Resource Distribution and Productivity Analysis within Pakistan’s Agriculture

A Case Study

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DEDICATION

Dedicated to my beloved (late) father, who strongly desired to see me as a Ph.D doctor. Perhaps, without his prayers and inspiring motivations, it was not possible for me to accomplish this task.

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ABBREVIATIONS

ADB	Asian Development Bank
Ag. GDP	Agricultural Gross Domestic Product
Ag. Labour	Agricultural Labour
CDI	Crop Diversity Index
C.D	Crop Diversity
C.I	Cropping Intensity
DFID	Department for International Development
F. I. Share	Farm Income Share
FAO	Food and Agriculture Organization
G.M	Gross Margins
GDP	Gross Domestic Product
ha	Hectare
I. C	Institutional Credit
I.N.P A	Irrigated Non Perennial Area
I.P A	Irrigated Perennial Area
IFAD	International Fund for Agricultural Development
I. D	Income Distribution
I.P	Irrigation Productivity
IWMI	International Water Management Institute
JBIC	Japan Bank for International Co-operation
L. P	Labour Productivity
M.B.D	Mandi Bahauddin
MAF	Million Acre Feet
mm	Milimeter
NWFP	North Western Frontier Province
OCT	Owner-Cum-Tenants
PIU	Produce Index Unit
RF A	Rainfed Area
RW	Rice-wheat
S.cane	Sugarcane
Sig. L	Significance Level
SPSS	Statistical Package for Social Sciences
T	Tenants
TFP	Total Factor Productivity
UNDP	United Nations Development Program
WB	World Bank

ABSTRACT

Land is a pivotal resource in agriculture production but its uneven distribution retards the welfare of developing nations. This study was, mainly, devised to address land distribution problems and consequent farm productivity in the study area. Furthermore, level of land distribution disparities was focused on to observe its relationship with different on-farm and socio-economic indicators including total and partial factor productivities, gross margins, cropping intensity, crop diversity, income distribution disparities and institutional credit availability etc. All of the aforesaid indicators were also assessed for small, medium and large farm size categories. Three distinct locations were chosen on the basis of varying irrigation endowments i.e. irrigated perennial area with year round, irrigated non-perennial area with six months irrigation availability through public infrastructure and rainfed area was mainly tubewell irrigated (without public irrigation infrastructure). Various statistical (i.e. Gini coefficient, Lorenz curve, Herfindahl Index etc) and econometric measures (i.e. log-log function) were employed to quantify different indicators to achieve objectives of the study. Land was observed evenly distributed in irrigated non-perennial area as compared to other areas while land distribution was found most skewed in rainfed area. The performance of most of the indicators i.e. yield, gross margins, farm income, labour productivity, income distribution, cropping intensity and crop diversity was found better as compared to other areas. While total factor productivity, irrigation productivity and rate of institutional credit availability was higher in irrigated perennial area. However, rainfed area was always least efficient with respect to all of the quantified indicators. The aforesaid indicators were observed better at small farms than larger ones. Moreover, regression results of the study also confirmed the existence of inverse relationship between farm size and productivity in all of the study locations. Therefore, it is concluded that better land distribution and small farms agriculture can help to produce more. So, it is strongly suggested that redistributive land reforms are necessary in land scarce and labour abundant developing countries like Pakistan. It can also alleviate poverty and help to bring food security in the deprived regions.

Key words: Land Distribution, Land Inequality, Farm Productivity, Inverse Relationship

ZUSAMMENFASSUNG

Land ist eine entscheidende Ressource in der landwirtschaftlichen Produktion, aber seine ungleiche Verteilung verzögert das Wohlergehen der Entwicklungsländer. Diese Studie wurde hauptsächlich entwickelt, um die Verteilung von land und die damit verbundenen Problemen der landwirtschaftlichen Produktivität in den zugehörigen Ländern zu erforschen. Darüber hinaus wurde die unterschiedliche Ebene der Verteilung von land auf die Beziehungen zu anderen betriebs und sozio-ökonomischen Indikatoren analysiert. Ebenso wurde die vollständige oder teilweise Faktor-produktivität, Bruttoergebnisse, Ernteintensität, Ernte-Vielfalt, die Unterschiede der Einkommensverteilung und die institutionelle Kredit Verfügbarkeit untersucht. Alle der genannten Indikatoren wurden für kleine, mittlere und große Kategorien der Betriebsgrößen bewertet. Drei verschiedene Standorte wurden differenziert nach ihrem zugang zu bewässerung aus gesucht z.B. ständig bewässerte. Flächen m0it ganzjährigen Dauerkulturen, nicht dauerhaft bewässerten Flächen mit sechsmonatiger Bewässerbarkeit durch die öffentliche Infrastruktur und Flächen mit dene bewässerungs-infrastrukture (vor allem durch Brunnen bewässert). Verschiedene statistische (zB. Gini-Koeffizient, Lorenz-Kurve, Herfindahl-Index etc.) und ökonometrische Maßnahmen (log-log-Funktion) wurden zu messung verschiedener Indikatoren zur Erreichung der Ziele der Studie verwendet. Der Ergebnisse belegen eine gleichmäßige Landverteilung in nicht dauerhaft bewässerten Gebieten, während die Landverteilung in regenbewässerten Gebieten zersplittert ist. Die Leistung der meisten der Indikatoren, d.h. die Rendite, Bruttoergebnisse, die landwirtschaftlichen Einkommen, Arbeitsproduktivität, Einkommensverteilung, Anbauintensität und Anbaudiversität war im Vergleich zu anderen Gebieten höher. Während die Faktorproduktivität, Bewässerungsproduktivität und die institutionelle Kreditverfügbarkeit in dauerhaft bewässerten Gebieten höher war. Allerdings wiesen regenbewässerung-gebiete immer die geringste Effizienz in Bezug auf alle der genannten Indikatoren auf. Die genannten Indikatoren waren bei kleinen Betrieben stärker ausgeprägt als bei größeren betrieben. Darüber hinaus bestätigten regressive Ergebnisse der Studie die Existenz der inversen Beziehung zwischen Betriebsgröße und Produktivität an allen Standorten der Studie. Daher wird der Schluss gezogen, dass eine bessere Verteilung von Land und kleine Betriebsstrukturen der Landwirtschaft dazu beitragen können, mehr zu produzieren. Es wird dringend empfohlen, dass die Umverteilungen der Land reformen notwendig sind, in Entwicklungs ländern mit Landknappheit und reichlichen Arbeitskräften wie Pakistan. Es kann auch zur Linderung von Armut beitragen und als Hilfe zür Ernährungssicherung in den benachteiligten Regionen dienen.

Schlüsselwörter: Verteilung von Land, Land Ungleichheit, landwirtschaftliche Produktivität, inverse Beziehung.

CHAPTER-1

INTRODUCTION

1.1- General Background and Problem Statement

Agriculture as an engine of growth, poverty alleviator and food security patron is equally important for the rural inhabitants as well as urban population of the globe. It serves the universe with its multi facet sectors to fulfill its food, clothing and shelter requirements in the form of crops, fisheries, livestock, poultry and forestry products. It also helps to keep the environment clean and with more and new sophisticated developments energy problems of the world are being solved in the form of bio-fuels. Agriculture is major source of earning and employment of the rural communities of the globe. It employs directly or indirectly 43.1 percent labor force of the earth. Despite the enormous importance of irrigation only 5.6 percent of the agricultural area contributed to irrigated agriculture. The raw materials contribute 1.6 percent of the imports and exports of all kinds of merchandise of the world (World Resources Institute 2007). World Development Report (World Bank 2008) argues that growth in the agricultural sector contributes proportionally four times more to poverty reduction than growth in any other non-agriculture sector. The literature proved that unprecedented fall in global poverty in Asia in the last three decades reflects a large contribution from successful agricultural transformation (Datt and Ravallion 1998a and 1998b, Ravallion and Chen 2004).

Land is a pivotal resource in agriculture production but its uneven distribution retards the welfare of developing nations. Skewed asset distribution in the rural areas is a cause of serious concern which consequently bring poverty and deprivations of basic necessities of life to the affected. Concurrently, agricultural growth has benefited poor people most where land ownership has been relatively equitable (DFID 2005, Easterly 2001, Mellor 2001). Egalitarian land distribution in high growth Asian economies such as China and Thailand has substantially contributed to their economic growth (World Bank 1999). Land ownership, however, often remains inequitable; reducing agriculture's potential to reduce poverty (Binswanger *et al.* 1995). In many developing countries land ownership remains highly skewed especially in Latin America, Southern Africa and some parts of Asia. When land ownership is unequal, agriculture growth delivers fewer benefits for the poor, as profits are taken away from the economy (DFID 2002).

The colonial masters distorted the asset distribution in the favour of their loyal ones to strengthen their illegitimate reigns. This phenomenon was started and was very common in Asian, African and Latin American countries centuries ago. Zamindari system (feudal system) was founded by Mughal Dynasty and, later on, strengthened by British Empire in India. Pakistan inherited that system from British and Indians with its liberation in 1947. Pakistan is one of the countries, facing the dilemma of skewed land distribution which could not be resolved despite the three failed land reform attempts in Pakistan due to overwhelming strength of landlords within the parliament and outside of it. Eighty one percent farmers own less than 5 hectares in size cover only 38.7 percent of the total farm area. Furthermore, 6.8 percent farmers hold more than 10 hectares accounting for 39.8 percent of the farm area (Bhutto and Bazmi 2007). Moreover, 1.4 percent largest farmers occupy 21.2 percent agricultural area of the country. As the land ownership is the sign of prestige and due to the imperfect land market structure and higher transaction costs poor farmers are unable to purchase land and can not enhance their asset holding (Heltberg 1998). Nevertheless, neither land reforms efforts nor green revolution changed significantly the land distribution structure of the country. There was a temporary downward change in the Gini ratio from 0.62 to 0.51 in 1960 and 1972, respectively. But this could not persist for longer time and raised continuously from1972 to 2000 (World Bank 2002, Khan 2006). Skewed land distribution can also be confirmed by Gini coefficient of land ownership at province level e.g. Punjab had the highest Gini at 0.63 followed by NWFP at 0.59 and Sindh at 0.51 in 2001-02 (Anwar *et al.* 2004).

Land distribution scenario in Pakistan might have built up a strong conviction about the core problem. Skewed land distribution is a dilemma which causes lower proportion of land cultivation keeping a vital share of it fallow for years. Though Pakistan is an agricultural economy but, unfortunately, it can not fulfill its food requirements. It has to spend billions of Pakistani Rupees to import cereals annually. Large agricultural estates cause rural labour force to be unemployed in land scarce and labour abundant countries like Pakistan. The overall labour productivity is strongly hurt due to uneven land distribution in agriculture sector. Sense of ownership and matter of survival compel family workers to strive hard for higher yield per unit area, while hired labour produce less as compared to family worker (Sen 1962 and 1966, Cornia 1985, Unal 2008). The ratio of permanent hired labour to family labour is only 0.03 in Pakistan (Eastwood *et al.* 2004). According to some latest studies, skewed land distribution hampers overall productivity and leads the affected nations towards underdevelopment (Deininger 2003, FAO 2002, Galor *et al.* 2005, Galor *et al.* 2006, Vollrath and Erickson 2007, Galor and Moav 2004, Easterly and Levine 2003, Galor *et al.* 2003, Bourguignon and Verdier 2000, Engerman and Sokoloff 2002, Deininger and Olinto 2000, Sokoloff and Engerman 2000, Deininger and Squire 1998, Deininger and Squire 1997, Engerman and Sokoloff 1997)

A significant negative relationship between land inequalities and output per hectare has been empirically verified (Vollrath 2006). A drop in the Gini coefficient for the size of operational land holdings of one standard deviation would increase output per hectare by 8.5%. Jeon and Kim (2000) have documented significant productivity gains from the land reforms undertaken in Korea in 1950s which limited the amount of land any individual could own. These inequitable land distributions distort the structure of land size. Therefore, the countries with higher Gini ratios endow a huge area to a small number of large farms holders and vice versa.

Mal-distribution of land draws a segregation line creating two different classes' i.e. small farmers' community and elite class with big landed estates. According to Nagayets (2005) Pakistan has large numbers of small farmers (i.e. 58 %) occupying a little share of land area (i.e. 15 %) like several other countries around the globe. A bulk of literature supports the hypothesis (i.e. inverse relationship) that small farmers produce more per unit of land than large farmers. Because of its wide-reaching implications, the inverse relationship between farm size and output is one of the most important and hotly discussed facts of rural development. This issue is contested one after a pyramid of research and it is still inconclusive since many decades in agriculture sector.

Enormous evidence shows that rate of rural poverty is higher (Arif 2006,) and it is strongly correlated with lack of assets in rural areas of Pakistan (Anwar *et al.* 2004). Landless are the absolute poor while largest farmers are the exception from this phenomenon. Moreover, increase in the size of land reduces the head count ratio in the poverty trap (Anwar *et al.* 2004). All of the four provinces of Pakistan portrays same scenario. In addition, land is used as mortgage weapon to attain institutional credit. As a result, landless farmers or small land holders are disadvantageous groups and they have to, solely, rely on non institutional credit and their family labour force for cultivation. Above all, landless as well as smaller farmers are low income groups and they also have to depend upon nonfarm income to make both ends meet.

Irrigation is amongst one of the most precious resource for agricultural production and plays conducive role to attain better farm output. It is accepted fact that 95 percent of water resources of Pakistan are used for agriculture production (Government of Pakistan 2002). Pakistan ranks fifth in the world and third in Asia in terms of area under irrigated agriculture (Rust *et al.* 2001). It is comprised of more than 80 percent of irrigated agriculture. Irrigated lands are considered as production friendly due to higher yields per unit area (Bhalla and Roy 1988). Large farmers attain more water than smaller one due to prevailing rent seeking practices of the public officials and their overwhelming influence in the area (United Nations 2006). But this aspect i.e. skewed distribution of irrigation is beyond the scope of the study. Nevertheless, the irrigation productivity gap per hectare on the small and larger farms is blight for the food security and poverty not only in Pakistan and in other developing countries as well. Likewise, labor productivity and prevalence of small farms yield gap between the small and larger farms is a cause of concern.

This study has been, mainly, devised to address land distribution problems and consequent farm productivity in the study area. Three areas i.e. irrigated perennial area with year round irrigation from public infrastructure, irrigated non-perennial i.e. with 6 months water availability and rainfed areas i.e. without public irrigation infrastructure were selected as study sites in district Gujrat and Mandi Bahauddin of Punjab province of Pakistan. Impacts of land distribution were quantified on farm productivity with many other indicators like irrigation and labour productivities, farm income and credit availability in each area and overall study area. Land distribution structure, cropping pattern, cropping intensities and crop diversities were also studied in each area as well as at small medium and large farms. The study was found in line with the proponents of the small farms and redistributive land reform promoters on the account of its results. Inequality in ownership holdings was found skewed in each study location but it was not so profound in case of operational holdings. Land was observed evenly distributed in irrigated non-perennial area as compared to irrigated perennial and rainfed areas. It was very interesting to know that better land distribution fostered higher yields and greater gross margins accompanied by highest farm income and higher cropping intensity and crop diversity as compared to other areas. Nevertheless, a strong intuition on the strength of acquired results of the study has been developed to put forth the conclusion that even land distribution can "indeed" reduce poverty and achieve food security. A comparison of various farm sizes was also undertaken and it was studied whether small farms were less factor investment intensive but more productive than larger farms in every respect in each area. The study also verified the existence of "stylized fact of inverse relationship" in each area under study.

1.2- Objectives and Hypothesis of the Study

Three different sites were selected for study with varying characteristics to carry out project with the ambition to make a small contribution to the economic development literature. This kind of task always needed some stipulated targets to achieve and in hand information to arrive at destination, and satisfy curiosity. The study is comprised of two major aspects concerning land resources of agriculture production i.e. its distribution and farm size patterns. Moreover, various indicators were quantified keeping in mind these both facets in various study locations. Therefore, following major **objectives** were set to proceed ahead .i.e.

Objectives

1. To gauge land distribution disparities and test its impacts on various indicators of interest i.e. total and partial factor productivities, cropping intensity, crop diversity, gross margins, income distribution etc in all of the study locations.

2. To explore farm size patterns and quantify the consequent outcomes of total and partial factor productivities, gross margins, cropping intensity, crop diversity, farm and off farm incomes etc in each farming system under study.

3. To run regression analysis to see the existence of inverse relationship between farm size and productivity in overall as well in the various study locations.

Hypothesis

1. Land distribution is skewed in overall study area as well as in the various farming systems i.e. irrigated perennial, irrigated non-perennial and rainfed areas

2. Cropping intensity, crop diversity, total and partial factor productivities (i.e. irrigation and labour productivities), gross margins income distribution etc are higher in evenly land distributed study location as compared to others.

3. All of the aforementioned indicators except labour productivity yield better results at small farms as compared to other farm size categories in each study location as well as overall study area.

4. Inverse relationship of farm size and productivity is a valid proposition and it exists in each study location i.e. irrigated perennial, irrigated non-perennial and rainfed areas under study.

The aforesaid objectives were achieved by employing various mathematical and econometric tools to know the final results of the study. Land distribution disparity, being one of the major objective, was quantified by using different tools i.e. quintile method, Lorenz curve and Gini coefficient to avoid any kind of bias. Moreover, total and partial factor productivities and cropping intensity were determined by applying various mathematical applications. While Herfindahl index was utilized to quantify crop diversity in all of the study locations as well as at small, medium and large farm size categories. In addition, inverse relationship between farm size and productivity was also determined as an important aspect of study with the help of log-log function. Nonetheless, hypothesis of the study were tested by using Kruskal Wallis test due to the specific nature of data.

1.3- Organization of the Study

The various components of the work have been presented in dissertation in the following sequence i.e. **i)** chapter-2 contains brief introduction of agriculture development in Pakistan since its independence (i.e. 1947). It also gives a elegant view of sources of water used in agriculture followed by post independence land distribution structure and land distribution efforts in form of land reforms promulgations and their implementation in the country. **ii)** chapter-3 is comprised of farm and family characteristics of study area based on empirical data. It also gives an eye view of socio-economics and agriculture structure of district Gujrat and Mandi Bahauddin because of the fact that the study site belongs to these both districts. The empirical research area lies within rice-wheat zone of the Punjab so characteristics of this zone have also been presented in this chapter**. iii)** In chapter-4, an attempt has been undertaken to present some relevant literature concerning land distribution disparities and its hazardous impacts on the farming communities and on the society as a whole. This chapter also contains facts regarding farm size productivity on the basis of previous literature. An effort has been done to explain the factors affecting farm size productivity in detail. **iv)** Chapter- 5 describes types of data, study locations, methodology and various data analytical tools utilized in the study. Furthermore, this chapter also presents hypothesis testing statistical measure as well as econometric model to observe inverse relationship between farm size and productivity in the study area. **v)** Chapter-6 is a pivotal part of this dissertation which contains empirical results of the study. The results of the study has been arranged in a sequence of land distribution disparity, cropping intensity and diversity, factor productivities, wealth distribution and existence of inverse relationship in the study area and **vi)** chapter -7 discusses the results of the study while **vii)** chapter-8 concludes the whole study and presents recommendations for policy makers.

1.4- Justification of the study

According to the latest figures the population of Pakistan has risen to 160 million amongst which 34 percent is urban and 66 percent is living in rural areas. A significant portion of rural and urban population of Pakistan is suffering from absolute poverty. Agriculture is the single sector of economy which has highest ratio of beneficiaries with reference to their employment and livelihood. The precarious condition of land distribution structure is not only a great barrier for the agricultural development and poverty alleviation but it also affects the efficiency of the rural scarce resources i.e. land and irrigation. Feudalism and absentee landlordism greatly hampers the agriculture production and they also distort the whole power structure of rural areas. Due to certain reasons number of small farmers keep on increasing and crossing subsistence farming limits. Though, small farming is more productive but subsistence or below subsistence farming can not help the poor to swim out of poverty. Two redistributive land reforms efforts promulgated in 1959 and 1972 could not change the land distribution structure in the country due to lack of political will and victimization of political rivals. While land reforms promulgated in 1977 could not be implemented due to military coup in the country.

This study will help to recognize actual land distribution, land distribution structure, cropping intensity, crop diversity on one hand but on the other side small and larger farms productivity will also be quantified. On the bigger holdings, absentee landlordism and fallow land practices contribute more to the miseries of the landless and smaller holders otherwise they can self cultivate free land. In the end suggestion and policy implication drawn from the study may attract the policy makers to follow them. Agriculture's friendly research and development and policies may reduce poverty and guaranty food security in Pakistan and in the developing world as well.

CHAPTER-2

AGRICULTURE DEVELOPMENT AND ABORTIVE LAND DISTRIBUTION ATTEMPTS IN PAKISTAN

2.1- Post Independence Agriculture Development in Pakistan

Pakistan is located at 33° 40′ 0″ N, 73° 10′ 0″ E on the globe and it is positioned in arid and semi arid regions. Its total land area is 307,376 Square miles (796,100 sq km) of which 50 percent is mountainous terrain, narrow valleys and foothills. The Indus plain where most of irrigated agriculture is located covers about 78,000 sq mile which is almost 25 percent of the total area (Government of Pakistan 2002a). Agriculture is utilizing 95 percent of the water resources of Pakistan (Government of Pakistan 2002) and share 80 percent agricultural outputs from irrigated agriculture (Chaturvedi 2000, Lipton *et al. 2003*). Scant and intermittent rainfall plays a complementary role to support agriculture which is only 240 mm per year (World Bank 2007a).

The population of Pakistan has increased from 33 million at the time of independence in 1947 to 153.95 million in 2005, making it the seventh most populous country in the world. The population grew at an average rate of 3 percent per annum from 1951 until the mid-1980s. Population growth slowed to an average rate of 2.6 percent per annum between 1985 and 2000. Since 2000–01 the country's population has grown at an annual average rate of almost 2.2 percent The current growth rate is still high compared with the average population growth of developed and developing countries which is 0.9 and 1.7 percent, respectively (Government of Pakistan 2005). The human capital in the rural areas of Pakistan is the lifeline of Pakistani economy which is either skilled or unskilled in the farm or non-farm sectors of the rural sphere. More than 65 percent of the population of Pakistan is still rural while a big portion of it i.e. almost 50 percent (women) are professionally inactive.

Agriculture serves as the back bone of Pakistan's economy. It generates 20.9 percent of its national income (GDP) and employs 43.4 percent of its labour force and accounts for nearly 9 percent of the country's export earnings (Government of Pakistan 2007). Moreover, this sector provides raw material to domestic agro-based industries such as sugar, ghee (plant oil), leather and textiles. Most notably, 65.9 percent of the country's population living in rural areas depend directly or indirectly on agriculture for their livelihood (Government of Pakistan 2006). Agricultural growth has historically played a major role in Pakistan's development and continues to be crucial for overall growth and poverty reduction. Table 2.1 shows the historical trends of the real GDP, real agricultural GDP and population growth since 1960 to 2004. Average annual share of agricultural GDP of Pakistan was 51, 42, 36, 28 and 25 percent in 1950s, 60s, 70s, 80s, and 90s respectively, by employing 68, 64, 58, 53, and 50 percent of the labor force of the country (Khan 2006). It has always been source and pillar of foreign exchange in the form of exports of Pakistan since many decades. Agricultural export shared 53, 35, 58, 47, 37 and 25 percent of the total export earnings of the Pakistan in 1950-55, 1960-65, 1970-75, 1980-85, 1990-95 and 2000-05 respectively (ibid).

Table-2.1 Agriculture Growth per Capita in Pakistan 1960-2004 (percent)

	1960-70	1970-80	1980-90	1990-00	1990-2004
Real GDP Growth	7.19	4.71	6.32	3.75	3.62
Real Ag. GDP Growth	4.89	2.33	4.04	4.42	3.54
Population Growth	2.79	3.18	2.70	2.49	2.47
Rural Population Growth	2.42	2.73	2.34	2.11	2.06
Real Ag. GDP Growth per Capita	2.04	-0.82	1.31	1.88	1.04

Source: World Bank 2007

Even though, agriculture's share of GDP has fallen from about 40 percent in the 1960s to about 20 percent today. Agriculture remains the largest source of household income for 38 million Pakistanis, including 13 million of the poorest 40 percent of rural households. However, Substantial scope exists for increasing productivity and overall economic efficiency in the agriculture sector of Pakistan (World Bank 2007). Despite progress in GDP and better per hectare yield in the agriculture sector, the level of rural poverty is quite higher than urban and national averages of the country. It reduced from 39.1 to 34 percent from 1998-99 to 2004-05 but the figures show that it has continuous increasing trends i.e. 25.2, 25.4, 33.1 and 33.8 in 1990-91, 1993-94, 1996-97 and 1998-99, respectively (World Bank 2006a , Bhutto and Bazmi 2007). Despite the fluctuations in a tangible to and fro manner of the poverty since decades in the rural areas of Pakistan, agriculture sector has helped the rural communities to avoid from food insecurity and malnutrition.

The green revolution mechanized Pakistan's agriculture sector by increasing use of tractors and tubewells. While high yielding varieties of hybrid seeds and use of chemical fertilizers enhanced farm efficiency of the country. The green revolution made susceptible to the smaller farmers for changes that are more resistant to the innovative ideas. It played a crucial role to adopt new techniques and technologies even to the laggards in Pakistan just like other developing countries of the world. Massive investments in large-scale surface irrigation with the "Indus Basin Waters Treaty" agreed in 1960 and subsequent major investments in the Tarbela dam (the world's largest earth-fill dam) and link canals provided the basis for a vibrant agricultural and the development of the country's economy. The worthier development in irrigation sector and advent of green revolution in 1960s boosted agriculture, and capture more and more cultivated land and attracted masses of labor from the rural population. Figure 2.1 illustrates the decennial increasing trends of cultivated land and labor since 1950s in Pakistan.

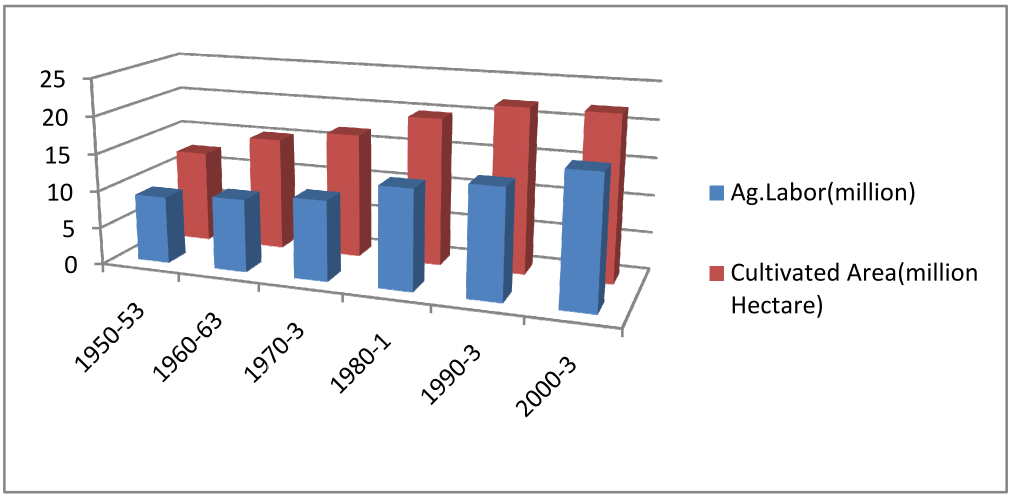


Figure-2.1 Growth in Cultivated Area and Agriculture Labor from 1950-53 to 2000-03

Source: Data used from Khan-2006

The average annual increase in cultivated land and labor passed off at the rate of 1.5 as well as 1.8 percent per year since 1950-3 to 2000-3. Furthermore, significant developments in the land and labor productivity were also visualized that augmented from 1345 to 4247 rupees per hectares and 1858 to 5375 rupees per worker since 1950-3 to 2000-03, respectively. The trends in land and labor productivity can be better understood form Figure 2.2.

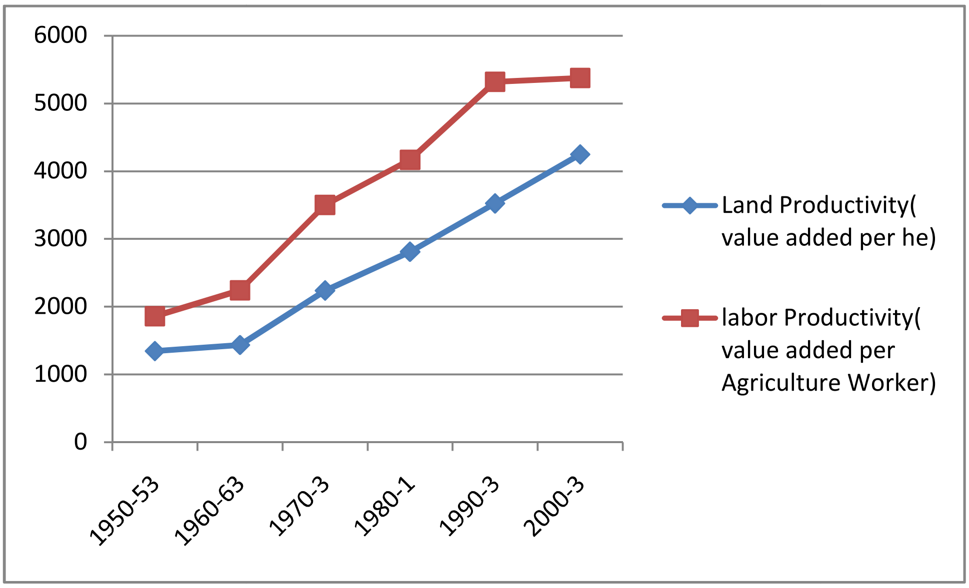


Figure-2.2 Land and Labor Productivity in Agriculture, in Pakistan

Source: Data used from Khan-2006

It is evident from the upward trajectory of the figure that both land and labor productivities took momentum in 1960s with the introduction of green revolution and surface irrigation after Indus basin treaty with India in 1960.

There are very distinguished two annual crop seasons to grow various major crops called Rabi (winter) and Kharif (summer) season. Pakistan has been endowed with good climatic conditions to grow different crops, with the favorable social and economic environment, high potential yield of the crops can be achieved. Average yield of major crops have almost doubled and in some cases it has tripled since 1950-3 to 2004-07.

Table-2.2 Average Yield of Major Crops (per hectare)

Year	Cotton (Kg)	S.Cane (m-t)	Rice (Kg)	Wheat (Kg)
1950-3	619	29	879	759
1960-3	732	32	913	824
1970-3	1023	33	1536	1175
1980-3	1041	38	1698	1629
1990-3	1927	42	1556	1926
2000-3	1825	47	1957	2325
2004-07	NA	51	2107	2596

Source: Government of Pakistan 2007 and Khan-2006

It is obvious from table 2.2 that wheat (i.e. staple crop in Pakistan) rose 3.4 times, while rice, cotton and sugarcane have attained 3, 1.75 and 2.5 times more yield in almost 50 years. Unfortunately, all these achievements in yields have been dissipated due to higher rate of population growth and vague public policies. Consequently, Pakistan is suffering from bad wheat shortage these days and is constrained to import bulk of it from other countries.

