. These stages are:

1. Need: this is a stage of discontent when an individual wishes to change his existing practices.

2. Awareness: the individual just comes to know about an innovation without knowing the details of it.

3. Interest: he makes an attempt to know more about the innovation.

4. Deliberation: this is a stage of deliberating on "to try or not to try"--(mental evaluation).

5. Trial: an individual uses an innovation in part or sometimes on the full scale.

6. Evaluation: the individual evaluates the performance of the innovation.

7. Adoption: it is a decision to use the practices on a continued basis.

Hodgon and Singh (1966), compare the U.S. and Indian situation related to these stages. In the U.S., adoption implies that a farmer is convinced of the profitability of a single practice and wants to continue using it. In Indian villages, adoption means simultaneous use of several practices and procedures. Adoption appears to be more a result of linking of cash credit with production

supplies than of farmers conviction about the profitability of recommended practices. In India farmer's need for credit may cause him to adopt the practices (adoption stage) and then evaluate the result later. Moreover, the adoption stage may conceivably continue because of a farmer's continuing need for cheap credit rather than of conviction based on trial.

In general, from those factors that have possible relationship with the decision-making to practice new farm inputs, the following general factors can be identified: the farm setting, the farmer's social context, the economic context, and the aspects of the communication process. Each of these factors will be further discussed--from both a theoretical and measurement perspective--in the next chapter.

CHAPTER 4

METHODOLOGY

Introduction.

The purpose of this study is to identify those factors that influence the extent to which small farmers practice new rice technology in West Java. It is hoped that future agricultural programs may be improved by isolating the reasons why small farmers do not adopt new farm practices as recommended.

Study data were collected from a sample of respondents that was selected among the small farmers in six villages of rural Subang, West Java. Subang was selected as the study site because it is one of the most important rice production regencies of West Java. It is also one of the "poor areas" in the province.

The design chosen in this study is a cross-sectional survey, i.e., data were collected at one time. Study data were collected through face-to-face personal interviews with respondents from August 2, 1981 to September 30, 1981 by a team of enumerators consisting of the writer and two graduate students at Padjadjaran University, Bandung.

The purpose of this chapter is to provide details on the study method. The chapter includes sections on:

Operationalization of the Theory, Study Hypotheses, Data Collection Method, and Data Analysis Approach.

Operationalization of the Theory.

The study of the adoption of agricultural technology in rural areas had received great attention from social scientists. Basically, the difference among these researchers is which explanatory variables account most for the adoption of new agricultural technology. The researchers consider different categories of independent variables. Conversely, there is a common feature in these studies: the emphasis on adoption as the main dependent variable of interest. Although most of these studies do not apply directly to Java, the studies provide guidelines for identifying the theoretical concepts and indicators used in this study.

The studies of the adoption of new agricultural technology and its related literature show, as presented in Chapter 3, that many factors influence farmers' decision to adopt new technology as fully as recommended. Within the total decision-making process of Java's small farmers, this study will focus on the following general factors as the independent variables:

Farm Setting;

Social Context;

Economic Context; and

Communication Context.

The dependent variable in this study is the extent to which farmers practice new farm inputs. For the purpose of operationalizing the theoretical concepts, this study specifies empirical observations that may be taken as indicators or operational measures of the attributes contained within a given concept.

The independent variables: Factors influencing small farmer decision making.

As previously mentioned, four general factors are hypothesized to affect the extent to which small farmers practice new farm technology: farm setting, social context, economic context, and communication context.

Farm setting. The farm setting in which farmers' decisions are made is one of the important causes or predictors of the small farmers decision to practice new technology. It is the larger farmer with larger farm and wealthier cultivator who is apt to adopt more new practices. Many innovations, such as practicing new farm inputs, require substantial capital outlay and involve substantial risk of crop failure that are beyond the investment and risk-taking of a smaller cultivator. In order to describe the farm setting, we intend to specify the nature of the farm firm through obtaining information on: farm size in hectares, farm business size in terms of degree of commercialization land fragmentation, farm status, and crop diversification.

Social context. The second cause, or predictor, of the dependent variable of this study is the farmer's social

context--the context in which he makes decisions. In general, the better educated, higher social status farmer (if he is linked with social systems beyond the immediate family) should be in the best position to know about, and to accept, new farm practices. Local development agencies are aware of the potential of this type of farmer and they tend to work more closely with the higher social status farmer--who is generally a progressive cultivator. In connection with the farmer's social context, this study sets out to describe the individual small farmer in a gross sense: formal education, size of family, his degree of involvement in formal and informal groups or organization, and his position in the village social structure in terms of his leadership in the local community.

Economic context. The third general factor used to explain small farmer decision-making is the economic context in which decisions are made. Since new farm practices, such as the use of new inputs, require capital investment, it is the wealthier farmer--with higher economic status--who is apt to adopt more practices and to adopt sooner. Availability of capital permits adoption, which leads to higher profits, which permits more adoption, and so forth. In order to describe this economic context variable, the study is interested in the context of economic relationships in which decisions are made: his socio-economic status, his economic activities, and off-farm employment.

Communication context. The fourth independent variable used to predict the dependent variable in this study is the communication context. There are differences among individual small farmers in access and exposure to communication about new technology. Communication is the transmission of a message from one person or institution to another. If the farmer is to utilize a new technology, he must come to know something about it. In this study, we are interested in information on his degree of reliance on mass media (such as radio, TV and printed communication channels), as well as the extent of contact with various types of change agents. Furthermore, we are interested in information on the extent to which the farmer is involved in, and dependent upon, the local community in terms of: extra-family contact with his neighbors and in demonstration plots located on the neighbors' farms.

Indicators of the independent variable.

Having considered these four general factors as the independent variables, i.e., farm setting, social context, economic context, and communication context, indicators of these variables were devised to project that meaning into concrete realm. According to Warren et al. (1977), an indicator is an estimate--an attempt to capture or measure the quality and/or quantity of a property or concept. In this study, two or more specific indicators will be identified as operational measures for each of the independent variables. These indicators were devised with the

confidence that they fulfill at least two criteria as adequacy indicators--high enough reliability and validity. Each indicator has an adequate accuracy or precision of a measuring instrument and it measures with an adequate degree what it purports to measure.

Farm setting. The farm setting, which shows the nature of the farm firm of the individual farmer, will be measured by: (1) farm size; (2) farm status; (3) land fragmentation; (4) crop diversification; (5) crop intensity; and (6) commercialization. Specific measures of the indicators of the farm setting are:

Farm size -- Measured in hectares of land operated by the respondent.

Farm status -- Classified as: owner operator, renter, and sharecropper.

Land fragmentation -- Measured by the number of non-contiguous plots of farm a farmer operates.

Crop diversification -- Measured by the number of crops a farmer cultivates on his farm.

Crop intensity -- Measured by how many times a farmer plants a crop or various crops during one year.

Commercialization -- Measured by the percentage of farmer's agricultural product that is sold to market.

In this study, it was found that all of the farmers grew rice twice-a-year and nearly all farmers grew only rice. Similarly, nearly all of the farmers had only one plot of land and they were owner operators on that land. Therefore, further analysis in this study will deal with

two indicators of farm setting: (1) farm size; and (2) commercialization.

Social context. The social context of a farmer in which he makes decisions will be measured by: (1) his formal education; (2) size of his family; and (3) social participation. Specific measures of the indicators of the social context variable are:

Education of the farmer -- Measured by the number of years of formal schooling;

Social participation:

(1) Membership in local organizations -- Indicated by the kinds and number of organizations to which the farmer belongs.

(2) Role or leadership in local community -- Measured by asking about farmer's position in the local community.

Economic context. The economic context of an individual farmer will be measured by his: (1) socio-economic status; (2) economic activities; and (3) off-farm employment. Specific measures of the indicators of the economic context variable are:

Socio-economic status index -- Indicated by the amount of farm taxes; the value of material possessions (radio, TV, tape recorder, sewing machine, motorcycle, and bicycle); farmer's house (its size, design, and material of the house).

Economic activites:

(1) Level of farmer's farm income used for purchasing new inputs.

(2) Credit performance -- Measured by the amount of production-loan a farmer gets from credit institutions or individuals.

Off-farm employment -- Measured by the earnings from off-farm jobs as compared to farm earnings.

Communication context. The communication context, in this study, will be measured by the extent of the farmer's: (1) contact with development change agents; (2) extra-family contact; (3) reliance on mass media; and (4) the extent of access to farm inputs. Specific measures of the indicators of the communication context variable are:

Extent of contact with development/change agencies -- Measured by the frequency of meetings, in the last year, with development/change agents, such as with the extension agent, the "village unit cooperative" people, and the credit institution/"Village People Bank" people.

Extent of extra-family contact -- Measured by the frequency, in the last year, or visits to the better neighbor farms, demonstration plots, and meetings with other progressive farmers.

Degree of reliance on mass media -- Measured by the frequency (hours per week) of the use of mass media sources of information (radio, TV, and printed materials: newspaper, pamphlet, etc.).

Access to new farm inputs -- Measured by how easy it is for the small farmer to obtain new farm inputs (e.g., fertilizer, pesticides) and the quality of the transportation system between the "input-kiosk" and the farm.

The dependent variable: The extent to which farmer practices new farm inputs

The dependent variable in this study is the extent to which farmers practice new farm inputs. The variable will be measured by the degree to which: (1) new farm inputs were used; and (2) farm inputs were used as recommended. Measures of the indicators of the

dependent variable are:

The degree to which new farm inputs were used -- Measured by the kind/variety and dosage of each input (fertilizer, rice seed variety, and pesticides) used.

The extent to which farm inputs were used as recommended -- Measured by the extent of each input used compared with recommended dosage* **):

(1) Extent of fertilizer use:

		N-fertilizer (Urea) kg/Ha	P_2O_5-fertilizer (TSP=Triple Super Phosphate) kg/Ha	Total kg/Ha.
1.	Great extent:	> 225	> 90	> 315
2.	Moderate:	190 - 225	70 - 90	260 - 315
3.	Little:	100 - 190	40 - 70	140 - 260
4.	Very little:	< 100	< 40	< 140
5.	No use:	---	---	---

(2) Extent of HYV use:

		Rice seed variety	Weight (kh/Ha)
1.	Great extent:	National HYV	20 - 25
2.	Moderate:	National HYV, or	< 20
		Local HYV	20 - 25
3.	Little:	Local HYV	< 20
4.	No HYV use:	Local traditional variety	

(3) Extent of pesticide use:

1.	Great extent:	> 3 liter per Ha.
2.	Moderate:	2 - 3 liter per Ha.
3.	Little:	1 - 2 liter per Ha.
4.	Verylittle:	< 1 liter per Ha.

*) The recommended dosage of each input according to the government's rice intensification program is:

Urea fertilizer:	200 kg/Ha
TSP fertilizer:	80 - 100 kg/Ha
HYV seed:	20 - 25 kg/Ha
Pesticide:	2 liter/Ha.

**) In the statistical analysis, the score of fertilizer use and pesticide use was weighted two times that of the score of HYV use.

Study Hypotheses.

Having identified the variables and their indicators, the following hypotheses and sub-hypotheses were constructed to look at important theoretical relationships between one or more independent variables and the dependent variable.

Hypothesis I: The extent to which the farmer practices new inputs is positively influenced by the farm setting.

This hypothesis suggests that there is a relationship between farm setting and the farmer's decision to practice new technology. The farm setting of a farmer, which consists of several items forming the nature of a farm firm [as shown by Roy's (1968) study in rural India] positively affects the farmer's decision to adopt new practices.

Sub-hypothesis I-1: The larger the size of the farm, the greater the degree to which farmers adopt new farm practices.

This hypothesis assumes that farm size positively affects the extent to which farmers practice new technology. As reported from many studies, farm size has consistently been shown to be related to adopt behavior.

The larger cultivator is more apt to adopt new practices and, for any given practice, practice it sooner.

Sub-hypothesis I-2: The greater the percentage of farm product that is sold to market, the greater the degree to which farmers practice new farm inputs.

This hypothesis predicts that the amount of product sold to market from a farm firm positively relates to the extent of practicing new inputs. Reasons for this relationship seem clear that the more market oriented a farm firm is, the more that incentives exist to increase production and, consequently, the more new inputs will be used in the farm.

Hypothesis II: The extent to which the farmer practices new inputs is positively influenced by his social setting.

This hypothesis assumes that there is a positive relationship between the farmer's social context, such as his education and social participation, and the extent to which the farmer practices new inputs. In general, better educated farmers with higher social participation in the local community are more likely to come in contact with sources of information, to know about, and to accept, new technology in agriculture.

Sub-hypothesis II-1: The higher the farmer's education, the greater the degree to which the farmer practices new farm inputs.

This hypothesis stresses that the farmer's education is significantly associated with the extent to which new inputs are practiced. From many studies, it has been concluded that better educated farmers are more prone to accept innovations in agriculture.

Sub-hypothesis II-2: The greater the extent of social participation, the greater the degree to which farmers practice new farm inputs.