Education plays a pivotal role to learn, organize, integrate and excel the societies and their progress and prosperity. Unfortunately, achievements in the education sector have been remarkably sluggish in the rural areas of Pakistan. The backwardness in the literacy rate might be the reason for slower economic growth and poor rural development of Pakistan. The literacy rate of the rural areas of Pakistan was mere 17.33 percent in 1981 which rose to 33.64 percent in 1998 (Government of Pakistan 1998), and reached ultimately up to 40 percent in 2004-05 (World Bank 2007). Literacy rate in the rural areas is not very impressive and its progress since last two and half decades is dismal.

2.2- Water for Agriculture

It is accepted fact that 95 percent of water resources of Pakistan are used for agriculture production (Government of Pakistan 2002a). Pakistan ranks fifth in the world and third in Asia in terms of area under irrigated agriculture (Rust *et al.* 2001). Pakistan is being irrigated by eminent Indus Basin irrigation system which is one of the most contiguous systems of the world. The system was designed for 80 percent of cropping intensities i.e. 50 percent during the Kharif season and 30 percent during the Rabi season (Starkloff and Zaman 1999). The water delivery system, after Indus Basin treaty with India and consequent construction of network of canals consists of 64,000 Km length to irrigate over 16 million hectares of land (Rust *et al. 2001).* Diversion from the Indus river system and groundwater extraction account for about 60 and 25 percent, respectively, of the annual water supply for agricultural production. Rainfall in the gross command area accounts for 15 percent of the total water supply (United Nations 2000). Table 2.3 shows core water resources situation in Pakistan.

Table-2.3 Water supplies for Irrigation of the Indus Plan

Sources of Irrigation	**Volume (MAF*)**	**Percent**
Rainfall	26	14.8
Diversion Canal Irrigation Systems	105	59.6
Ground Water	45	25.6
Total	176	100

Source: United Nations 2000

MAF*= Million Acre Feet

Agriculture in Pakistan is basically irrigated with 82 percent of cultivable area equipped with irrigation infrastructures. During the last 46 years, the area with irrigation facilities increased from 8.21 to 18.0 million ha, at an average annual rate of 1.7 percent. Moreover, most of the increase took place in canal and tubewell irrigated areas (United Nations 2000). From the total irrigated area (i.e. 19.02 million ha) 7 million ha is canal irrigated, 7.78 million ha is canal plus tubewell irrigated and 3.5 million ha is tubewell irrigated while the rest is irrigated with some other sources (Government of Pakistan 2005-06). During the era of green revolution Salinity Control Area Reclamation Project (SCARP) was introduced to the brackish water zone with high water table areas with the help of World Bank. The ground water is charged with river flow, canal seepage and natural precipitation. This aquifer, with a potential of about 50 MAF, is being exploited to an extent of about 38 MAF by over 562,000 private and about 10,000 public tubewells (Kahlow and Majeed 2004). Figure 2.3 expresses the scope of ground water exploitation in Pakistan since 1900.

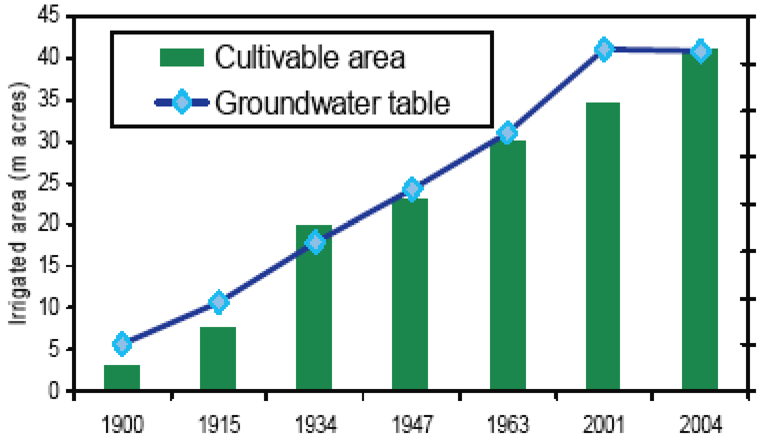


Fig-2.3 Ground water exploitation since 1900

Source: World Bank 2005

Hill-torrents in the hilly areas of the country provide another source of surface water, which has not been developed to its full potential. There are 14 distinguishable hill-torrent areas with a total potential of about 19 million acre feet (MAF) at about 1,200 sites in all the four provinces of Pakistan. Out of this, almost 60 per cent can be developed for crop production. This water offers excellent opportunity to irrigate almost 6 million acres of culturable wasteland in the hill torrent areas (Kahlow and majeed 2004).

2.3- Background of Land Concentration and Rectification Efforts

Dynasties and colonial masters distorted the asset distribution in the favour of their loyal ones to strengthen their illegitimate reign. This phenomenon was started and was very common in Asia, Africa and Latin American countries centuries ago. Mughal Empire established two different insti-tuitions with the name of Zamindars and Jagidars. Zamindars were assigned lands without property rights to collect revenue for the state while Jagirdars had property rights with dual obligations of revenue collection and catering knights for wars. Later on, British replaced Mughal imperialism by colonizing India and bestowed property rights to Zamindars to strengthen their grip on the rural class. Nevertheless, in the second quarter of 19^{th} centaury, influential Zamindars were ranked as Lumberdars and assigned task of revenue collection from peasants at village level (Khan 1981). Consequently, rural society was converted, explicitly, into a class structure of landed elites and peasantry.

At the time of independence in 1947, along-with many other challenges land concentration, absentee landlordism and temporary and uncertain tenure of sharecropping were very important to address. Political influence of landed elites was not diminished with the creation of Pakistan and only 130 feudals of Sind owned 1.1 million acres of land (Khan 1981). According to Nasr (1996) the Muhajirs (i.e. migrants from India to Pakistan) first demanded land distribution in 1947 and they had to face a strong resistance of the landed elites, especially in Sind where the Muhajirs predominated. The landed elites reacted by appealing to Sindhi nationalism--standing united with their peasants in defending Sind and the rights of sons of soil against the onslaught of migrants.

With the advent of Pakistan in 1949, government started working on the land issues due to its severity and its long-lasting impacts on the future development of the newly born nation. The "Hari (i.e. sharecropper) Enquiry Committee" of Sind was established in 1947-48. The committee categorized two kinds of absentee landlordism i.e. (a) who do not reside on their lands and (b) who reside but do not take care of their lands. The committee argued that such landlords do not support their tenants and subjected them to harassment through their intermediaries. Afterwards, the "Muslim League Agrarian Committee" suggested devolution of Jagirs and to give greater security to tenants in 1949 (Herring 1983). This report was comprised of two parts having full lay out of agrarian reforms. Subsequently land reforms of 1959 and 1972 were designed on the basis of recommendations put forth by this committee. Consequently, "Sind Tenancy Act of 1950" and "Punjab Protection and Restoration of Tenancy Rights Act of 1950" were promulgated (Khan 1981). Landlords used different tactics to put pressure and avoid from redistributive land reforms as a second step from the government. They created dummy shortage of grains in 1952-54 and government had to import from abroad to fulfill the gap. The worse economic conditions of Pakistan provided opportunity of imposing first Martial Law to a military dictator in 1958. He appointed a land reform commission in the same month he took over the country. The commission presented their report with consolidated outlines which mainly include,

1- Size of individual holdings

2- Resumption of excess land and its distribution

3- Abolition of Jagirs

4- Security for tenants

5- Prevention of fragmentation and consolidation of individual holdings

On the basis these recommendations first land reforms of the country were promulgated in February 1959.

2.3.1- Land Reforms 1959

In this part, preconditions and land ceiling, resumption, redistribution of land and achievements of the reforms regarding land distribution will be briefly discussed.

The regulations were set at the ceiling of 500 acres of irrigated and 1000 acres of un-irrigated lands (Jalal 1995, Herring 1983, Khan 1981). But some certain exemptions were bestowed to landowners to keep their land equivalent to 36,000 Produce Index Units (PIU) which was based on pre-independence revenue settlements (Jalal 1995). The Produce Index Unit (PIU) reflected the measure of productivity of land according to their type (Hussain 1984). Khan (1981) defined PIU as: any two different acres of land located separately are assigned the same PIU if they are producing same gross output in the same year.

Relaxation was also granted on orchards to keep an additional area of 150 (6,000 PIU) acres but not less than 10 acre block. 18,000 PIU could also be transferred to heirs and 6000 could be gifted to female family members. Moreover, landowners were allowed to retain area of their choice in compact blocks not less than of an economic holding i.e. 50 acres in Punjab and 64 acres in Sind. However, the compensation was to be paid on average Rupees 8 per PIU in interest bearing bonds over 25 years which were heritable but not negotiable. The resumed land was to be sold to landless tenants already cultivating and to small farmers to enhance their holding up to 12.5 acres in Punjab and 16 acres in Sind. Furthermore, a part of resumed land was to be sold to other than landless and small farmers i.e. civil and military servants (Khan 1981).

During the implementation process numbers of declarants were 5,064 but only 15 percent of them were affected by provision of ceiling on individual land holding. The area of affected declarants was 5.5 million acres of which 27 percent was in Sind and 66 percent in Punjab. Average holding of each declarant in the country was 7,028 acres but it was an astonishing 11,810 acres in Punjab (Jalal 1995) and 3,765 acres in Sind (Khan 1981).

Jalal (1995) concluded that the lacunae in the land reforms legislation effectively derailed this exercise rather than the process of implementation. A large proportion of the declared land was retained by the owners which were 66 percent in the country, 71 percent in Punjab and 56 percent in Sind. Only 1.9 million acres of land was resumed by the government (Khan 1981, Jalal 1995, Bhatia 1990, Herring 1983), 55 percent from Punjab and 35 percent from Sindh (Khan 1981). While 57 percent of resumed land was classified as uncultivated (Ibid). Government of Pakistan paid 89.2 million Rupees to former landowners for the resumption of land until 1967 (Jalal 1995).

As far as the sale of land is concerned only 50 percent of total resumed was sold until 1967. However, most of the area was sold to landless and small owners while remaining area was sold to rich farmers and civil and military officials. Bhatia (1990) said that total 196,000 tenants benefitted from the sale of resumed land while Herring (1983) mentioned the figure of 150,000 to 2000,000 tenants with reference to public depart but he greatly suspected it. Moreover, state benefited from the abolition of the Jagirs in the form of accretion of Rupees 3.1 million of land revenue to the treasury every year (Bhatia 1990). Many authors criticize the reforms having political motives rather economic and these were termed as failed land reforms.

2.3.2- Land Reforms 1972

A federal land commission was established, in 1972, to monitor and coordinate between constituted provincial land commissions and to assist the government in implementing the regulations uniformly through out the country. Before to promulgate land reforms, the main targets of the reforms which were to be achieved, were announced on 1st March, 1972. Those were ideal features, if would have been implanted honestly it might have changed the country into a progressive and prosperous nation until now. According to Khan (1981) the objectives were as under,

1- New and lower ceiling on individual holdings

2- Resumption of land by the state without compensation

3- Free distribution of land to landless and small peasants

4- Small peasants and landless were exempted to pay for their bought lands during 1959 reforms.

5- Restrictions on the evictions of the tenants

6- Consolidation of land holdings

7- Beginnings of programs to create employments for agriculture labourers

While land Reform regulations were promulgated on March 11, 1972 in the reign of Zulfiqar Ali Bhutto to place ceiling on the agricultural holdings of Pakistan's large land lords. It was asserted that the dissolution of Pakistan's large agricultural holdings would foster a transformation from absentee landlordism to modern agricultural entrepreneurship. Kennedy (1993) elucidated that the rationale for 1972 land policies were threefold,

- Redistribution of land to the landless would alleviate poverty in the state and would result in greater equality in rural areas.
- Land reforms would weaken the power and dominance of Pakistan's feudal class.
- The reforms were crafted to make Pakistan's agricultural production more efficient.

1972 land reforms were akin to 1959 reforms with reference to individual land ownership rather to set ceiling at households' level. However, the ownership ceiling was lower i.e. 150 acres upon irrigated and 300 acres on un-irrigated lands as compared to 1959 reforms (Hussain 1984, Kennedy 1993, Nasr 1996, Herring 1983) with the exception to an additional 20 percent of land to the farmers owning a tractor and tubewell before December 1971, in the form of additional 2000 PIU (Khan 1981, Nasr 1996). But later on, time frame of tractor and tubewell ownership to retain extra units of land was exempted. Moreover, two main features distinguished these reforms from the previous one. First, compensation was not given to the affected landlords and second, land was distributed free of charge to the landless peasants. The exemption of orchards and livestock farms given in 1959 reforms was dishonoured. The land owners were allowed to retain area of his choice as long as it was in compact blocks of not less than 50 acres in Punjab and 64 acres in sind similar to 1959 reforms regulations. Moreover, due to the understatement of land productivity standard set according to 1940 PIU the actual ceiling in Punjab was 466 and 560 acres in sind for a tractor or tubewell owner (Hussain 1984). The land declared by the landlords circumventing the ceiling, only 42 percent was resumed in Punjab and 59 percent in Sind. The total area resumed by the government was 0.6 million acres which was far less than the area resumed under 1959 reforms (i.e. 1.9 million acres) (Ibid). The resumed land was to be allotted free of charge to landless and small peasants. Of the total resumed area, only 308,390 acres of land were allotted to the beneficiaries until 1978 (Khan 1981). In addition, most of 257,594 acres of resumed land was unfit for cultivation in some regions of Punjab and sind. According to land commission of Punjab and Sind, a total of 50,548 people benefitted from the redistribution of land during 1972-78 in these provinces. The average area allotted to each beneficiary was 5.3 acres in Punjab and 7.9 acres in Sind (Ibid).

1972 land reforms mainly targets opposition leaders and workers in general in all of the provinces but especially in the provinces of Balochistan and NWFP (North West Frontier Post) (Kenedy 1993). Both of the land reforms (i.e. promulgated in 1959 and in 1972) were failed to achieve their real targets even did not reach nearby of them.

2.3.3- Post Independence Farm size structure in Pakistan

This part of the work will materialize the notion of jagged structure of land distribution to express the fact that a small number of big landlords own large tracts of land occupying high percentage of total agricultural land area in Pakistan. According to Griffin *et al.* (2004), most of the public policies with the rationale to boost agriculture sector favour big land holders whether those are in form of cheaper credit, input subsidies or irrigation infrastructure development in rural areas. In a country like Pakistan, where land is scarce and labor is abundant absentee landlordism is a kind of practice which might exacerbate the food insecurity and dampen poverty alleviation efforts to support the rural poor. As it has been mentioned in previous section that feudalism was a major cause of distorted land distribution in Pakistan. Table 2.4 shows ownership pattern regarding farm size at the time of independence of the country and just after it.

Table- 2.4 Land Ownership in Pakistan and Major Agricultural Provinces 1950-55

Farm Size	Pakistan		Punjab		Sind	
(Acres)	Owner (%)	Owned Area (%)	Owner (%)	Owned Area (%)	Owner (%)	Owned Area (%)
up to 5	64	15	66	16	30	4
5-25	29	32	29	39	46	19
25-100	6	22	4	22	16	23
100-500	1	16	1	14	7	25
Above-500	0.1	15	0.1	10	1	29

Source: Khan 1981

Land reform promulgations that gave some security to the leased land tillers greatly affected the traditions to lease out the land for crop production purposes. As a result owner kind of tenure is getting stronger with the passage of time in the country. Table 2.5 articulates the facts about the history of land tenure structure in Pakistan. It is evident from the table that number of ownership holding had a continuous increasing trend from 1960 to 2000. It might be due to tenurial clauses of land reforms in the country. Furthermore, Hussain (1984) concluded that anticipated high profit margins due to mechanization brought by green revolution further distorted the land tenure structure. Big landlords preferred to self cultivate rather to rent out their lands.

It should be noted that two forms of tenant-operated holding exist i.e. (a) fixed rent and (b) share cropping. In case of “fixed rent”, tenants have to pay agreed amount of cash while share croppers have to share 50 percent of inputs as well as outputs of the crops or any other amount according to the contract. Most of the time cash croppers are losers, they have to abide by the terms and conditions set by the land owners.

Table-2.5 Land Tenure Structure in Pakistan

	No. of Farms (million)				Farm Area (million ha)			
census Year	**Total**	**Owner**	**O-C-T**	**Tenants**	**Total**	**Owner**	**O-C-T**	**Tenants**
1960	4.85	1.99	0.83	2.02	19.60	7.58	4.46	7.77
1972	3.76	1.56	0.89	1.29	19.86	7.85	6.14	5.87
1980	4.07	2.27	0.78	1.05	19.06	9.93	5.02	4.11
1990	5.1	3.49	0.63	0.95	19.15	12.44	3.64	3.08
2000	6.6	5.13	0.56	0.93	20.41	14.96	2.96	2.48

Source: Pakistan Agriculture Census Reports. 1960, 1972, 1980, 1990 and 2000

There has been an inverse relationship between owner-operated and tenant-operated farms. As owner-operated farms rose in size and number while tenant-operated holdings declined almost in the same proportion. The best available data on this point have to do with the distribution of landholdings. These data confirm a constant rise in owner-operated farms and an equally constant decline in tenant-operated farms from the1960s to the 2000. As it can be seen from Table 2.5, owner-operated holdings rose from nearly 2 million in 1960s to 5.13 million in 2000, an increase of 3.3 million farms. By contrast, tenant-operated holdings declined from just over 2 million in 1960 to less than a million in 2000, halving of their number over a three decade period. These data are confirmed by the findings of a study undertaken by Kuhnen (1990), in which the Gini coefficients of landownership and landholdings were 0.79 and 0.63 respectively.

Table 2.6 shows the agricultural land distribution by farm size and their occupied areas in Pakistan. It is evident from the table that numbers of farm in less than 5 acres category continuously increase from 1972 to 2000. The decline in number of farms in the same category during 1960 to 1972 might be because of promulgation of land reforms which was later reversed. According to Bhutto and Bazmi (2007) eighty one percent of owned farms are less than 5 hectares in size and cover only 38.7 percent of the total farm area. Only 6.8 percent large farmers hold more than 10 hectares accounting for 39.8 percent farm area. Small farmers tend to use farming systems that are more labor intensive and less risky, while big farmers prefer farming systems that are more intensive in capital as they can afford to take risks with the ambitions of higher returns. To avoid from subsistence farming as well as absentee landlordism government must take some rectification measures by promulgating and implementing land reform efforts. As more skewed distribution of land aggravate poverty situation in the affected areas.

Table-2.6 Number of Farms and Area in Pakistan

Size of Farm (Acre)	No. of Farms %					Farm Area %				
Size of Farms	**1960**	**1972**	**1980**	**1990**	**2000**	**1960**	**1972**	**1980**	**1990**	**2000**
<5	19	28.2	34.1	47.5	57.6	3	5.2	7.1	11.3	15.5
5<12.5	44.3	39.9	39.4	33.4	28.1	23.6	25.2	27.3	27.5	27.9
12.5<25	23.8	21.1	17.3	12.2	8.8	27	26.6	24.7	21.5	19.1
25<50	9	7.7	6.5	4.7	3.9	19	18.8	17.8	15.8	16.3
50<150	3.3	2.7	2.4	1.8	1.2	16	15.1	14.7	13.9	9.6
>150	0.5	0.4	0.3	0.3	0.2	11.5	9.1	8.5	10.1	11.6
Total	100	100	100	100	100	100	100	100	100	100

Source: Pakistan Agriculture Census Reports 1960, 1972, 1980, 1990, 2000

2.3.4- Land Distribution Disparities

Skewed land distribution with distinct power structure obstructs the pace of development and hits badly the rural societies and is used as a tool to suppress others in developing countries. Pakistan is one of the countries, facing the dilemma of skewed land distribution which could not be resolved despite three land reforms attempts in Pakistan due to overwhelming strength of landlords within the parliament and outside of it. Green revolution also could not nudge positively towards rural asset structure of the country. Table 2.7 portrays the skewed land distribution in the country.

Table-2.7 Land Gini Ratios in Pakistan 1960-2000

	1960	**1972**	**1980**	**1990**	**2000**
Ownership Holding	NA	.065	.063	.064	0.65
Operational Holding	0.62	.51	0.54	0.58	0.60

Source: Khan 2006

Table 2.7 shows that neither land reforms efforts nor green revolution changed significantly the land distribution in the country. As the land ownership is the sign of prestige and due to the imperfect land market structure and higher transaction cost poor farmers are sheer unable to purchase land and can not enhance their asset holding (Heltberg 1998). There is a reasonable downward change in the Gini ratio from 0.62 to 0.51 in 1960 and 1972 in operational holdings respectively. But it could not persist for longer time and raised continuously from1972 to 2000. Skewed land distribution can be confirmed by Gini coefficient of land ownership at province level. Punjab had the highest Gini at 0.63 followed by NWFP at 0.59 and Sindh at 0.51 in 2001-02 (Anwar *et al. 2004*). Distribution of land holding at province level indicates that about 85 percent households own no land in Sindh (landless plus non agriculture), followed by 78 percent in Baluchistan and 74 percent in Punjab (ibid). The unequal land ownership pattern is clearly reflected by the fact that a very small portion of all households holds large farm size in all provinces. Notably, merely 0.05 percent households own greater than 2 hectares of land (ibid) in Punjab as well as in Sindh suggesting a highly skewed land ownership pattern.

The information mentioned above revealed that there is dire need of true land reforms to make the balance of land ownership in the favour of poor farmers. Prudent promulgation and successful implementation of land reforms can enhance overall productivity and bring prosperity for the country as a whole and especially to the prevalent rural population.

CHAPTER-3

THE STUDY AREA: GENERAL AND FARMING CHARACTERSITICS

Pakistan consists of four major administrative units (provinces) i.e. Punjab, Sindh, North Western Frontier Province (NWFP) and Balochistan. Each province is subdivided in to many sub-areas known as “division”. Each division contains three or more “districts”. According to the area and population, each district has been further subdivided in to two or more than two “tehsils”. These have been devolved into “municipalities” which are further divided into “union councils”. The administrative unit of division was dissolved by the previous government in the year 2000 while it was restored by the current government in Punjab. Punjab is divided into 8 divisions and 35 districts. Figure 3.1 shows various administrative units of Pakistan. District Gujrat and Mandi Bahauddin have been selected as study sites from central Punjab. Due to certain topographical characteristics, a large part of district Gujrat is rainfed along with irrigated areas while Mandi Bahauddin has, mainly, irrigated agriculture. These both districts were found very suitable to achieve the set targets of the study. The chapter has been organized to elaborate a) overview of district Gujrat and Mandi Bahauddin followed by b) Rice-wheat farming systems while c) farm and family characteristics d) land tenure structure and e) cropping patterns in the study area, are based on empirical work of the thesis.

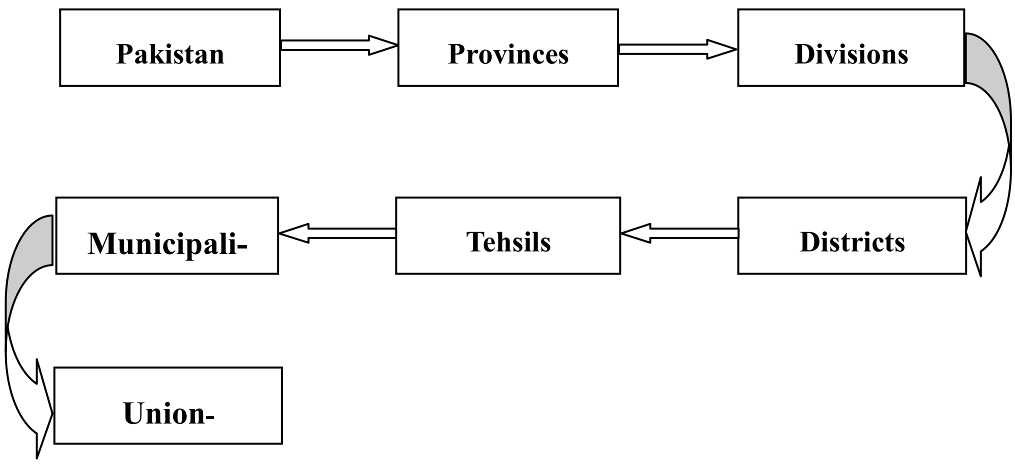


Figure 3.1-Administrative Structure of Pakistan

Source: By Author

3.1- An Overview of District Gujrat and Mandi Bahauddin

District Gujrat was established in 1849 (Government of Punjab 2008 a). It consisted of a vast area of current districts Gujrat and Mandi Bahauddin until year 1993. Later on, during the year 1993, Mandi Bahauddin was announced as an independent district for the sake of better governance and management (Cheema 2006). After splitting into two districts, Gujrat is still bigger (i.e. 3192 square Km) than M.B.D (i.e. 2673 square Km). District Mandi Bahauddin lies in the centre and Gujrat in the north part of Chaj Doab between the Jehlum and Chenab rivers (figure 3.2 exhibits the location). Climate of both districts is similar with minimum and maximum average annual temperatures i.e. 31 and 16 ^{0}C but average rainfall in district Gujrat is far higher than M.B.D due to its upland areas. The hottest months are May, June, July and August and coldest ones are December and January in both districts (see appendix 3.1 for detailed temperature and rainfall).

Figure- 3.2 Location Map of District Gujrat and M.B.D

Source: Mapquest 2008

According to government of Punjab (2008), Gujrat is more populated (i.e. 2.4 million) than M.B.D (i.e. 1.3 million) with higher population density (758 person/square Km) as compared to Mandi Bahauddin (500 person/square Km). Table 3.1 expresses details regarding periodic increase in population of both districts.

Table 3.1- Population of Gujrat and Mandi Bahauddin Districts

Gujrat						
Year	**1951**	**1961**	**1972**	**1981**	**1998**	**2008**
Population (000)	743	835	1177	1408	2048	2421
Intercensal Differences	**1951-61**	**1961-72**	**1972-81**	**1981-98**	**1998-2008**	
Percent	12	41	20	45	18	
Mandi Bahauddin						
Year	**1951**	**1961**	**1972**	**1981**	**1998**	**2008**
Population (000)	415	491	722	846	1161	1336
Intercensal Differences	**1951-61**	**1961-72**	**1972-81**	**1981-98**	**1998-2008**	
Percent	18	47	17	37	15	

Source: WB, ADB, DFID and Government of Punjab 2005, Government of Punjab 2008

Gujrat is comparatively more urbanized than Mandi Bahauddin with 28 percent urban population (Government of Pakistan 1998). While Mandi Bahauddin holds only 15 percent urban and 85 percent rural population (Ibid). Different employment sectors in both districts have absorbed various proportions of their labour force. Agriculture and construction sectors provide livelihood opportunities to maximum inhabitants of both districts along with a number of other sectors. Construction sector is engaging maximum of labour force i.e. 31 percent followed by agriculture in district Gujrat. While agriculture is leading sector with highest percentage (i.e. 40 percent) of employed people of district Mandi Bahauddin followed by construction and other sector (see appendix 3.2 for detailed rural and urban employment trends in both districts).

3.1.1- Agricultural Land and Irrigation Status of District Gujrat and Mandi Bahauddin

Total reported area of district Mandi Bahauddin is 269 thousand hectares, 81 percent of which is being tilled by the land tillers. Only 2 percent area is covered by forests, 4 percent is culturable waste and 12 percent is not available for cultivation in the district (Government of Punjab 2008). Land degradation is not so daunting with 2 percent saline and 0.4 percent waterlogged area, out of 184198 thousand hectares surveyed in the district (World Bank, ADB, DFID and Government of Punjab 2005). The cultivated areas is being utilized in form of "'net sown" (76 percent), "current fallow" (24 percent), "area sown more than once" (84 percent) and "total cropped area" (161 percent) in the district. As far as district Gujrat is concerned, farming is being carried out on 79 percent of the total reported area (i.e. 321 thousand hectares). In addition, 4 percent of land is under forest cover while the rest (17 percent) can not be used for cultivation. Furthermore, 8 percent of total land area is preyed by salinity and 0.16 percent is waterlogged (World Bank, ADB, DFID, and Government of Punjab 2005). Land utilization statistics show "net sown area" as 91 percent and the area left fallow was only 9 percent in the whole district. Moreover, 20 percent area was cultivated more than once in a year and total "cropped area was 111 percent in the district (Government of Punjab 2008).

Total irrigated and un-irrigated area in M.B.D district is 98 and 2 percent, respectively. Due to uneven topography a large area of district Gujrat lacks irrigation infrastructure and, consequently, 49 percent of lands are un-irrigated here (Government of Punjab 2008). Moreover, canal-tubewells and canal-wells irrigate 75 and 6 percent of sown area while tubewells, canals and wells irrigate 14, 3 and 2 percent sown area in district Mandi Bahauddin. Whereas, major portion of land is being irrigated by tubewells followed by canals, canals plus tubewells, canals plus wells and wells in district Gujrat. Furthermore, these aforementioned modes irrigate 31, 10, 8, 8 and 1 percent of total land area in the district, respectively. Details regarding land distribution, per capita food production, food availability and food security regarding both districts have been given at the end (i.e. appendix 3.3, 3.4 and 3.5).

3.2- Farming Systems and the Study Area

***Farming System** is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. Depending on the scale of the analysis, a farming system can encompass a few dozen or many millions of households (Dixon et al. 2001).*

Farming system research was initiated in 1970s and some certain criteria were set by the scientists and, as a result, a number of farming systems were identified in previous decades. Latest farming system classification was done on the basis of criteria set by Dixon *et al.* (2001). Seventy two farming systems has been identified with eight broad and generic categories each in the developing regions. An overview of global farming systems reveals that six irrigated and rice based wetland systems contain an agricultural population of nearly 900 million. These systems consist of 170 million hectares of cultivated land of which nearly two thirds are irrigated. There are three major categories of smallholder rainfed farming systems in humid, highland or dry/cold areas. These different rainfed systems altogether comprise of an agricultural population of more than 1.4 billion with 540 million ha of cultivated land. Dualistic systems comprise of farms of mixed size contain a further 200 million farm people, with a cultivated area of 11 million ha. Finally, two further minor categories of smallholder systems i.e. four coastal artisanal fishing-mixed and six urban-based systems contain a combined total of about 100 million people (Dixon and Gulliver 2003).

Pakistan has two main cropping seasons i.e. Kharif (winter) and Rabi (summer). Cotton, rice, maize, sorghum and sugarcane are Kharif crops, while wheat, oilseeds, grams and barley are Rabi crops. Pickney's (1989) classification of rural areas into agro-climatic zones is based primarily on the Kharif crops, because wheat is the predominant crop in the Rabi season virtually in all areas of the country. He distributed agro ecological zones into 9, with 5 in Punjab, 2 in Sindh, 1 in North-Western Frontier Post (NWFP) and 1 in Balochistan. While Food and Agriculture Organisation (2004) divided Pakistan into 15 tiers with respect to its crop production zones. The irrigated plains of Pakistan constitute the largest irrigation system in the world, extending from Peshawer valley through the valley of Punjab and Sindh provinces. A number of major cropping systems dominate farming in the irrigated plains. Almost, every where wheat is the major Rabi crop while major Kharif crops varies depending on climate, soil and access to market (Byerlee and Hussain-1992). Table 3.2 delineates crop production zones in Pakistan explained by FAO (2004) and Khan (2006). Balochistan province with least agricultural production area of all of the provinces has four agro-climatic zones whereas Sindh and NWFP, each of them, has 3 while Punjab has 5 zones.