This hypothesis expects that farmer's social participation, measured by his membership in local organizations and leadership in local community, will relate positively with the extent to practice new farm inputs. This relationship has been demonstrated by several studies (e.g. a study conducted by Fliegel, et al. (1967) on Agriculture Innovations in Indian Villages). Greater social participation typically means that there is a higher integration of social activites and leadership pattern in the village. This phenomenon may then lead to higher adoption of agricultural innovations.

Hypothesis III: The extent to which the farmer practices new inputs is positively influenced by his economic context.

This hypothesis explores the relationship between farmer's economic context and the extent to which he practices new farm inputs. It demonstrates that the farmer, who is better off economically, is also higher in the extent to which he adopts new farm practices.

Sub-hypothesis III-1: The higher the farmer's socio-economic status, the greater the extent to which he practices new farm inputs.

This hypothesis assumes that there is significant relationship between farmers' socio-economic status and the extent to which they practice new farm inputs. Many studies of individual differences in adoption behavior show that higher socio-economic farmers are: (1) quicker to adopt modern practices; and (2) adopt more of such practices. This may stem, to some extent, from the fact that change agents work more closely with higher socio-economic status farmers.

Sub-hypothesis III-2: The more a farmer is engaged in economic activites, the greater the extent to which he practices new farm inputs.

This hypothesis predicts that a positive relationship exists between farmer's economic activities, as measured by his level of investment on new inputs and credit performance, and the extent to which he adopts new practices. The higher the percentage of farmer's income used for new inputs investment, the more likely that he wants to take a risk by practicing new inputs; and the more that a farmer obtains production-loans reflects the availability of the means to adopt new practices.

Sub-hypothesis III-3: The more a farmer is engaged in off-farm employment, the higher the degree to which he will utilize new farm practices.

In constructing this hypothesis, we expect that off-farm employment will contribute to a higher level of new farm practices. This assertion is made on the grounds that off-farm employment can provide an additional source of income for investing in the farm.

Hypothesis IV: Given that new farm practices stem from the larger society, communication aspects (indicated by contact with change agencies, extra-family contact, reliance on mass media, and access to farm inputs) will positively influence the extent to which the farmer practices new farm inputs.

Sub-hypothesis IV-1: The more a farmer has contact with change agencies, the more likely he is to practice new farm inputs.

This hypothesis predicts that the more a farmer contacts with change agencies--the sources of information--the more exposed he will be to information and, subsequently, will be more likely to accept new farm practices. Through this hypothesis, we are interested in looking at whether the local small farmers could easily make contact with the village change agents or whether these agents use the strategy to contact only the progressive farmers.

Sub-hypothesis IV-2: The greater the degree of extra-family contact, the greater the degree to which farmers practice new farm inputs.

Extra family contact with friends, neighbors, relatives or other cultivators provides an informal, interpersonal channel of communication. Some studies conclude that this kind of interpersonal communication channel plays an important role in introducing new farm inputs.

Sub-hypothesis IV-3: The greater the use of mass media, the greater the degree to which farmers practice new farm inputs.

In general, we expect that farmers, who are exposed to information from the larger society through the mass media, are more likely to accept new practices. Users of the mass media generally come from the farmers who have more wealth, education, knowledge and experience. This hypothesis is interested in understanding the performance of mass media channels and their function at the local level in the process of the introducing of new farm inputs.

Sub-hypothesis IV-4: The easier it is to obtain farm inputs, the greater the degree to which farmers practice new farm inputs.

This hypothesis assumes that farmers' access to new farm inputs relates positively to the extent that farmers will practice these inputs. The difficulty in getting these farm inputs is one possible reason why farmers practice farm inputs at variance with those recommended by the agricultural extension agents. For the purpose of adoption of new farm inputs as recommended, these inputs should be provided at the right local place and the right

time so that farmers can easily get these inputs whenever needed.

Hypothesis V: The farmer's economic context and communication aspects variables are the most important factors associated with the extent to which farmers practice new farm inputs.

This hypothesis indicates the expectation that two blocks of empirical variables or indicators, i.e., farmer's economic context and communication, have the most significant influence on the extent of new inputs practiced by the small farmer. Practicing new farm inputs, such as fertilizer, new seed and pesticides, means an additional capital outlay to the farmers. Particularly for the smaller farmers, it is a risk to practice these new inputs. Thus, farmers need information and assurance--through interpersonal and/or mass media communication channels--that they will benefit from practicing new farm inputs.

Hypothesis VI: Commercialization, economic activites (level of farm inputs investment and credit performance), extent of contact with change agencies, and access to farm inputs are the important variables associated with the extent to which farmers practice new farm inputs.

The higher commercialization of a farm firm tends to promote a more market-oriented farmer, which causes the

farmer to take the risk of using new inputs. Similarly, the high farmer's economic activites will picture more capital availability which, in turn, will increase his ability to invest in the additional cost of farm inputs. The more frequent a farmer has contact with change agents, the more he gets information on the benefits of practicing new inputs and, consequently, the more likely he will be confident in using these inputs. Farmers with adequate capital and more confidence in the benefits of new inputs will immediately practice these inputs when the procedure of getting them is adequate or easy. Accordingly, this hypothesis predicts that some empirical variables or indicators, such as commercializaton, economic activites, extent of contact with change agents and access to farm inputs, have the most important influence on the degree to which a farmer practices new farm inputs.

Data Collection Method.

This section presents details on: the study site; sample design; the data collection instrument; and the data collection process.

The study site

This study was carried out in six villages in the irrigation areas of the regency of Subang.

Site selection criteria. The study site was selected on the grounds that the regency of Subang is one of the important rice production areas among the regencies of

West Java. In addition, the regency belongs to one of the "poor areas" of West Java. Many small farmers operate tiny ricefields and struggle for their livelihood.

An overview of West Java's agriculture. Subang regency is one of twenty regencies in the province of West Java. This province is one of the important provinces among the 27 provinces in Indonesia.

West Java covers a land area of 46,300 square kilometers, about one third of the island of Java, and only 2.4 per cent of the whole land of the country. However, this province has a population of more than 27 million people (in 1980)about 19 percent of the total population of the country. The role of West Java's agriculture is very important for the country. About 23 percent of Indonesia's rice production is produced in West Java. Its 1979 rice yield of 32.5 quintal per hectare was higher than that of the national average rice yield of 29.8 quintal per hectare.

Similar to the agricultural production composition of the country, West Java's agricultural production basically made up of two components: the plantation sector and the small farms or peasant sector. The plantation sector of West Java produces mainly tea, rubber, and cinchona as export commodities, and cane sugar for domestic market. Whereas the peasant sector produces mostly rice, and secondary food crops, such as cassava, pea nut, corn, sweet potato and soybean. Most of the farmers in Banten

(Western part) and Northern West Java areas, to which the regency of Subang belongs, farm mostly rice during the whole year; those areas are known as monocultural areas. On the other hand, the Central and Eastern West Java is known as poly-cultural areas. Many farmers in this agricultural area farm other crops after rice or between two rice cultivations. In general, it is considered that the farmers in this area are more market oriented, are more economically minded in using their resources, and, thus, are more progressive as compared with those farmers in the other areas of West Java.

The regency of Subang: its rural areas. The regency of Subang consists of 11 sub-districts ("kecamatan") and 160 villages ("desa") with a land area of 2,052 square kilometers. In 1975, the population of Subang was 928,802 inhabitants with a density of 551 people per square kilometers. In general, Subang belongs to the "poor area," whereas six of its sub-districts belong to "very poor areas"*); this condition is a typical characteristic of mono-cultural rice areas.

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*) The Indonesia's Directorate of Land Use conducted a study, in 1978, on "Location of Poor Areas in the province of West Java." A "poor line" was set based on the minimum need per capita on nine basic commodities consumed for living (i.e., rice, dried fish, sugar, food oil, salt, kerosene, soap, rough textile, and batik).

"Very poor area" referred to an area where the income per capita is below 75 percent of the "poor line."

"Poor area" referred to an area where the income per capita of the population in that area is between 75 percent and 125 percent of the "poor line."

The regency may be divided into: a coastal area in the north; a lowland plain in the middle; and upland plain in the south. In general, in the upland area farmers plant perennial crops, such as tea, fruits, and woods. In the lowland plain, farmers cultivate mostly rice, together with a number of secondary food crops, such as peanuts, beans and vegetables. In the coastal area, almost all farmers plant rice (monoculture); only a few farmers rear fish in their ponds.

Most of the ricefields in the northern, or coastal parts of Subang get irrigation provided by the "Jatiluhur Irrigation Dam Project," which is located in the adjacent regency of Purwakarta. All of the six sample villages selected as the site of this study are located in this irrigation area.

Most of the Subang inhabitants live in the rural area; 71.9 percent of the families live as farmers.

A typical village in rural Subang is a cluster of houses surrounded by ricefield ("sawah") or dry fields ("tegalan") and occasionally by hedges or bamboo groves. The head of the village, called "Kepala desa" or "lurah," is generally elected by the villagers. Village officials generally consist of: one or two clerks, village police, "penghulu" (the person who handles the religious matters), and "ulu-ulu" (the person who handles the irrigation system in the village level). Usually a "desa" hall, called "balai desa," is found near the house of the village head.

Other public buildings in Subang villages might include a mosque, a community health center hall ("Puskesmas") and 2 or 4 elementary schools. Village markets vary considerably in size and appearance. It may be just an open space at the junction of main roads of the village or it may be a building with tiled roof and a number of stalls. These markets usually open only once a week; two or three adjacent village markets have a different "market day."

As in other parts of Java, most Subang farmers operate tiny farms. In the village of Rancasari, for example, more than 50 percent of the farmers operate under one hectare of land. The majority of Subang's farmers are owner-operators--about 70 percent of them own all of their farmland; and 5 percent do not own any of the land that they cultivated. The land owners in the village have an obligation to contribute a portion of their rice product for the salary of the village officials. This kind of contribution, called "pancen," is distributed to the officials according to their rank (Palmer, 1978).

Increasing crop intensity and rice intensification methods are the two important ways to compensate for the problem of small farm size. Rehabilitation of the irrigation and the construction of new irrigation facilities in Subang will increase the cropping intensity. In this way, ricefields can be planted two times a year and provide the opportunity to practice rice intensification method.

Sample design.

A sample of small farmers for this study was selected through a multistage cluster sampling design. According to Babbie (1973), cluster sampling may be used when it is either impossible or impractical to compile an exhaustive list of the elements comprising the target population. Multistage cluster sampling involves the repetition of two basic steps: listing and sampling. In the first stage, three sub-districts (i.e., Binong, Pamanukan and Ciasem) were selected on purpose, based on the homogeneity of the area irrigation distribution from "Jatiluhur Dam Project." In the second stage, two villages or clusters were randomly chosen from a frame of all villages in each chosen sub-district. In the third stage, 30 respondents were randomly selected from a list of all small farmers in each chosen village.

A problem was encountered in making a decision on the correct sample size. It is understood that the larger the sample, the more precise will be the estimate of the characteristic in the population. This is especially true in the lowest ranges of sample size, i.e., below 100 (Neale and Riebert, 1973). In practice, however, especially in the developing countries, it is rarely possible to follow textbook procedures for determining sample size without making a heavy expenditure of time and finance (Spencer, 1976). Soewardi (1972) argues that a sample size of 25 for each village is reasonable under Java's conditions.

According to Babbie (1973), the general guideline for cluster design is to maximize the number of clusters while, at the same time, decreasing the number of elements within each cluster. Based on the above arguments, taken together with the time and budget constraints associated with this study, a sample of 180 farmers was selected--30 small farmers from each sample village.

Description of the sample villages. The six sample villages belong to three sub-districts (Binong, Pamanukan and Ciasem) in the lowland plain of northern Subang. Generally, the cropping pattern in these sample villages is similar: rice is typically the sole crop cultivated by farmers in the wet land. Water is supplied by "Jatiluhur Irrigation Project." Soil in the sub-district of Binong is generally more fertile than in the other two sub-districts. Farmers in Binong are considered more progressive; several cultivate other crops between two rice cultivation periods. The sub-district of Ciasem and Pamanukan are considered as "very poor areas," whereas Binong sub-district belongs to "poor area." A short description of each of the sample villages will now be presented.

Mulyasari village. This sample village is one among the ten villages of Binong sub-district. In general, Mulyasari is a relatively developed village within a "poor area." It is located on the side of the mainroad that connects the city of Subang to other big cities of West Java, such as Cirebon and Jakarta. The distance of

the village to the city of Subang is approximately 27 kilometers, and to Binong (the sub-district town) is only 6 kilometers. The village covers a land area of 647.2 hectares. In 1980, the population of this village was 5,468 inhabitants with a high density of 845 people per square kilometer. The density is higher than that of the Subang regency of 551 people per square kilometer (in 1975). The village has a farm area of 586.24 hectares with an average farm size of 0.64 hectare. It has been reported that all of the farmers in this village practice the rice intensification method; the average yield was five ton of rice per hectare.

The material possessions registered by the villagers include: 385 radios, 33 tape recorders, 24 TV's, 40 motorcycles, two trucks and 69 bicycles.

Tambakdahan village. This village also belongs to the sub-district of Binong.

In general, this sample village has similar conditions and the same level of development as the Mulyasari village. It is located on the side of the main road and has good road and transportation facilities to the city of Subang and to the other places outside the village.

The village covers 656.12 hectares including 587.75 hectares of ricefields or wetlands. The 1980 population was 5,582 inhabitants with a high density of 850 people per square kilometer and an average family size of 3.8.

The kinds and numbers of things registered by the villagers are: 247 radios, 58 TV's, 32 motorcycles, three trucks and eight minibus/taxis.

Rancasari village. Administratively, this sample village belongs to the sub-district of Pamanukan. There are 12 other villages in this sub-district. Rancasari village is located about seven kilometers to the west of the main road to Subang-Pamanukan. The distance from the village to the city of Subang is 37 kilometers and ten kilometers to Pamanukan. The area of the village is 546.32 hectares including 471.48 hectares of ricefield. It has been reported that all of the farmers participated in the rice intensification method using new farm inputs. The 1980 population of the village was 4,985 inhabitants with a density of 912 people per square kilometer. Several farmer organizations were introduced by the government in the rural area of Subang, such as: Farmer Contact Group, Village Irrigation Society, Youth Farmer Discussion Group, Group of Discussion on Village Radio Program, and the Village Unit Coops. The possessions registered in the village include: 175 radios, 65 TV's, four trucks, seven minibus/taxis, two sedan cars, 51 motorcycles, 39 "becaks" (rickshaws), and 571 bicycles.

Rancahilir village. This village also belongs to the sub-district of Pamanukan. In general, the rural condition of this village is not quite different with that of Rancasari: Rancahilir is located six kilometers to the east of the

Subang-Pamanukan main road. The distance from the village to the city of Subang is about 40 kilometers and to Pamanukan is eight kilometers.

With a land area of 600 hectare, and total population of 7,642 inhabitants (in 1980), the village has a very dense population of 1,252 people per square kilometer. The total area of ricefield in this village is only 378.20 hectare; more than half of the farmers farm less than 0.5 hectare of land. However, it has been reported that more than 90 percent of the ricefield in Rancahilir was cultivated using the rice intensification method, with an average yield of 4.5 ton per hectare.

Blanakan village. This sample village is one of the ten villages of the sub-district Ciasem. A central government's "Rice Seed Development Project," called "Sang Hyang Sri," is located in Ciasem to develop and distribute high yielding varieties of rice.

Blanakan village is located in the coastal plain of Java's Ocean--about eight kilometers to the north of Cirebon-Jakarta highway. The village road condition to Blanakan is rather poor, particularly in the rainy season. This village has an area of 987.92 hectares including 510 hectares of ricefield, 96 hectare of dry land, and 54 hectares of ponds; the rest of the area is mostly covered by briny forest. It was reported that the average rice yield was four ton per hectare, in 1980.

Sukahaji village. This village also belongs to the sub-district of Ciasem. Sukahaji is located about ten

kilometers to the south of Cirebon-Jakarta highway--a distance of approximately 67 kilometers from the city of Subang. The village has a land area of 825.98 hectare including 720.92 hectare of wet land or ricefield with an average from size of 0.6 ha. It has been reported that the average rice yield during the last five years was four ton per hectare. With a total population of 5,961 inhabitants, in 1980, the population density of this village was relatively moderate: 679 people per square kilometer. The condition of rural roads is generally adequate, but becomes poor in the rainy season. The most important transportation modes are bicycle and motorcycle; "becaks" (rickshaws) are mostly used during the dry season. The number of each transportation mode in the village is: two minibus/taxis, 39 motorcycles, 1,093 bicycles and 28 "becak." Other villagers' possessions that were registered in the village were: 490 radios and 20 TV's.

The data collection instrument.

An interview schedule was used to collect data from the selected farmers. A structured interview was used; a similar stimulus was given to all responents. Most of the questions in the schedule were close-ended questions.

The interview schedule was organized into five sections: (1) farm setting; (2) social context; (3) economic context; (4) communication context; and (5) extent to which the farmer practiced new farm inputs.

Farm setting. In this section, several questions on the farm setting were asked; such as :

1. The size of the ricefield operated by the respondent: (answered in hectare);
2. The respondent's status to his land: which was answered by selecting among a list of responses: (1) owner-operator; (2) renter; (3) sharecropper; and (4) others: ......;
3. Respondent's land fragmentation: which was measured by the number of his non-contiguous plots, and the distance (in meter) between each plot and his house;
4. The respondent's farm intensity: which was measured by how many times the farmer planted rice in a year, and what other crops that were cultivated;
5. The rice yield and production of respondent's farm: which were measured in kilogram per hectare;
6. The degree of respondent's commercialization: which was measured by the amount of rice sold to the market (in quintal and percentage).

Social context. In this section, several questions concerning the social context of the respondent were asked:

1. Respondent's education: which was measured by the number of years he attended formal school, and whether he got a formal diploma or not.
2. Respondent's family size: the number of family members.

3. Respondent's social participation in his local community: which was measured by the number of organizations to which the farmer belongs.
4. Respondent's general social standing in the local community: which was measured by the number of leadership positions held by the farmer in local organizations and/or his role as: (1) religious leader/"kyai," "haji," "ustad"; and (2) teacher (as indicators of the respondents' level of social status).

Economic context. In this section, questions concerning the economic context of the respondent were asked:

1. The respondent's socio-economic standing: which was gauged by his house (possession, material and design of his house), other material possessions (TV, radio, tape recorder, sewing machine, motorcycle, bicycle), the amount of taxes paid (in rupiah per year), and his income per year (in rupiah).
2. The respondent's level of farm input investment: which was measured by the amount of "rupiah" for the purchase of each input (fertilizer, HYV, and pesticides) and the total of inputs, and also measured this total by percentage to the total farm income.
3. The amount of respondent's loans: which was measured by rupiah per year.

4. Respondent's off-farm employment: which was measured by the number of hours-per-week spent in off-farm employment and the percentage of earnings from off-farm jobs as compared to farm earnings.

Communication context. In this section, questions concerning communication context by which the respondent comes to learn about new practices were asked:

1. The extent of respondent's contact with the local formal change agents: which was measured by the total number of times per year (last year) that: (1) the change agents visited the respondent); (2) the respondent visited the change agents; and (3) the respondent attended village meetings.
2. The extent of respondent's extra-family contact: which was measured by the total number of times per year (last year) that the respondent: (1) visited neighbors or progressive farmers; and (2) visited demonstration plots.
3. The degree of respondent's reliance on mass media: which was measured by the total number of hours per week that the respondent spent: (1) listening to the radio; (2) watching "agricultural extension" programs on TV; and (3) reading printed materials on agricultural improvement.
4. The respondent's access to new farm inputs (fertilizer, HYV, and pesticides): which

was measured by the degree of access (very easy; easy; difficult; very difficult) to various farm inputs.

Extent to which the farmer practices new farm inputs. In this section, questions concerning the extent to which the farmers practiced new inputs (the dependent variable) were asked:

1. The degree to which new farm inputs were used by the respondent: which was measured by: (1) the kilogram per hectare of fertilizers used; (2) the variety of rice seed used and kilogram per hectare of that seed; (3) the kind of pesticide used and liter per hectare of that pesticide.
2. The extent of which new farm inputs used as compared with the amount recommended: which was measured by selecting one of the following response options: (1) Great extent; (2) moderate; (3) little; (4) very little; and (5) no use.

The complete interview schedule is reprinted in Appendix A.

The data collection process.

Study data were collected through face-to-face interviews with the respondents from August 2, 1981 to September 30, 1981. These data were collected by a team of interviewers, or enumerators, that consisted of this writer and

two graduate students of Padjadjaran University at Bandung. Each interviewer collected the data from respondents living in two villages of the same sub-district.

The recruitment of the two interviewers to help in the field was of paramount importance. They were selected based on the following criteria: (1) they had previous knowledge of agriculture and rural study; (2) they spoke Sundanese, the language of respondents; (3) this opportunity represented practical training for them (important because they will continue to conduct further study for their thesis); and (4) they were hard working students and had an appropriate attitude for working in rural areas.

The two students enumerators were trained intensively for about one week before they went to the field. The training emphasized: (1) an understanding of the study objectives; (2) the problems of the rural areas; (3) the usefulness of the data to be collected; and (4) techniques of interviewing. In the training period, every question in the schedule was discussed and explained.

Interviewing was done by visiting respondents' houses and took a maximum of two hours. When the questionnaire could not be completed in a session, another session on a different day was held. Every weekend during the data collection period, the three enumerators met together to discuss the problems related to the data collection process.

Data Analysis Approach.

Basically, data analysis deals with the analysis of

relationships among variables; in this study, the focus is on the relationship between the independent variables and the extent to which farmers practice new farm inputs (as stated in study hypotheses).

Weisberg and Bowen (1977) call attention to the increasingly major role of interval statistics in social science research. Many social scientists, whose data are not interval level, nevertheless, find interval statistics useful. Interval level techniques are much more powerful than ordinal-level and nominal-level techniques. These techniques permit us not only to measure how strongly related a pair of variables are, but also--by means of such techniques--we can measure the affect that a change in the independent variable has on the dependent variable. One of the most common applications of interval statistics to what are usually ordinal or nominal data is in the field of survey research (Weisberg and Bowen, 1977). This study also used interval-level techniques for analyzing data to test the study hypotheses.

Pearson correlation to test Hypotheses I-IV.

Pearson correlation is employed in this study because it serves the purpose of measuring the strength of the linear relationship (shown by Pearson's product-moment correlation coefficient, r) between two variables as stated in those sub-hypotheses associated with Hypotheses I-IV. r^2 is a more easily interpreted measure of association when our concern is strength of the relationship (Nie, et al., 1975).

It can be interpreted as the proportion of variance in one of the variables explained by the other variables.

Pearson correlation analysis provides a single summary statistic, the correlation coefficient, describing the relationship between two variables (e.g. the relationship between farm size and the degree to which farmers adopt new farm practices).

Multiple partial correlation to test hypothesis V.

According to Blalock (1970), and also Loether and McTavish (1974), multiple-partial correlation analysis may be defined as the multiple correlation between a block of predictors and a dependent variable after other independent variables have been statistically controlled. Warren, et al. (1980) argue the fundamental characteristics of multiple-partial correlation relates to the size of explained variance in multiple regression analysis. Unlike multiple correlation, multiple partial correlation involves the partitioning of explained variance. The square of multiple correlation coefficient (R^2) represents the proportion of variance simultaneously explained in a dependent variable by two or more independent variables. The square of the multiple-partial correlation coefficient (MPC-square), on the other hand, pertains to the proportion of the remaining variance explained by a block after still other predictors have explained as much variance as possible in the dependent variable.

In this study, the focus is on economic context and communication aspects associated with the dependent variable

(the extent to which farmers practice new inputs), after other independent variables of farm setting and social context have been controlled.

Multiple regression to test Hypothesis VI.

Multiple regression is employed because it serves the purpose of measuring the strength of the relationship between a dependent variable and a set of independent variables as stated in hypothesis VI. Kim and Kohout (1975) define multiple regression analysis as a general statistical technique through which one can analyze the relationship between a dependent variable, or criterion variable, and a set of independent or predictor variables.

We have hypothesized that a set of independent variables--commercialization, economic activities, extent of contact with change agencies, and access to farm inputs--have significant relationship with the extent to which farmers practice new inputs. The approach that will be used in this study is through the forward (stepwise) inclusion procedure. This procedure is used when we wish to isolate a subset of available predictor variables that will yield an optimal prediction equation with as few terms as possible. The order of inclusion is determined by the respective contribution of each variable to explained variance. The variable that explains the greatest amount of variance unexplained by the variables already in the equation enters the equation at each step. Thus, the independent variable which is chosen for entry is the one

which has the largest squared partial correlation with the dependent variable. Through multiple regression analysis using forward (stepwise) inclusion procedure, it will be shown whether the set of independent variables stated in hypothesis VI (commercialization, economic activities, extent of contact with change agencies and access to farm inputs) are the "best 4" predictor variables of the dependent variable.

CHAPTER 5

SUBANG'S SMALL FARMERS AND FACTORS ASSOCIATED WITH THE EXTENT TO WHICH FARMERS PRACTICE NEW FARM INPUTS

In this chapter, study findings are discussed. Chapter 5 consists of two major sections. The first section deals with a description of the items in the survey questionnaire. In the second section, the previously stated hypotheses are tested.

A Description of Small Farmers in the Sample Villages of Subang.

In this section, a general description of small farmers, based on data from the sample villages, will be discussed. This section consists of three subsections: (1) the small farm setting; (2) small farmers and their social and economic context; and (3) communication aspects and the degree to which the respondents practice new rice technology.

Small farm setting in Subang villages

The small farm setting in the sample villages will be described in three ways: (1) the farm land; (2) the crop production of the farm land; and (3) the commercialization level of the farm firms.

Farm land. As stated earlier, the respondents in this study were selected from among the small farmers who

operated farm land of .7 hectare or less. Table 5-1 displays the frequency distributions for the respondents' farm size and land status. Data presented in this table indicate that the mean size of land operated by small farmer respondents is .45 hectare with a standard deviation of .172.

Table 5-1. Respondents' farm size and land status.