Table 3.2- Crop Production Regions in Pakistan

No.	Region	Cropping pattern	Agricultural area (million ha)	Source of Irrigation	Rainfall mm (1966-2002)	
					Average	Range
1	Punjab I	Cotton-wheat	5.5	Canal, tubewell	156	55-247
2	Punjab II	Rice-wheat	2.8	Canal, tubewell	800	600-1 100
3	Punjab III	Mixed crops	4.1	Canal, tubewell	446	240-688
4	Punjab IV	Pulses-wheat	1.9	Canal, rain-fed	300	200-550
5	Punjab V	Maize/wheat-oilseeds	1.2	Rainfed	900	700-1 200
6	Sindh I	Cotton-wheat	1.6	Canal	50	43-70
7	Sindh II	Rice-wheat	1.1	Canal	58	40-78
8	Sindh III	Mixed crops	1.3	Canal, dry	123	62-200
9	NWFP I	Maize-wheat	0.9	Rainfed	1050	240-1700
10	NWFP II	Mixed crops	0.53	Canal	520	400-670
11	NWFP III	Pulses-wheat	0.36	Canal, dry	500	300-600
12	Balochistan I	Mixed crops	0.4	Tubewell, Karez	180	65-3405
13	Balochistan II	Orchards/vegetables-wheat	0.3	Tubewell, Karez	115	27-290
14	Balochistan III	Rice-wheat	0.35	Canal	-	-
15	Balochistan IV	Peri-urban	0.02	Tubewell, Karez	167	167

Source: FAO 2004, Khan 2006

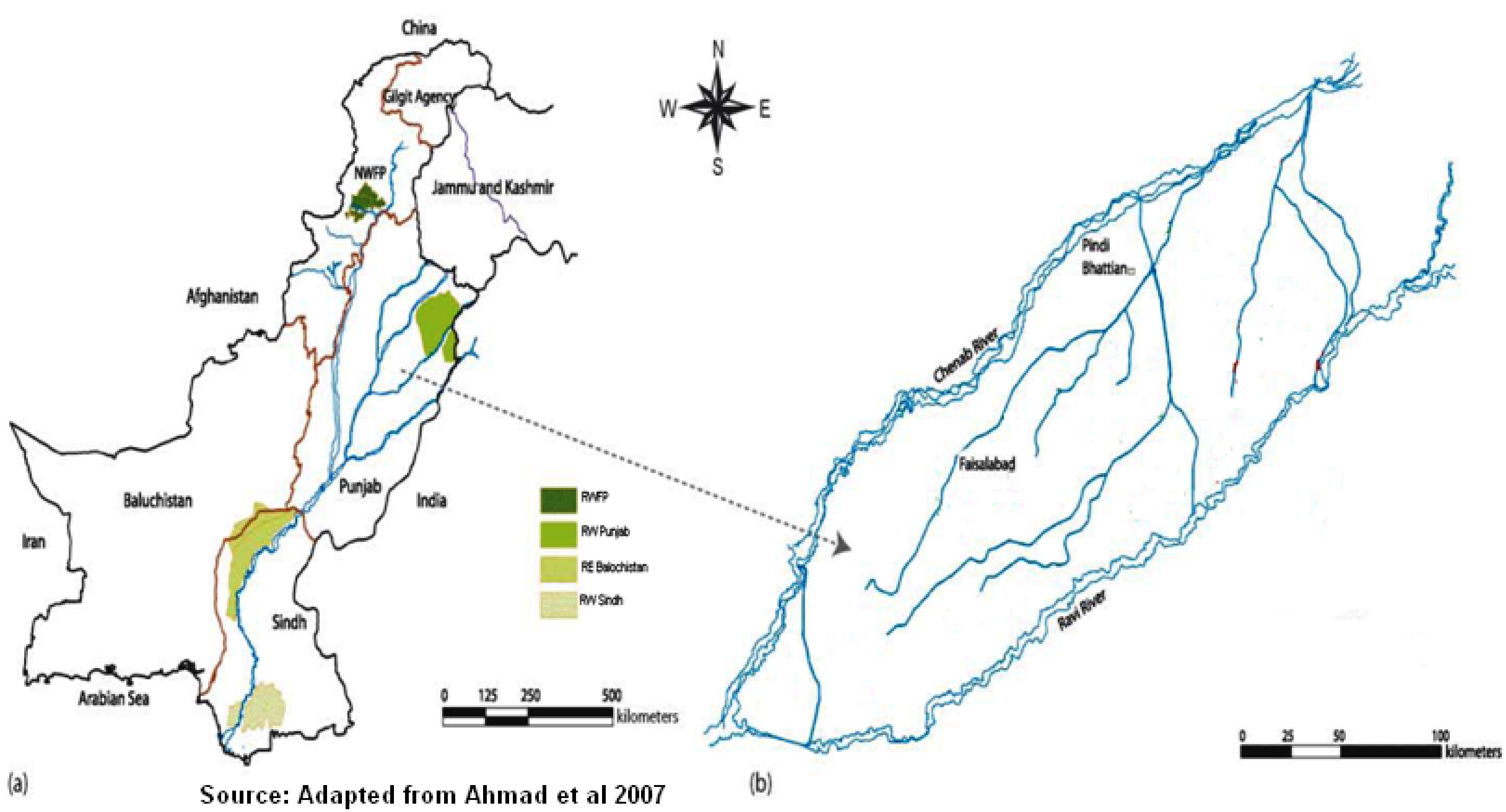
The critical view of these crop production zones reveals that these zones form seven different farming systems in Pakistan. While Byerlee and Hussain (1992) categorized Pakistan only into three farming systems i.e. irrigated, rainfed and mountainous systems. Salient features of rice-wheat farming system will be briefly addressed in the following section as the study area belongs to this system.

3.2.1- Rice Wheat Farming System

In Southeast Asia, the main agro-ecological zones are characterized by humid-subhumid climates, whilst those in South Asia are arid-semiarid. Irrigated agriculture is well developed in high potential areas but, with the exception of Pakistan, the countries still depend heavily on rain-fed production systems (Devendra and Thomas 2002). Amongst the eleven broad farming systems, rice-wheat has the biggest population and is the second largest land area in South Asian region. It forms a broad swathe across northern Pakistan in the Indus basin irrigated areas of Sindh and Punjab provinces and extends up to the northeastern Bangladesh passing through the Indo-Gangetic plains of India. More than 60 percent land of the area is cultivated and 78 percent of which is irrigated (Dixon *et al.* 2001). The study area belongs to irrigated Indus plains and rice-wheat (RW) farming System of Pakistan. RW farming system is extremely crucial to produce wheat as a staple crop of the country. This system occupies 14 percent of irrigated Indus plains of Pakistan and form a core base for national food grain output (Ahmad *et al. 2007*). Figure 3.3 shows the location of RW systems in Punjab (2.8 million hectares), Sindh (1.1 million hectares), Balochistan (0.35 million hectares) (Khan 2006) and NWFP provinces of Pakistan. It comprises of six central districts (i.e. Gujrat, Mandi Bahauddin, Narowal, Sialkot, Gujranwala and Hafizabad) of Punjab province. The climate of RW zone is semi-arid with long and hot summers lasting from April through September with maximum temperatures ranging from 21-49 ^{o}C and winter lasts December through February with maximum 27 ^{o}C day time temperatures and some time falling below zero at night. The average annual rainfall is 400 mm, 75 percent of which falls during monsoon months i.e. June-September (Ahmad *et al.* 2007). This area is famous for quality basmati rice production and contains biggest rice market of Asia.

The large population of RW system is attached with agriculture. Amongst the different categories of income, share of crop income was 44.5 percent in 2001-2002 (Malik 2003). Moreover, Malik (2003) reckoned that farm poverty in RW system of Punjab was significantly lower (25 %) than non-farm (40 percent) households. The facts show that the percentage share of crop income of the overall income rises with increase in number of acreage holding in the area i.e. crop income increase form 23 to 55, 78 and 84 percent with operational holdings up to 1 , 5, 12.5 and more than 12.5 acres per household, respectively.

Figure 3.3- Rice Wheat Farming System in Indus Basin of Pakistan



Source: Adapted from Ahmad et al 2007

The study area belongs to Punjab rice-wheat zone in the Indus basin irrigation system. On the basis of field observations, three sub farming systems were selected i.e. irrigated perennial, irrigated non-perennial and rainfed areas. Irrigated perennial area attains water year round from the public irrigation system while irrigated non-perennial area gets only for 6 months per annum. In rainfed system farmers have to irrigate their lands by using tubewells or they depend, solely, on rainfall. Following sections of the chapter will illuminate descriptive statistics along with land tenure structure, cropping pattern of different farming systems under study.

3.3- Farm and Family Characteristics of the Study Area

To gauge the distinction amongst the three farming systems regarding their farm and family characters descriptive statistics was run in the SPPS. Tables 3.3 and 3.4 describe the descriptive results exhibiting close similarities in demographic as well as farm factors within irrigated areas, while rainfed region is a bit different from them. The descriptive results of table 3.3 have been presented in rounded figures to give a quick overview while farm factors have been kept in decimals due to the small figures involved. Table 3.3 explains that average family size and average number of children were similar in all of the areas. The average ages of household head was 53, 51 and 55 years and their education level was 4, 4 and 6 years of schooling in irrigated perennial, irrigated non-perennial and rainfed areas, respectively. As far as average primary education is concerned, 36 percent household's

Table 3.3- Family Characteristics of the Study Area

Demographic Factors	Overall Area	I.P Area	I.N.P Area	RF Area
Average Family Size (Number)	7	7	7	7
Average. No. of Children	5	5	5	5
Average Age of Household Head (years)	53	53	51	55
Average Education of Household Head (Years)	4	4	4	6
Average Primary Education of household members (%)	34	36	36	32
Average Matriculated household members (%)	14	15	12	14
Average Graduated & Above household members (%)	1	2	1	3
Average Male Family Members	4	4	4	3
Average Female Family Members	4	4	4	3
Family Workers with more than one Job (%)	7	7	5	12

Note: I.P A= Irrigated Perennial Area, I.N.P A= Irrigated Non Perennial Area
RF A= Rainfed Area

members of each irrigated while 32 percent household members of rainfed area were found literate until 5 years of schooling. Matriculated, and graduated and above family members were observed 15, 12 and 14, and 2, 1 and 3 percent in irrigated perennial, irrigated non-perennial and rainfed areas, respectively. Average male and female family members were 4 in each irrigated area as well as overall area while those were 3 in rainfed area. The rainfed area took an impressive lead in dual or more than one job category over irrigated areas with 12 percent family workers working in various sectors of economic activity. Table 3.4 depicts the farm characteristics concerning average area owned, operational holding, casts of production, labour man days investments, yield, owned tractors and tubewells in each area under study. The average area owned by the households is quite low in rainfed area as compared to irrigated areas. The average operational holding delineating the similar trends, both irrigated areas are not reasonably different from each other with respect to operational holding per household which is 3.14 and 3.64 for irrigated perennial and irrigated non-perennial area, respectively. A closer look at table (3.4) reveals that ownership and operational holdings per household are highest in irrigated non-perennial area while the average operational holdings of the overall study

Table 3.4 - Farm Characteristics of Study Area

Farm Characteristics	Overall Area	I.P A	I.N.P A	RF A
Av. Area Owned (Hectares)/Household	2.75	3.14	3.19	1.27
Av. Operational Holding (Hectares)/Household	2.95	3.14	3.64	1.61
Land Owned Per capita (Hectare)	0.38	0.43	0.43	0.19
Land Holding per capita (Hectare)	0.41	0.43	0.49	0.24
Av. Total Labour Man-Days/Hectares	62	61	73	53
Av. Hired Labour Man-Days/Hectares	13	12	18	9
Av. Family Labour (Man-Days/Hectares)	49	49	54	44
Av. Yield/Hectares (Rupees)	33,100	32,126	41,822	24,076
Av. Irrigation cost/Hectares (Rupees)	5,527	5,197	7,019	4,361
Av. Credit/Hectare (Rupees)	28,090	30,521	12,941	42,054
Av. Own Tractor/ Households (Numbers)	0.14	0.12	0.23	0.10
Av. Own Tube well / Household (Numbers)	0.98	1.03	1.28	0.46

area are 2.95 hectares per household. The total labour, hired labour, family labour (in man labour days), irrigation cost and yield per hectare are also shown in table (3.4). Irrigated non-perennial area was always higher in each category than irrigated perennial area, and the rainfed area was lower still. Nonetheless, rainfed farmers attained more credit than both irrigated areas while farmers of irrigated non-perennial area took least credit. As far as the machinery is concerned, the ownership of tractors was not encouraging with only 0.12, 0.23 and 0.10 average numbers of owned tractors in irrigated perennial, irrigated non-perennial and rainfed area, respectively. In addition, each household owned almost average 1 tube-well in irrigated areas and this average was only 0.46 in rainfed area.

It is grasped from the above stated facts that all of the bestowed as well as available resources are higher in the Irrigated non-perennial area as compared to irrigated perennial and rainfed areas except the money borrowing. With the top to bottom categorization regarding resource availability and investment except credit, irrigated non-perennial area stands first, irrigated perennial area second and rainfed area third.

3.4- Land Tenure Structure in the Study Area

Land tenure is a customary or legal relationship of an individual or group of people to land (FAO 2002). Rules of tenure define how property rights to land are to be allocated within societies (Ibid). To discuss any kind of rules and regulations as well as property rights concerning land tenure is beyond the scope of this study. Rather this section of the chapter has only been arrayed to highlight the land tenure structure in the study area. Table 3.5 exhibits the detailed results of the land tenure and tenancy in the study area. Owner farmers make up the biggest percentage in all of the farming systems under study, including overall area. Rainfed area was top of the list with 73 percent owner farmers along with 20 percent owner-cum-tenants and 8 percent landless farmers or tenants while irrigated perennial area showing the same trend with only 1 percent deviation in owner farmers. Moreover, irrigated non-perennial area had 66 percent owner tillers of land and 3 percent landless farmers which were minimum figures in this farming system. As far as the overall land tenure scenario is concerned, it exhibited the similar descending trends with

Table 3.5- Land Tenure and Tenancy in the Whole Study Area

	Numbers				**Percent**			
	Owner	**OCT**	**T**	**Total**	**Owner**	**OCT**	**T**	**Total**
Overall	299	97	28	424	71	23	7	100
Irrigated Perennial	153	43	17	213	72	20	8	100
Irrigated Non Perennial Area	79	36	4	119	66	30	3	100
Rainfed	67	18	7	92	73	20	8	100

Note: The figure showing 1 percent plus or minus due to rounding of decimals

OCT= owner-cum-tenants

T= Tenants

71, 23 and 7 percent of owner, owner-cum-tenants and tenants, respectively. It was very interesting to disclose tenure structure on the basis of small medium and large farm areas in each farming system under study. Table 3.6 shows the distribution of owner, owner-cum-tenants and tenants of the overall area. The information quoted by table 3.6 coincides with the previous table 3.5, which explained that owners were in considerable higher percentage followed by the owner-cum-tenants and then tenants. Small farmers owned 73 percent farms while owner-cum-tenants were found 16 percent and tenants were only 11 percent in the small farm category.

Table 3.6-Land Tenure Structure, Overall Study Area (Percent)

	Owner	OCT	Tenants	Total
Total	71	23	7	100
Small	73	16	11	100
Medium	66	30	4	100
Large	72	25	3	100

Note: Small= < 2 Hectare

Medium = 2-4 Hectare

Large = > 4 Hectare

As far as the owner farmers are concerned in medium sized category, it was found that 66 percent farms belonged to owner, 30 percent to owner-cum-tenants and only 4 percent to tenants' category. In the large farms category, it is quite interesting to see that tenants were in smallest percentage i.e. only 3 while owner were 72 and owner-cum-tenants were 25 percent. On thrashing the facts about the small, medium and large farm categories of irrigated perennial and irrigated non-perennial areas it was revealed (in table 3.7) that the trend did not change from owner to tenants in irrigated perennial area while there was no tenant found in medium and large farm categories of irrigated non-perennial area.

Table 3.7- Land Tenure Structure at Small, Medium and Large Farms in Study Area (Percent)

Irrigated Perennial Area				Irrigated Non Perennial Area				Rainfed Area			
Area	**Owner**	**OCT**	**T**	**Area**	**Owner**	**OCT**	**T**	**Area**	**Owner**	**OCT**	**T**
Total	72	20	8	**Total**	66	30	3	**Total**	73	20	8
Small	73	15	12	**Small**	62	24	14	**Small**	78	14	8
Medium	67	26	7	**Medium**	69	31	0	**Medium**	55	40	5
Large	77	20	4	**Large**	67	33	0	**Large**	71	14	14

OCT = Owner-cum-tenants, T = Tenants

Note: Small= < 2 Hectare

Medium = 2-4 Hectare

Large = > 4 Hectare

Land tenure structure delineated consistency in the results of small and medium farmers but large farmers in owner category were found 71 percent while owner-cum-tenants and tenants were 14 percent each in rainfed area.

The aforementioned land tenure structure exhibited the prevalence of ownership holdings in all of the study locations, following owner-cum-tenants and with least percentage of landless farmers except in large farm category of rainfed area.

3.5- Cropping Pattern in the Study Area

"Cropping Pattern" tells about the crops grown in a specific area, unveiling the percentage area occupied by each crop. It's a tool from which one can easily deduct the significance of various crops with the distinction of major and minor crops of the area. This section followed the cropping pattern of various farming systems of the study area. Due to the massive information recorded in the form of overall and small, medium and large farms it has been chosen to place most of it in the appendix (3.6). Figure 3.4 has been extracted to show percentage area occupied by major and most frequent crops (occupying highest percentage area) grown in the study area. Sugarcane was cultivated as a cash crop in irrigated areas while bajra served as cash for rainfed farmers and as a fodder crop along with bajra and berseen in all of the farming systems. It is evident from Figure 3.4 that wheat which is a staple crop was predominant in all of the areas under study while rice as a cash crop was second after wheat except in rainfed area. Farmers in the rainfed area grew more wheat and bajra than all other areas which covered 42 and 21 percent area, respectively. Rice, sugarcane and berseen were grown at 31, 7 and 14 percent of area in irrigated non-perennial farming system and covered the largest area as compared to other areas under study.

As far as the important crops are concerned, it was found that, wheat, rice, jawar, berseen, bajra and sugarcane were grown in ascending order in irrigated perennial area. Farmers of irrigated non-perennial area adopted a pattern of wheat, rice, berseen, jawar, sugercane and bajra. Moreover, wheat, bajra, berseen, rice, sugarcane and jawar were grown adopting ascending area percentage of the said crops in the rainfed farming system. In addition course rice, pulses, lucern, maze fodder, and mong (a kind of pulse) were also grown along with the aforementioned crops in the study areas.

The above mentioned empirical analysis reveals that family characteristics of all of the study locations are almost similar but farm characteristics, perhaps, would make difference amongst the results of the study. Farm characteristics are different with an edge to irrigated non-perennial area to other comparative areas with higher average ownership as well operational land holdings. This study location is also better in yield per hectare though cast of productions are also higher than others which is

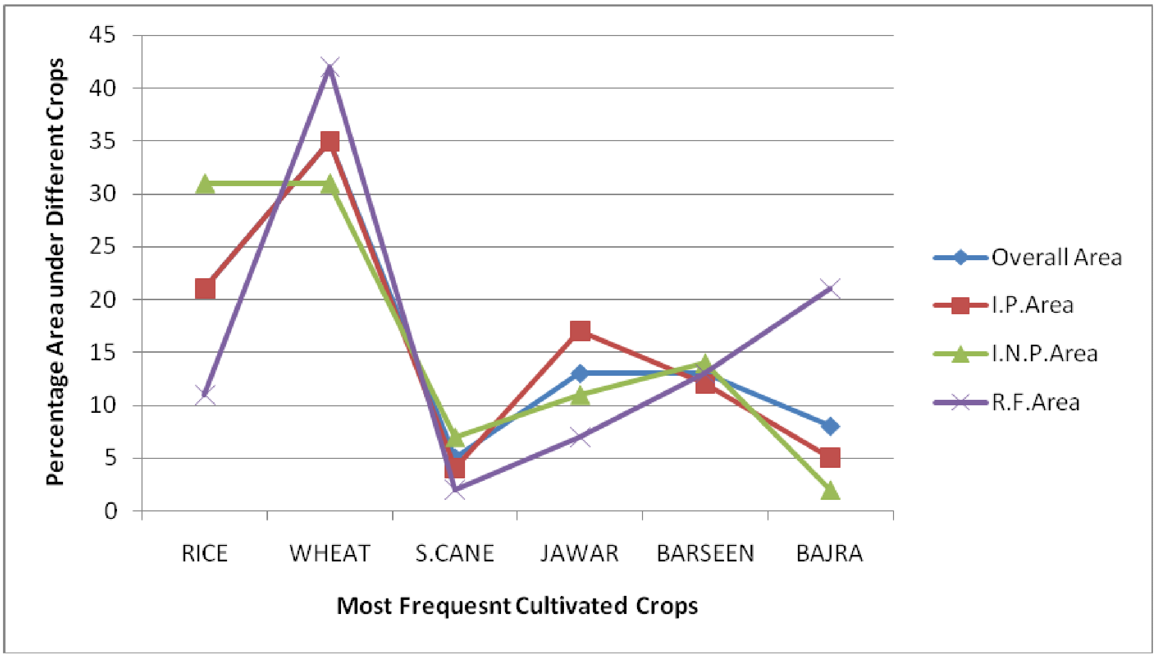


Figure 3.4- Major Crops Grown in the Study Area

Source: By Author

not an advantageous indicator. It is quite interesting fact that farmers of irrigated non-perennial area cultivate higher percentage of farm area with cash crops i.e. rice and wheat as compared to other areas. Nevertheless, having a keen look on the descriptive table of farming characters, it can be concluded that various study locations follow the sequence of irrigated non-perennial, irrigated perennial and rainfed area lies at the end.

CHAPTER-4

LAND DISTRIBUTION AND FARM SIZE PRODUCTIVITY

Land is a symbol of pride and prestige in rural areas. It is a main source of livelihood, poverty alleviator and a means of food security in the marginal, as well as distant regions of the world. It helps some nations to earn foreign exchange by producing exportable surpluses and plays the role of life savior in some pockets of the poor countries. It is strongly anticipated that with better and even land distribution in the agriculture sector farm productivity can be augmented which may lead to overcome the dread of poverty, food insecurity and substandard living of the communities. The chapter has been organized to view the 1) significance of global land distribution scenario as a core resource of food production amongst the farming communities 2) how skewed land distribution affects development and its role in the economies 3) the issue of farm size in connection with various indicators and in the end 4) farm scale productivity with the explanation of factors affecting it and review of **inverse relationship** of the farm size and productivity is to be presented.

4.1- Global Land Distribution Scenario

Diverse statements with almost similar meanings highlight the worst effects of inequality and its significance in the recent literature accentuate the need of further as well as profound research on this issue. According to Kanbur and Lustig (1999) "inequality is back on the agenda" both in discussions and theoretical debates by policy makers, and Piketty (1999) argued that the possibility of inverse relationship between inequality and poverty and its significance is evident from the growing theoretical literature. That is why, international institutions aim to face up to inequality (Inter-American Development Bank-1998).

The drawbacks and sensitivity of inequality are so grave that World Bank had to publish a complete report i.e. "World Development Report (2006)" to address this issue. Skewed agricultural land distribution is a dilemma which undermines, not only, overall progress of the developing nations but it also reduces the well being of the people of the victimized nations of the world. A series of redistributive, market oriented and negotiated reform efforts could not resolve the problem with the exceptions of few countries like Japan, China, Taiwan and South Korea and a few states of India. Although, land reforms were introduced and legislated on full fledge national scale in many countries on the initiative of international institutions but lack of political will and overwhelming influence of feudals made them futile with their juggling tactics by transferring ownership rights to their kins to escape from set land ceilings. Figure 4.1, exhibits the land distribution scenario in various continents of the world. It shows that the land distribution was most skewed in Latin American region while East and Southeast Asian region had minimum Gini ratio (Gini ratio is being explained in detail in methodology chapter-5). High concentration of land in few hands, create sense of impoverishment in the peasantry as a consequence of which popular revolutionary movements broke out in some countries of Latin America i.e. Mexico and Bolivia (IFAD 2001) in the first half of the previous century. With the advent of the cold war in 1950s two broad spectrum thoughts were evolved in the form of capitalism and socialism to rein the national systems which not only affected the life styles but two extremely contradictory approaches towards resources distribution including land and income also paved their way. It is beyond the scope of the study to discuss **Capitalist and Socialist** school of thought concerning resource, and especially land distribution in detail here.

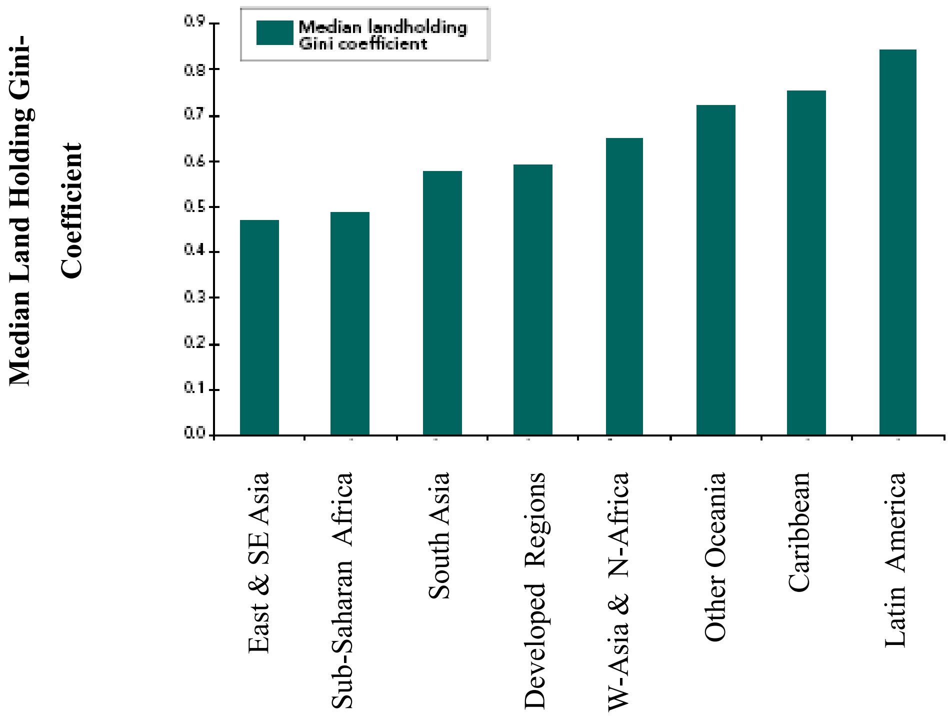


Figure 4.1- Distribution of Agricultural Land Holdings (1990 Round of Agri. Censuses)

Source: United Nations 2008

4.2- Is Skewed Land Distribution a Syndrome?

A bulk of literature is available on the issue of inequality and economic growth which was ignited about sixty years earlier with the ground breaking development of “Kuznets Curve” (Kuznets1955). Various development economists (Erickson and Vollrath 2004, Galor and Moav 2004, Easterly and Levine 2003, Galor *et al.* 2003, Mo 2003, Bourguignon and Verdier 2000, Engerman and Sokoloff 2002, Deininger and Olinto 2000, Sokoloff and Engerman 2000, Aghion *et al.* 1999, Deininger and Squire 1998, Deininger and Squire 1997, Engerman and Sokoloff 1997, Persson and Tabellini 1994) attempted to reveal connections of income as well as asset inequality to the economic growth. This part of the chapter would corroborate various malicious impacts of the skewed land distribution avoiding any unnecessary details and it has been strived hard to hit right on the target witnessing relevant previous literature.

The land is more important in developing countries being, not only, the household asset portfolio but it is also a key determinant of household welfare strategy. In the environment of highly unequal asset distribution and opportunities, it is extremely hard to pour down the developmental impacts to the poor avoiding fewer elites and influentials of the society (Byerlee *et al.* 2005, Deininger 2003). Figure 4.2 depicts the trends of economic growth with changing land distribution scenario in a number of selected countries of the world. It exhibits the countries, generally, with more skewed land distribution concurrently with slower rate of economic growth.

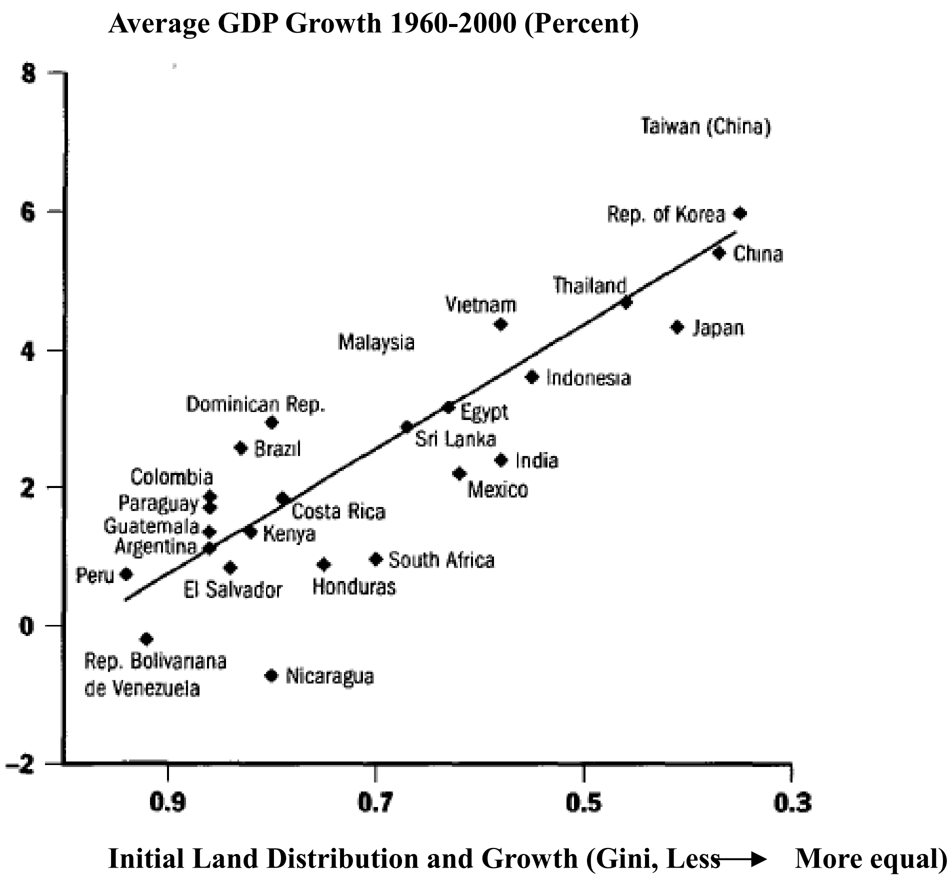


Figure-4.2 Equality of Land Distribution and Economic Growth, Selected Countries
Source: Deininger 2003

Undernourishment and malnutrition is a grave humanitarian condition which exists in many developing as well as least developing nations of the globe. Food and Agriculture Organization (2002a) considers skewed land distribution as one of the major causes of undernourishment of human population along with some other reasons. Figure 4.3 delineates status of undernourishment in connection with level of land distribution disparities within various developing countries.