Size of land (hectare)	Respondents N	Respondents %	Land status	Respondents N	Respondents %
.10 - .20	21	11.7	Owner operator	137	76.1
.21 - .30	26	14.4	Renter	3	1.7
.31 - .40	30	16.7	Sharecropper	38	21.1
.41 - .50	50	27.8	Renter and sharecropper	2	1.1
.51 - .60	17	9.4			
.61 - .70	36	20.0			
	180	100 %		180	100 %
Mean: .449					
Standard deviation: .172					

More than 76 percent of the respondents operated their own land, whereas 21.7 percent operated land as sharecroppers. Only about 2 percent rent their farm. Since the size of the farm is very small, the lands cultivated by the farmers are generally not fragmented. Almost 90 percent of respondents cultivated one plot of land; only one respondent operated on three separate plots of land.

Farm production. All of the respondents in the sample villages planted rice two times a year. More than 83 percent of the respondents did not cultivate other crops after the rice cultivation or between two rice cultivations;

and only 17 percent of them planted other crops after rice, such as red beans, mungbeans, cassava, and other vegetable crops.

The average rice yields of respondents' farms of 24.94 qt/ha and 40.66 qt/ha in the dry and wet season, respectively, were lower than the yield of the Subang farms included in the rice programs. It was reported that the rice yield of farms included in the "Bimas" program was 62.30 qt/ha, as compared to 55.58 qt/ha, in 1976 for the farms included in the "Inmas" program (Agricultural Extension Service of the Regency of Subang, 1977). The average yield in both 1980 seasons, 32.80 qt/ha, was also lower than the yield of 33.45 qt/ha for West Java in 1979 (Indonesia's Central Bureau of Statistics, 1980).

Commercialization level of the farm firm. Although small farmers in the sample villages of Subang operated small farmlands with low yield and produced small amounts of rice, the respondents' farm firm generally showed an adequate degree of commercialization, i.e., some portion of their rice product was sold to market. Table 5-2 shows that, on the average, more than half of the respondents' rice product--43.5 percent in dry season and 60.9 percent in wet season of 1980--was sold to market. The data show that 14.4 percent of the respondents in the dry season and 2.2 percent of the respondents in the wet season did not sell their rice product.

Table 5-2. The percentage of respondents' rice product sold to market in 1980.

Percentage of rice product sold to market (%)	Product produced in:					
	Dry season		Wet season		The whole year	
	N	%	N	%	N	%
0	26	14.4	4	2.2	4	2.2
5 - 25	17	9.5	14	7.8	20	11.1
25.1 - 50	68	37.8	36	20.0	43	23.9
50.1 - 75	49	27.2	71	39.4	84	46.7
More than 75	20	11.1	55	30.6	29	16.1
	180	100 %	180	100%	180	100%
Mean:		43.5		60.9		55.6
Median:		43.0		66.8		59.4
Standard dev.:		25.7		22.9		20.4

This situation suggests that the Indonesian government was successful in its efforts to stabilize the price of rice. Small farmers tend not to store their rice production for their own consumption during the whole year.

Subang's small farmers and their social and economic context.

Based on the frequency distribution analysis of data, small farmers in the sample villages can be described from several points of view: (1) level of education; (2) social participation; (3) socio-economic context; (4) income; (5) investment of new farm inputs; and (6) credit performance.

Respondents' level of education. Study findings show that respondents, as the head of families, had generally low levels of education. Figures in Table 5-3 indicate that almost one-third of the respondents did not complete a single year of formal education; none of them had an opportunity to attend Middle School or a higher level of school. More than

Table 5-3. Respondents' formal education.

Number of years of formal education	Respondents N	%
0 (No formal education)	57	31.7
1 year	1	.6
2 - 3 years	71	39.5
4 - 5 years	17	9.5
6 years	34	18.9
More than 6 years	0	0
	180	100 %

40 percent of the remaining respondents had attended three years of formal education and less than one-fifth of the respondents attended six years of formal school. Around 19 percent of the respondents had a primary school diploma. Reports from the four sample villages (Mulyasari, Rancasari, Rancahilir and Tambakdahan) indicate that, on the average, around 32 percent of the population of these villages graduated the Primary School (6^{th} grade), 5 percent passed Middle School (9^{th} grade) and around 1 percent passed High School.

Family size. The average family size of the respondents was 4.4 with a mode of 4 persons. The average family size in the sample was lower than that of the regency of Subang--4.6 persons in 1976 (Subang Agricultural Extension Service Report, 1977).

Small farmers' social participation. The study data indicate that small farmers in the sample villages had low levels of social participation. Although several farmer's

organizations were introduced by the government in rural Subang, small farmers did not activitely participate in these local organizations. Nearly seventy percent of the respondents answered that they belonged to only one local organization--that organization being the "Village Irrigation Users Group." Only three respondents belonged to three rural organizations. In addition, more than 90 percent of the respondents did not have any position of leadership in the local community.

Small farmer's houses and other major material possessions. The study data show that 94 percent of the respondents lived in their own houses, 2.2 percent lived in their parents' houses, and less than 2 percent rented their houses. In general, houses in rural Subang may be differentiated into three categories based on the quality of the material of the house, i.e., bamboo house, wood house, and brick house. More than 50 percent of respondents' houses were built from wood, 26 percent were bamboo huts, and only 18 percent were brick houses.

None of the respondents owned a TV or a sewing machine. Table 5-4 shows that one-fourth of the respondents owned bicycles and only 5 respondents (1.7 percent) owned a motorcycle. Other major material possessions owned by small farmers include: radio (owned by 21.7 percent of the respondents) and tape recorder (owned by only 5 percent of respondents). More than one-fourth of the respondents owned

Table 5-4. Respondents' major material possession.

Material categories	Respondents	
	N	%
Nothing	37	20.5
Radio	39	21.7
Bike	45	25.0
Motorcycle	3	1.7
Tape recorder	5	2.8
Two materials	45	26.1
More than two	3	1.7
No answer	1	.6
	180	100 %

two kinds of materials (mostly consisting of bike and radio); only 3 persons owned more than two kinds of those materials.

Respondents' family income. Small farmers family income mostly came from farm revenue plus an additional revenue from outside farm jobs. Table 5-5 presents the respondents' gross family income. This table shows that the average respondent's farm income was Rp 289,100, the average off-farm income was Rp 59,780 and the average family income was Rp 347,500 (approximately $556; $1 = Rp 625). Around 12 percent of the respondents had income of Rp 200,000 or less and only one respondent had an income of more than Rp 750,000 ($1,200).

Table 5-5. Respondents' 1980 income: (1) farm income; (2) off-farm; and (3) family income.

Income:								
Farm income (Rp 1,000)			Off-farm income (Rp 1,000)			Family income (Rp 1,000)		
	N	%		N	%		N	%
Less than 101	7	3.9	0 (No off-	9	5.0	200 and less	23	12.8
101 - 200	47	26.1	farm income)			201 - 300	49	27.2
201 - 300	48	26.7	50 and less	85	47.2	301 - 400	48	26.8
301 - 400	43	23.9	50.1 - 75	36	20.0	401 - 500	41	22.7
401 - 500	26	14.4	75.1 - 100	41	22.7	501 - 600	12	6.6
501 - 600	7	3.9	100.0 - 150	8	4.5	601 - 750	6	3.3
More than 600	2	1.1	More than 150	1	.6	More than 750	1	.6
	180	100 %		180	100 %		180	100 %
Mean: 289.10			Mean: 59.78			Mean: 347.50		
Stand. deviation: 124.48			Stand. deviation: 42.72			Stand. deviation: 131.07		
Mode: 350.00			Mode: 50.00			Mode: 425.00		

Although the median of the off-farm income comprised only 20 percent of the total farm income, as shown in Table 5-6, off-farm employment opportunities represent a very important source of additional family income. Table 5-6 presents the respondents' off-farm job situation in the sample villages. This table shows that only 5 percent of the respondents were not employed in off-farm jobs. Around 40 percent of the respondents worked in off-farm jobs for less than 15 hours per week. About the same percentage (44.5%) worked between 15 - 30 hours per week in off-farm jobs. And only 15 respondents (around 8 percent) worked for more than 30 hours per week outside their farms. Nearly 60 percent of small farmers worked outside their farms as farm laborers. Other important off-farm jobs were: coolie (12.7 percent of respondents worked in this job) and small merchants (more than 7 percent of respondents worked in this job).

Respondents' level of new farm inputs investment. Table 5-7 presents the respondents' level of farm investment for new inputs (fertilizer, HYV and pesticides) in 1980 and the percentage of this investment to farm income. This table shows that all of the respondents had invested in these new inputs, but in various amounts of capital outlay. The average amount of the respondents' new inputs investment was Rp 18,980; the average percentage of this investment was 7.7 percent of respondents' farm income. Around 45 percent of the respondents had invested between Rp 10,000 - Rp 20,000

Table 5-6. Analysis of respondents' off-farm jobs: (1) Kind of job; (2) Length of time; and (3) Percentage contribution to farm income.

Kind of off-farm job			Length of off-farm job time (hour/week)			Percentage of off-farm to farm income (%)		
	N	%		N	%		N	%
Farm laborer:	106	58.9	0 (No off-farm job):	9	5.0	Less than 25:	101	56.1
Coolie:	39	21.7	1 - 15:	76	42.2	25 - 50:	55	30.6
Carpenter:	2	1.1	16 - 30:	80	44.5	50 - 75:	13	7.2
Handicraft:	2	1.1	More than 30:	15	8.3	More than 75:	11	6.1
Small merchant:	14	7.8						
Fishing:	6	3.3					180	100 %
Village official:	2	1.1		180	100 %			
No other job:	9	5.0						
	180	100 %						
			Mean: 16.79			Median: 20.00		
			Stand. dev.: 8.57			Stand. dev.: 23.00		

Table 5-7. Respondents' 1980 new farm inputs investment and the percentage of this investment to farm income.

Amount of new inputs investment (in Rp 1,000)	Respondents N	Respondents %	Percentage of new inputs investment to farm income (%)	Respondents N	Respondents %
10 and less	26	14.4	5 and less	13	7.2
10.1 - 20	80	44.5	5.1 - 7.5	81	45.0
20.1 - 30	54	30.0	7.6 - 10	65	36.1
More than 30	20	11.1	More than 10	21	11.7
	180	100 %		180	100 %
Mean: 18.98			Mean: 7.7		
Standard deviation: 8.75			Standard deviation: 2.4		

on these new farm inputs or 5% - 7% of their farm income. Around 11 percent of the respondents spent more than Rp 30,000 for these new investments; nearly 12 percent of them spent more than 10 percent of their income for this investment.

Respondents' credit performance. Together with the investment in new farm inputs, respondents' credit performance indicate the degree of farmers' economic activity in conducting their farm firms. Table 5-8 displays information on the respondents' production loans. In general, farmers got production loans for new farm inputs investment from the "Bimas" program in the form of a "package loan" and from other money lenders outside the government's rice programs.

Table 5-8 shows that around 27 percent of the respondents did not obtain production loans through the rice program. Around 28 percent of these respondents did not borrow money from other lenders outside the program. About

Table 5-8: Respondents' 1980 production loans: (1) loans through rice program; (2) loans outside the rice program; and (3) total loans.

Loan:								
Rice program (Rp 1,000)			Outside rice program (Rp 1,000)			Total loan (Rp 1,000)		
	N	%		N	%		N	%
0	49	27.2	0	51	28.3	0	18	10.0
10 and less	13	7.2	10 and less	50	27.8	10 and less	2	1.1
10.1 - 20	82	45.6	10.1 - 20	56	31.1	10.1 - 20	52	28.9
20.1 - 30	31	17.2	20.1 - 30	21	11.7	20.1 - 30	55	30.6
More than 30	5	2.8	More than 30	2	1.1	More than 30	3	1.7
	180	100 %		180	100 %		180	100 %
Mean: 13.322			Mean: 11.436			Mean: 24.589		
Stand. deviation: 9.537			Stand. dev.: 9.745			Stand. dev.: 12.705		

10 percent of the respondents used capital from their own sources and did not seek loans for production from either the rice program or from money lenders. Around 45 percent of the rice program participants got their loans from the program between Rp 10,000 - Rp 20,000, whereas nearly 60 percent of the respondents got loans from money lenders at an amount of less than Rp 20,000.

Communication aspects and the degree to which farmers practice new farm inputs.

This section presents information on communication in terms of the communication between the respondent and the sources of information about new farm technology and the degree to which respondents' practice new farm inputs. With regard to the communication aspects, we shall focus on: (1) respondents frequency of contact with development agencies; (2) the frequency of neighbor and demonstration plot visits; and (3) the respondents' reliance on mass media.

Respondents frequency of contact with development agencies. The contact between farmers, who need information, and the development or change agents (e.g. agricultural extension agents, Bank's officials) generally occurs through regularly scheduled village meetings. Table 5-9 shows that the traditional village meeting provides greater contact opportunities for small farmers and development agents to meet each other. Only 4 respondents (2.2 percent)

Table 5-9. Respondents' frequency of contact with development agents in 1980.