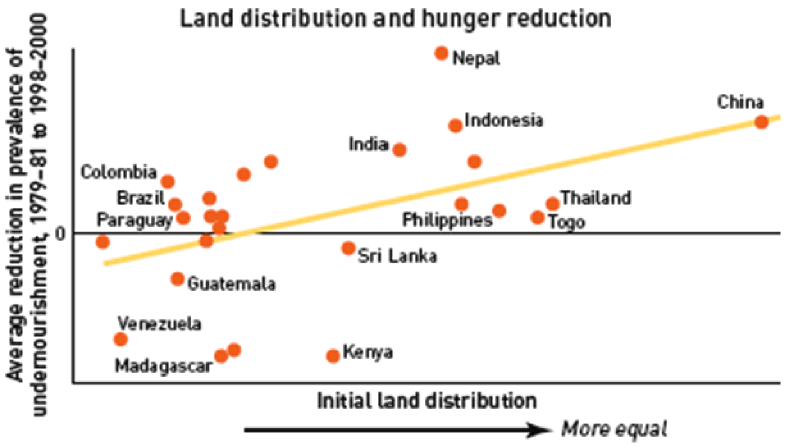


Figure-4.3 Impact of Skewed Land Distribution on Undernourishment

Source: FAO 2002a

Land distribution pattern, either skewed or better distributed, played a crucial role in transition of agrarian economies to industrial ones. Abundance of land was pivotal in early stages of development while it posed serious hurdle in later phases in the accumulation of human capital and economic growth in the countries in which the land was unequally distributed. Some of the land abundant countries considered as rich nations like many Latin American countries in the pre-industrial era were overtaken by the scarce land nations in which the land was, rather, comparatively better distributed. Though United States and Canada were land abundant countries like Latin American countries but those had relatively egalitarian land distribution unlike of concentrated land in a few hands only. Even land distribution in North American countries made them capable of to invest better in human capital as compared to Latin Americans (Galor *et al.* 2005). The same group of authors (Galor *et al. 2006)* in another publication discussed the repercussion of unequal distribution of land ownership on human capital promoting institutions. Cross state public investment on education was studied keeping in view the unequal land ownership in United States in the early 20th century. It was concluded that public expenditures on education promoting institutions were inversely related as it is evident from figure (4.4) which depicts the public expenditures and Gini of Land on Y and X axis respectively.

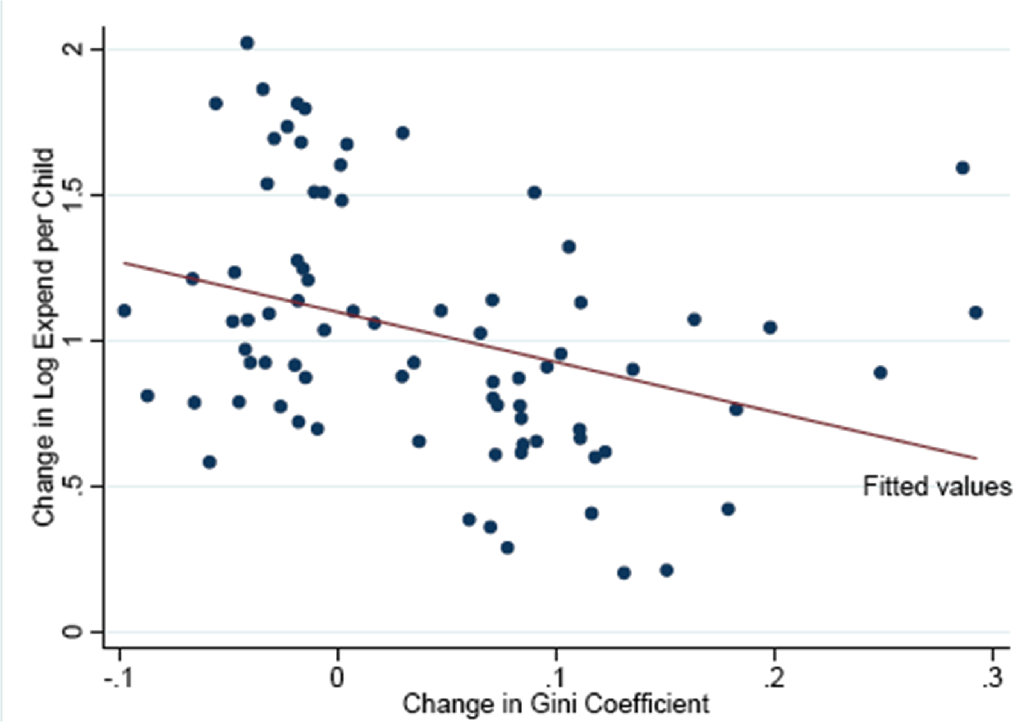


Figure-4.4 Unequal Land Ownership and Public Expenditures on Education

Source: Galor *et al. 2006*

Adams and He (1995) studied rural areas of Pakistan to know sources of income inequality and their impacts on the extent of poverty. They disintegrated income in to five sources i.e. agriculture, non-farm, transfer, livestock and rental incomes and overall poverty impacts were observed on the basis of each source of income independently by using panel data (i.e. three years data from 1986/87-1988/89). The inequality level of households was, most, strongly affected by agricultural income while least influenced by livestock income in the study area. Authors concluded that the main reason behind the inequality of the income was unequal distribution of land in the study area, as the agricultural income was robustly correlated with land distribution while livestock income was poorly correlated.

World Bank (2007) reported that land inequality in rural Pakistan was a basic cause of income distribution disparity. It was also obsrved that Gini coefficient for land ownership was 0.66 in the year 2000 and it increased to 0.86 when the rural landless households were included in. The study further indicated that skewed land distribution cause lack of access to credit, hamper labour mobility and reduce return to family labour. However, Qureshi and Qureshi (2004) explored that land ownership inequality in Pakistan and in its provinces has increased from 1972 to 2000. They claimed that a sharp increase in inequality was found in Punjab and NWFP provinces during the period while operational holdings followed the same trend in Pakistan and its provinces. As far as different tenurial classes are concerned they said that the distribution of farm area among farms of various sizes has been more unequal under owner operated category of farmers.

In a comparative study of five African countries (i.e. Ethiopia, Kenya, Rwanda, Mozambique, and Zambia) Jayne *et al.* (2003) explored relationship between household per capita land holdings and per capita income. They concluded that the increase from zero to 0.25 hectare of household per capita land enhanced 40 percent per capita households' income in Kenya. In their empirical work, they found that similar level of increase in per capital land holdings (i.e. 0.25 hectare) raise more than 40 percent in Rawanda, just less than 40 percent in Mozambique and about 30 percent income per capita household in Ethiopia, respectively. They argued that improving land access to land constrained small holders would be an effective way to reduce poverty. Moreover, a very small addition to the existing land stock of small farmers can increase their income very significantly.

Vollrath and Erickson (2007) studied a very different land inequality aspect using econometric modeling. It was concluded by the authors that there were some certain informational asymmetries between farmers and lending institutions. As land is utilized as collateral for borrowing, consequently, land distribution determines the credit distribution. Furthermore, highly skewed distribution of land would make credit market grim due to the lack of capability of landless workers to borrow due to mortgage inability while large landlords are self-sufficient. Financial depth with relation to land inequality was also observed, in the same cross country research, including many other factors. They found that land inequality was deeply hazardous to the financial systems and those had strong inverse relationship but causal channel could not be identified. Furthermore, It was also concluded that skewed land distribution had strong positive or direct relationship with net interest margins which shows that more unequal land distribution cause more inefficiency to financial system.

Deininger and Squire (1998) in a multi-country analysis by working on assets as a proxy of land distribution as well as income distribution concluded that initial inequality of land has a profound impact on future growth of the countries. However, income does have robust relationship with future growth neither in developing countries nor in the whole sample (i.e. total 66 countries). They found that three main results emerged as a result of their analysis a) initial inequality in the land distribution is significantly associated with the subsequent growth b) initial unequal income distribution does not affect, robustly, to the future growth and c) there is no significant relationship between inequality and growth in democratic societies which suggest that there might be some explanation other than voting phenomenon.

Chirwa (2004) said that, despite, forty years of post independence agriculture-led development in Malawi economic growth has been erratic and large population live under poverty line. Small farmers face several problems including landlessness, small holdings, declining productivity and above all agriculture policies favour large farmers while small farmers compose more than 80 percent of the households. The author argues that previous policies ignored the land question amongst the small holders, albeit, access to land means better agriculture production, higher growth and achievement in poverty reduction. According to regression results of this study, mean large land holders had least chances to be poor while a unit increase in land ownership reduces 1.8 percent probability of falling in to poverty.

Witnessing the above mentioned facts, it can be concluded that skewed land distribution acts like a syndrome which translate in to retarded economic growth, poverty, social and political instability. However, it can also work as engine of growth and development when it is available as an equitable resource. Moreover, its better distribution helps in future human capital development as well as industrial growth.

4.3- Farm Size as an Issue

According to United Nations Development Program (2008), 80 percent of world´s poor belong to agriculture sector while, only, 20 percent are urban slum dwellers. Small farmers make up 50 percent share of the global total poor population, 10 percent each pastoralists, forest dwellers and fishers. Moreover, skewed land distribution is a colonial phenomenon (Frankema 2006, Bakewell 2004, Williamson 1992, Fernandez 2003) but now a day some well-off nations following the colonial tactics to control poor (i.e. African) countries like South Korean Daewoo has negotiated a deal with Madagascar for 1.3 million hectares of land on a 99 years lease. Furthermore, land inequality hampers economic growth, undermines poverty reduction, causes social and political instability, increases conflicts and acts as an impetus for land degradation (UNDP 2008).
The concept of small farms can be viewed from different angles i.e. small farm agriculture is, often, used interchangeably with small holders, family, subsistence, low income, low output or low technology farming (Heidhues and Bruntrup 2002, Abele and Frohberg 2003). While Lipton (2005) defines family farms as "operated unit in which most of the labour comes from households of farm family, which invest much of their working time at farm. Narayanan and Gulati (2002) viewed smallholder as farmer performing commercial and subsistence production, where the family provides the majority of labour and they receive principal source of income from it as a reward. World Bank (2003) identifies smallholders as those with a low asset base operating less than two hectares of cropland.

The prevalence of small farms in the developing world can be seen from their share of total farm households (as shown in table 4.1). But inequitable land distribution in many countries means that the number of small farms usually does not equate with the share of total agricultural land. According to government of India (1995-96), 80 percent of farm households cultivate only 36 percent of total agricultural area. However, 58 percent of all farmers fall into the smallholder category in Pakistan, but they cultivate only 15 percent of total agricultural land. Similar trends are also evident in Africa. In Egypt, three-quarters of all farms are small farmers but they cultivate less than a half of all land. In Uganda, where a proportion of smallholders is comparable to Egypt, small farmers cultivate only 27 percent of all land. Smallholders in Ecuador constitute 43 percent of all farmers but they cultivate only 2 percent of the land. In Brazil only 20 percent of all farmers are smallholders, but their share of total land is less than 1 percent. In Eastern Europe 51 percent of Poland's small farmers cultivate only 7 percent of the land while in Ukraine small farms constitute 99 percent of all farms cultivate only 8 percent of all agricultural land (World Bank and OECD 2004).

In developing countries, a higher percentage of farmers are tilling below subsistence level of farm areas. Egypt is one of the top five countries amongst the African nations with largest number of small farms (Nagayets 2005). Table 4.1 represents Pakistan with the smallest percentage area ploughed by small farmers amongst the five major Asian agrarian economies. Where skewed land distribution created numerous social disorders and deprivations, it also makes larger farmers as blue eyed in the wake of public policies. According to Griffin *et al.* (2002), the policies which discriminated against small farmers and favoured larger farmers are said to be "landlords biased policies".

Table- 4.1 Small Farms as Share of Total Number of Farms and Cultivated Area

	Egypt 1990	**Ethiopia 19999/2000**	**DR Congo 1990**	**Uganda 1991**	**Bangladesh 1996**	**India 1995/96**	**Indonesia 1993**	**Nepal 2002**	**Pakistan 2000**	**Brazil 1996**	**Ecuador 1999/2000**	**Panama 2001**	**Georgia 1998**	**Poland 2002**	**Romania 1998**	**Russia 2002**	**Ukraine 2003**
Small Farms (%)	75	87	97	73	95	80	88	92	58	20	43	53	96	51	58	98	99
Share of total Area (%)	49	60	86	27	69	36	55	69	15	0.3	2	0.6	33	7	14	3	8

Source: Nagayets 2005

They pointed out following landlord biased policies which divest smaller farmers and are advantageous for large farmers' i.e.

(i) Extension policies ➡➡ concentrate on large farmers who are, often, called progressive farmers.

(ii) Research policies ➡➡ neglect poor farmers crops i.e. sorghum, millet and maize and favour export crops and 'superior' grains of larger farmers.

(iii) Agricultural price support policies ➡ ➡ provide greater support for the wheat crop often grown by relatively large farmers as compared to rice which is often grown by small farmers.

(iv) Regional development policies ➡ ➡ favour more accessible and more fertile regions, where land ownerships is more concentrated due to certain historical reasons.

(v) Large scale public irrigation schemes ➡ ➡ also favour the large land owners.

(vi) Credit policies ➡ ➡ discriminate against small farmers who are less risk averse with higher administrative costs and naturally in favour of literate, large landowners who have a large marketable surplus.

(vii) Institutional policies ➡ ➡ discourage rural labour unions, small farmers cooperatives and peasant leagues.

4.4- Evidence of Farm size and Productivity

Before to start the literature review regarding farm size and productivity it is to be mentioned that a plentiful (Griffin *et al.* 2002 and 2004, Unal 2008, Kiani 2008, Masterson 2007, Thapa 2007, Heltberg 1996 and 1998, Cornia 1985, Berry and Cline 1979), studies have proven the dominance of the

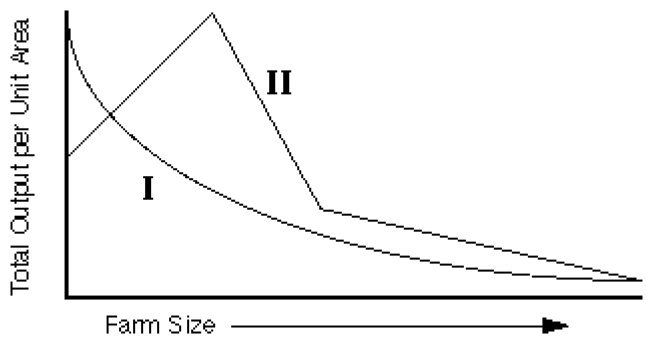


Figure- 4.5 Farm Size and Output per Unit Area

Source: Rosset 1999

small farmers over the larger ones concerning higher output per unit area as result of their empirical research but the issue is still unresolved. Rosset (1999) is an enthusiastic proponent of small farmers. He poses certain questions regarding farm size productivity like how many times we have heard that large farms are more productive than small farms? Or they are more efficient? Or it is strongly desired to consolidate land holding to take advantage of that great productivity and efficiency and, later on, answer them in a single sentence in the same paragraph i.e. the empirical research shows the reverse results and proves that smaller farms are more productive than larger ones. He attributed the higher productivity of small farms as "small farm wisdom". In figure 4.5, it is explained that in type-I curve, the smallest farms were most productive while in type-II the smallest ones were not most productive but relatively smaller. Rosset (1999) also expressed the overwhelming superiority of smaller farms over larger ones in different manner i.e.

a) Small farmers tilled their land more intensively and may cultivate many crops per year but larger farmers grow only one or two crops per year.

b) Larger farmers tend to fallow their parcels while small farmers don't leave their land un-tilled.

c) Small farmer use family labour which is very committed and determined to the cultivation while larger farmers hire alienated labour.

Singh *et al. (*2002) confirms the previously mentioned arguments of Rosset (1999) regarding higher cropping intensity on smaller farms as compared to larger ones. Table 4.2 depicts that "cetres pari-bus" a comparison of various farm categories exhibit increasing cropping intensities with ascending farm size categories in 1971, 1981 and 1991 except small and medium farms in 1981.

Table-4.2 Relationship of Farm Size and Cropping Intensity in Increasing Irrigated Area

Farm Size	**Irrigation (% of Net Sown Area)**			**Cropping Intensity**		
Years	**1971**	**1981**	**1991**	**1971**	**1981**	**1991**
Sub-marginal	35	40	43	134	135	147
Marginal	31	36	39	128	133	138
Small	26	31	33	122	125	130
Medium	24	27	31	119	125	128
Large	16	19	25	112	117	122
All Farms	20	25	30	116	122	128

Source: Singh *et al. 2002*

Farm productivity depends upon varying **deterministic** as well as **socio-economic** or **inefficiency variables** in the process of crop production at field level. Land (i.e. farm size), labour, Irrigation, seed, fertilizer, chemicals, manures etc are accounted for deterministic while age, health, family size, literacy rate, sources of income etc are called as socio- economic variables which play a very crucial role in the process of crop production. Farm size is one of the most important factors of production and it is also serving as a focal point in this study. The **inverse relationship,** which means "the smaller the farm size the greater the output per unit area" has been proven as stylized fact of agriculture in developing countries. The inverse relationship debate was started with the ground breaking work of Indian author Amartya K. Sen in 1962. Later on, milestone work was done on the issue by various renowned development economists like Berry and Cline (1979), Bhalla (1979) Cornia (1985), Carter (1984), Feder (1985), Bhalla and Roy(1988), Benjamin (1995), Masterson (2005 and 2007), Thapa (2007), Unal (2008), etc. Though, the debate regarding farm size productivity depends upon many factors directly or indirectly but it revolves, mainly, around farm size and labour (i.e. family, blood sibling, and hired labour) but rest of the factors sink and drown in the seen in various studies.

To see, whether an inverse relationship amongst factors of production exists, a classical regression model based on Ordinary Least Square Method (OLS) was,

Classical Regression Model $\log (y) = \alpha + \beta \log (x) + \mu$………………………………. (1)

modified by the successors according to the nature and requirements of the research methodologies with the addition and subtraction of desired and redundant variables, respectively. In the equation (1) y is the value of monetary or physical output which might be total or output per unit area, x is farm size including owned, leased in and excluding leased out land and μ is the value of the error term. The existence of IR can be observed between farm size and productivity with two different methods of explanations of output and β .e.g. 1) when the value of β is less than unity along with total output, on the other hand, 2) when its sign is negative exclaiming output per unit area on the left hand side (i.e. dependent variable) of the equation, respectively.

The studies based on farm size-productivity analysis in which the whole produce is taken as a single unit but the prices of the various crops grown on the same farm differ significantly across the various regions under study, which may cause bias in the final results concerning inverse relationship research (Bardhan 2003). The forthcoming section of the chapter would unveil the facts regarding four major factors affecting inverse relationship of farm productivity which delineates deterministic as well as socio-economic phenomenon of agriculture production. The key controversy in the IR studies like **i)** mis-specification or mis-identification hypothesis was emphasized and proved by Bhalla and Roy (1988), **ii)** labour duality or bimodal or agricultural dualism **iii)** factor market imperfections and **iv)** farmer's attributes displayed causal effects to give policy implications in the end of IR studies in the form of land redistribution. Nevertheless, the turning down of IR phenomenon cause to advocate large farms in the end of these studies. The up coming parts would explain how aforementioned four major factors affect inverse relationship in the light of previous literature.

4.4.1 Mis-Specification in Farm Productivity Analysis

The mis-specification issue was arose as a heart of inverse yield relationship debate exhibiting the fact, small farmers own more fertile lands as compared to larger farmers and it was put forth that inter-village IR is more robust as compared to intra-village (Cornia 1985, Benjamin 1995 and Sen 1999). Furthermore, fertile lands support dense populations resulting in higher fragmentations, whereas at the time of financial bottlenecks low quality lands is sold first and consequently smaller farmers are more likely to have higher quality lands. It is crucial to account for land quality to observe the systematic inverse yield relationship (Unal 2008). Heltberg (1998) defined impact of land quality on the farm productivity phenomenon by elaborating it in a way that if land quality is inversely proportional to the size of farm then its omission from the regression modeling would show the spurious results. In addition, he said that the value or sign of beta would confirm inverse relationship. A systematic relationship between land quality and farm size is possible (Sen 1966, 1975), and to avoid from unbiased results it would be, very, vital to account for land quality. The "stylized fact" of inverse relationship was challenged by Bhallah and Roy (1988) for the first time on the basis of this hypothesis after almost two and half decades of its inception and its proven existences in several studies including famous Cornia (1985), and Berry and Cline contributions (1979). He worked on Indian macro level data and found presence of inverse relationship in 16 Indian States out of 17. But the conformity of the results was severely damaged, when he run regression on disaggregated data at district level and found that IR existed only in 51 districts out of 176. The authors concluded that unobserved land fertility can, better, be accounted for, by disaggregating geographical units and they also concluded, disaggregated data would distort or reverse the importance of IR. But later on, the conclusions were rejected by Heltberg (1998) and Unal (2008) on the basis of following methodological flaws in the study,

A) The sample size was much smaller as a result of disaggregation which would have entailed a large loss of degree of freedom.

B) District level disaggregation avoid heterogeneity within districts while it only accounted for inter district heterogeneity.

In Pakistani Punjab, village level study by Berry and Cline (1979), based on much more homogeneous but disaggregated sample than Bhalla and Roy found strong existence of IR.

4.4.2 Labour Duality: Mode of Production

Labour duality (Kiani 2008), agriculture dualism (Sen 1966), mode of production (Chayanov 1966, Unal 2008) or "bimodal agriculture production" (Cornia 1985) are similar terms used in various studies to explain the relationship between labour and land and their impact on farm productivity.

It is a well accepted fact that Sen's (1962, 1966) theory of **agricultural dualism** was the first account of size-output relationship which flared up the debate of inverse relationship. He described in his theory that peasantry is severely credit constrained but endowed with plenty of family labour with zero or minimum opportunity cost. On the other hand, larger farmers have better access to credit but they have to rely on expensive hired labor. Nevertheless, small farmers apply more labour per unit area as compared to capitalists. He added that this kind of functioning reduces productivity and augments profitability per unit area with increasing farm size when cost of family labour is based on imputed market wages.

Cornia (1985) claimed that agricultural production is carried out under bimodal conditions; larger farms cultivate their lands by keeping fallow a big portion of it but small farmers undergo inverse conditions with excess labour with little opportunity of productive work on their farms. It is obvious that small farmers are different from larger ones in many ways; they cultivate a larger portion of their land, intensive use of labour is used in each crop activity, land terracing, canalization and land infrastructure is managed in a better way by the small farmers which require more intensive use of labour.

Lamb (2003) argues that according to the classical model of labour market dualism, small farmers are unable to market their labour and they over allocate it to their own farms. Consequently, the marginal productivity of their labour is lower than the market wage rate. Carter (1984) re-affirms by contradicting a bit from the previous statement quoting that the cause of inverse relationship is over-allocation of family labour as well as other variables but family labour alone does not suffice to create inverse relationship alone.

It is suggested that dual labour markets contribute, primarily, to the existence of inverse relationship. Dual labour markets mean that plenty of labour is involved in small farm production and the labour to land ratio is much higher than on larger farms. Masterson (2007) said, the cheaper family labour is a basic reason for higher labour to land ratios on the small farms. It is quite apparent that due to sincere and higher efforts of family labour than hired labour make their opportunity cost lower (Mazumdar 1965). Sen (1975) argued that workers prefer to work either for themselves or for their family rather to work for some one else. The family workers can produce more can be explained on the basis of three proposition put forth by Feder (1985), a) family labour is more efficient than hired labour b) family labour is more motivated than hired labour due to the sense of ownership and c) the supply of working capital is directly related to farm size. Moreover, Boyce (1987) argued that family labour may be more effective due to the factors, when ratio of hired to family labour rises the supervision becomes less effective and more time consuming. As far as the larger farms are concerned, the increased social distance between the hired labour and supervisors reduces the impact of effective supervision. It is a commonly known fact that rural labour market is divided into family and hired labour. With better supervision, hired labour show better efficiency and marginal productivity of both types of labour is higher than the wage rate but the wage rate of family labour is found to be less than hired labour due to certain facts. Kiani (2008) supported this on the basis of previous studies. She explained with the help of figure 4.6, which depicts the relationship of additional units used in crop production with their marginal product, and marginal productivity fall well bellow the wage rate to enhance crop productivity. It is also shown by figure 4.6 that market wage rate is higher than imputed cost of family labour.

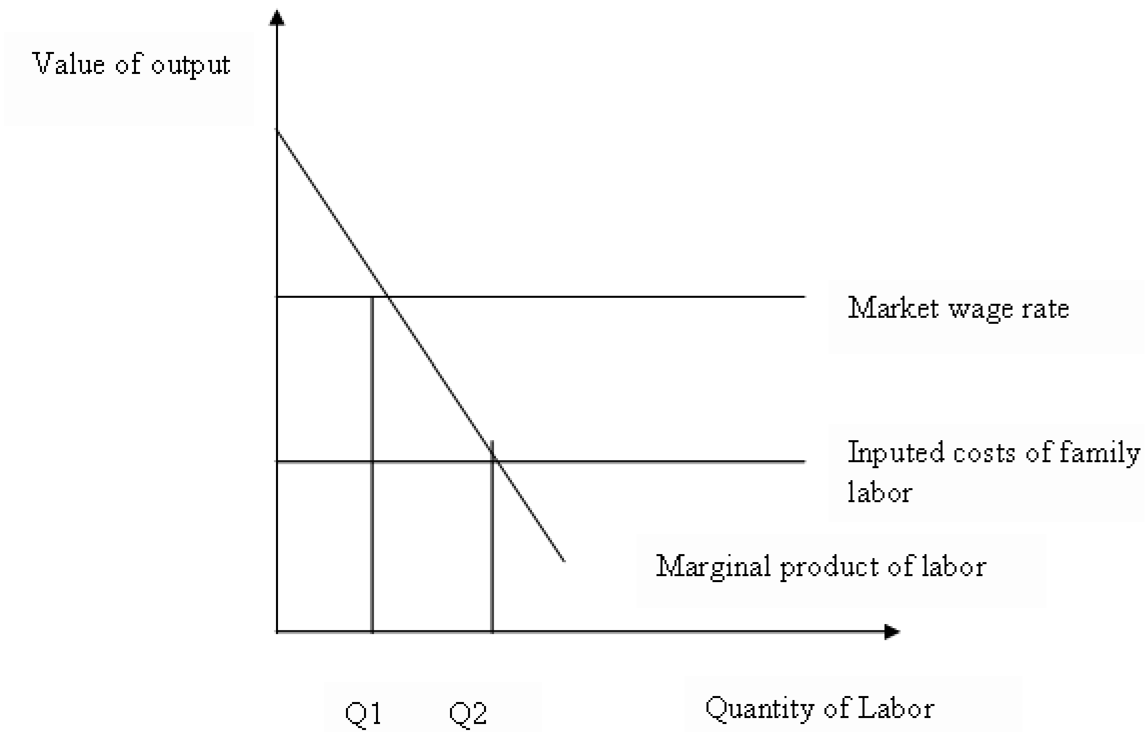


Figure 4.6- Labour Productivity: Relationship of Wage Rate, Imputed Family Labour Costs and Marginal Product

Source: Kiani 2008

The aforementioned cited literature confirms that the family labour is one of the pivotal factors to contribute to higher yield per unit area especially in small farms which lay the deep foundation of the stylized fact of inverse relationship.

4.4.3 Factor Market Imperfections

The mal-functioning of agricultural factors markets due to some particular reasons are designated as rural market imperfections. The central theme of this hypothesis in the inverse relationship debate is that different prices of various inputs are the fundamental reason to use varying amounts of inputs on their farms. (Mazumdar 1965, Sen 1966, Berry and Cline 1979, Sen 1981, Cornia 1985, Eswaran and Kotwal 1986, Griffin *et al.* 2002, Benjamin and Brandt 2002,)

In a neoclassical world, in a perfect market scenario with same prices of factors of production it is forecast that all factors of production can be fully utilized, and resources are allocated efficiently across alternatives uses. Hence, no systematic yield difference will be observed (Schultz 1964, Heltberg 1998). Unal (2008) corroborated perfect market idea by ascribing it to two major factors of production i.e. land and labour, and she assumed constant return to scale operating under the same production function. She added that in a perfect market mechanism when the land is more productive than labour it should be transferred to small farms while more productive labour should be shifted towards larger farms. As a result, small and large farms should undergo similar marginal rates of technical substitution. In this way, agricultural production would be attained free of inverse relationship. In the end, the puzzle was solved by commenting that factor markets are imperfect and so the resource allocation is inefficient across the agricultural production process.

Cornia (1985) in a study of 15 developing countries observed IR phenomenon by using different factors as independent variables like land use intensity, share of cultivated land, labour in man days while irrigation, fertilizer, pesticides and fuel etc were utilized as intermediate inputs. He found that Bangladesh, Peru and Thailand, which were more densely populated and with very small holdings deviated from inverse relationship, while the rest 12 countries showed stronger inverse relationship results. He concluded from the result of the study, inverse relationship prevails due to better management of intermediate as well as primary inputs i.e. land and labour on the small farms. Moreover, small and larger farmers are exposed to different prices regarding labour and capital i.e. prices of labour are higher for large farms while capital is more expensive for small farms.

Land and labour are the two fundamental factors of production in the agricultural sector. Due to the profound importance of labour it was decided to accommodate it in a small but separate section. Although, land is equally important, not only, in the agricultural sector and especially in the inverse relationship studies but to avoid from unnecessary protraction, it has been decided to incorporate it with some other factors. **Land market imperfections** are one of the fundamental causes of inverse relationship phenomenon and it affects per unit farm productivity in two ways i.e. through imperfect land rental markets and imperfect land sale markets (Heltberg 1998). As a result of “Marshallian inefficiency law” many developing countries followed the vague land tenurial reforms (Skaufias 1995), especially in

South Asia as a so called land to the tillers adherents which seriously curtailed land rental markets especially for long term lease (Hayami and Otsuka 1993, Shaban 1987). In the two major form of land rents i.e. share cropping and fixed rent to some certain ex-ante and ex-poste conditions prevent lan-downers to follow suite as it is required. Share cropping is curtailed due to the fact that tiller does not employ optimal use of inputs and, consequently, attain lower yields per unit area and owners have to face loss in this respect. As far as the fixed rent is concerned, the owners should be contented in this kind of lease but tenants have to bear whole responsibility. As a matter of fact, If the rent is to be paid in advance, the credit constrained farmers might hesitate to lease in land as described by Feder (1985), and Eswaran and Kotwal (1986). While in case of after payment, owners are skeptical or uncertain whether the tenants would pay the agreed amount or not? (Wiens 1977).

According to Heltberg (1998), the major reason for imperfect land sale markets is the failure of farmers to adjust their holdings according to the size of their family workers. This trend can be explained in following manner,

a) Government interventions whether they are, in form of inputs or outputs, are not neutral to scale. These interventions are always in favour of landed elites to intact their economic and political power as a result of successful lobbying by feudals (Griffin *et al.* 2002, Carter and Barham 1996, Binswanger *et al.* 1995).

b) In some parts of the world, land markets might be thin and restricted to sell land to the outsider.

c) Small farmers are usually unable to mobilize their resources for credit and savings to finance land purchases and heavy transaction costs do not allow them to follow suit. But, some times small farmer sell their land for their subsistence which is an opportunity for larger holders to concentrate more (Carter and Wiebe 1990).

d) Land is an asset of insurance, power, prestige and bondage. It also a place of ancestral home, and it is a portfolio asset to hedge against inflation in countries with underdeveloped capital markets and it serves as collateral for credit (Cornia 1985, Kaldjian 2001, Platteau 1992).