Frequency contact categories (time/year)	Nature of interaction: Agents visit respondents		Respondents visit agents		Village meeting	
	N	%	N	%	N	%
0	48	26.7	74	41.1	4	2.2
1 - 5	51	28.3	76	42.2	31	17.2
6 - 12	69	38.3	29	16.1	132	73.3
13 - 18	2	1.1	-	-	3	1.7
19 - 24	10	5.6	1	.6	10	5.6
	180	100 %	180	100 %	180	100 %
	Mean:	5.8	Mean:	2.7	Mean:	9.4

did not attend a village meeting during 1980; on the average, respondents attended 9 times village meetings in that year. On the other hand, more than 40 percent never visited change or development agents and nearly 27 percent of them had never been visited by the agents in 1980. The average number of times that development agents had visited respondents was 6 times in 1980; whereas the "average" respondent had visited development agents 3 times in the same period.

Respondents' frequency of neighbor and demonstration plot visits. Table 5-10 displays the number of respondents who visited neighbor farms and demonstration plots in 1980. This table shows that more than 40 percent of the respondents had never visited a demonstration plot during 1980, whereas the remaining 40 percent had made less than 3 times in that year.

Table 5-10. Respondents' frequency of visits to neighbor farms and demonstration plots.

Frequency visit neighbor farm (times/year)	Respondents N	Respondents %	Frequency visit demonstration plot (times/year)	Respondents N	Respondents %
0	34	18.9	0	79	43.9
1 - 5	51	28.3	1 - 3	72	40.0
6 - 12	87	48.4	4 - 6	28	15.5
13 - 18	2	1.1	More than 6	1	.6
19 - 24	6	3.3		180	100%
	180	100 %			
Mean: 6.2			Mean: 1.6		

Respondents' visits to a neighbor's farms--farm operated by progressive farmers--were more frequent with an average of 6 times in 1980. However, nearly 19 percent of the respondents had never visited a neighbor's farm in that year.

Respondents' reliance on mass media. In general, small farmers in rural Subang did not extensively use mass media channels of communication in getting information on new farm technology. Table 5-11 shows that more than 90 percent

Table 5-11. Respondents' reliance on mass media.

Frequency categories (hour/week)	Type of media used: Listening to Ag. Ext. Progr. on the radio		Watching A. Ext. Progr. on TV		Reading printed material on Ag. Improvement	
	N	%	N	%	N	%
0	57	31.7	122	67.8	169	93.9
.5 - 2.0	63	35.0	45	25.0	3	1.7
2.0 - 4.0	56	31.1	13	7.2	3	1.7
Over 4.0	4	2.2	---	---	5	2.7
	180	100 %	180	100 %	180	100 %

of the respondents had never read printed materials that included information on new technology. Nearly 70 percent of the resondents had never watched agricultural extension program on TV. More than 30 percent of the small farmers interviewed in this study had never spent time listening to "village programs" on the radio. On the other hand, around 30 percent of the respondents answered that they had had an opportunity to watch the agricultural program (for around 2 hours per week) on a TV owned by others.

The extent to which respondents practice new farm inputs. Study data indicate that all of the respondents practiced new farm inputs on the farm (such as fertilizer, HYV seeds and pesticides) but in various dosages. Table 5-12 presents the frequency distributions of the extent to which farmers' practice fertilizer, pesticide, and HYV seed. As stated earlier, the extent of using each of these inputs was categorized--based on the recommended dosage of each input set by the government's rice intensification program.

The table shows that all of the respondents used seeds as recommended--they practiced HYV seed in the recommended dosage. More than half of the respondents used pesticides on their farm at a "moderate" level--they practiced pesticides around the recommended dosage. More than 38 percent of the respondents used pesticide below the recommended dosage and nearly 3 percent of them used pesticides at a "very little" level. Whereas the use of fertilizer was

Table 5-12. The extent to which respondents practice fertilizer, HYV seed and pesticide.

Degree of practice (*)	Type of input: Use of fertilizer		Use of HYV		Use of pesticide	
	N	%	N	%	N	%
Great extent	5	2.8	160	88.9	11	6.1
Moderate	23	12.8	20	11.1	95	52.8
Little	141	78.3	---	---	69	38.3
Very little	11	6.1	---	---	5	2.8
	180	100 %	180	100 %	180	100 %

(*)

	Fertilizer (kg/ha)		
	N-fert.	TSP-fert.	Total
Great extent	225	90	315
Moderate	190 - 225	70 - 90	260 - 315
Little	100 - 190	40 - 70	140 - 260
Very little	100	40	140

	HYV (kg/ha) "National" or "Local"	Pesticide (liter/ha)
Great extent	20 - 25	--- 3
Moderate	---	20 - 25 2 - 3
Little	---	20 1 - 2
Very little	---	--- 1

The recommended dosage by the government:

N-fertilizer (urea)	:	200 kg/ha
TSP fertilizer	:	80 - 100 kg/ha
HYV seed	:	20 - 25 kg/ha
Pesticide	:	2 liter/ha

generally below that recommended, more than 80 percent of the respondents used fertilizer at lower dosages than that recommended. Nearly 13 percent of them used fertilizer at the amount around the recommended dosage; only 2.8 percent used higher than recommended dosage.

Factors Associated with Small Farmers' Level of New Rice Technology.

New rice technology began with the introduction of "miracle" or high yielding varieties (HYV) that promised to increase rice production. To achieve its optimum productivity, the HYV involved other additional production factor inputs, such as the additional use of fertilizer, use of pesticide, better water conditions, and better preparation of farmland tilling. In this study, we shall focus attention on the extent to which farmers' use fertilizer, HYV seed, and pesticides. This research concentrates on those inputs because: (1) it is difficult to measure the level of farmers' land tilling; and (2) there is little variance in the use of irrigation in the sample villages.

In this section, the results of data analysis concerning factors associated with the farmers' level of new rice technology--employing Pearson Correlation, Multiple-partial Correlation and Multiple Regression analyses--are presented. In employing these analyses, the package program SPSS (Statistical Package for the Social Sciences) was used. As stated in the study hypotheses, generally the hypotheses

predicted that each of the four general variables--farm setting, farmer's social context, farmer's economic context, and communication aspect--was related to the extent to which farmers practice those three new farm inputs. Accordingly, this section is separated into sub-sections following the differentiation of these general variables.

Farm setting related to the extent to which farmers practice new farm inputs.

Theoretically, farm setting affects the farmer's decision to practice new farm inputs. Several studies indicate that farm size is significantly related to the adoption of new farm technology. Although the results of this study support this expectation, the two variables are inversely related (as shown in Table 5-13). An interesting finding

Table 5-13. Product moment correlation among measures of farm setting and the extent to which farmers practice new inputs.

	Extent to which farmers practice new inputs	Size of farm	Degree of commercialization
Extent to which farmers practice new inputs	1.00	-.14*	.19**
Size of farm		1.00	.29**
Degree of commercialization			1.00

* Significant at .05 level
**Significant at .01 level

is the negative relationship between the extent to which farmers practice new inputs and small farmer's farm size. Table 5-13 shows that the product moment correlation coefficient between these two variables is -.14. Although the coefficient is not high, this indicates that the smaller the farm size (for small farmers--farmers with an average farm size of .45 hectare in this sample) the greater the use of new rice technology. In other words, the larger farm operator tends to use farm inputs in lower dosages, particularly in terms of fertilizer use. As stated earlier, more than 80 percent of the small farmers used fertilizer at the dosage lower than the recommended dosage. Thus, the result does not support the expectation as stated in Sub-hypothesis I-1.

The correlation between the degree of commercialization of the farm firm--measured by the percentage of rice product that is sold to market--and the extent to which farmers practice new inputs is positive with a correlation coefficient of .19. This indicates that as the degree of commercialization increases, the extent to which farmers practice new inputs tends to slightly increase. This result supports the expectation as hypothesized in Sub-hypothesis I-2.

Table 5-13 also shows a moderate relationship between size of farm and the degree of commercialization ($r = .29$). As the farm size increases, the degree of commercialization of the farm firm tends to increase also.

Farmer's social context related to the extent to which farmers practice new farm inputs.

It was hypothesized that the extent to which the farmer practices new inputs is influenced by his social context. We expect that the higher the farmer's education, the greater the degree to which the farmer will practice new inputs. It is also predicted that farmer's social participation is positively related to the dependent variable. However, the study analysis results do not support those expectations. The results indicate that the extent to which farmers practice new inputs, particularly fertilizer use, is not related to their social context. Table 5-14 shows that the farmer's level of education is very weakly and inversely related to the extent to which a farmer practices new inputs (r=-.01).

Table 5-14. Product moment correlation among measures of farmer's social contact and the dependent variable.

	Extent to which farmers practice new inputs	Level of education	Extent of social participation
Extent to which farmers practice new inputs	1.00	-.01	-.14*
Level of education		1.00	.28**
Extent of social participation			1.00

* Significant at .05 level.
**Significant at .01 level.

This indicates that a farmer's dosage of inputs is not greatly influenced by his level of education. The correlation coefficient between the extent of the farmer's social participation and the dependent variable is -.14, which indicates that these two variables are inversely related. Table 5-14 also shows a positive relationship between the farmer's level of education and the extent of his social participation (r=.28). This finding supports the notion that as level of education increases so does the farmer's social participation.

Farmer's economic context related to the extent to which farmers practice new farm inputs.

It had been hypothesized that the extent to which farmers practice new farm inputs is influenced by their economic context. Farmers, who are better off economically, practice new farm inputs at a greater level. The results presented in Table 5-15 do not support all of these

Table 5-15. Product moment correlation among measures of farmers' economic context and the extent to which farmers practice new inputs.

Variable	Variable number			
	1	2	3	4
1. Extent to which farmers practice new inputs	1.00	-.12*	.14*	.06
2. Farmer's socio-economic status		1.00	.26**	-.32**
3. Farmer's economic activities			1.00	-.29**
4. Off-farm earning				1.00

* Significant at the .05 level.
**Significant at the .01 level.

expectations. As shown in the table, the farmers' socio-economic status--as measured by farmers' taxes, house status and major material possession--is inversely related to the extent to which farmers' practice new inputs. The correlation coefficient is not high, (r=-.12), but it is statistically significant at the .05 level. This indicates that farmers with lower socio-economic status tend to practice more farm inputs per unit of farmland. On the other hand, the farmers' economic activities are positively related to the extent to which farmers practice new inputs. The Pearson correlation coefficient between these two inputs, r=.14, is significant at the .05 level. This result supports the expectation of the significant relationship between the two variables, as predicted in Hypothesis III-2. The off-farm job earning is also positively related to the extent to which farmers' practice new inputs, but the relationship is very weak (r=.06) and statistically insignificant (at the .05 level). This indicates that off-farm earning is generally used by the Subang small farmers for additional family living expenses, rather than for the purpose of farm investment.

Table 5-15 also shows the intercorrelations among the measures of farmers' economic context. Farmers' socio-economic status is significantly and positively related to their economic activities (r=.26). Each of these two variables also has significant relationships with the off-farm earning, but each is inversely related (r=-.32 and

r=-.29, respectively). This indicates that as the farmers' socio-economic status increases and the level of their economic activities increases, the percentage of off-farm earnings to their farm income tends to decrease.

Communication aspects related to the extent to which farmers practice new farm inputs.

As stated earlier, communication is the transmission of messages and information from one person or institution, as the sources of information, to other persons through channels of communication. Channels of communication generally can be differentiated on the basis of personal or face-to-face contact vs. the impersonal channels of the mass media. They can also be indirect, as when a farmer observes neighbor's farm. Since information on new farm practices stem from the sources outside the farm, it is expected that communication aspects--indicated by the frequent use of channels of communication and the ease of obtaining farm inputs will influence the extent to which farmers practice new farm inputs. However, Table 5-16 shows that the study results do not support the expectation. The interesting results are the inverse relationships between extra-family contact and the extent to which farmers practice new inputs and between the ease of obtaining farm inputs and the dependent variable (r=-.13 and r=-.14, respectively). These findings suggest that as the frequency of extra-family contact increases, and the ease of obtaining

Table 5-16. Product moment correlation among measures of communication and the extent to which farmers practice new farm inputs.

Variable	Variable number				
	1	2	3	4	5
1. Extent to which farmers practice new inputs	1.00	.06	-.13*	-.01	-.14*
2. Development agents contact		1.00	.003	-.06	-.17**
3. Extra-family contact			1.00	.18**	-.03
4. Use of mass media				1.00	-.04
5. Ease of obtaining farm inputs					1.00

* Significant at .05 level
**Significant at .01 level

farm inputs increases, the willingness to "save" farm inputs (particularly fertilizer) also increases, thus resulting in the decreasing use of that input. The other two communication variables, i.e., the development agents contact and the use of mass media, have a very low and insignificant relationship (at the .05 level) with the dependent variable. This indicates that small farmers in rural Subang do not extensively rely on either the local development agents or on mass media. From the previous frequency distribution analysis, it was also shown that the respondents did not extensively use channels of communication available in the local village.

Subsets of independent variables related to the extent to which farmers practice new farm inputs--A multiple-partial correlation analysis.

In the previous sub-sections, the results of computing Pearson correlation coefficients of pairs of variables, i.e., relationships between each of the independent variables and the dependent variable as stated in the sub-hypotheses of Hypotheses I - IV, were presented and discussed. These were zero order correlations--no controls for the influence of other variables were made. In this sub-section, the results of testing Hypothesis V using multiple-partial correlation analysis will be presented.