Hence, imperfect land markets significantly hamper the farm efficiency due to the distorted equation of family workers endowments' and farm size. Secondly, land accumulation due to imperfect land markets cause supervision constraints on the hired labour at bigger farms which is a basic reason of inverse relationship in farm production (Heltberg 1998).

As far as the **capital markets imperfections** are concerned, there are very strong pros and cons of it regarding inverse relationship theory in the agricultural sector. Ceteris paribus, imperfect credit markets make it difficult for the bigger landlords to plough it efficiently because they cannot, readily, borrow money from the market when they direly need it and inverse relationship might be a reason of this fact. Contrarily, farmers can access credit, conditionally, by pledging their lands as collaterals (Binswanger and Rosenweig 1986) and financial institutions may also charge some fix fee or may have some certain "minimum standard amount of loan" which can work as restraint for the small farmers to obtain credit from the formal institutions. But larger farmers can work efficiently and enhance their output benefiting from collateral conditions by attaining credit (Feder 1985, Feder and Onchon 1988), this fact exposes the weakening of inverse relationship. However, when operative land holding plead for supervision constraint of the larger holdings affecting inverse relationship, at the same time ownership holding caters evidence concerning credit constraint (Heltberg 1998). Cornia (1985) argues that financial institutions are not well developed in rural areas as a result of which farmers have to rely on local informal money lenders with higher, usurious, interest rates. He added that credit available on soft terms basis goes to the richer peasants due to their better reputation regarding returning capacity plus they use their influence to channelize official finance to the rural areas. In the end he noted that cost and access to credit may be inversely proportional to the farm size.

The debate concerning imperfect credit markets is quite ambiguous with its positive or negative relevance to the inverse relationship. As far as collateral conditions for credit availability is concerned, it seems more rational that easy access and availability of credit to the larger farmers might weaken the inverse relationship in the agriculture by making bigger estates more productive than smaller ones but latest studies reiterate that inverse relationship strongly exist at its full fledge scale (Unal 2008, Kiani 2008, Thapa 2007, Matchaya 2007, Fan and kang 2005).

4.4.4 **Farmers Attributes: Family Size, Age and Education**

Farmer's heterogeneity can be explained in terms of certain characteristics of households and household heads. In the farm size-output relationship, the literature, mainly, includes size of the household as well as age and education of household head. Logically speaking, mounting family size and increasing education of household head should influence positively while rise in age of household head should reduce yield per acre, as age affect decision making capability and repel the adoption process of new technology. Through a keen and detailed survey of literature it has been found that there are few output-farm size relationship studies which incorporate socio-economic or demographic variables. On the other hand, the literature regarding farm efficiency either on the basis of single crop or studying whole farm integrated demographic variables in econometric models to observe their impacts.

Miller (2008) explained the positive and negative signs of linear as well as quadratic terms to divulge relationship of age of household head and labour productivity at the farm level. He found the mean age of operator 55.39 years and he concluded that when this value is increased by one standard deviation labour productivity decreases by 6.71 percent. Furthermore, he observed the rise in farm productivity with the decrease in average ages of the respondent. Similarly, Villatoro (2007) studied the relationship between farm growth rate (i.e. nominal assets, real assets including farm area, and number of workers) and operator age. He concluded that increasing age of household head obstructs or negatively affects the growth rate of assets.

In a farm size-yield relationship study, Matchaya (2007) concluded that age of the household head in 5 districts of Malawi was found to be negatively related to farm productivity while level of education (i.e. years of schooling as a proxy for farmers ability) was found to be positive.

In the beginning of the green revolution Schultz (1964) put forth his opinion regarding education and farm productivity relationship by arguing that education can increase productivity and Sen (1999) favoured his view and said, literate farmers can read the instructions on the machines and have better capability to apply new techniques to enhance productivity. Unal (2008) did not turn down aforementioned statements but she added that, though, small farmers lack access to such machines but they are still more productive than larger farmers.

Asadullah and Rehman (2006) studied 141 villages for farm productivity and efficiency with a special focus on education along with other variables in Bangladesh. But they concluded that impact of land dominated all other factors of production e.g. one percent increase in land enhances 0.65-0.71 percent rice production. In addition, increase in one year of schooling of household head or any adult family member affects positively the rice production i.e. 3-6 percent. They observed that by controlling education of households head or adult family members in a regression model, make the results insignificant.

As far as the effect of family size on productivity is concerned Chayanov (1926) was the first to draft a book on the issue of peasant and their demographic behavior on farm productivity. He argued that the basic objective of a peasant worker is subsistence and he strives, accordingly, keeping in mind family needs. Chayanov added that greater the family members mean higher yield to be produced and vice versa. Thapa (2007) is one of the agriculture economists who focused special attention on farm productivity and family size relationship in his work. He concluded that, although, family size plays a crucial role in the crop production process but in case of larger farms its share is not much stronger with the better access to resources e.g. credit, advanced technology, irrigation and market information. Furthermore, bigger family size is pivotal for family farms because it is highly conducive to work efficiently, conditional, with better access to resources. In addition, family size and other socio-economic characteristics do help in production decisions in rural economies which, ultimately, affect farm productivity.

The conclusion on the basis of facts presented in the chapter would reveal that there must be an evolution of some mechanism to reduce inequality in asset holdings which will definitely diminish food insecurity threats. It would also alleviate poverty and would help to boost up development process in the developing countries. However, it is strongly needed to restructure the farm size to produce and employ labour intensive technologies to decrease rural unemployment. It will also help to attain food security and alleviate poverty of 80 percent poor of the world living in rural areas.

CHAPTER-5

DATA SOURCES AND ANALYTICAL TOOLS

This undergoing study has been devised to observe, mainly, land distribution disparities and productivity differentials in three different areas based on irrigation endowments and various farm sizes. Various approaches were employed in order to examine the land distribution, tenancy structure, cropping pattern, cropping intensity and crop diversity of the farmers by disintegrating total numbers of farming households in three distinct size groups. Furthermore, inverse relationship between yield per hectare and factors of production with special emphasis on operational land holding in the study area was also examined by taking up econometric model. The chapter has been organized in to two major portions following their sub-parts to express data types and sampling methods, data collection, analytical tools and techniques to achieve set objectives of the study.

5.1- Data Sources

5.1.1- Types

Two types of data sources were used i.e. primary as well as secondary data. A huge amount of primary data comprising of many thousand variables was collected from the field as part of project launched in district Gujrat and Mandi Bahauddin titled as "Impact Assessment of Irrigation Infrastructure Development on Poverty Alleviation" by the International Water Management Institute (IWMI) Lahore, Pakistan. The data with some relevant selected variables was, later on, attained from IWMI with kind support of Dr Intizar Hussain (Executive Director of International Network for Participatory Irrigation Management) for the purpose of this study. The further details about data are being laid out in a forthcoming section of the chapter. As far as the secondary data is concerned, the office of Agriculture Census Organization, Punjab Economic Research Institute (PERI), International Network for Participatory Irrigation Management and University of Agriculture Faisalabad were visited in search of some relevant reliable secondary data. Afterwards, on the basis of consultations and discussions with professionals of the aforementioned organizations the data was extracted from various sources like Agriculture Census Reports of Pakistan 1960, 1972, 1980, 1990 and 2000, Agriculture Census Reports of Punjab 2000, Punjab Development Statistics 2008, various reports of Food and Agriculture Organization, different World Bank publications. Some publications of Punjab Economic Research Institute were also thrashed to obtain concerned secondary data as a supplement to highlight and emphasize the scope of the study.

5.1.2- Site Selection and Sampling Methods

To start with, a general survey of the site, was done by the project team to get knowledge of the area regarding local agricultural methods, climate and cropping patterns. Above all, the purpose was to identify specific sites for the project. These visits gave a good insight of the area concerning living standard, overall sources of income, dependence on agriculture etc inside the villages of district Gujrat and Mandi Bahauddin. Tehsil Kharian of district Gujrat was abandoned as study area in the project due to a large number of its inhabitants being employed abroad in the Middle East and Europe. Four different sites were selected with different patterns of irrigation endowments, two amongst them were "irrigated perennial areas" (i.e. with year round canal irrigation) with a minor difference of crop rotation, a third one was "irrigated non-perennial area" (i.e. with 6 months canal irrigation). While the fourth area opted for the project was without any public canal irrigation infrastructure. It was observed that most of the farmers rear their crops through own tubewell irrigation or by purchasing water from the neigbours but this area has been considered as "rainfed" due to the lack of public irrigation facilities. The purpose of this study is entirely different from the mother project, so the selected areas have been modified according to the scope and requisites of this study. It is worth-mentioning here, both perennial areas were dealt as a single entity by adding them together and titled "irrigation perennial area" in the study while the rest two areas were kept same as "irrigated non-perennial area" and "rainfed area". Figure 5.1 shows irrigated and rainfed territories in district Gujrat and Mandi Bahauddin.

To avoid any kind of bias in the final results, stratified random and cluster sampling methods were adopted to select the households for the purpose of primary data collection in the study area. Irrigated areas were selected along the Upper Jehlum and Gujrat Branch canals. The canals as well as watercourses were divided into three distinct areas by taking special care to avoid mixing up the boundaries of adjacent water channels. A strong vigilance was kept that each respondent be from its own cluster i.e. head, middle and tail. The data was collected along the water source i.e. from head, middle and tail following the typical style of International Water Management Institute because it yields, definitely, better results which help to give bias free policy implications at the end of the study. The mother project was to observe the poverty differentials on head, middle and tail of the irrigation source and sampling and data collection was done accordingly but to describe all those methods is beyond the scope of this study. So, it is favourable, just, to mention the tools concerning this ongoing study.

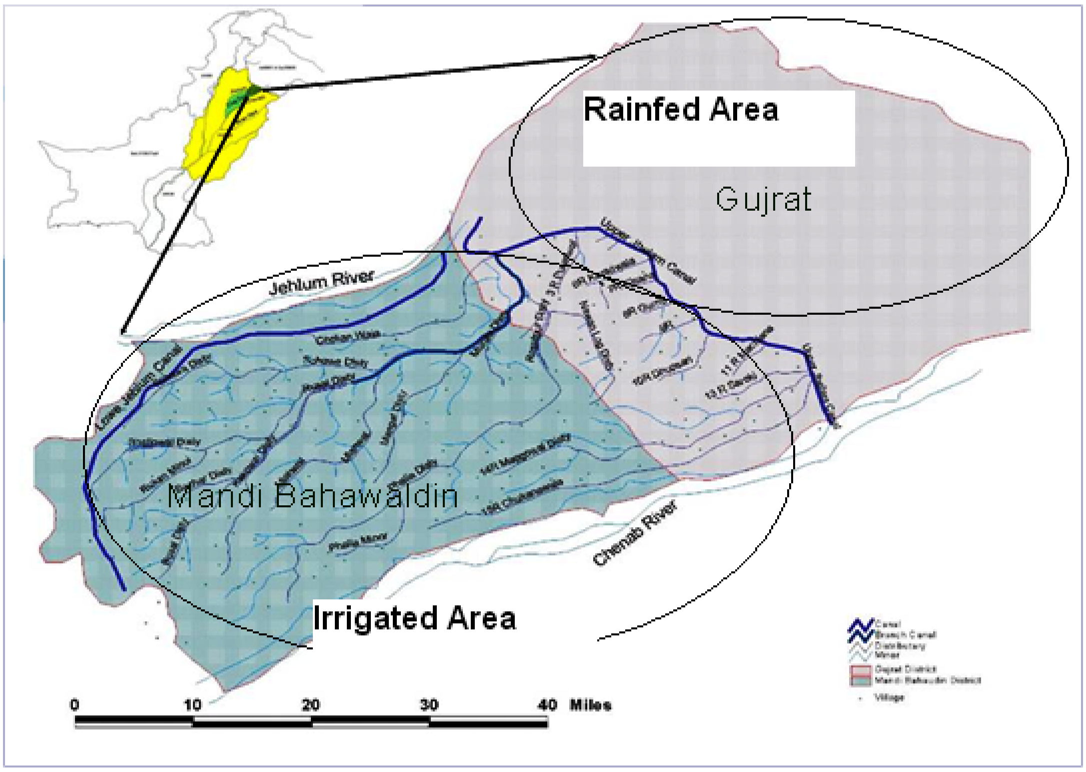


Figure- 5.1 Irrigated and Rainfed Areas of District Gujrat and Mandi Bahauddin

Source: Salik-2005

5.1.3- Data Collection Techniques

For the purpose of data collection formal and informal techniques were carried out and the respondents were probed in different manners to attain the reliable data. Focus group discussions with owner and landless farmers were arranged along with semi structured and formal questionnaires. It was preferred to interview only household head otherwise some adult family member had to be interviewed to attain required information.

5.1.4- Sample Size and Data Cleaning

As it has been elaborated in previous sections that data belong to different irrigated and rainfed zones and in case of irrigated areas respondents were selected along the head, middle and tail region of the distributaries. The head middle and tails has only been mentioned in former and latter sections just to unveil the kind of data would be worked on. Otherwise, keeping the nature of study in mind, to exclaim the number of distributaries and water courses is beyond the scope of the study. According to the area specification of IWMI 180 respondents were selected from each areas totaling 720 in 5 surveys from the year 2001 to 2003. While during the course, 13 respondents were dropped making it 707 due to different reasons, keeping rainfed respondents 177, irrigated perennial 351 (i.e. two irrigated perennial areas has been converted to single area by adding them together) and irrigated non-perennial 179. As this study is based on the farming households, therefore, all the non-farm households and farm households with poor information were also omitted from the original data keeping in hand 447 respondents.

Total 23 respondents were dropped from the final analysis by making them 424 by filtering out outliers and with lack of information which might have biased the final results of the study. However, it is noteworthy that two full cropping years i.e. 2001 and 2002 were covered in the IWMI study but to fulfill some specific objectives, only one year data (i.e. 2002) was untilled in this study. Finally, farms were divided into three farm size groups' i.e.

- < 2 hectares
- 2-4 hectares
- > 4 hectares

Farms size with less than 2 hectares was categorized as small while 2-4 and greater than 4 hectares were designated as medium and large farms in the study area. Farm size groups were constructed by observing carefully size of total number of farms in the study area. Moreover, farm size of each individual farmer was determined by subtracting leased out and adding leased in land in the ownership holdings.

5.2 Analytical Tools

In the socio-economic studies data analytical tools plays a vital role to reach the objectives of the studies. Various types of analytical methods were used to attain set objectives. The following section has been arranged to express the major analytical tools to gauge land distribution disparities, total and factor productivities per hectare, inverse relationship between farm size and output per unit area along with some other measures like cropping intensity, and crop diversity etc.

5.2.1- Distributional Measures

Frequency distribution of farm holding and farm area with respect to holding size was studied to observe land distribution disparities in the study area. The magnitudes of the skewedness were determined with the help of "Lorenz curve and "Gini coefficient" in the areas (.i.e. irrigated perennial, irrigated non-perennial and rainfed areas) under study. It is noteworthy that Lorenz curve and Gini coefficients are general measures to gauge inequality levels of asset as well as income distribution in the population. As far as the Lorenz curve is concerned, it has been expressed in detail in chapter 6.

Gini coefficient is a mathematical measure to find out the extent of inequality. Gini coefficient was employed, after Lorenz curve, to further investigate the level of inequality, in terms of numeric figures, in the study area. It was utilized for auxiliary investigation of land ownership and operational holding inequalities in the study area. This is the most commonly used measure of inequality (World Bank 1999a). The coefficient varies between 0, which reflects complete equality and 1, which indicates complete inequality e.g. one person has all the income or assets.

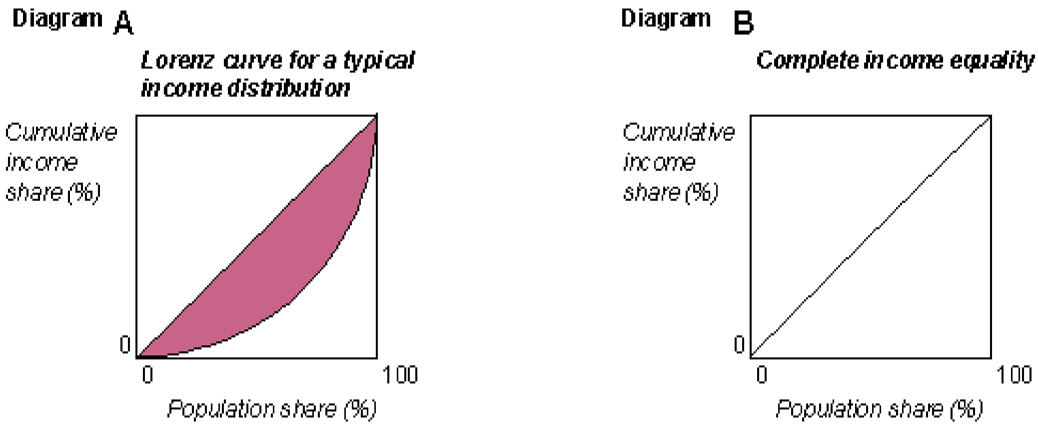


Figure-5.2 Lorenz Curves for Typical Income Distribution and Perfect Equality

Source: National Statistics UK 2005

As far as the estimation of Gini coefficient is concerned it is, fundamentally, obtained from the Lorenz curve by estimating one side of the diagonal line of the rectangle involving some mathematical mechanisms as explained ahead. In Figure 5.2, diagram A and B depict the level of disparities and perfect equality, respectively. The perpendicular drawn from the horizontal axis to observe the point of maximum distance between Lorenz curve and diagonal line is called Gini coefficient. Higher the distance between diagonal line and Lorenz curve means greater level of inequality amongst the population. Smaller distance interprets lower level of inequality and if there is no distance as explained earlier, Lorenz curve is attached with 45 degree line it is meant perfect equality (in diagram B).

If the coloured portion of diagram A is considered as “a” and its belower part is marked as “b” then mathematically Gini coefficient can be expressed as,

$$\textbf{Gini Coefficient} = \frac{a}{a+b}$$

It seems quite simple to calculate with the available quantities of "a" and "b" but for this purpose the magnitudes of these areas need to be determined prior to estimate Gini coefficient. After simple explanation of Gini coefficient and its determination method it is mandatory to elaborate the method which was rendered to calculate Gini coefficient. Lorenz curves and Gini coefficients were, actually, determined with the help of DAD software developed by university of Laval Canada.

5.2.2- Total and Partial Factor Productivities

Output of any crop attained by land unit (i.e. Hectare, Acre, Decare etc) or farm level expressed in monetary or physical terms of their weights (i.e. tons, mounds, kilo grams, grams etc) divided by cost or quantity of all factors of production is called as total factor productivity (of land unit or farm) in a particular area. Total factor productivity was determined by using the following formula,

$$TFP = \frac{\sum_{i=1}^{n} Ri / hectare}{\sum_{i=1}^{n} CPi / hecater} * 100$$

Where, TFP = Total Factor Productivity

Ri = Farm Revenue obtained by multiplying multiple crop outputs and their prices

CPi = Cost of Production of all of the factors involved

Normally, total factor productivity is determined in a ratio form i.e. output / inputs. As the difference amongst the ratios was small so to avoid from any ambiguity and for sake of quick understanding it was converted in to percentage. Keeping in mind the importance of labour and Irrigation, partial productivity for labour as well as irrigation were also determined. These indicators were calculated by using the similar approach i.e.

$$IP = \frac{\sum_{i=1}^{n} Ri / hectare}{\sum_{i=n}^{n} ICi / hectare} * 100$$

Where, IP = Irrigation Productivity

Ri = Farm Revenue obtained by multiplying multiple crop outputs and their prices

ICi = Sum of irrigation costs of canal, owned tubewell and purchased water

To determine labour productivity family labour man days were converted in to monetary terms by multiplying it with predetermined average per day wage (i.e. 100 Rupees) of the study area. Furthermore, hired labour and family labour man days in monetary form were added together to attain labour productivity of the study area.

$$LP = \frac{\sum_{i=1}^{n} Ri / hectare}{\sum_{i=1}^{n} LCi / hectare} * 100$$

Where, LP = Labour Productivity

Ri = Farm Revenue obtained by multiplying multiple crop outputs and their prices

LCi = Family and hired labour costs together incurred on crop production

5.2.3- Crop Diversity

Crop diversity is derived from biodiversity concepts but in agricultural production research it can be associated with extension of cropping pattern. On the other way, it can also be explained as number of various kinds of crops grown in the study area based on their species and cultivars etc. Inverse of Herfindahl Index was utilized to determine crop diversity index in the study area. Crop diversity index was determined by using following mathematical equations i.e.

$$\textbf{CDI} = \frac{1}{\sum_{i=1}^{n} S_i^2}$$

Where, CDI = Crop Diversity Index

S_i is share of individual crops in total cropped area

This measure was simply used to quantify the diversification level of farmers on the basis of crops in the study area.

5.2.4- Cropping Intensity

Cropping Intensity is defined as "total cropped area or total sown area in terms of total cultivated area multiplied by 100 or it indicates the extent to which the cultivated area was used for cropping. This is an extremely good measure to determine the intensiveness of agriculture per annum in form of crop production in a specified area. Following formula were utilized to determine cropping Intensity in the various study locations as well as at different farm size categories,

$$CI = \frac{\sum_{i=1}^{n} TCAi}{CA} * 100$$

Where, CI= Cropping Intensity

TCAi = Total cropped area and CA = Cultivated area

5.2.5- Kruskal Wallis Test: A Test for Research Hypothesis Verification

Kruskal Wallis test was utilized to test the hypothesis of the study. This is most commonly used measure when data does not fulfill normality assumptions for analysis of variance (ANOVA) and homogeneity of variance of the means of samples. Keeping in mind the pre- requisites of Kruskal Wallis test data was tested for normality and homogeneity of variance by using **Kolmogorov-Smirnov as well Levene's test, respectively**. The results of normality and homogeneity of variance fulfilled the pre-requisites of the Kruskal Wallis while deviated from ANOVA. Statistical Package for Social Sciences (SPSS) was used to render Kruskal Wallis measure to test the hypothesis. It will be worth mentioning here to describe the method that how Kruskal Wallis test works to test the hypothesis? To observe the difference amongst various farm size productivities following null and alternative hypothesis were used to test i.e.

Null hypothesis Ho = There is no significant difference amongst the mean productivities of small, medium and large farms of study area.

Alternative hypothesis H_1 = There is a significant difference in the mean productivities of small, medium and large farms of study area.

Similar procedure was adopted to test all of the rest hypothesis i.e. partial productivities, gross margins, on and off farm incomes etc at maximum probability level of 10 percent. The significance level of the results to show probability level in each table has been marked with number of stars. Results with *, ** and *** show significance at 1, 5 and 10 percent probability levels.

5.2.6- Econometric Model

Econometric tools were employed to observe existence of kind of relationship amongst various variables utilized in the study. Output per hectare was used as dependent variable to observe the impact of various regressors upon it. "Log-log function" was used by employing Ordinary Least Square (OLS) method to investigate the relationships of the variables on both sides of the equation whether it was positive or negative. A description of dependent and independent variables used in econometric models has been presented as under,

A) Dependent variable

Abbreviations	**Names of Variables**
• **yield**	**= yield / hectare**

B) Independent variables

• Opholding	= farm Size
• Irrigation	= irrigation Cost / hectare
• Labour	=labour man days/ hectare (family labour +hired labour)
• Int.inputs	= Intermediate input costs (i.e. seed + fertilizer + manure + chemi cal + mechanization) / hectare
• F.size	= Family size
• Credit	= Credit / hectare
• Agehead	= Age of household head
• eduhead	= Education of household head
• %FW	= Percentage of family workers working in agriculture sector
• NF income	= Non-farm income of households
• Downtractor	=Dummy variable of own tractor
• Downtubewells	= Dummy variable of own Tubewell

Natural logs of all of the variables were taken before to start analysis. To avoid multicollinearity problems and to reduce the number of variables different kinds of input cost were added together under the name of "int.inputs". The modeling was done in SPSS to achieve better and reliable results of the study. The following model was used to see relation between dependent variables and the independent variables for all study locations.

C) Model- to observe existence of Inverse Relation between output and factors of production

$$In\sum Yield = \alpha + \beta_1 In\sum Opholding + \beta_2 In\sum labour + \beta_3 In\sum irrigation + \beta_4 In\sum \text{int}.inputs + \beta_5 In\sum credit +$$

$$\beta_6 In\sum Downtractor + \beta_7 In\sum Downtubewell + \beta_8 In\sum \%FW + \beta_9 In\sum NFIncome + \beta_{10} In\sum F.Size +$$

$$\beta_{11} In\sum agehead + \beta_{12} In\sum educationhead + e$$

Same econometric model was used to observe inverse relationship for all of the three study locations along with overall study area. The aforementioned tools, techniques and econometric model helped to analyze data to attain results and to test research hypothesis. Moreover, these tools were utilized for data analysis with the help of different computer softwares like SPSS, DAD and Microsoft Excel.

CHAPTER- 6

LAND DISTRIBUTION AND PRODUCTIVITY ANALYSIS
A VIEW OF INVERSE RELATIONSHIP

The detailed description of the study areas was elaborated regarding farm and family characteristics, land tenure structure and cropping patterns of the farmers of the various farming systems in chapter-3. This present chapter has been drafted to articulate the observed land distribution disparities, cropping intensity and diversity, farm productivities, and the existence or absence of inverse relationships between farm size and productivity along with some other indicators. All of the indicators have been quantified on the basis of various study locations and comparison amongst different farm size categories. The outcome of data analysis is expressed in tabular as well as in graphical format to better understand the spirit of the results. This chapter can be recognized into three distinguished portions: the first portion is started with description of "land distribution disparities" in form of quintiles representing the numbers of households followed by Lorenz curve and Gini coefficient in the study area. Subsequently, cropping intensity, crop diversity, farm productivity comprising of total and partial factor productivities and gross margins also share this portion of the chapter. While next portion of the chapter consists of wealth distribution corroborated on the basis of land distribution disparities following share of farm and off farm income of the farmers and institutional credit availability in the study area. While last segment of the chapter divulges the results of the regression model used for the sake of inverse relationship exploration in the study area. This section expresses the relationship of the yield trends per hectare with farm size and other factors of production which was the second major motive following land distribution disparities to undertake this study. The validity of "stylized fact" of inverse relationship examined in this portion of the chapter would guide towards major policy recommendations at the end of the thesis write up. Hypothesis needs to be restated to observe compliance or defiance of the results from them in the following sections.

6.1- Hypothesis Restated

1. Land distribution is skewed in overall study area as well as in the various farming systems i.e. irrigated perennial, irrigated non-perennial and rainfed areas

2. Cropping intensity, crop diversity, total and partial factor productivities (i.e. irrigation and labour productivities), gross margins, income distribution etc are higher in evenly land distributed study location as compared to others.

3. All of the aforementioned indicators except labour productivity yield better results at small farms as compared to other farm size categories in each study location as well as overall study area.

4. Inverse relationship of farm size and productivity is a valid proposition and it exists in each study location i.e. irrigated perennial, irrigated non-perennial and rainfed areas under study.

6.2- Extent of Land Inequality in the Study Area

This section of the chapter, being the foremost significant component of the study, expresses results concerning degree of inequality and land distribution skewedness in the various areas under study. Various measures have been carried out to gauge land distribution disparities in the area. An attempt has been made to delineate relationship between number of holdings and farm area. It starts with simple graphical representation of owned and operational land holdings, explaining percentage of owned with percentage of operational farm area distribution in different quintiles in ascending order. Afterwards, Lorenz curve and Gini coefficient present a more comprehensible view regarding land inequality in the area. This section would conclude the outcomes showing their relevance or contradictions to the concerned research hypothesis at the end.

6.2.1- Percentage Distribution of Owned and Operational Farm Area

Figure-6.1 expresses the percentage of owned and operational farm area under cultivation in five equal partitions of total number of households in the form of quintiles. Each quintile represents 20 percent farmers in ascending order from lowest 20 percent to highest category. It can, easily, be grasped that percentage ownership and operational holding area rise with every subsequent quintile and it can be observed in ascending order in figure (6.1) in every study area. Figure 6.1 also unveils the fact that there was highly unequal distribution of owned and operational holding as a very low percentage of farm area acquired by the lowest quintile as compared to highest quintile in each area. Irrigated non-perennial area represents a bit better situation in first two and last quintiles as compared to others but with same ascending trend like all other areas. The lowest 20 % of farmers in irrigated perennial, irrigated non-perennial and rainfed areas owned only 2, 4 and 2 percent of the total land area, respectively. As far as the second quintile is concerned 6, 9 and 8 percent of total area was owned by the farming households while 12, 15 and 14 percent area was owned by farmers belonging to the third quintile in irrigated perennial, irrigated non-perennial and rainfed areas. Furthermore, the farmers belonging to 4th and fifth quintile owned jointly 80, 72 and 76 percent of farm area in irrigated perennial, irrigated non-perennial and rainfed areas under study. According to the quintile results operational holdings were found less skewed as compared to ownership holdings in every study area. Farm area covered by the first 20 percent of operational holding in irrigated perennial, irrigated non-perennial and rainfed area was 4, 7 and 3 percent of total area under cultivation by the concerned households while farmers in the second quintile operated 9, 12 and 8 percent of total land area. As far as the third quintile is concerned it was observed that 15, 16 and 13 percent of total farm area fell in this category. The highest 40 percent farmers commanded 72, 65 and 75 percent of farm area in irrigated perennial, irrigated non-perennial and rainfed area. It is worth mentioning here that owned area covered 80 and operated area 72 percent of the total area in highest two quintiles of overall study area which demonstrates the similar trend like sub study areas.