Multiple-partial correlation is an elaboration of multiple correlation between a set of independent variables and a dependent variable when other independent variables are statistically controlled (Blalock, 1972; Loether and McTavish, 1974).

As discussed in Chapter 4, the fundamental characteristic of the multiple-partial correlation coefficient relates to the issue of explained variance in the dependent variable by independent variables as a result of multiple regression analysis. While the square of the multiple correlation represents the percent of explained variance by all independent variables "taken together," the square of multiple-partial correlation focuses on the proportion of variance explained by a specific block of indicators after other independent

variables have explained all the variance they can. The key to the multiple-partial approach is that indicators of constructs can be grouped together in blocks, without incorporation into a summary measure.

As stated earlier, in this study we have classified the predictors of the extent to which farmers' practice new farm inputs according to four major variables: (1) farm setting; (2) social context; (3) economic context; and (4) communication context. Each of the four major variables has been measured by a variety of indicators:

Major variable	Indicator
1. Farm setting	X_1 - Size of farm X_2 - Degree of commercialization
2. Farmers' social context	X_3 - Level of education X_4 - Extent of social participation
3. Farmers' economic context	X_5 - Socio-economic status X_6 - Economic activities X_7 - Level off-farm earnings
4. Communication context	X_8 - Extent of agents contact X_9 - Extra-family contact X_{10} - Use of mass media X_{11} - Ease of obtaining new farm inputs
Dependent variable -	Extent to which farmers practice new farm inputs.

In this study, it is hypothesized that the farmer's economic context and communication context variables are the most important predictors regarding the extent to which farmers practice new farm inputs. Related to this expectation, this study is interested in analyzing the affect of the level

of each of the major variables or blocks of indicators--i.e., farm setting (indicated by X_1 and X_2), farmer's social context (indicated by X_3 and X_4), farmer's economic context (indicated by X_5 - X_7) and communication context (indicated by X_8 - X_{11})--on the dependent variable, respectively, <u>after</u> the other indicators have explained all the variance in the dependent variable they can. For example, in analyzing the effect of farmer's <u>economic context</u> on the dependent variable, after the other indicators have explained all the variance in the dependent variable they can, we then concentrate on how much of the remaining variance in the dependent variable is explained by the block of indicators representing X_5 - X_7.

The multiple-partial correlation coefficient and its square were derived from a computer regression program using a multistep or hierarchial format for inclusion of the independent variables. In terms of the hierarchial format (using the economic contact example described above) the dependent variable was regressed on the block of the other independent variables (X_1 - X_4, X_8 - X_{11}) in step one of the procedure. Step two involved regressing the dependent variable on the entire compliment of indicators (X_1 - X_{11}). In other words, the remaining block of indicators (farmer's economic context [X_5 - X_7]) was <u>added</u> in the equation in the second step of solution. Thus, the dependent variable was regressed on (X_5 - X_7) after the control block (X_1 - X_4, X_8 - X_{11}) had already been introduced into the equation.

For the purpose of comparison among the multiple-partial correlation, the following regressions were set up:

1. The dependent variable was regressed on farm setting indicators (X_1 and X_2) after the inclusion of all other indicators (X_3 - X_{11}).
2. The dependent variable was regressed on farmer's social context indicators (X_3 and X_4) after the inclusion of all other indicators (X_1, X_2, X_5 - X_{11}).
3. The dependent variable was regressed on farmer's economic context indicators (X_5 - X_7) after the inclusion of all other indicators (X_1 - X_4, X_8 - X_{11}).
4. The dependent variable was regressed on communication context indicators (X_8 - X_{11}) after the inclusion of all other indicators (X_1 - X_7).

Table 5-18 presents the multiple-partial R, the multiple-partial R^2, and the F values for the above four regressions. To illustrate the procedure of calculating the statistics presented in the above table, we will give an example of computing the multiple-partial R^2 of the farm setting variables (X_1 and X_2) from the output for the first regression. Table 5-17 presents the summary output of the first regression, i.e., the regression of the dependent

Table 5-17. Summary table for the first regression.

Step	Variable/ indicator	Multiple R	R^2
1	Level of education	.01638	.00027
	Ease of obtaining inputs	.14316	.02049
	Extra-family contact	.19946	.03978
	Off-farm earnings	.20345	.04139
	Use of mass media	.20416	.04168
	Change agents contact	.20955	.04391
	Economic activities	.26273	.06903
	Social participation	.29396	.08641
	Socio-economic status	.31218	.09746
2	Degree of commercialization	.33749	.11390
	Size of farm	.41039	.16842

variable on farm setting indicators (X_1 and X_2) after the inclusion of all other indicators (X_3 - X_{11}). From this table, we could learn the proportion of the total variance in the dependent variables by all eleven predictors ($R^2_{y \cdot x_1 x_2 \ldots x_{11}}$), discover the proportion of the total variation that is accounted by the blocks of indicators of social context, economic context and communication context variables ($R^2_{y \cdot x_3 x_4 \ldots x_{11}}$), and then identify the proportion of the unexplained (remaining) variance that is explained by the block of farm setting variable [$R^2_{y \cdot (x_1 x_2), x_3 x_4 \ldots x_{11}}$]. This amount of the remaining variance explained by X_1 and X_2, after the effect of X_3 - X_{11} has been taken into account, can be computed by the following formula (Warren, et al., 1980):

$$R^2_{y \cdot (x_1 x_2), x_3 x_4 \ldots x_{11}} = \frac{R^2_{y \cdot x_1 x_2 \ldots x_{11}} - R^2_{y \cdot x_3 x_4 \ldots x_{11}}}{1 - R^2_{y \cdot x_3 x_4 \ldots x_{11}}}$$

$$R^2_{y\cdot(x_1x_2)\cdot x_3x_4\cdots x_{11}} = \frac{.16842 - .90746}{1 - .09746} = .07862 \quad .$$

The other computations of multiple-partial R^2 and the procedure for computating the F ratios, as presented in Table 5-18, are presented in the Appendix B .

Table 5-18. Comparison of multiple-partial R and multiple-partial R^2 for the four regressions.

Variables/Block of indicators	Multiple-partial R	Multiple-partial R^2	F
Farm setting (X_1 and X_2)	.2804	.0786*	6.4474
Social context (X_3 and X_4)	.1315	.0173	1.4176
Economic context (X_5 - X_7)	.2302	.0530*	2.9010
Communication context (X_8 - X_{11})	.1565	.0245	1.0038

* Significant at the .05 level.

Table 5-18 shows that the multiple-partial R^2 between the dependent variable and the block of indicators of farm setting is the highest (R^2=.0786) and is significant at the .05 level. This indicates that nearly eight percent of the variance in the dependent variable is explained by farm setting (measured by farm size and the degree of commercialization) after the other independent variables have explained all that they can. The next highest multiple-partial R^2 is between the dependent variable and farmer's economic context (R^2=.0530). It is significant at the .05 level, thus indicating that farmer's economic context (measured by socio-economic status, economic activities and level of off-farm earnings) is significantly related with the dependent

variable after other independent variables have been statistically controlled. The other two R^2 s--the multiple-partial R^2 between the dependent variable and the social context and the multiple-partial R^2 between the dependent variable and communication context--are low and insignificant at the .05 level with R^2=.0199 and R^2=.04158, respectively. This indicates that each of these two variables does not significantly contribute to the variance explained in the dependent variable after the other independent variables have explained as much variance as they can.

Thus, the results of the four regression analyses do not support all of the expectations stated in Hypothesis V, viz., that farmer's economic context and communication context are the most important factors associated with the degree to which farmers practice new farm inputs. At least in terms of this data set, the farm setting and farmer's economic context seem to be the most important factors related with the dependent variable. Conversely, the extent to which farmers practice new farm inputs is not significantly determined by the subset or block of independent variables reflecting the communication context.

The most important predictor variables associated with the extent to which farmers' practice new farm inputs--The stepwise inclusion procedure.

In this study, we are also interested in the contribution of specific independent variables to explaining variation

in the dependent variable. Hypothesis VI predicts that certain indicators will explain the most variance in the dependent variable. These indicators include: commercialization, farmer's economic activities, contact with change agents and access to (or ease of obtaining) farm inputs. To test this hypothesis, linear multiple regression analysis using stepwise inclusion procedure was employed. In this procedure, a stepwise regression--of the dependent variable with the eleven independent variables or indicators stated earlier--was called for without specifying any parameters (n, F, T) values. According to Kim and Kohout (1975), the variable that explains the greatest amount of variance unexplained by the variables already in the equation enters the equation at each step. The variable that explains the greatest amount of variance in the dependent variable will enter first, the variable that explains the greatest amount of variance in conjunction with the first will enter second, and so on.

By using this method; nine independent variables remained in the equation. Two of the variables--socio-economic status and use of mass media--were dropped out and, consequently, were not included in the equation. Table 5-19 presents a summary table of selected statistics from the multiple regression. This table shows the order of inclusion which is determined by the respective contribution of each variable to explained variance. From this table, we can see that the degree of commercialization is the best

Table 5-19. Summary table of selected statistics from multiple regression analysis using stepwise procedure.

Variable	F	Significance	Multiple R	R^2	R^2 Change	Simple R
1. Degree of commercialization	6.5548	.01	.1905	.0363	.0363	.1905
2. Size of farm	6.5534	.01	.2674	.0715	.0352	-.1238
3. Economic activities	9.8664	.001	.3491	.1219	.0504	.1618
4. Social participation	3.7556	.05	.3751	.1407	.0188	-.1393
5. Ease of obtaining farm inputs	1.8359	.18	.3872	.1499	.0092	-.1416
6. Extra-family contact	1.8091	.18	.3986	.1589	.0090	-.1345
7. Off-farm earnings	1.0766	.30	.4053	.1643	.0054	.0292
8. Change agents contacts	.7985	.37	.4102	.1682	.0039	.0687
9. Level of education	.0235	.88	.4103	.1684	.0002	-.1064

predictor variable and level of education is the worst among the nine variables in the equation. It should be noted that only the first four variables--ie., degree of commercialization, size of farm, economic activities, and social participation--were included as variables that significantly contribute to explain variance (at the .05 level). In other words, these four predictor variables yield an optimal prediction equation. The regression coefficients and its standard errors of these four predictor variables are presented in Table 5-20. Since the independent variables in this study are measured on different units, the standardized coefficients, Beta, are also presented in this table.

Table 5-20. The regression coefficients and standard errors in stepwise-regression.

Variable	Regression coefficient	Standard error of regr. coeff.	Beta (standardized coeff.)
Degree of commercialization	.2436	.8234	.2217
Size of farm	-4.0759	1.1091	-.3052
Economic activities	.5724	.1832	.2565
Social participation	-.4058	.2094	-.1378
(Constant)	17.0122		

The results of the analysis do not support all of the expectations as stated in Hypothesis VI. Only the degree of commercialization and economic activities variables appear as expected--they contribute significantly to explaining variation in the dependent variable. The other two variables--the extent of change agent contact and ease of obtaining farm inputs--are not included as important predictors. However, these results parallel and support the results of the Pearson correlation discussed earlier.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This last chapter will attempt to identify the key findings of the study, draw important conclusions for the findings, and relate the findings to policy and research recommendations.

Summary.

In principle, food self-sufficiency is still a national goal of most developing countries. It was thought that the application of science and technology--through the practice of HYV seed and the use of more fertilizer and pesticides--might produce a dramatic increase in food crop production and make it possible to achieve the goal of self-sufficiency.

In the last several decades, many countries have embarked upon a variety of projects that are aimed at increasing food production. Through these projects, technological change has been either guided or managed.

Major rice programs were launched in Indonesia, especially in Java, to increase food self-sufficiency and to increase the farmers' welfare. Because of the large number of small farmers in rural Java, an increase in the output

of small farmers would have had an important effect upon the overall agricultural yield. There is some evidence to suggest that small farmers do not benefit from these rice programs; many of them do not practice new farm inputs fully as recommended. This study was conducted with the purpose of better understanding those factors that may be associated with the extent to which small farmers practice new farm inputs.

The Subang regency was selected as the study site because it is one of the most important rice production regencies of West Java. Study data were collected through a multistage cluster sampling from a sample of 180 small farmers--farmer respondents who operate on farmland of .7 hectare or less--in six sample villages.

Data were collected through an interview schedule that was organized into five sections: (1) farm setting; (2) social context; (3) economic context; (4) communication aspects; and (5) the extent to which farmers practice new farm inputs. The first four sections included questions that constituted independent variables of this study; the fifth section focused on the dependent variable in this study.

Among those indicators of the four general independent variables, attention was focused on eleven major indicators and they were included in the study hypotheses. In general the sub-hypotheses of Hypotheses I - IV focus on the

relationships between each of these independent variables and the dependent variable:

1. Sub-hypothesis I-1 predicted that the larger the size of the farm, the greater the degree to which farmers adopt new farm practices;
2. Sub-hypothesis I-2 predicted that the greater the percentage of farm product that is sold to market, the greater the degree to which farmers practice new farm inputs;
3. Sub-hypothesis II-1 predicted that the higher farmers' education, the greater the degree to which farmers practice new farm inputs;
4. Sub-hypothesis II-2 predicted that the greater the extent of social participation, the greater the degree to which farmers practice new farm inputs;
5. Sub-hypothesis III-1 predicted that the higher the farmers' socio-economic status, the greater the extent to which they practice new farm inputs;
6. Sub-hypothesis III-2 predicted that the more farmers are engaged in economic activities, the greater the extent to which they practice new farm inputs;
7. Sub-hypothesis III-3 predicted that the more farmers are engaged in off-farm employment, the higher the degree to which they will utilize new farm practices;

8. Sub-hypothesis IV-1 predicted that the more farmers have contact with change agents, the more likely they are to practice new farm inputs;
9. Sub-hypothesis IV-2 predicted that the greater the amount of extra-family contact, the greater the degree to which farmers practice new inputs;
10. Sub-hypothesis IV-3 predicted that the greater the use of mass media, the greater the degree to which farmers practice new inputs; and
11. Sub-hypothesis IV-4 predicted that the easier it is to obtain farm inputs, the greater the degree to which farmers practice new farm inputs.

Hypothesis V predicted that the farmer's economic context and communication aspects are the most important blocks of indicators (or general independent variables) associated with the dependent variable. Hypothesis VI predicted that commercialization, economic activites, extent of contact with change agents, and access to farm inputs (or ease of obtaining farm inputs) are the most important indicators or independent variables related to the dependent variable.

Pearson correlation was employed to test the sub-hypotheses of Hypotheses I - IV; multiple-partial correlation analysis was used to test Hypothesis V; multiple regression analysis, using stepwise inclusion, was employed to test Hypothesis VI.

The initial analysis of the study data (presented in Tables 5-1 through 5-12) focused on the frequency distribution of the study variables. The major findings derived from this analysis included:

1. The average size of land operated by small farmers in the sample villages was .45 hectare. In general, there was no fragmentation of farmland.

2. The average yield of small farm of 32.8 qt./ha was lower than the yield of the farms in Subang participating in the rice programs and also lower than the average yield of West Java in 1979.

3. Generally, the small farm firms in the sample villages of northern Subang have an adequate degree of commercialization--more than 40 percent of rice production was sold to market in the dry season and more than 60 percent in the wet season.

4. Most of the small farmers (more than 75 percent) were owner operators, more than 20 percent were sharecroppers, and only 2 percent of them rent their farm.

5. The off-farm employment opportunity represented a very important source of additional farmily income; almost all small farmers were employed in off-farm jobs. Most of them worked as farm laborers.

6. In general, almost all small farmers get loans from the "Bimas" program and/or from other money lenders.

7. In general, the small farmers in rural Subang did not extensively use channels of communication in getting information on new farm technology. Most of them had never read printed material and had never watched agricultural programs on TV.

   The traditional village meeting provided greater contact opportunities for small farmers and the development agencies.

8. All of the small farmers in the sample villages of Subang regency practiced fertilizer, HYV seed and pesticide in various dosages. All of the small farmers used HYV seed in the recommended dosage. More than half of them generally used pesticides around the recommended dosage; whereas most of them used fertilizer at an amount below the recommended dosage.

The results of Pearson correlation analysis presented in Table 5-13 through Table 5-16 indicate that most of the findings do not support the expectations as stated in the study hypotheses. Only the degree of commercialization and eocnomic activities variables, respectively, have a positive and significant relationship (at the .05 level) with the extent to which farmers practice new farm inputs. The size of farm, social participation, socio-economic status, and extra-family contact variables have a significiant, but inverse, relationship with the dependent variable. Other variables--such as education, off-farm earnings, change agents contact, use of mass media, and ease of obtaining farm inputs--have a weak and insignificant relationship with the extent to which small farmers practice new farm inputs.

The results of Multiple-partial correlation analysis, as presented in Table 5-18, also do not support all of the hypothetical expectations. The block of indicators associated with the farmers' economic context had a significant association with the dependent variable as hypothesized.

On the other hand, the block of indicators associated with the communication context was insignificant when related to the dependent variable. The block of indicators associated with farm setting also had a significant relationship with the dependent variable. It was also the best predictor variable (i.e., explaining the most of the remaining variance in the dependent variable after the other independent variables had been explained as much variance as they could).

The results of the Multiple regression analysis using stepwise inclusion procedure, which parallel the results of Pearson correlation, do not support all of the expectations stated in the study hypotheses. Only the degree of commercialization and economic activities variables contribute significantly in explaining variation in the dependent variable. The other two variables--size of farm and social participation--belonged to the best four predictor variables that had significant relationship with the dependent variable. Yet, it was not expected that these variables would be included in the optimal prediction equation.

Conclusions.

From the study findings stated earlier (and also from the key findings identified in this summary), we may conclude that the small farmers in rural Subang have unique characteristics related to the extent to which they practice new technology, such as the use of HYV seed, fertilizer

and pesticide. This study indicates that most of the findings do not support the expectations as stated in the study hypotheses. Some factors that theoretically will influence the practice of new agricultural technology, as found by some other studies on the adoption of agricultural technology (in the 1960's), is not relevant to the small farmers in rural Subang.

As stated in Chapter 1, some reports have shown that the new technology of new farm inputs practices are still beyond the reach of many small farmers; thus, not all of Java's farmers have gained benefits from participation in the rice programs. According to Hansen (1974), the average landholding for participants in the rice program was about .75 hectare, a figure that is well above the average farm size of respondents of this study. However, this study finds that the new agricultural technology--in terms of the use of HYV, fertilizer, and pesticides--could be reached by Subang's small farmers. All of the small farmer respondents practice these new inputs in their farms, but in various dosages. Because the small farmers almost always work in their tiny farms, close to the edge of poverty, they will use every opportunity available to support their family. This solution by small farmers, to overcome the difficulty in supporting their families, is related to their decision to invest in each of those three farm inputs. Among the three inputs, the cost of investment in HYV seed

is the lowest, so it should be concluded that all the small farmers could use HYV seed in the recommended dosage. However, the cost of pesticide investment is higher than the cost of HYV, but lower than that of fertilizer. In addition with the experiences of the occurance of pests and diseases in Subang rural areas, more than half of the small farmers generally use pesticides around the recommended dosage. On the other hand, since the cost of fertilizer investment comprised the largest portion of the investment of the three farm inputs, it appears that the small farmers see the use of fertilizer as a form of savings. Small farmers might get loans from the program that could facilitate using the recommended quantities, but they may not apply the entire amount. Or, because the present rice program is not packaged, small farmers might choose their own fertilizer dosage, which may be lower than the quantity recommended. Thus, the poor and small farmers in the rural Subang appear to use available opportunities to support their families. Their decisions may explain many of the other findings in this study.

Among the factors or indicators of the general independent variables, the degree of commercialization and economic activities are positively weak and significantly related to the dependent variable. The small farmers generally have an adequate degree of commercialization. It appears that they have changed from the earlier tradition

to store and consume what they grow to meet the needs of their families. With the relatively stable price of rice, small farmers prefer to sell some portion of their product to market. And when they need rice for their family consumption, in the future, they will purchase this commodity from market. The more the degree of their commercialization, the more they will get capital and the more that they will invest for new farm inputs.

Similarly, the more the degree of farmers' economic activities--as measured by the amount of their production loans and the level of their investment in the new farm inputs--the more that they will get capital and, subsequently, want to take the risk of practicing new inputs.

On the other hand, the study findings indicate that the more land the farmers operate (within the limit of .7 hectare), the less is the amount of the farm inputs that they will use. It appears that the small farmers who operate larger farms have a "better" economic sense to save fertilizer for "other uses."

In rural Subang, other factors, such as education, off-farm earnings, ease of obtaining farm inputs, use of mass media, and change agents contact, insignificantly influence the extent to which farmers practice new inputs. It appears that the very low education among the small farmers has no influence on the farmers' decision to practice new farm inputs. Although off-farm earnings was an important source

of additional family income, it appears that small farmers do not use this additional income for additional investment on farm inputs. But they use it for their living consumption purposes.

The study data also show that all small farmers in rual Subang have similar access to new farm inputs--provided through the rice programs or by private kiosk--which means that they have similar ease in obtaining new inputs, so that this factor does not influence the level of practicing those inputs.

The weak influences of change agent contact and the use of mass media on the extent to which farmers practice new inputs show that small farmers practice new inputs at the present level without getting much input from outside. On the average, the change or development agents (including the agricultural extension agents) visited a small farmer less than 6 times in 1980. This may indicate that local agricultural extension agents do not intensively work with the small farmers; they seem to use the "progressive farmers" strategy in their extension work.

Recommendations.

This section will attempt to seek the possible implications of the study findings in terms of government policy, extension work and needed research.

Policy implications.

By understanding the small farmer's situation and considering the factors associated with the farmer's decision

to practice new farm inputs, it is anticipated that a better development strategy will be planned for the goal of providing more benefits to the small farmers. With an extremely high cost associated with the rice intensification program, particularly with regard to the government's subsidy on controlling fertilizer price, efforts should be directed more toward controlling and encouraging the small farmers to use additional fertilizer on their farms. They should be convinced that using more fertilizer might provide significantly higher returns.

In addition, food self-sufficiency does not always mean self-sufficiency in terms of rice that has to be produced in the country. In facing the food problem, it might be better economically for the Indonesian government to export more urea fertilizer and import rice--rather than steadfastly retaining the policy of achieving self-sufficiency in terms of rice. Currently, a small farmer receives relatively less of the portion of this subsidy as compared to the large farmer. More attention should also be focused on "palawija" (second crop) crops--neglected in the last decade given the preoccupation with rice in northern Subang.

Because Subang small farmers are generally good decision makers (at least in their solution to support their family needs) and they already have an adequate degree of commercialization, the development strategy should be focused also upon making economic changes through changes in local cropping patterns. This strategy direct particular

focus on the development of locally-tested new agricultural crops, besides rice, that are more productive and provide significantly higher returns for the investment. This strategy leads to policies for directing activities of national agricultural research to insure the availability of new agricultural patterns to local farmers.

Extension.

Local extension agents are very important for the success of the programs directed by the above strategies. This study finds that the communication aspects in rural Subang did not have a significant influence on small farmers' decision to practice new farm inputs. The local extension agents did not frequently contact, and did not intensively work with, the small farmers. They should change their strategy from a "progressive farmers" approach to a "small farmers" approach. Traditional village meetings, which small farmers frequently attend, represent good opportunities for extension agents to learn and discuss small farmers' problems. This study shows that many small farmers never visited local demonstration plots or demonstration farms. Because small farmers will be readily convinced by results and performances, not only by suggestions, demonstration farms which illustrate both results and method should be extended to help facilitate communication among small farmers.

Further research.

Few studies that specifically focus on the problems of small farmers have been conducted in Indonesia. This study may be seen as an effort to invite other researchers, particularly in Indonesia, to focus the attention of their studies on the increasing welfare of small farmers. And because this study was based on data collected at one time, replication studies need to be conducted. Researchers should also be aware of the fact that income from Subang's farms is limited by the small farm size--a situation that is not likely to change in the near future. Consequently, further studies are needed that focus attention on the potential local resources that can provide economic opportunities in the non-farm sector. Similarly, studies of rural community development, for example needs assessment studies of the rural people, should be undertaken.

More studies that focus on the rural poor will provide findings that can be used as policy inputs. With adequate inputs based on those studies, planners can design better "development plans" that include targets for reducing poverty, unemployment, and inequality.

Closing Observations.

Limitations of the study.

Relatively weak relationships between the independent and dependent variables were found in this study. Why were these relationships weak? Several explanations seem plausible.

First, these findings may suggest that important predicator variables (e.g., the social psychological variable of the farmer's commitment to the land) were excluded from the theoretical framework. Second, the weak relationships may be due to imprecise measurement of the variables. Third, and perhaps the most noteworthy possibility, pertains to the use of a cross-sectional survey design to study an area of human behavior as complex as the adoption process. It is recommended that social science researchers truly consider the advantages associated with qualitative approaches to studying the adoption process.

Final comments on factors influencing the extent to which farmers practice new farm inputs in Indonesia.

After a span of almost two decades--through trials and errors of several successive rice programs--the present Indonesian rice program seems to be headed in the appropriate direction in its effort to handle the problem of food insufficiency. In the last three years, Indonesia has achieved significant increases in rice production. As reported by Indonesia's Ministry of Agriculture, the rice production in 1981 was at a record high--more than 22 million tons. In addition, this figure was more than two million tons above the government's estimate.

As the result of increasing production, the government's rice importations have decreased. In 1979, Indonesia imported rice was at a record high amount of 1.9 million tons. Importations decreased in 1980 to 1.3 million tons

and it has been estimated that no more than 0.5 million tons was imported in 1981.

It was found in the study that all small farmers in the sample villages of rural Subang already practiced new farm inputs. However, the use of fertilizer was at a lower than recommended level--with an average of 135 kg/ha of urea (as compared to the recommended dosage of 200 kg/ha of urea). It can be concluded that without more concentrated efforts to encourage Indonesian small farmers to use increasing fertilizer dosages, it is unlikely that self-sufficiency can be reached within a near future.