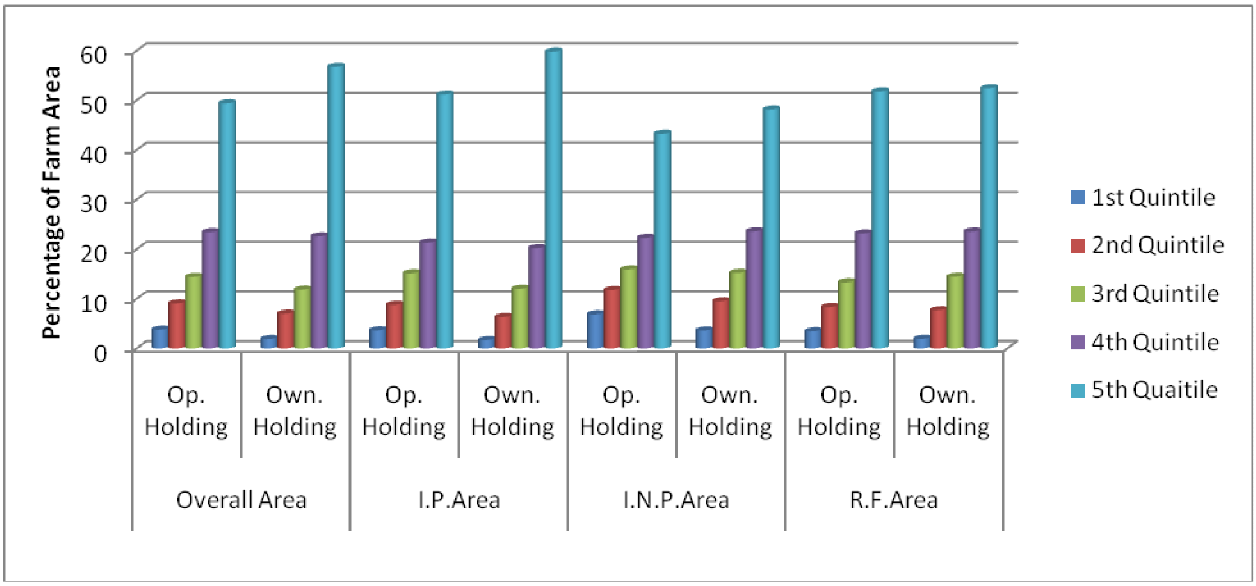


Figure-6.1 Percentage Distribution of Farm Area of Operational and Ownership Holdings in Quintiles

Note: I.P.Area = Irrigated Perennial Area

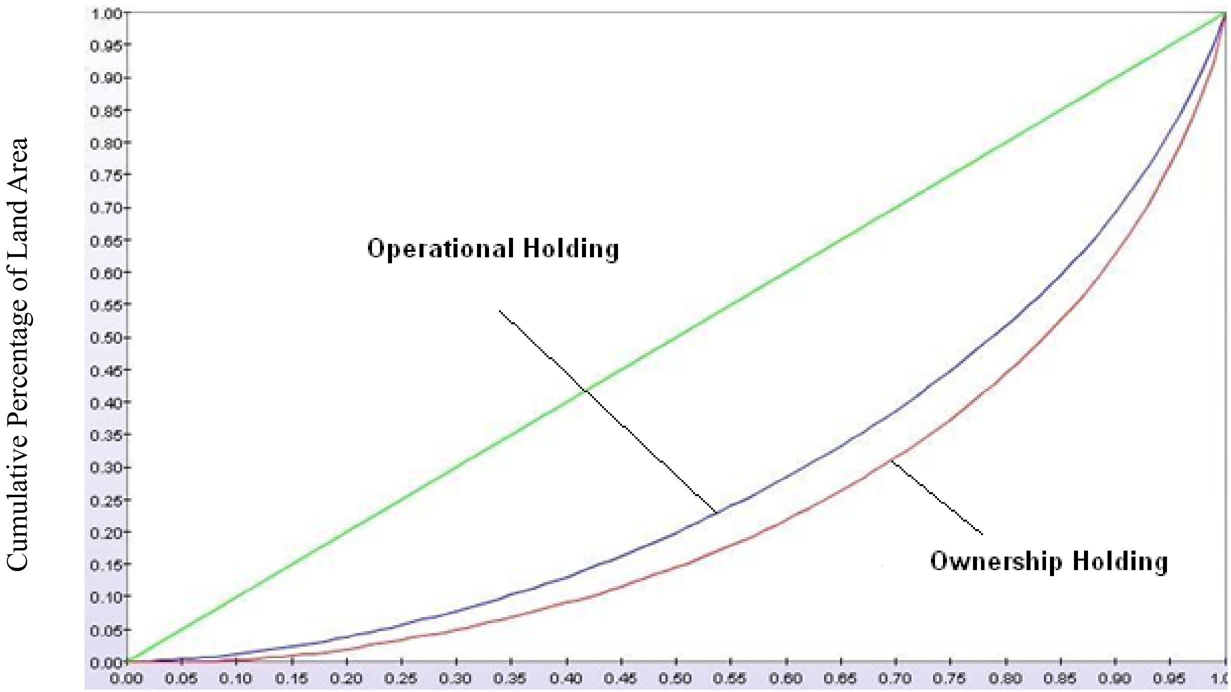
I.N.P.Area = Irrigated Non-Perennial Area

R.F. Area = Rainfed Area

The explanations of the results regarding owned as well as operated areas in different quintiles revealed that the situation in irrigated non-perennial area was less skewed than both other areas under study. Furthermore operational holdings were found better distributed than ownership holdings in every study area. The following section will explain the land distribution through the Lorenz curve.

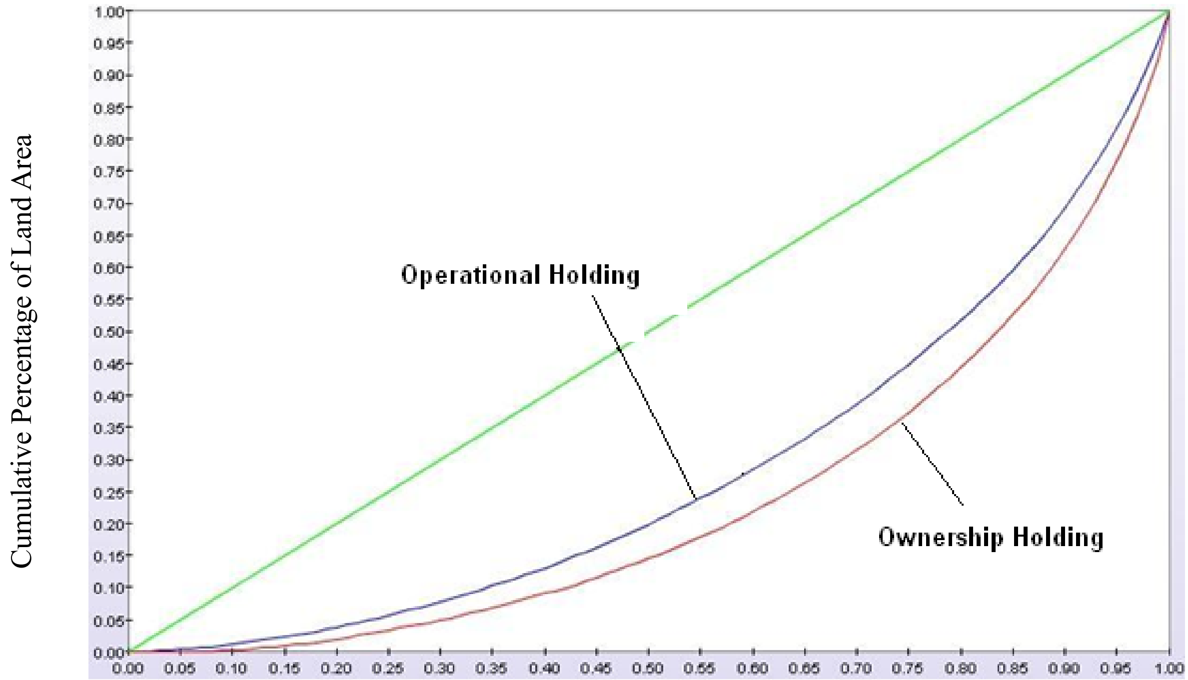
6.2.2- Lorenz Curves for Ownership and Operational Holdings

It is a common way to analyze distribution disparities of income and assets by constructing a "Lorenz curve" named after "Max Otto Lorenz" (1905)", an American economist. The Lorenz curve is a graph, depicting variation in income or asset from perfect equality. This curve has been constructed to show the relationship between number of owned and operational farms and their farm areas. On the horizontal axis the number of farms (i.e. number of households) are plotted in cumulative percentage rather in absolute terms e.g. at point 25, lowest 25 percent of farms, at point 75, 75 percent of farms and at the end of the axis all of the 100 percent farms are represented. The vertical axis portrays the share of total area associated with farms and it is cumulative up to 100 percent. So, both axes are equally long and the entire figure is enclosed in a square. The diagonal line is drawn from the lowest left hand corner of the square. At every point on the diagonal, the percentage of farms is exactly equal in proportion to the percentage of farm area. It is representative of perfect equality in the size distribution of farms as each percentage of farm groups has the same percentage of farm area. The ownership and operational holdings Lorenz curves show the depth of inequality in overall study area as well as sub-areas. The distance between Lorenz curve and diagonal line decides the depth of the inequality.



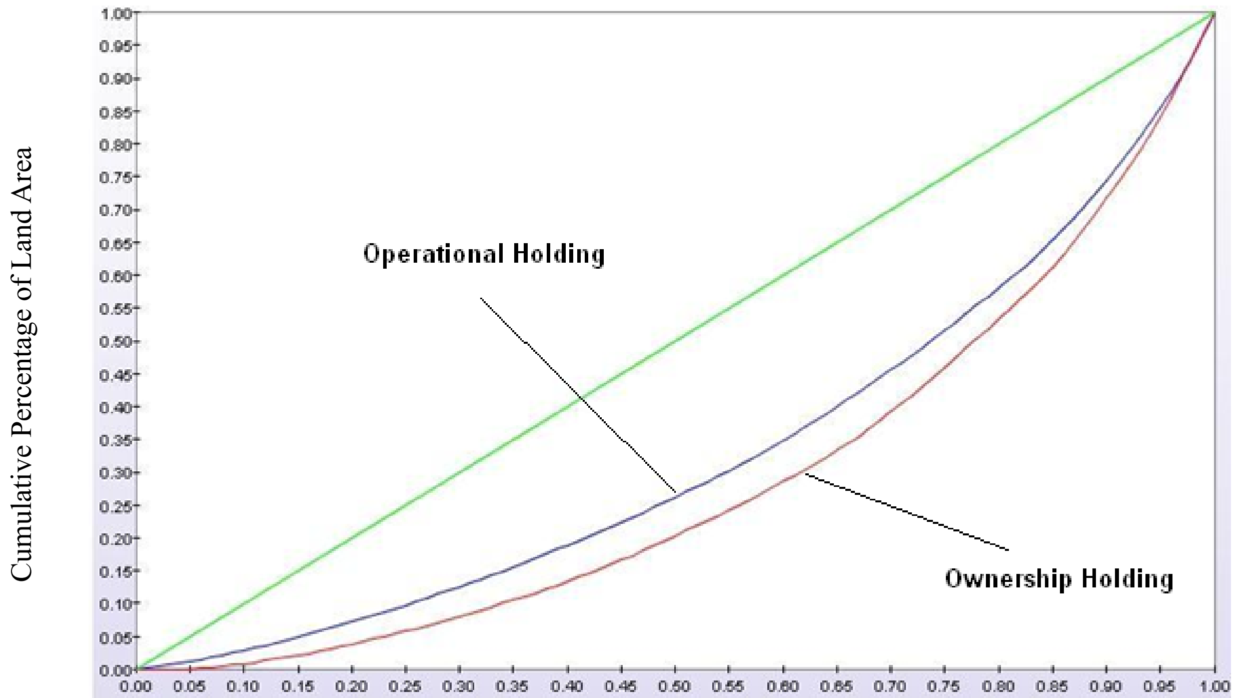
Cumulative percentage of Households

Figure-6.2 Overall Area: Lorenz Curve for Ownership and Operational Land Holdings



Cumulative percentage of Households

Figure-6.3 Irrigated Perennial Area: Lorenz Curve for Ownership and Operational Land Holdings



Cumulative percentage of Households

Figure- 6.4 Irrigated Non-Perennial Area: Lorenz Curve for Ownership and Operational Land Holdings

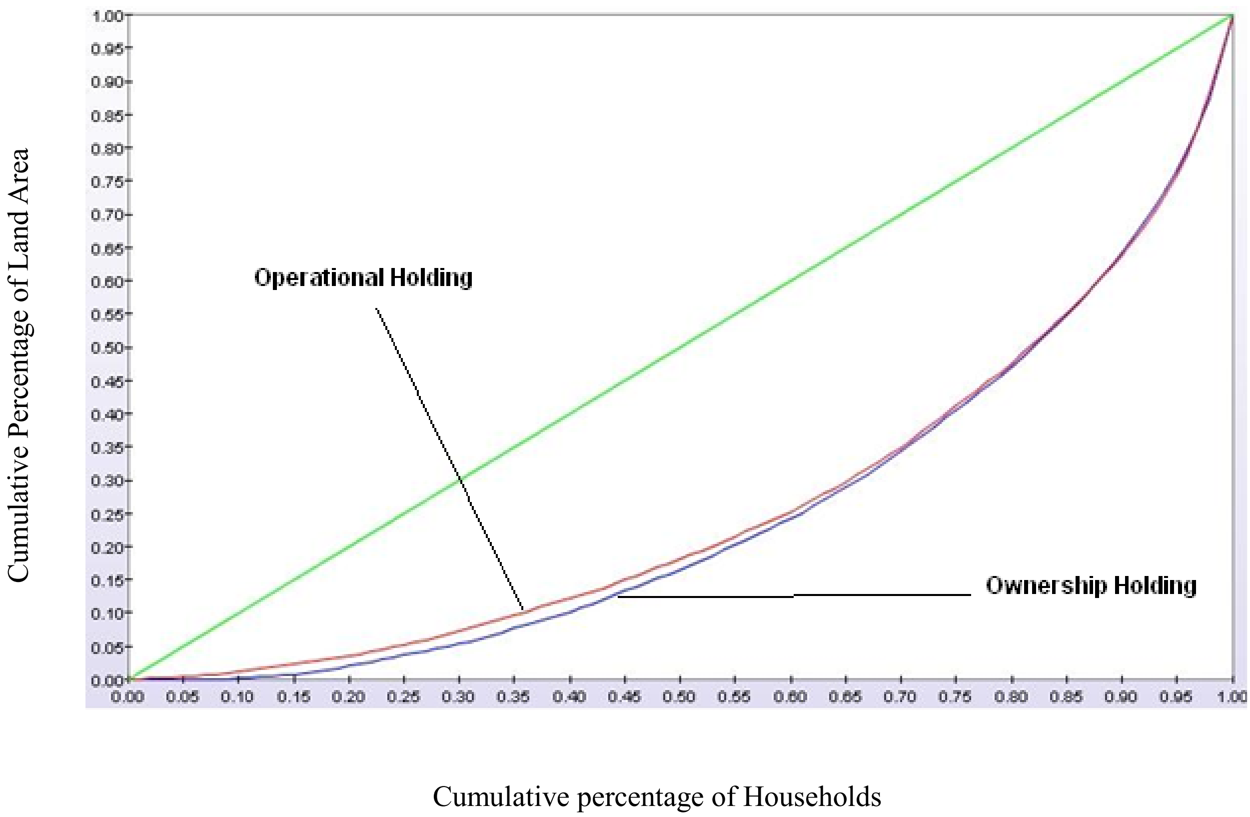


Figure-6.5 Rainfed Area: Lorenz Curve for Ownership and Operational Land Holdings

As far as the land inequality is concerned in various areas under study, a considerable difference between the ownership and operational holding from the Lorenz curves of each area can be observed on the basis of distance between the curves and the diagonal lines. The distance between Lorenz curve and diagonal line is always greater than operational holding in case of ownership holding in every area except in the rainfed area. Figures (6.2, 6.3 and 6.4) show that ownership holding is skewed than operational holdings in overall and irrigated areas. While level of ownership and operational land distribution disparities in rainfed area (i.e. figure 6.5) are almost akin to each other with very minor differences. The trends of ownership and operational holdings are similar in irrigated areas under study. The drawn graph presents the fact that ownership land inequality was maximum in irrigated perennial area while it is minimum in irrigated non-perennial area. As far as, the skewedness in operational holding is concerned, it is once again minimum in irrigated non-perennial area and converse in the rainfed area. On the other hand, the distance between ownership and operational holdings curves, also, delineated the facts concerning land rental markets in the study area. Lorenz curve of rainfed area shows that farmers with smaller ownership holdings prefer to rent out their land that is why operational holding curve is closer to 45 degree line in the beginning. While irrigated areas did have rental markets but not so active exhibited by their concerned curves.

6.2.3- Gini Coefficient of Ownership and Operational Holdings

Gini coefficient is a mathematical measure to find out the extent of inequality. It has been employed, after Lorenz curve, to further investigate the level of inequality in terms of numeric figures in the study area. It has also been utilized here for auxiliary investigation of land ownership and operational holding inequalities in the study area. This is the most commonly used measure of inequality (World Bank 1999a). The coefficient varies between 0, which reflects complete equality and 1, which indicates complete inequality e.g. one person has all the income or assets but keeping in mind the purpose of this study it might be said all of the land while all others have none. Figure 6.6 displays Gini coefficients for ownership and operational land holdings in each study area. The bars representing ownership holding are always taller than those for operational holding which points out to more inequality in the ownership holding as compared to operational holding. The inequality in irrigated perennial area was ranked first in ownership holding followed by rainfed area and irrigated non-perennial area with minimum inequality. The Gini coefficient for ownership holding of irrigated non-perennial area, rainfed area and irrigated perennial area was observed at 0.43, 0.50 and 0.54, respectively. As far as the inequality is concerned in Operational holding, the figure demonstrates that the rainfed area with the tallest bar had highest level of inequality. Irrigated perennial area held second position while the irrigated non-perennial area is with the shortest bar reveals that it had minimum inequality in operational land holding. The figures for the irrigated perennial, irrigated non-perennial and rainfed areas are 0.44, 0.34 and 0.48 for the operational land holding, respectively, exclaiming the level of inequality in these study locations.

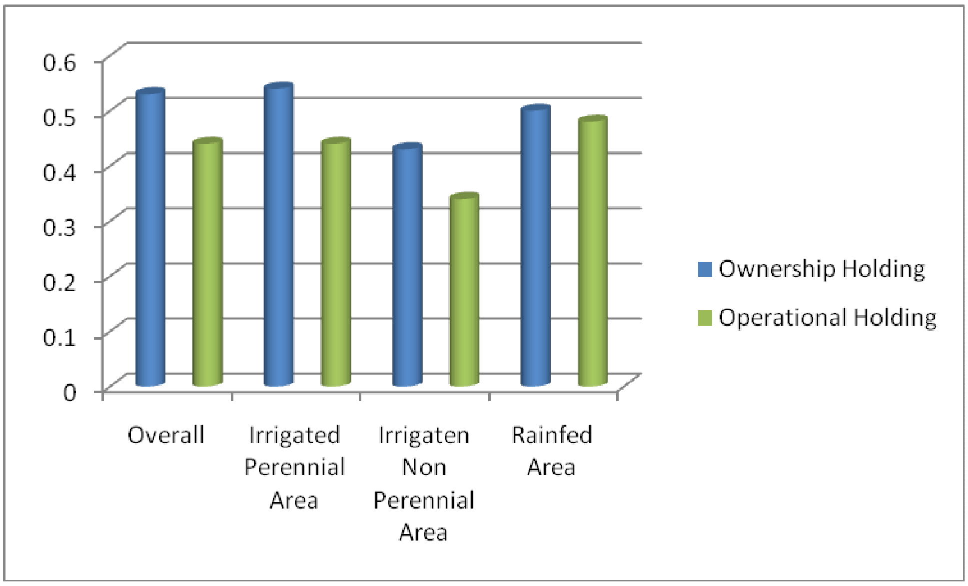


Figure 6.6 Gini Coefficient for Ownership and Operational Land Holding in Study area

Moreover, the overall study area corroborates the results of the ownership and operational land holdings by following the similar trend of disproportionate land distribution amongst the households as well. Figure 6.2 shows that the bar for ownership holding is taller than for operational land holding. The Gini coefficient for ownership and operational holding is 0.53 and 0.44 for overall study area.

All of the inequality tools mentioned above found that irrigated non-perennial area had the minimum inequality in both “ownership as well as operational land holding”. While the irrigated perennial area stood second and the rainfed area had the maximum inequality proved by Lorenz curve and Gini coefficient in operational holding. It is worth mentioning here that results of land ownership distribution disparities determined by all of the tools were inline with research hypothesis of the study. Though, operational holdings were also found skewed but skewedness was not so profound. Furthermore, land holding was very small in all of the study locations or it can be ascribed as marginal farming which is a dilemma and to discuss it is beyond the scope of the study.

6.3- Cropping Intensity and Crop Diversity in Study Area

6.3.1- Cropping Intensity

Cropping Intensity is defined as “total cropped area in terms of total cultivated area multiplied by 100 (Government of Pakistan 2000). It indicates the extent to which the cultivated area was used for repeated cropping in a particular year (Mahmood 2000). Figure 6.7 exposes the facts about the cropping intensity of overall areas of irrigated and rainfed farming systems as well as small, medium and large farms under study. It is noteworthy that irrigated non-perennial is at the top with highest cropping intensity (i.e. 169 %), irrigated perennial area is second with 161 % and rainfed area with 153 % lies beneath both of them. The comparison of small, medium and large farms shows that the cropping intensity at small farms is higher than medium and large farms in every area and the large farms were the least crop intensive in all areas, too. Furthermore, farm size categories of overall study area follow the similar trend with decreasing rate of cropping intensity from small to large farms like fellow categories of various study location. Table 6.1 delineates the detailed results regarding cropping intensity in each study location along with their concerning farm size categories.

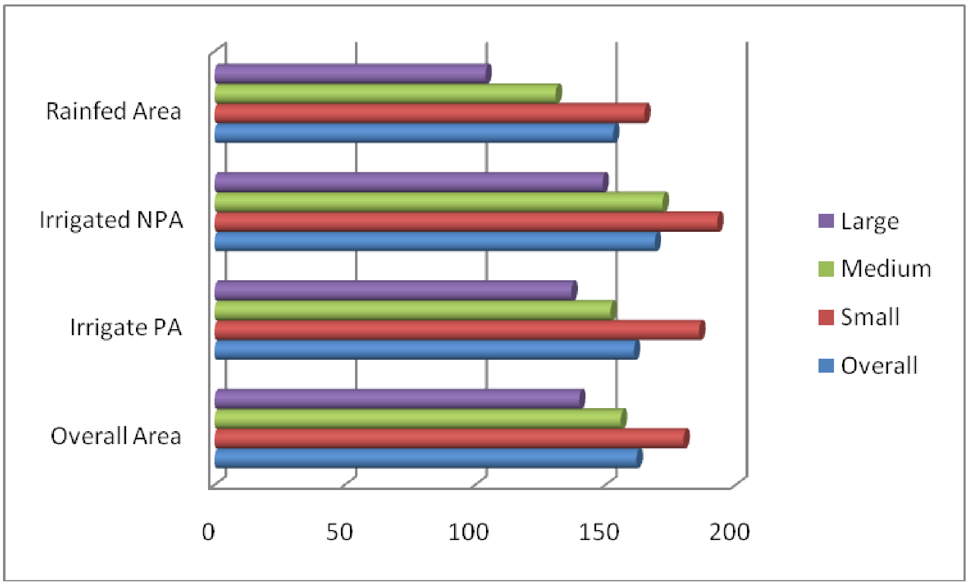


Figure 6.7- Cropping Intensity in the Study Area

Kruskal Wallis test was applied to test hypothesis, difference amongst the results and their significance level. It is quite interesting to know that all of the results concerning various study location as well as farm size categories are inline with hypothesis and significant except farm size categories of rainfed area. Table 6.1 illustrates that the significant figure of rainfed area slightly deviate the significance level i.e. just 0.003 percent higher than the set standard of significance level in this category of results. Moreover, the results of cropping intensities of various study locations comply with the research hypothesis of the study i.e. cropping intensity is higher on evenly distributed area (i.e. irrigated non-perennial area) and it is also higher on small farms as compared to respective farm size categories.

Table- 6.1 Cropping Intensity in the Study Area

Study Location		**Area categories**			**Kruskal Wallis**	
	Total	**Small**	**Medium**	**Large**	χ^2	**Sig**
Overall	162	180	156	140	16.72	0.000*
Irrigated P	161	186	152	137	13.604	0.001*
Irrigated NP	169	193	172	131	13.424	0.001*
Rainfed	153	165	131	104	4.539	0.103
χ^2	9.312	-	-	-	-	-
Sig. Level	0.010**	-	-	-	-	-

*, **, *** *Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

Cropping intensity is a valuable measure to gauge the farm use with respect to number of crops grown on a particular farm area per year or per season. So, it has been proven that small farms are more crop intensive in all of the areas under study while irrigated non-perennial area had higher cropping intensity as compared to other areas.

6.3.2- Crop Diversity

Crop diversity is a measure which is normally used in pure biological sciences as "biodiversity" to distinguish various kinds of species. This measure is, generally, used to observe numbers and kinds of animals and vegetations on the basis of their physical as well as genetic make up. But later on, it was adopted not only in agriculture but also in agriculture production economics to make various crop production decisions on the basis of their physical as well as monetary gains. It is also called as crop rotation diversity. Decisions of crop rotational diversification are, mainly, rendered to cultivate disease resistant, land fertility enhancing, high yielding varieties, reduction in cost of production, easily marketable crops etc.

Crop diversity in various study location as well as on the basis of farm size categories was observed. It was found that irrigated non-perennial area was more crop diverse (i.e. 3.66) as compared to other comparative areas i.e. irrigated perennial and rainfed areas. Moreover, rainfed area had least crop diversity (i.e. 2.33) while irrigated perennial area (i.e. 3.31) was found in between both of them. It is noteworthy that crop diversity was higher in study location with better land distribution as compared to other locations under study.

As far as farm size categories in various study location are concerned, it was observed that crop diversity was always higher at large farms as compared to small and medium farms in each study area. Furthermore, small farms had least diversity in crop rotation while medium farms were found in between small and large farms. Table 6.2 shows that crop diversity in farm size categories has increasing trend from small to large farms in all of the study locations.

Table- 6.2 Crop Diversity Index

Study Location	Area Categories				Kruskal Wallis	
	Total	Small	Medium	Large	χ^2	Sig. Level
Overall	3.19	2.7	3.37	3.77	60.20	0.000*
Irrigated Perennial	3.31	2.89	3.39	3.85	22.12	0.000*
Irrigated Non-Perennial	3.66	2.29	3.63	3.88	5.51	0.064***
Rainfed	2.33	2.19	2.72	2.56	7.61	0.022**
χ^2	74.09	-	-	-	-	-
Sig. Level	0.000*	-	-	-	-	-

, **, * Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

The crop diversity results at farm size categories of overall area delineates the similar trend like the fellow categories of irrigated perennial , irrigated non-perennial and rainfed areas under study. The whole results of the table regarding farm size categories are absolutely contrary to research hypothesis i.e. crop diversity is higher at small farms as compared to large farms. Moreover, the results of small, medium and large farm areas are significant at 1, 10 and 5 percent level in irrigated perennial, irrigated non-perennial and rainfed areas respectively. However, results of overall study locations are inline with expectations i.e. irrigated non-perennial area was found more crop divers as compared to others. Above all, the table illustrates that all of the crop diversity results are statistically significant which explain the real difference between the values of the results. Kruskal Wallis test is significant at 1 percent while comparing the results of irrigated perennial, irrigated non-perennial and rainfed areas.

6.4- Productivity Analysis in the Study Area

This section of the chapter critically analyzes and will describe the “total factor productivity” and “Partial Productivities” scenarios in the study area. Productivity examination on the basis of categorized small, medium and large farms would follow an overall assessment of the crop productivity in each study area. No doubt, land is a subject of primary importance in this study but irrigation on the basis of which three sub-study areas i.e. irrigated perennial, irrigated non-perennial and rainfed areas were distinguished from each other would also be explored for irrigation and labour productivities (i.e. partial productivities). This section, also, compares irrigation and labour productivities, not only, based on different study locations but it also undertakes investigation for small, medium and large farms in the study areas along with overall area.

6.4.1- Total Factor Productivity (TFP)

Many definitions of TFP exist but the very simple and common of them is ratio of outputs to aggregate of inputs. But in this ongoing work these ratios has been converted to percentages by multiplying them with 100 to avoid from complexity of very small figures. Table 6.3 renders the facts about “total factor productivity” in the study area. The table depicts that productivity in small, medium and large farms is different from each other exhibiting a decreasing trend from small to large farms except with the deviating tendency in rainfed medium farms with higher productivity than small farms but following the same trend with respect to large farms. The productivities were found 160, 149 and 138 at small, medium and large farms of irrigated perennial while it was observed 152, 149 and 126 percent in case of irrigated non-perennial area. As far as the rainfed area is concerned it was found that large farmers were least productive with 106 percent while 136 and 142 percent of total factor productivity was observed at small and medium farms in this area. Furthermore, small, medium and large farms of overall area secured the same decreasing trend like irrigated areas with 150, 148 and 131 percent, respectively. However, irrigated perennial, irrigated non-perennial and rainfed areas exhibited 160, 152 and 136 percent of productivity as a whole, respectively.

Table-6.3 Total Factor Productivity in the Study Area (Percent)

	Area Categories				Kruskal Wallis	
	Total	**Small**	**Medium**	**Large**	χ^2	**Sig. Level**
Overall Area	145	150	148	131	9.84	0.01**
Irrigated Perennial	150	160	149	138	5.31	0.07***
Irrigated Non-Perennial	142	152	149	126	8.89	0.01**
Rainfed Area	135	136	142	106	3.63	0.16
χ^2	6.45	-	-	-	-	-
Significance Level	0.04**	-	-	-	-	-

*, **, *** *Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

Total factor productivity was found 145 percent in overall study area. Irrigated perennial and irrigated non-perennial areas exhibited the similar trend in different farm size categories and medium sized farms of both locations showed the same percentages of outcome. While in rainfed area, large farms showed similar trend with minimum productivity while small farms were quite divergent from the fellow categories of irrigated areas.

The hypothesis formed for this category of results was, TFP is higher in the area with better land distribution as compared to other areas and TFP of small farms is higher than larger ones.
The results of comparative areas show that TFP was considerably higher in irrigated perennial area as compared to others which is a strong deviation from the set hypothesis i.e. TFP is higher in evenly land distributed area. Albeit, results did not comply with hypothesis but those were highly significant at 5 percent level. However, second part of the hypothesis i.e. TFP is higher at small farms as compared to larger ones was found predominantly true. Small farms of irrigated perennial and irrigated non-perennial areas were observed as more productive than medium and large farms with their significance levels at 10 and 5 percent, respectively. The results of the rainfed area turned down the research hypothesis with medium farms more productive as compared to others and those were insignificant, tested by Kruskal Wallis measure.

6.4.2 Partial Productivity

Partial productivity can be defined as ratio of output to ratio of some specific input, the productivity of which is to be determined. Following section presents the partial productivities of irrigation and labour costs which were reckoned to elaborate inter and intra study area differences.

6.4.2.1 Irrigation Productivity

It can be observed from table 6.4 that the farmers of irrigated perennial area used their irrigation most productively as compared to irrigated non-perennial and rainfed farmers, while rainfed farmers were found least productive. Comparison of small, medium and large farms is quite interesting on the basis of irrigation costs incurred in each area. As it is obvious from table 6.4, the assessment of small, medium and large farmers of irrigated perennial area delineated decreasing trend from small to large farms which is entirely different from irrigated non-perennial as well as rainfed area. Moreover, irrigation productivity trends at various farm size categories of irrigated non-perennial and rainfed areas are just like a replica of each other. Irrigation productivity in irrigated perennial area was highest (i.e. 1498 %) at small farms while large farms of this area with 649 % were found least productive. In case of irrigated non-perennial area, medium farmers were most productive (i.e. 660%) while small farmers were found least productive (i.e. 571 %). As far as the rainfed area is concerned, it was observed that small farmers were least productive like irrigated non-perennial area with 527 percent of irrigation productivity while medium farmers took a lead from all other categories with 686 percent. Moreover, various farm size categories of overall study area showed similar decreasing trend like irrigated perennial area from small to large farms.

Table 6.4- Irrigation productivity in the Study Area (Percent)

	Area Categories				**Kruskal Wallis**	
Study Areas	**Total**	**Small**	**Medium**	**Large**	χ^2	**Sig. Level**
Overall Area	822	995	735	645	1.208	0.55
Irrigated Perennial Area	1038	1498	798	649	7.687	0.021**
Irrigated Non-Perennial Area	633	571	660	644	3.495	0.17
Rainfed Area	568	527	686	611	5.409	0.07***
χ^2	21.611	-	-	-	-	-
Significance Level	0.000*	-	-	-	-	-

*, **, *** *Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

Table 6.4 reveals that the irrigation was best managed in overall irrigated perennial followed by irrigated non-perennial and rainfed area with 1038, 633 and 568 percent productivity, respectively. In summary, small farmers in irrigated perennial area and medium farmers in irrigated non-perennial and rainfed areas were most productive. Irrigation productivity was higher in irrigated perennial area as compared to irrigated non-perennial area while rainfed area was least productive as a whole.

The hypothesis formed on the basis of land distribution with respect to irrigation i.e. irrigation productivity is higher in evenly distributed farm areas has been proven wrong in case of this category of results. The results show that productivity is far higher in irrigated perennial area which is comparatively less evenly distributed than irrigated non-perennial area. Kruskal wallis test shows that though the hypothesis has been turned down but the results are highly significant at 1 percent level. The rest part of the hypothesis i.e. irrigation productivity is higher at small farms as compared to large farms has been, partly, proven true. Irrigation productivity of small farms of irrigated perennial area is so high that it changes the whole canvass of the results leaving all other areas behind. Nevertheless, irrigation productivity of small farms of irrigated perennial area was found inline with hypothesis at 5 percent significance level. Furthermore, results of the irrigated non-perennial and rainfed areas deviated a bit from the hypothesis with maximum irrigation productivity at medium farms category. The Kruskal Wallis significance level was found at 10 percent in case of rainfed area while results of irrigation productivity regarding farm categories of irrigated non-perennial area was observed as insignificant.

6.4.2.2 Labour Productivity

Labour is one of the most important factors of crop production. The current part of this section provides a view of labour productivity by comparing irrigated and rainfed areas including their small, medium and large farmers. Table 6.5 witnesses that labour productivity in irrigated non-perennial area is higher (598 %) than irrigated perennial (579%) and rainfed areas (496 %) under study. Table 6.5 displays the rhythmic increasing relationship of labour productivity amongst small, medium and large farms in irrigated areas under study. These results move like a straight upward trajectory from small to larger farms of each irrigated area. The labour productivity at small, medium and large farms was found 547, 549 and 666 percent in irrigated perennial and 553, 597 and 630 percent in irrigated non-perennial areas, respectively. As far as the rainfed area is concerned inverse trend from irrigated areas was observed. Labour productivities of small, medium and large farms of rainfed area were observed 511, 482 and 394 percent, respectively. As far the small, medium and large farms of the overall area are concerned, it was found that they followed the example set by irrigated areas with 535, 556 and 633 percent labour productivity at small, medium and large farms, respectively.

Table 6.5- Labour productivity in the Study Area (%)

Study Areas	Area Categories				Kruskal Wallis	
	Total	Small	Medium	Large	χ^2	Sig. Level
Overall Area	566	535	556	633	24.11	0.000*
Irrigated Perennial Area	579	547	549	666	14.71	0.000*
Irrigated Non-Perennial Area	598	553	597	630	5.15	0.08***
Rainfed Area	496	511	482	394	0.78	0.68
χ^2	22.16					
Sig. Level	0.000*					

*, **, *** *Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

It is concluded that irrigated non-perennial area is the most labour productive in comparison with irrigated perennial and rainfed areas. The small farms were observed least productive in irrigated areas accompanying large farms of rainfed area.

The results of farm size categories of overall, irrigated perennial and irrigated non-perennial areas are in line with the hypothesis that large farms are more labour productive than smaller ones. These results were also tested with Kruskal Wallis measure to gauge difference amongst them. It was quantified that overall and irrigated perennial areas were highly significant at 1 percent while irrigated non-perennial area was found significant at 10 percent. As far as the farm size categories of rainfed area are concerned, it deviated from the hypothesis and was also not significant. The results of overall irrigated perennial, irrigated non-perennial and rainfed locations for labour productivity on the basis of land distribution are in line with hypothesis i.e. labour productivity is higher in irrigated non-perennial area with even land distribution than other comparative areas. Furthermore, it is highly significant at 1 percent level.

6.4.3- Gross Margins in the Study Area

Profits obtained by subtracting variable costs of all of the factors of production from the gross output value of the grown crops per hectare are designated as gross margins per hectare. Table 6.6 depicts the scenario of gross margins variability of different farming systems under study. It is illustrated in the table that amongst the three farming systems gross margins per hectare were highest in irrigated non-perennial area while farmers of rainfed area had minimum profits. Comparison of small, medium and large farms of the each farming system highlighted the fact that small farmers were the most efficient with highest margins in all of the study areas followed by medium and large farms. It is quite pinching to realize that large farmers of the rainfed area went into loss. In case of overall study area, gross margins at medium farms were highest as compared to others while small farms had higher margins than larger ones. It is noteworthy that the difference between small and medium farms of overall study area is quite minor.

It was found that farmers of the irrigated non-perennial area were most profitable and small farmers of all of the study locations had higher gross margins than medium and large farmers. Hypothesis of greater profitability with even land distribution study location has been proven true statistically. Kruskal Wallis, statistical analysis with a high significance level (i.e. at 1 percent) proves that there is a clear difference between the results of irrigated perennial, irrigated non-perennial and rainfed areas. Furthermore, the results exhibited by the table are inline with hypothesis that small farmers are more profitable than large farmers in all of the farming systems. However, the table corroborates that the difference exhibited by Kruskal Wallis test is also significant for various farm size categories in all of the study locations. Nevertheless, gross margins of different farm size categories of irrigated perennial, irrigated non-perennial and rainfed areas are significant at 10, 5 and 5 percent, respectively.

Table 6.6- Gross Margins in the Study Areas (Rupees)

Gross Expenditures /Hectare	**Areas**	**Total**	**Small**	**Medium**	**Large**		
	Overall	24309	21768	23940	29130		
	Irrigated P	23337	21640	22377	27148		
	Irrigated N P	30848	30075	29582	32829		
	Rainfed	18099	18230	16030	22800		
Gross Returns /Hectare	Overall	33100	31900	34107	33805		
	Irrigated P	32126	32672	31376	32260		
	Irrigated NP	41822	45081	43027	38194		
	Rainfed	24076	25008	22531	19837	**Kruskal Wallis**	
						χ^2	**Sig.Level**
Gross Margins /Hectare	Overall	8792	10132	10167	4675	8.22	.02**
	Irrigated P	8788	11033	8999	5112	6.15	0.05***
	Irrigated NP	10974	15007	13445	5365	8.31	0.02**
	Rainfed	5977	6778	6501	-2963	8.35	0.01**
	χ^2	22.220					
	Sig. Level	0.000*					

Note: Gross expenditure is the sum of costs/hectare .i.e. seed, labour, irrigation, fertilizer, manure, chemicals, and mechanization (machinery costs rented in for cultivation)

Gross Returns= gross value of grown crops per hectare

Gross Margins= gross returns - gross expenditure

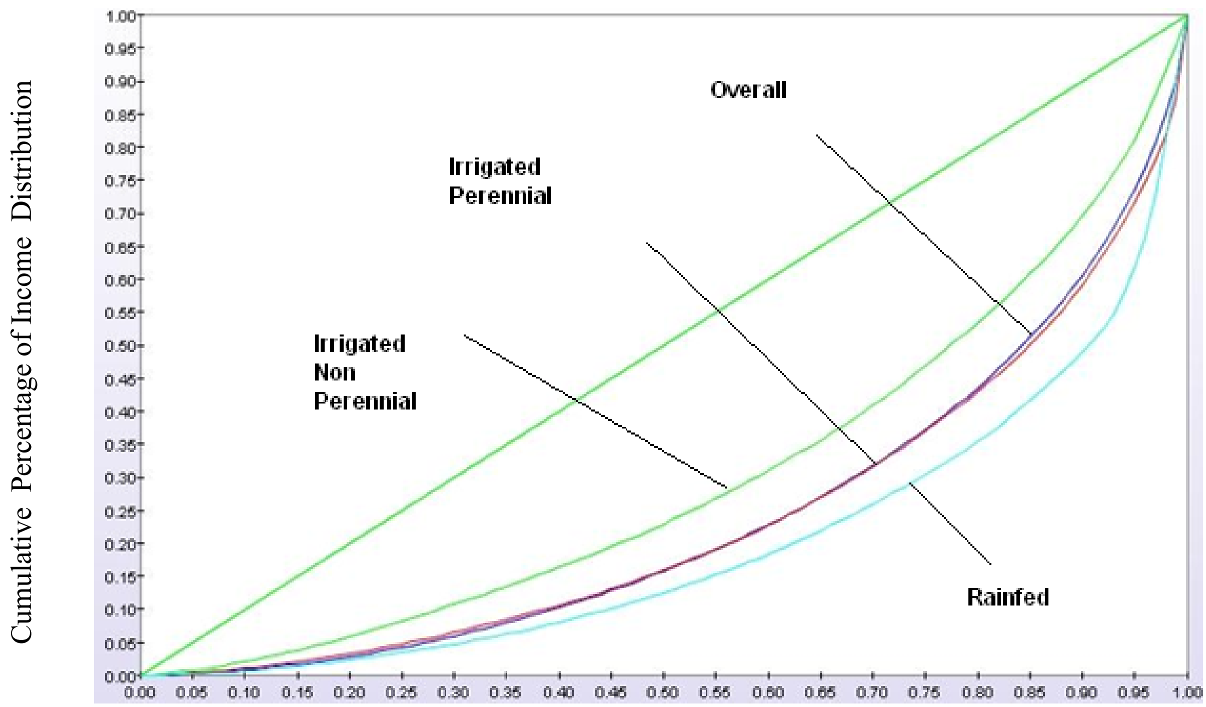
, **, * Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

6.5- Wealth Distribution

This section of the chapter illuminates the level of income distribution disparities and percentage share of farm and non-farm incomes in the study area. Income distribution disparities amongst the farm households were quantified and their relationship with land distribution was observed in each study location. While share of farm and non-farm incomes were also gauged in all of the farm size categories i.e. small, medium and large farms along with overall study locations.

6.5.1- Income Distribution in the Study Area

Income distribution was quantified in a similar manner like land distribution with the help of Lorenz curves as well as Gini coefficients in the study area. It is quite interesting to know that income distribution in various study location is following the trend of land distribution explained in the previous sections (i.e. 6.2.2 and 6.2.3) of the chapter. Figure 6.8 shows that Lorenz curve of irrigated non-perennial area is closest to 45 degree line of Lorenz graph which represents minimum income distribution disparity as compare to other areas.



Cumulative Percentage of Households

Figure- 6.8 Lorenz Curves for Income distribution in the study area

However, Lorenz curve of rainfed area is showing maximum income distribution disparity while irrigated perennial area lies in between both of them. It is obvious from the figure that Lorenz curves of irrigated perennial and overall study area are overlapping each other due to very minute income distribution difference between them.

Gini coefficients for income distribution were also gauged in each study location with the help of "DAD" computer package to confirm the results of Lorenz curves. Table 6.7 delineates the level of income distribution disparity exhibiting concerned values of Gini coefficient of each study location.

Table- 6.7 Income Distribution: Gini Coefficients of various Study Locations

Study Locations	Gini Coefficients
Overall	0.52
Irrigated Perennial	0.53
Irrigated Non-Perennial	0.40
Rainfed	0.60

The table illustrates that income distribution amongst the farming community of irrigated non-perennial area (i.e. 0.40) is more egalitarian than other study areas while income distribution in rain-fed area (i.e. 0.60) is more skewed than both irrigated areas. As far as Gini coefficient (i.e. 0.53) of irrigated perennial area is concerned, it is evident from the table that it is higher than irrigated non-perennial and less than rainfed area. Both figure (6.8) and table(6.7) constructed for the sake of better and quick understanding of income distribution disparities show that overall study area is slightly different i.e. only one percent less than irrigated perennial area. An extremely interesting fact was revealed from the results of income distribution disparities of various study location that income distribution follow similar trends like land distribution disparities in various study areas. These results are inline with research hypothesis proving that area with least skewed land distribution has more egalitarian income distribution than other areas and vice versa.

6.5.2- Farm and Off Farm Income in the Study Area

As, land is a symbol of prestige and a major support to livelihoods in rural areas. Consequently, people wish to stick with it for the sake of pride, food production and income. This section gives a view about farm and non-farm income in the study area. Table 6.8 depicts the facts that households belonging to irrigated non-perennial area earned maximum farm income which was 89 percent of the total income. As far as the non farm income is concerned, it can be seen from the table that rain-fed area took the lead with 33 percent of non-farm income from both irrigated areas under study. Moreover, irrigated perennial area secured always second place, in both categories of income, 82 percent farm income and 18 percent non-farm income, respectively. The comparison of small, medium and large farms interprets that farm income was always higher than non-farm income in all of the categories described in the table. Moreover, table 6.8 reveals that non-farm income of the small farmers was higher than the medium and large farms while large farmers earned non-farm income always more than medium farmers but less than small farmers in the irrigated perennial, Irrigate Non Perennial and rainfed areas, respectively. By comparing small farmer's income of each area it was discovered that rainfed farmers earned 37, irrigated perennial 22 and irrigated non-perennial 15 Percent of off farm income. While the trend was similar in medium and large farms with lead of rainfed, and then irrigated perennial and irrigated non-perennial area with the lowest non-farm income. Taking the view of farm income, it is obvious from the table that small, medium and large farmers took the vice versa position with respect to non farm incomes in those areas.

Table 6.8- Off and On farm Income Share of the Households in the Study Area (Percent)

	Area Categories									
Study Location	**Total**		**Small**		**Medium**		**Large**		**Kruskal Wallis**	
	Off Farm	**Farm**	**Off Farm**	**Farm**	**Off Farm**	**Farm**	**Off Farm**	**Farm**	χ^2	**Sig. Level**
Overall	19	81	26	74	14	86	15	85	24.17	0.000*
Irrigated P	18	82	22	78	15	85	17	83	2.44	0.030**
Irrigated N P	11	89	15	85	8	92	11	89	3.25	0.197
Rainfed	33	67	37	63	22	78	32	68	5.94	0.051***
χ^2	40.44	-	-	-	-	-	-	-	-	-
Sig. Level	0.000*	-	-	-	-	-	-	-	-	-

Farm Income = Crop income, livestock sale and livestock product, rent out machinery and livestock income

Off farm Income = Salaries, foreign and local remittances, enterprise income, artisan income, daily labour income etc

, **, * Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

Statistical results of Kruskal Wallis test confirm the hypothesis that farm income is higher with even land distribution study location than others. As far as statistical distinction of the results is concerned it is evident from the table that results regarding the various study locations are highly significant at 1 percent level. The rest part of the hypothesis i.e. share of farm income is higher at small farms as compared to others could not be accepted due to the leading share of medium farms. Furthermore, the results of farm size categories of irrigated perennial and rainfed areas are significant at 5 and 10 percent level.

Nevertheless, table 6.8 results can be summarized as follows: farmers of irrigated non-perennial area earned a minimum of off-farm income and maximum of farm income. Moreover, irrigated perennial area was found on second and rainfed area on third in a vice versa position in case of on farm and off farm incomes in the study area.

6.5.3- Credit Availability in the Study Areas

The availability of modest financial resources plays a vital role in the progressive agriculture production. An analytical view of credit availability to the farmers revealed that there was quite a different attitude of the varying sized farmers in the study area. It was also interesting to know that the contradiction regarding credit availability existed not, just, only in different farm size categories but was, also, observed in irrigated perennial, irrigated non-perennial and rainfed areas, respectively.

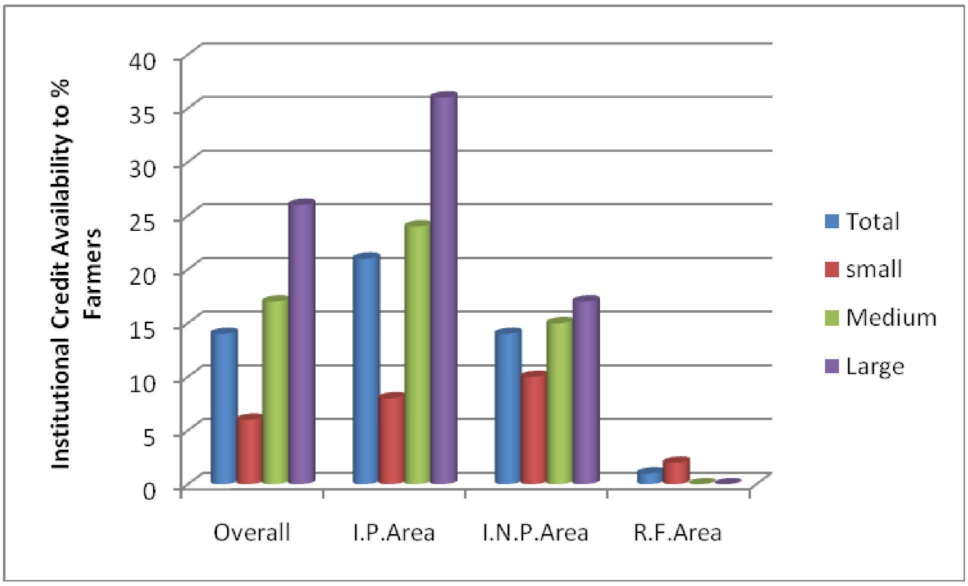


Figure 6.9- Institutional Credit Availability to the Farmers in study Area (Percent)

Institutional Credit = Credit borrowed from banks and cooperatives

Non-Institutional Credit = Credit borrowed from friends, relatives, non-relatives, traders and dealers, etc.

Figure 6.9 expresses that irrigated perennial and irrigated non-perennial areas followed the similar increasing trends in the small, medium and large farms towards the intuitional credit availability. The figure also reveals that only 8, 24 and 36 percent small, medium and large farmers of the irrigated perennial area while 10, 15 and 17 percent farmers of same farm size categories of irrigated non-perennial area gained institutional credit, respectively. As far as the rainfed area is concerned, it is noteworthy that medium and large farmers did not take institutional credit while the rate of credit availability for small farmers was only 2 percent which was low as compared to other areas under study. Furthermore, 21, 14 and 1 percent farmers belonging to irrigated perennial, irrigated non-perennial and rainfed locations had access to institutional credit as a whole while 14 percent farmers obtained this kind of credit in the overall study area. There were considerable numbers of households who took both kinds of credits i.e. institutional as well as non-institutional credit. For details, regarding total, institutional and non institutional credit availability see appendix 6.1 and 6.1 A.

It can be concluded that large farmers were entertained with more institutional financial resources while small farmers were least accommodated within irrigated areas. However, higher percentage of large farmers' attained institutional credit within irrigated areas which is exactly inline with research hypothesis of the study which was formed based on the theory. While farm size categories of rainfed area showed deviation from hypothesis. Moreover, higher percentage of irrigated perennial farmers took more institutional credit as compared to other study areas. The results regarding institutional credit availability for overall study locations deviated from the research hypothesis i.e. farmers of even land distribution take more institutional credit as compare to other areas.

6.6- Evidence of Inverse Relationship: Productivity and Factors of Production

This section helps to expose the kind of relationship whether it was direct or inverse, between the output per hectare and various factors of production used to till the land in study area. Particular attention was given to the explanatory factors which directly affect the crop productivity per hectare to attain the maximum rationale results and, consequently, can also foster to give workable policy recommendations in the end of the study. Table 6.9 presents the outcome of Cobb-Douglas production function (i.e. log-log function) which was utilized for the sake of data analysis. The results quoted in table 6.9 verified the negative relationship between operational holdings and output per hectare by a negative sign in all of the areas along with overall area under study. Surprisingly, credit availability per hectare had a similar inverse relationship with output per hectare in all of the areas. As far as the age of the households head is concerned, it is illustrated by table 6.9, productivity per hectare was found directly proportional to the increasing years of households head life span in irrigated non-perennial area while it was inversely proportional in the irrigated perennial, rainfed as well as Overall study area. It is evident from the table, contrary to the age of household head, the family size or number of household members took on different trends towards crop productivity per hectare. The rise in number of family members also enhanced productivity in positive direction in irrigated perennial and rainfed area while in irrigated non-perennial area ascending family size set the productivity towards diminishing trend. Nevertheless, crop productivity increased with increase in the rest of the factors of production including, labour, irrigation, intermediate inputs, education of the household head, percentage of family workers in agriculture sector and own tubewell in all of the areas under study. It is illustrated in the table that labour (man-days) and intermediate inputs had the strongest productivity raising impact in all of the areas while some factors of production had mixed coincidence of strong and weaker relationship with productivity in various areas under study. It was an astonishing revelation that non-farm income and tractor ownership made no differences in the productivity per hectare in irrigated perennial area.

Table 6.9 says that there are only two explanatory variables (i.e. labour investment and intermediate inputs) which are not only significant but also highly significant with maximum effect on productivity in all of the areas. Though operational holding is showing inverse relationship but this relationship is significantly weaker in each study area. The elasticities were not so vibrant and can reduce productivity at the level of 0.05, 0.07 and 0.07 percent with 1 percent increase in operational holding in command in irrigated perennial, irrigated non-perennial and rainfed areas respectively. The credit

Table-6.9 Regression Results with Dependent Variable Yield per Hectare (Rupees)

	Overall Area	I.P.Area	I.N.P.Area	R.F.Area
F	105.98	49.48	16.5	17.25
Constant	3.90*	4.53*	4.24*	3.08*
Opholding	-0.06**	-0.05****	-0.07****	-0.07
Labour	0.46*	0.46*	0.33*	0.41*
Irrigation	0.08*	0.03	0.24*	0.06**
Int.input	0.38*	0.37*	0.25*	0.48*
Credit/H	-0.01**	-0.01****	-0.01	-0.02****
F.size	0.05	0.08****	-0.03	0.05
Agehead	-0.02	-0.08***	0.04***	-0.04
Eduhead	0.01	0.01	0.04***	0.02
%FW	0.11**	0.10***	0.04	0.18
NFI	0	0	0.01***	0.01
Downtractor	0.05	0	0.10***	0.03
Downtubewell	0.10***	0.08****	0.06	0.11
R2	0.76	0.75	0.65	0.72
N	424	213	119	92

Opholding = ln operational holding in hectares, labour= ln labour man days/hectare, irrigation cost / hectare, int.inputs= ln intermediate inputs (including seed, fertilizer, chemicals, manure and mechanization cost/ hectare), credit= ln credit obtained/ hectare, F.size= ln family size, Agehead = ln age of household head, Eduhead= ln education of household head, %FW = ln % family worker

in agriculture production, NFI= ln non-farm income of households, Downtractor= ln dummay variable own tractor, Downtubewell = ln dummay variable own tubewell.

, **, * Indicates significance at 1 %, 5 % and 10 % probability level, respectively.*

availability per hectare also reduces productivity with the rate of 0.01, 0.01 and 0.02 percent with 1 percent increase in it in irrigated perennial, irrigated non-perennial and rainfed areas. As far as the labour and irrigation is concerned , it was found that 1 percent addition in labour man days increase 0.46, 0.33 and 0.41 percent while 1 percent enhancement in irrigation cost per hectare augment 0.03, 0.24 and 0.06 percent in productivity per hectare in irrigated perennial, irrigated non-perennial and rainfed area , respectively. The 1 percent addition in intermediate inputs enhance productivity with the rate of 0.37, 0.25, and 0.48 percent, and own tubewell helped to rise 0.08, 0.06 and 0.11 percent of productivity in irrigated perennial and irrigated non-perennial and rainfed area, respectively.

The results of the different farming systems showed that inverse relationship between irrigation productivity and operational holding do exist in all of the areas which is also online with hypothesis of the study that inverse relationship exists between farm size and productivity in all study locations. Interestingly, IR exists in all of the study locations regardless of irrigation infrastructure, water availability and land distribution disparities scenario of the study area. Furthermore, results of IR are significant at 10 percent in overall study area while those are significant at 20 percent in both irrigated areas and insignificant in rainfed area. Irrigated perennial and irrigated non-perennial area contained 8 variables with significant results each, while rainfed area had few variables with significant results i.e. only 4. As far as the overall area is concerned, 7 variables were found with significant results in it.

The significance level limit of regression results has been set at 20 percent which might be unusual but this notion has been scrounged from a famous inverse relationship study (i.e. Cornia 1985).

The chapter briefs that the results of land distribution disparity delineated strong skewedness in ownership holdings while operational holdings were found, comparatively, better distributed. Furthermore, operational holdings were observed as least skewed in irrigated non-perennial area followed by irrigated perennial and rainfed study locations. The results of income distribution in the study area revealed that it followed the similar trends with minimum income distribution disparities in irrigated non-perennial area while rainfed area was found most skewed. It is quite interesting to know that most of the results of the study were akin to ranking of land distribution disparities in various study locations. Various indicators of the study showed mixed results supporting small and large farms but those were more inclined towards small farms. It is noteworthy that most of the research hypotheses were found true whether those were formed in favour of small and large farms depending on kind of indicators. Moreover, it was observed that inverse relation between farm size and productivity existed in all of the study locations including overall study area. But the presence of IR was found as weak with small coefficients of operational holdings.

CHAPTER-7

DISCUSSION

The results of the study presented in chapter 6 are being discussed in this chapter. The findings of the study are supported by the previous literature. The difference to observe same or similar aspects of this subject are also dealt with. A lot of dimensions have been thrashed, and it is hoped that some of them are new. But also some of older ideas with innovative factors are incorporated. The discussion mainly concentrates upon the land distribution and productivity analysis in three different farming systems i.e. irrigated perennial, irrigated non-perennial and rainfed areas. The results would be discussed on the basis of land distribution disparities in three study locations while the discussion will also focus on farm size categories (i.e. small and large farms). The chapter has been organized in a format i.e. a) inverse relationship restated b) land distribution c) land distribution, input levels and yields d) land distribution and factor productivity e) land distribution, cropping intensity and diversity f) small versus large farms and at the end of the chapter g) inverse relationship is concluded.

7.1- Inverse Relationship Restated

Small farms are more productive than larger ones is designated as inverse relationship. It is very famous and perhaps most debated issue in the field of agriculture production economics since last many decades. Though a lot of economist has proved its validity but this idea was turned down by a lot of its opponents keeping it still unresolved leaving the potential for further investigation. In the early 20th century a Russian economist (Chayanov 1926) was the first one who hypothesized the idea of productivity dominance of small farms over the larger ones with the better endowments of the family labour force. Unfortunately, he was mistreated by the Russian socialists with the fear of hurting socialism. Although his book was translated into English in 1966 but in the modern literature an Indian development economist Sen (1962, 1966) is considered as a founder of this idea on the basis of his publication on this issue. It might be expressed as renaissance of an ideology. It has been a hot debate for development economists and sociologists for decades with many new interventions of its research and study aspects and discoveries in analytical tools to arrive at some common conclusion but in vain. After five decades, it is still a very significant part of development economics research. It is worth mentioning that redistributive land reform is one of its very strong implications which paved the way for redistribution of lands by grabbing agricultural lands from big landed elites and bestowing it to smaller peasants in many countries of the world. The burgeoning population of the earth and increasing food demands in the world has once again diverted the attention of the researcher and policy makers towards this issue which results in brain storming of many reputed institutions of USA, UK, Germany and many others. This study is also such a kind of an endeavor to observe productivity differentials on various farm sizes and to give policy recommendation for the policy makers to act accordingly to produce more food for humanity. In addition, various locations were studied on the basis of their land distribution disparities employing various indicators to observe the differences. These both approaches of study i.e. land distribution disparity and farm size patterns ultimately lead to similar kinds of policy recommendations.

7.2- Land Distribution

Mal-distribution of land and its ill impacts has been presented regarding Pakistan in chapter 1 and in detail in chapter 4 in the light of previous literature including local, country and cross country studies carried out indigenously or funded by international organizations like World Bank, International Monetary Fund (IMF) and International Food Policy Research Institute (IFPRI). Furthermore, positive impacts of even land distribution have been referred to in the same chapter in the form of rapid economic growth as well as human development in different countries. Figure 7.1 illustrates the ailing and healthy impacts of uneven and even land distribution, respectively, on the basis of previous research as well as undergoing study.

Land distribution being a prime object of the study was gauged by more than one measure (i.e. quintiles, Lorenz curve and Gini coefficient) to avoid any kind of bias in the study but results were quite similar. To ignore tedious details, just two measures has been discussed here i.e. land distribution by quintile and Gini coefficient. It is worth mentioning here that land distribution disparities were observed on the basis of two core criteria i.e. ownership holding as well as operational holdings and it would be quite favourable to demonstrate that the whole study was focused upon operational holdings in spite of ownership holdings in the study area. It is noteworthy that the study area was comprised of overall small holdings or it could be referred to as marginal farmers. According to the descriptive statistics average land holdings in each area either ownership or operational holding was not found more than four hectares and it was less than 3 hectares in the overall study area. As far as per capita land ownership is concerned, it was found to be less than 0.5 hectares per person in each area including overall area under study. Furthermore, the trend is similar regarding per capita operational holdings.

The results of quintile show that the 20 percent farmers of lowest quintile own only 2, 4 and 2 percent of total area in irrigated perennial, irrigated non-perennial and rainfed area, respectively. Furthermore, 20 percent farmers of second quintiles own 6, 9 and 8 percent of total area while farmers of third and fourth quintiles own 12, 15 and 14, and 20, 24 and 24 percent of total area, respectively. While 60, 48 and 52 percent of total area was owned by top 20 percent of the farmers in irrigated perennial, irrigated non-perennial and rainfed area. The quintile based analysis of the land distribution exclaims that land distribution is not evenly distributed in the study area and a wide gap between the percentage area owned by top and lowest quintiles explores the land distribution disparities in the study area.