It should be added, however, that rice programs are not panaceas--they should be accompanied by other government development programs. Preliminary results from the 1980 census show that the population growth rate in the period of 1971-80 was still high--2.34 percent per year. Family planning programs should be intensified so that the increasing demand for food can be controlled through limited population growth. Similarly, government programs should focus more attention on increasing opportunities for small farmers to increase their non-farm incomes.

In conclusion, it can be argued that progress toward enhancing small farmers' welfare will markedly improve the prospect of achieving long-term stable economic growth and, subsequently, reducing the levels of poverty.

APPENDIX A: INTERVIEW SCHEDULE

RURAL SUBANG RESEARCH

Study on Factors Influencing the Decision to Practice New Farm Inputs by Small Farmers

A Dissertation Study of : Lukito Sukahar

Department of Resource Development

Michigan State University

1981

No.

Name/Code of respondent:

Village:

This questionnaire deals with understanding the factors that have possible relationship with the decision to practice new farm inputs by small farmers. It is organized into five sections:

A. Farm setting

B. Social context

C. Economic context

D. Communication context

E. Extent to which new farm inputs are practiced

Section A -- Farm Setting

In this section we would like to ask several questions on the farm setting in which decisions are made.

Q-1 What was the size of the rice-field operated by respondent last year? _____ Ha

Q-2 What was the respondent's status to his land? (Circle number)

1. owner operator
2. renter
3. sharecropper
4. others: _____

Q-3 Respondent's rice-field consisted of _____ non-continguous plots/places.

The average distance between each plot and respondent's house is:

1st plot: _____ m

2nd plot: _____ m

3rd plot: _____ m

Q-4 How many times did the respondent plant rice in a year?

1. one time *)
2. two times
3. three times

*) What other crops did he plant after rice crop?

_____

Q-5 What was the rice yield and production of the farm?

Season	Yield (qt/ha.)	Production (kg/ha.)
Dry season:	_____	_____
Wet season:	_____	_____
		_____
		(Total production/year)

Q-6 How much did the respondents sell his rice product to the market, last year?

Dry season: _____ qt.; _____ %

Wet season: _____ qt.; _____ %

Total: _____ qt.; _____ %

Section B -- Social Context

In this section, we would like to ask some questions on the background concerning the social context of the farmer in which he makes decisions.

Q-7 How many years did the respondents attent formal school?

0 1 2 3 4 5 6 7 8 9 10 11 12 more than 12

Does the respondents have a formal school diploma?

1. Yes
2. No

If yes, what school diploma? _____

Q-8 How many family members are in the respondent's household? _____

consist of: wife (circle); son(s) _____

daughter(s) _____

others _____

Q-9 What kind of local organization does the respondent belong to?

List of organizations	Position in the organization
_____	_____
_____	_____
_____	_____
_____	_____

Q-10 What is the general social standing of respondent in the local community? (Rated by enumerators through asking the formal village leaders or farmer's neighbors)

Respondent's role as: (circle number)

1. religious leader/"Kyai"/"Haji"/"Ustad"
2. higher level of social status
3. _____
4. _____

Section C -- Economic Context

In this section we would like to ask some questions concerning the economic context of the farmer in which he makes decisions.

Q-11 What is the respondent's socio-economic standing? (Indicated by his house, some material possession, amount of tax, and his income).

House: (Circle number)

Possession	Material	Design
1. Own	1. Brick	1. Excellent
2. Rent	2. Wood	2. Good
3. Parent's	3. Bamboo	3. Fair
4. Live with relative's		4. Poor

Material possession: (Circle number)

1. TV
2. Radio
3. Sewing machine
4. Motor-cycle
5. Bicycle
6. _____

Amount of tax paid last year:

- Formal government tax : Rp. _____/year
- Informal payment : Rp. _____/year

Total : Rp. _____/year

Income of the respondent:

- Farm income : Rp. _____/year
- Off-farm income : Rp. _____/year

Total income : Rp. _____/year

In these following two questions, Q-12 and Q-13, we would like to ask questions concerning respondent's economic activities.

Q-12 What was the respondent's level of farm input investment?

Amount of "rupiah" for the purchase of new farm inputs:

	Rps.
- Fertilizer	_____
- HYV	_____
- Pesticides	_____
- _____	_____
- _____	_____
Total	_____

What was the percentage of this total to the total farm income? _____

Q-13 How much was the amount of loans received by the respondent?

Loan from the rice program Rp. _____/year

Loan from outside the program Rp. _____/year

The following three questions deal with off-farm employment opportunity.

Q-14 About how many hours a week on the average does the respondent work for pay outside of his farm job?

_____ hour(s)

Q-15 What was the percentage of earnings from off-farm jobs compared to farm? _____ %

Q-16 a. How did he learn about the off-farm job availability?

b. What is the primary reason to employ or not to employ off-farm jobs?

c. What kind of off-farm job does he actually prefer to work at? Is he employed in that job? If not, why?

Section D -- Communication Context

In this section, we would like to ask some questions concerning communication context by which the farmer comes to learn about new farm practices.

Q-17 What was the extent of respondent's contact with the local "change agents" in the last year? (such as: agricultural extension service, credit institution, distributor of farm inputs, etc., etc.,):

a. Frequency of the change or service agents *) visit to the respondent in one year (last year) _____ times

b. Frequency of respondent's visit, and discussed problems related to new farm practices, to the change agents (at their place of work) last year _____ times

c. Frequency of the respondent's attendance in the village meeting where the change agents gave information or extention _____ times.

Q-18 How was the extent of respondent's extra-family contact in the last year?

a. Frequency of respondent's visit to neighbor or "progressive farmers, last year: _____ times

b. Frequency of respondent's visit to the demonstration plots, last year: _____ times

Q-19 How was the degree of respondent's reliance on mass media?

a. How many hours per week did the respondent spend his time for listening to the radio? ("agricultural extension program" or "village program") _____ hour/week

b. How many hours per week did the respondent spend his time watching "agricultural extension" program on TV? _____ hour/week

c. How many hours per week did the respondent use for reading materials on agricultural improvement? _____ hour/week

Q-20 How was the respondent's access to new farm inputs?

a. How easy was the procedure to get each of the farm inputs?

	Very easy	Easy	Difficult	Very Difficult
Fertilizer	1	2	3	4
HYV	1	2	3	4
Pesticides	1	2	3	4

(circle number)

b. How was the procedure to transport farm inputs from the kiosk to respondent's farm? (Circle number)

1. Poor
2. Fair
3. Good
4. Excellent

Section E -- Extent to Which the Farmer Practices New Farm Inputs

In this section we would like to ask questions concerning the dependent variable, i.e., the extent to which the farmers practice new inputs.

Q-21 How was the degree to which new farm inputs were used by the respondent?

a. Fertilizer: 1) N-fertilizer: _____ kg/ha

2) P_2O_5-fertilizer: _____ kg/ha

b. HYV: 1) What variety? _____

2) How much? _____ kg/ha

c. Pesticides: 1) What pesticide? _____

2) How much? _____ liter/ha

Q-22 To what extent was each of the new farm practices used as recommended?

	Great extent	Moderate	Very little	None
a. Use of fertilizer	1	2	3	4
b. HYV	1	2	3	4
c. Use of pesticides	1	2	3	4
d. Land tilling	1	2	3	4
e. Irrigation	1	2	3	4

Q-23 What was the main reason stated by the respondent of not practicing the inputs as recommended?

APPENDIX B: PROCEDURES FOR THE COMPUTATIONS OF MULTIPLE-PARTIAL R^2 AND F RATIO FOR THE FOUR REGRESSIONS

1. The regression of the dependent variable on <u>farm setting</u> indicators (X_1 and X_2) after the inclusion of all other indicators (X_3-X_{11}):

$$R^2_{y\cdot(x_1x_2)\cdot x_3x_4\cdots x_{11}} = \frac{R^2_{y\cdot x_1x_2\cdots x_{11}} - R^2_{y\cdot x_3x_4\cdots x_{11}}}{1 - R^2_{y\cdot x_3x_4\cdots x_{11}}}$$

$$= \frac{.16842 - .09746}{1 - .09746} = .07862.$$

$$F = \frac{(R^2_{y\cdot x_1x_2\cdots x_{11}} - R^2_{y\cdot x_3x_4\cdots x_{11}})/M}{(1 - R^2_{y\cdot x_3x_4\cdots x_{11}})/(N - k - 1)}$$

where: k is the total number of independent variables; M is the number of independent variables (indicators) in the subset; and N is the number of cases.

Thus:

$$F = \frac{(.16842 - .09746)/2}{(1-.09746)/164} = 6.4474.$$

2. The regression of the dependent variable on farmer's social context indicators ($x_3$and x_4), after the inclusion of all other indicators (x_1, x_2, x_5-x_{11}):

Summary table of the second regression

Step	Variable/ indicator	Multiple R	R^2
1	Socio-economic status	.12149	.01476
	Degree of commercialization	.22528	.05075
	Ease of obtaining farm inputs	.26336	.06936
	Use of mass media	.26341	.06938
	Extra-family contact	.29317	.08595
	Change agents contact	.29320	.08597
	Off-farm earnings	.29332	.08603
	Economic activities	.32325	.10449
	Size of farm	.39215	.15378
2	Level of education	.39319	.15460
	Social participation	.41039	.16842

$$R^2_{y\cdot(x_3x_4)\cdot x_1x_2x_5\cdots x_{11}} = \frac{R^2_{y\cdot x_1x_2\cdots x_{11}} - R^2_{y\cdot x_1x_2x_5\cdots x_{11}}}{1 - R^2_{y\cdot x_1x_2x_5\cdots x_{11}}}$$

$$= \frac{.16842 - .15378}{1 - .15378} = .0173$$

$$F = \frac{(R^2_{y\cdot x_1x_2\cdots x_{11}} - R^2_{y\cdot x_1x_2x_5\cdots x_{11}})/2}{(1 - R^2_{y\cdot x_1x_2x_5\cdots x_{11}})/164}$$

$$= \frac{(.16842 - .15378)/2}{(1 - .15378)/164} = 1.4176$$

3. The regression of the dependent on farmer's economic context indicators (x_5-x_7) after the inclusion of the other indicators (x_1-x_4, x_8-x_{11}).

Summary table of the third regression

Step	Variable/indicator	Multiple R	R^2
1	Level of education	.06138	.00027
	Ease of obtaining farm inputs	.14316	.02049
	Extra-family contact	.19946	.03978
	Use of mass media	.20034	.04014
	Size of farm	.23627	.05583
	Change agent contact	.24268	.05889
	Social participation	.27803	.07730
	Degree of commercialization	.34909	.12187
2	Economic activities	.40348	.16279
	Off-farm earnings	.41036	.16840
	Socio-economic status	.41039	.16842

$$R^2_{y \cdot (x_5 x_6 x_7) \cdot x_1 x_2 x_3 x_4 x_8 \cdots x_{11}} =$$

$$= \frac{R^2_{y \cdot x_1 x_2 \cdots x_{11}} - R^2_{y \cdot x_1 x_2 x_3 x_4 x_8 \cdots x_{11}}}{1 - R^2_{y \cdot x_1 x_2 x_3 x_4 x_8 \cdots x_{11}}}$$

$$= \frac{.16842 - .12187}{1 - .12187} = .05301$$

$$F = \frac{(R^2_{y \cdot x_1 x_2 \cdots x_{11}} - R^2_{y \cdot x_1 x_2 x_3 x_4 x_8 \cdots x_{11}})/3}{(1 - R^2_{y \cdot x_1 x_2 x_3 x_4 x_8 \cdots x_{11}})/164}$$

$$= \frac{(.16842 - .12187)/3}{(1 - .12187)/164} = 2.9010$$

4. The regression of the dependent variable on communication context indicators (x_8 - x_{11}) after the inclusion of all other indicators (x_1 - x_7).

Summary table of the fourth regression

Step	Variable/indicator	Multiple R	R^2
1	Level of education	.01638	.00027
	Off-farm earnings	.03272	.00107
	Degree of commercialization	.20034	.04014
	Social participation	.24580	.06042
	Economic activities	.28028	.07856
	Socio-economic status	.29510	.08709
	Farm size	.38412	.14755
2	Ease of obtaining farm inputs	.39699	.15760
	Use of mass media	.39713	.15771
	Extra-family contact	.40545	.16439
	Change agent contact	.41039	.16842

$$R^2_{y\cdot(x_8x_9x_{10}x_{11})\cdot x_1x_2\ldots x_7} = \frac{R^2_{y\cdot x_1x_2\ldots x_{11}} - R^2_{y\cdot x_1x_2\ldots x_7}}{1 - R^2_{y\cdot x_1x_2\ldots x_7}}$$

$$= \frac{.16842 - .14755}{1 - .14755} = .02448$$

$$F = \frac{(R^2_{y\cdot x_1x_2\ldots x_{11}} - R^2_{y\cdot x_1x_2\ldots x_7})/4}{(1 - R^2_{y\cdot x_1x_2\ldots x_7})/164}$$

$$= \frac{(.16842 - .14755)/4}{(1 - .14755)/164} = 1.0038$$

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