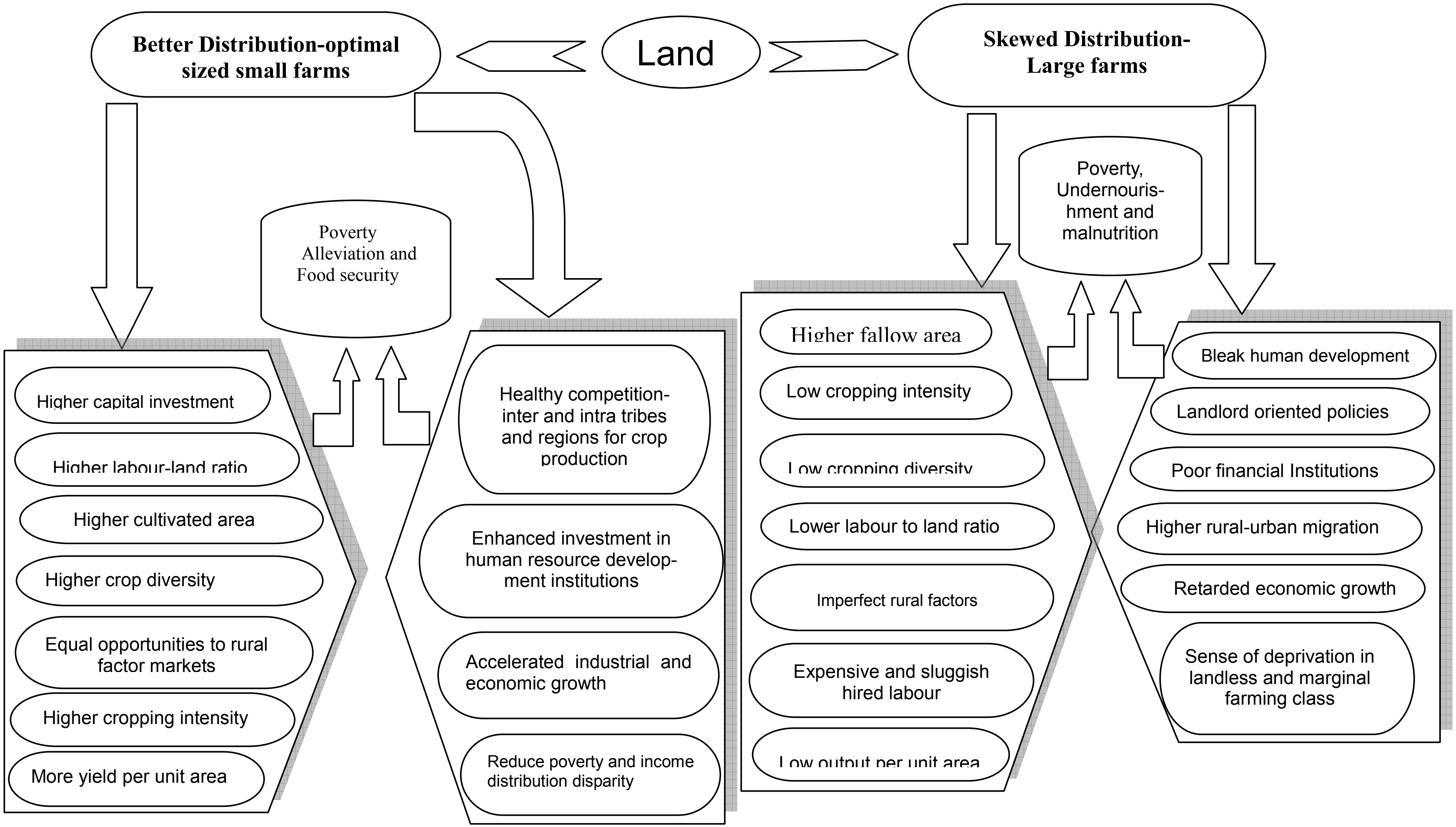


Figure- 7.1 Advantages of Even and Disadvantages of Skewed Land Distribution **Source: by Author**

As far as the operational land holding is concerned, the results exhibited similar trends through quintile analysis but a bit better than ownership holdings in each area under study. Nevertheless, this simple arithmetic was needed to be confirmed with some scientific measure. So, World Bank recommended "Gini coefficient" accompanied by some others to know the exact level of land distribution disparities in the study area. The results obtained for ownership holdings were categorized in an ascending order of land distribution disparities in various areas i.e. least skewed irrigated non-perennial (0.43), then rainfed (0.50) and irrigated perennial area was found (0.54) with most distorted land distribution. The pattern of operational holdings considering the same order with respect to Gini coefficient were found as, irrigated non-perennial area (0.34), irrigated perennial area (0.44) and rainfed area (0.48). The difference between the Gini of ownership and operational holdings explains existence of land rental markets in both irrigated areas. It is noteworthy that the area with comparatively even ownership holdings (i.e. irrigated non-perennial area) has better land rental markets which made its operational holdings relatively equal as compared to rest of the study locations. The most skewed ownership holdings in irrigated perennial area might be a cause of land market imperfections but it is compensated perhaps with year round water availability in this area. But it is a matter of further investigation to get acquaintance with this fact. Moreover, due to unavailability of irrigation infrastructure and skewed land distribution severely hampers land rental markets in rainfed area. The variations in ownership and operational holdings Gini is very small i.e. 0.02 in this area. The differences between ownership and operational holdings can easily be understood by visualizing Lorenz curves of each study location in chapter 6. During land distribution disparity analysis very few cases of large holdings were omitted from the analysis to draw a real picture of the results. The chapters of the study incorporated as preamble site that land distribution in the country is more skewed as compared to the area under study. Neither land reform efforts nor green revolution could rectify this phenomenon in Pakistan. A bulk of literature concerning farm size studies ignored ownership holdings and had concentrated upon operational holdings to examine the relationship of farm size and productivity e.g. Berry and Cline (1979), Dyer (1997), Cornia (1985), Bhalla (1979) Thapa (2007) Unal (2008) etc.

Uneven land distribution, in Pakistan, like most of the developing countries is a direct consequence of imperialism and colonialism. A lot has been written on the significance of land but skewed land distribution is really a blight which not only impedes the overall agriculture productivity (Vollrath 2006) but it also curtails the mental maturity, human resource development and, above all, tarnishes self esteem of the small peasants. Skewed land distribution, marginal farming and landless agriculture is a cause of poverty and food insecurity in Pakistan (Anwar *et al.* 2004). A number of land reforms attempts were undertaken in 1959, 1972 and 1977 but desired results could not be achieved due to lacunae in promulgations as well as in implementation processes. The depth of the issue is so grave that many nations of the globe had to initiate different kinds of land reforms in order to get rid of big estates which worked as an impetus in their development e.g. Japan, South Korea, Taiwan, and China. Now a day, Vietnam is tracking the same path. As the whole study has been founded on land distribution, so, it was felt mandatory to discuss foremost land distributional matters in the study area. Furthermore, it is illustrated that the current land distribution disparity is in accordance with many previous studies which include Mahmood (2000), Sain (1974), Salman and Moinuddin (1980), Rehman (1986), Nazir (1999), and Eastwood *et al.* (2004). They all and many others observed mal-distribution of land in their studies.

7.3- Land distribution, Input Levels and Yield

A great deal of studies followed the appraisal of investment costs linking up yields per unit area by standardizing various farm sizes but non of them (as far as I know) pursued on the basis of actual existence of land distribution except Vollrath (2006) who worked on macro data in a cross country study. Most studies are based on macro data while a substantial amount of them are also available on micro level data, too. But none of the researcher recorded the differentiation of the areas like in this study except Heltberg (1998) worked on two distinguished locations i.e. irrigated and rainfed area in Pakistan.

The results under discussion in this section of the chapter have been elucidated in chapter six. It has been exposed that land distribution was least skewed in irrigated non-perennial area and rainfed area contained most distorted and irrigated perennial areas was in between both of them. A certain relationship of labour (in man days), irrigation and intermediate inputs (i.e. seed, fertilizer, chemical & manure, mechanization) costs with yield per hectare was found in each area. It was assessed that a very strong positive relationship existed between overall costs of production, better land distribution and outcomes which might be a great stimulus for the farmers to invest more in an environment of pure competition. It is very interesting to mention here, regardless of materials as well as human beings, every factor was intensively cast to achieve higher yield per hectare. Therefore, it achieved more revenue according to the land distribution level which has always been the objective of any entrepreneur. It can better and simply be explained by quoting that better distribution of land would enhance the investment capacity and inspire motivation in the farmers to grow more and produce in bulk. It helps change imperfect factors market towards pure competition. Irrigated non-perennial area, being evenly distributed than other areas, was most intensively ploughed with more labour man days not only with overall but with family as well as hired persons than both other areas. Furthermore, all of the factors of productions were found more intensively utilized in irrigated non-perennial area while least investment had been found in rainfed area. As far as the **yield per hectare** is concerned, once again irrigated non-perennial area was found more productive than any other region under study. While irrigated perennial area was found in between both other areas according to its land distribution status. Furthermore, bigger **gross margins** were also achieved by the cultivators of irrigated non-perennial area and the similar trends had been observed from rest of the areas under study i.e. irrigated perennial area on second while rainfed area was found on lowest level with respect to gross margins of the field crops.

Investment on factors of production and the consequent yield per hectare exhibit some certain implications in the presence of land distribution level in each area which would be elaborated in conclusions and recommendation part of the study. However, the hypothesis of factors market imperfection can be better understood and might be confirmed in the outcome of present results and discussion in this section of the chapter. In addition, even land distribution may provide an opportunity to get rid of monopoly or oligopoly and to create the environment of pure competition in the local factor markets. The aforementioned results and discussions come closer to the, already, work done by Heltberg (1998, 1996), Unal (2008) Cornia (1985) and Vollrath (2006).

7.4- Land Distribution and Factor Productivity

The results regarding crop productivity, and labour and irrigation productivities were determined as total factor productivity and partial factor productivities in various areas, has been discussed here in the light of land distribution levels. It could be interesting to integrate farm size categories together with productivities but it was avoided due to the overlapping hazards of so many things together which might create ambiguity for the reader. Nevertheless, the facts regarding various farm sizes categories will be discussed in a separate section as it is one of the most significant aspects of this study.

The aforementioned indicators i.e. yields, gross margins etc per hectare reveal the superiority of irrigated non-perennial area, conceivably, on the basis of better land distribution over both other areas. Productivity facts showed little deviation from the preceding results. Though, the difference is quite petty but it can not be ignored rather to put forth some strong rationale. The total factor productivity puts output in monetary terms against costs of all of the factors of productions which include labour and irrigation costs as well. Total factor productivity in irrigated non-perennial area is lower than irrigated perennial area but higher than rainfed area. In the irrigated non-perennial area with the input of 1 rupee farmers attained 1.42 rupees in return while with the same level of inputs in irrigated perennial area and rainfed area 1.50 and 1.35 rupees were earned. The difference is due to the decisive role of irrigation expenditures. The upcoming section (i.e. 7.6) will reveal the very fact of this difference of total factor and irrigation productivities between irrigated non-perennial area and irrigated perennial area. As the irrigated non-perennial farmers had to spend for full six months on tubewell irrigation while in irrigated perennial area canal irrigation was enjoyed for the whole year and occasional deficiencies were overcome by the conjunctive use of tubewells. Furthermore the rainfed farmers had to either rely upon tubewells or rain. Unfortunately, 2001 and 2002 were extreme drought years and rainfed farmers had to rely more and more on pumped irrigation. Partial productivities of irrigation and labour revealed different trends. Irrigation followed the same trend like the total factor productivity while labour productivity was highest in irrigated non-perennial and least in rainfed area. Albeit, there is no alternative of cheap irrigation but wise use and management of labour helped to diminish the total factor productivity gap between irrigated perennial and non-perennial areas.

It is believed that the total factor and irrigation productivity differentials in the two irrigated areas were due to the varying irrigation costs whereas those differences had been minimized due to better land distribution in irrigated non-perennial area along with other supporting factors of production. It is concluded that ceteris paribus, level of land distribution along with prudent labour use would play decisive role in productivity enhancing mechanism.

7.5- Land Distribution, Cropping Intensity and Crop Diversity

The results regarding cropping intensities and cropping diversity of the farmers were elaborated in chapter-6. These two measures discussed here keeping the distinction of each area in mind along with their land distribution. It was found, once again like previous results, apart from total factor productivity and irrigation productivity, irrigated non-perennial area asserted maximum cropping intensity as compared to other areas under study. While irrigated perennial area stood second and rainfed area like always acquired last position. These results (regarding cropping Intensities) were found in accordance with their level of land distribution as the distribution gets nearer equality which means a lower Gini coefficient. Nevertheless, it can be explained more precisely by expressing it in terms of direct (∞) relationship between land distribution and cropping intensity which implies that better land distribution connotes higher cropping Intensity, more revenue, more food security and less poverty in the concerned areas. Crop diversity of the farmers in different areas was observed and its results were also delineated in chapter 6. Crop diversity followed the similar trends like many other indicators of the study i.e. cropping intensity, gross margins, input costs, yield per hectare etc. Crop diversity was higher in irrigated non-perennial area which had better land distribution as compared to other areas under study.

The results of the aforementioned three farming systems distinguished in the context of irrigation infrastructure and seasonal as well as permanent availability of water for crop production were discussed in detail to understand the differences. It was inferred that, though, irrigation plays a vital role in agriculture production and crop productivity per unit area but even land distribution is also important which affects each and every measure in the favour of land tillers. No doubt, irrigation plays a crucial role in agriculture production but even land distribution can also help to get rid of hunger, mal-nutrition and food insecurity from the earth. Moreover, successful land distribution efforts can augment the tilling intensity of the peasants and ending absentee landlordism which will increase land use intensity, cropping intensity and better per unit output of land area. That is why it can be implicated that land reforms must be promulgated and implemented with full political will which could establish egalitarian rural society but those land reforms should not be used to victimize political rivals as was done during 1970s in Pakistan (Jalal 1995).

Figure 7.2 summaries the results discussed in the former part of the chapter. It is to help to better grasp the trickle down effects of the land distribution regarding input and outcome measures presented in the study.

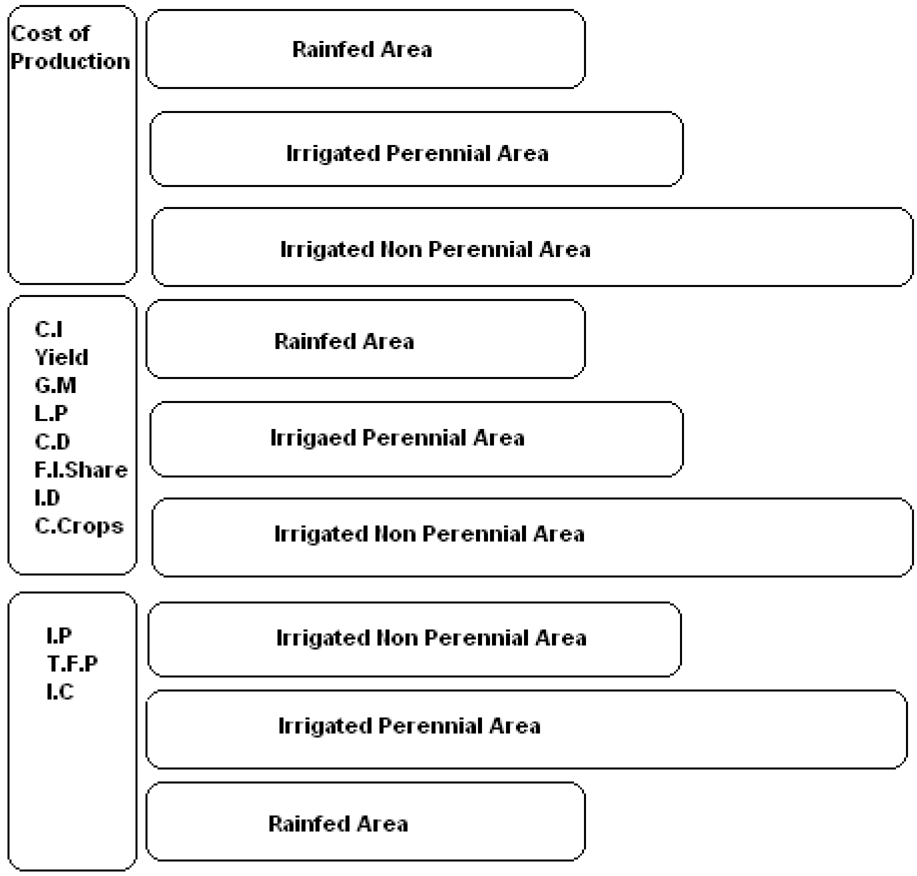


Figure-7.2 Ranking of Investment and Outcomes as a Consequent Land Distribution

Note: *The shortest bar expresses the lowest and minimum while the longest delineates better and largest.*

7.6- Small versus Large Farms

Two different approaches were adopted to observe the farm size productivity differentials. One of them was a simple mathematical measure just like a cost benefit ratio, while to examine the trends a pure econometric approach was rendered by using Statistical Package for Social Scientists (SPSS) which will be discussed in next section of the chapter.

Following part of this section would express the differences in input level costs, cropping intensity and factor productivities in small, medium and large farms, respectively. However, this section has been organized to delineate a brief comparison of various farm size categories. As the next section is concerned with the inverse relationship, so a detailed view of the trends regarding relationship between yield per unit areas and factors of production including socio-economic factors would be discussed in some more detail. Due to the smaller holdings in the area small, medium and large farms segregation was only less than 2, 2-4 and greater than 4 hectares respectively, which might be a draw back of the study.

As far as the factors (inputs) are concerned, seed, fertilizer and manure, and mechanization costs were always in rhythmic descending order with decreasing rate per unit area from small to large farms in each study location. But, a very little difference of mechanization cost on large farms which was a bit higher than medium farms in irrigated perennial category. While costs incurred on chemicals were all the times higher in larger farms and rather low on smaller ones. The difference is so enormous that it changes the ultimate fate of the total inputs in the end and overall input level of larger farms exceeds the smaller ones. It unveils that fact that small farmers prefer weeding manually instead to spray expensive weedicides and herbicides. Moreover, the labour cost intensity was found highest on smaller farms followed by medium and large farms in irrigated perennial and irrigated non-perennial areas. The rainfed area deviated from the trend in a reverse order i.e. higher labour was used at large farms and than other both farm size categories while small farms utilized minimum hired labour. The descriptive part of chapter three shows that average land ownership holdings in rainfed area was very small which might be the reason for small farmers households to find some alternative earning opportunities. This phenomenon would have reduced labour intensity at small farms of rainfed area. Moreover, unavailability of irrigation is also a dilemma which turned their attention to non-farm livelihood. However, labour intensity on the various farm size categories was according to the, previously, proven theory in irrigated areas. Small farmers are more sensitive to their food requirements and their lacking capacity to purchase motivates them to work more on the farm. Furthermore, comparison of farm size categories confirmed the sequence of highest costs intensity of irrigation on small sized farms followed by large and then medium farms in irrigated non-perennial and rainfed areas. Moreover, irrigation cost intensity was found highest at large farms and minimum at small farms in irrigated perennial area. Water use intensity (i.e. cost of irrigation) in irrigated perennial area showed that small farms use their irrigation more wisely. They better manage and do their best to grow maximum with minimum water. Amongst the three categories of farms i.e. small, medium and large it was observed that generally small farms were most factor intensive as compared to large farms in all of the study areas except chemicals in all and irrigation costs in irrigated perennial area. The logic to spend more on the factors of production might lie in the price differentials due to imperfect factors markets (Heltberg 1998, Unal 2008). Secondly, small farmers are more sensitive towards their survival and they work more, and use more inputs per unit area. Higher mechanization costs incurred by the smaller farmers are due to the fact that they lack machinery and they have to rent in, in the sowing seasons along with harvesting and threshing times as well. Moreover, seed is, mostly, used from the home stored inventories. It is also used more intensively but some times it reduces final output due to higher use than recommended by the agriculture department. The dominance of factor intensity on small farms is inline with the theory concerning inverse relationship debate.

Comparison of cropping intensity amongst small, medium and large farms shows that it is higher at small farms in all study locations i.e. irrigated perennial, irrigated non-perennial and rainfed areas. Moreover, the trend is same at small farm size categories of overall study area. These results are inline with previous theory mentioned by various scientists (Kiani 2008, Bardhan 1973, Griffin *et al.* 2002). Small farmers are upon the teetering brinks of poverty and food security. They grow more numbers of crops per annum leaving no or minimum land fallow to escape hunger. Higher cropping intensity on small farms is one of the most weighted arguments of the proponents in favour of inverse relationship. Small farmers are least labour productive in both irrigated and overall study areas due to the fact that small peasants devote maximum of their labour force by employing far more man labour days than medium and large farms. According to some economists' utilization of large amount of labour makes fundamental difference of yield per unit area between small and large farms (Sen 1962, 1966, 1999, Unal 2008, Cornia 1985). It is normally done in land scarce and labour abundant countries with skewed land distribution. As far as the labour productivity of various farm size groups of rainfed area is concerned, it was observed that it was in reverse order of the other study locations. Due to lack of public irrigation infrastructure people do not, overwhelmingly, depend on agriculture production. That is why, it was found that percentage share of non-farm income was significantly higher in this area as compared to other areas.

It is worth mentioning here that similarities were observed in various farm size categories concerning total factor productivity i.e. it decrease with increase in farm size in irrigated perennial and irrigated non-perennial area. As it has been discussed earlier small farmers are more conscious about their food security due to limited buying capacity and they work hard and also strive for crop per drop to secure more food. In addition, medium farms of rainfed has higher total factor productivity than other categories but the difference between small and medium farms is not wide in all of the study locations including irrigated and rainfed areas. As far as irrigation productivity is concerned, it was observed that in case of overall and irrigated perennial areas the trend is same i.e. decreasing from small to large. Furthermore, irrigated non-perennial and rainfed area have similar trends with higher irrigation productivities at medium farms following large and then small farms. Due to very small average land holdings, the difference between farm size categories is not too big and it will not be surprising if for a moment medium farms are annexed with smaller ones in rainfed and irrigated non-perennial area. Consequently, it can be said that large farms use more irrigation and those are less productive than small farmers. Irrigation availability results comply with the work of Haq (2007) i.e. water distribution is skewed with reference to farm size holdings.

7.7- Inverse Relationship Concluded

The productivity dominance of small farms over large farms is designated as "inverse relationship" (IR). A detailed view was presented in chapter- 4 regarding IR and the previous section of the chapter corroborated facts which were determined with the help of simple mathematical tools and discussed with reference to this study. This section of the study has been organized to discuss the regression results concerning farm size productivity. Log-log econometric function was utilized to observe the impacts of explanatory variables on yield per hectare. This study is different from the previous studies in the sense that impact of different deterministic as well socio-economic variables on the dependent variables was examined which has not ever been studied earlier. Furthermore, IR was quantified on the basis of three different farming systems with micro level data which is a kind of new effort in this sector of research.

The negative relationship between yield per unit area as dependent variable and farm size along with many others as regressor was determined. A negative relationship, between farm size and productivity, was proved in all of the study areas which confirm the several studies like Unal (2008), Thapa (2007), Matchaya (2007), Heltberg (1996 and 1998), Benjamin (1995) and Carter (1984) but it is noteworthy that its existence was very weak. As far as its significance level is concerned, it was found that IR in irrigated areas was significant at 20 percent. The rationale of weak IR and lower level significance might be the high share of very small holding in the study area which is in line with Cornia's (1985) cross country study; he dropped three countries (according to him) due to marginal holdings hurting the final result of the study.

It is evident from the regression results that labour man days and intermediate inputs which included seed, fertilizer plus manure, chemical and mechanization costs played an important role in the farm size productivity. The positive signs, in each area, of these both factors illustrate that farm yield increase with increase in labour man days and intermediate inputs investments. "More yields with more labour input" has been accepted in the development economics literature and these farms are termed "family farms". Though, family labour could not be incorporated directly as a single entity due to multicollinearity problems but was utilized together with hired labour in the regression analysis. However, it is confirmed from the field visits as well as from the crude data on hand family labour played a key role in farming in the study area. It is very interesting to know that labor man days and intermediate inputs per hectare were highly significant i.e. at 1 percent level which confirms that these results can easily be generalized in any situation and any place. Moreover, the regression results concerning more labour cause higher yield per unit area is inline with the famous dualistic labour hypothesis of formers studies (Bhalla 1979, Sen 1962, 1966).

Output per hectares and irrigation cost results showed that more irrigations attains higher yield per hectare (positive signs in every area). It is really interesting to note that irrigated perennial area where water is available for whole year from the public infrastructure its relationship with yield is insignificant and least strong as compared to other areas under study. Irrigation cost contributed to yield more than any other area and highly significant in irrigated non-perennial area. The reason might be restricted availability of water for 6 months, farmers have to spend more on irrigation and, consequently, they gained more yield with better management. As far as impact of Irrigation cost on output is concerned in rainfed area, it was obvious from the regression results that its contribution is higher than irrigated perennial area but lower than irrigated non-perennial area, and interestingly, it is significant at 10 percent level. Moreover similar results were obtained for overall study area i.e. positive relationship between yield and irrigation cost and highly significant. Though land distribution is better in irrigated non-perennial area but, in general, overall farm size is small in all of the study areas, so it would not be irrational to term these farms as family farms. In irrigated perennial areas water is as cheaper just as attained for granted from the public infrastructure, resultantly, it is poorly managed, and farmers of irrigated non-perennial area and rainfed areas have to expend higher so they strive hard to grow crop per drop.

Credit per hectare was also tested against the yield. A negative relationship between credit and output per hectare was found. The examination of overall study area revealed its significance at 10 percent level while irrigated perennial and rainfed areas at 20 percent, respectively. This negative relationship may have two kinds of explanation. First, the decreasing amount of credit stimulates output per hectare in the positive direction and productivity is reduced with increase in borrowing level. Due to the lack of financial institutions, illiteracy, small holdings, tedious documentations, fear of confiscation etc farmers borrow from local merchants and money lenders at higher interest rates but they lack capacity to return. Consequently, they have to sell their produce to the lenders at low rates than market prices which severely reduce their overall revenue and they have to become a part of the vicious circle of poverty.

The relationship of the share of non-farm income with productivity had two various dimensions in different study areas. As far as the overall and irrigated perennial areas are concerned, the regression results showed that there is, absolutely, no relationship between non-farm income and productivity but in case of irrigated non-perennial and rainfed areas the relationship is positive. However, the impact on productivity is meager i.e. just 0.01 value of non-farm income which means that a 1 percent increase in off-farm income would enhance 0.01 percent output per hectare in both study areas. Moreover, this relationship is significant in case of irrigated perennial area at 10 percent while it is insignificant in rainfed area. By recalling, on and off-farm income module in the results section, the economies of the concerned rural areas were not diversified, as a lion's share of income was attributed to farm income. People rely on farm income either as self-cultivator or farm worker. Secondly due to smaller holdings in the area, family member don't use their off-farm earning to the farm operations and they might prefer to keep both types of income for different purposes. The employment module (i.e. appendix 3.2) of chapter-3 revealed facts and figures about the employed labour force in the concerning districts of the study area with distinguishing figures of labour force participation in various sectors. The agricultural sector absorbs most of the labour force followed by construction work. Land is a sign of prestige and farming communities considers any work other than agriculture as petty job. So they get stuck up with agriculture.

As far as socio-economic or efficiency factors of production i.e. family size, age, and education of household head are concerned, negative relationship between increasing age of household head and productivity was observed in overall, irrigated perennial and rainfed areas which is in accordance with the previous studies (Unal 2008). It seems quite logical because aged people impair their decision making capability as well as resistant to new technologies and methods of innovative agricultural practices. While in irrigated non-perennial area, age delineated positive impact on farm productivity. The descriptive section in chapter five gave the glimpse of average ages of the household heads, and the households' head of the irrigated non-perennial areas were found younger than both other areas of comparison that might be reason of positive relationship between productivity and age in this area.

A positive relationship between productivity and education of households head was observed in all of the study areas including overall area, but this relationship was found significant only in irrigated non-perennial area at 10 percent level. For the time being keeping significance of the results aside, it is a natural phenomenon that education promotes and polishes the capabilities which is known as a human resource development these days. It has been observed that the relationship is positive but it is not as strong as it should be. However, the results are in line with previous studies (World Bank1999, Asadullah and Rehman 2006). Family size and farm productivity were directly proportional in irrigated perennial, rainfed and overall areas while irrigated non-perennial area had negative relationship with Productivity per unit area. The positive relationship between productivity and family size is similar to previous studies. It is insignificant in overall and rainfed area while it is significant in irrigated perennial area. Though the relationship is positive, its impact is not strong.

It is concluded that the study proves the existence of inverse relationship i.e. small farmers are more productive than large farmers in the whole study area. Albeit, the relationship is not very strong due to prevalence of perhaps marginal land holdings along with some other reasons which needs to be further investigated. The empirical work done in three different areas also exposed the better agriculture production with better land distribution location compared to others might be a proxy of inverse relationship.

CHAPTER-8

CONCLUSIONS AND RECOMMENDATIONS

The prepositions mentioned in chapter one regarding unequal land distribution in Pakistan and general views concerning land distribution and farm size productivity presented in chapter four seem true based on the results of the undergoing study. However, skewed land distribution presented in chapter two supported by macro level data is confirmed by the study but, unfortunately, size of holdings was observed very small in the study area. Most of the research hypotheses formed on the basis of theory were found true while few of the results contradicted from their hypothesis. Nevertheless, matter of land distribution disparity, its impacts on farm size productivity were addressed especially to gauge the differences in various farming systems according to the objectives of the study. Moreover, cropping intensity, crop diversity, yield, gross margins, total and partial factor productivities per hectare and income distribution disparities were examined for varying environments of land distribution situation. Furthermore, different indicators were also assessed to quantify the better gains in various farm size categories i.e. small, medium and large farms. In the end; stylized fact of “inverse relationship” was also studied to observe its existence in various farming systems. However, aftermaths of the study including recommendations for the policy makers are being described in this brief chapter. Land and water play pivotal roles in the agriculture sector. The following are the main conclusions extracted from the study.

8.1- Conclusions

1- Land distribution was found skewed in ownership holdings but the level of inequality was not so profound in operational holdings. Rather it pointed to the marginal or subsistence farm sizes in the study area. The contribution of ownership holdings in the study was, only, uptil distribution disparities while operational holdings were utilized to quantify all of the study indicators. On the basis of differences in land distribution in three areas i.e. irrigated perennial, irrigated non-perennial and rainfed areas, the following conclusions were drawn,

a) Inequality in operational land holdings was graded as, least in irrigated non-perennial, intermediate in irrigated perennial and most pronounced in rainfed area. Moreover, the average operational holdings were higher in irrigated non-perennial area than both others. However, ownership holdings were found highly skewed in all of the study locations. Land ownership inequality was maximum in irrigated perennial and was minimum in irrigated non-perennial area while rainfed area was found in between both of them. It is very interesting revelation that the area (i.e. irrigated non-perennial) with better land distribution had healthier land markets as compared to others which means more farmers participate in leasing in and out activities to grow more and to earn more. Furthermore, irrigated perennial area also had good land markets perhaps due to year round water availability but it could not succeed irrigated non-perennial area. Unfortunately, land markets were highly imperfect in rainfed area due to lack of irrigation infrastructure and skewed ownership land holdings.

b) Although the cheaper irrigation was available in irrigated perennial area year-round but due to better land distribution and equality in irrigated non-perennial area the competition amongst farmers was high for greater yields and net profits. So, they applied more inputs and achieved higher yields and gross margins per unit area than both others. While rainfed area produced least accompanying the minimum gross margins per hectare.

c) Irrigated non-perennial area was found more labour productive than both other areas. Higher family labour as well as hired labour man days were put in. This mean that better distribution of land creates more work opportunities in the area and it may help to reduce rural-urban migration in search of work which results in slums in the cities. It was also observed that irrigated non-perennial area was leading in the share of farm income followed by irrigated perennial and rainfed areas.

d) Irrigation productivity per unit area was higher in irrigated perennial area than irrigated non-perennial and rainfed areas which was an outcome of cheaper water availability. Moreover, the farmers of irrigated perennial area used tubewells, too, for conjunctive water use as a supplement which resulted in poor water management. Total factor productivity was also found higher in irrigated perennial area than irrigated non-perennial and rainfed areas. Actually, small farm irrigation and total factor productivity of irrigated perennial area makes a significant difference in the overall productivities of this area. It is believed that this difference was due to lower costs of water, although, there might be some other factors involved which should be the topic of further research.

e) Cropping intensity is another very important indicator to assess the intensiveness of farming activity on a certain farm in some particular area along with grown number of crops per annum. Incredibly, cropping intensity was higher in irrigated non-perennial area as compared to other areas. Moreover, these three locations were also studied for crop diversity. It was found that crop diversity was also higher in irrigated non-perennial area than other areas under study. Cropping intensity and crop diversity, both, were least in rainfed area while irrigated perennial area was found in between both other study locations regarding these measures.

It was observed that except total factor productivity, irrigation productivity and institutional credit all of the other results complied with hypothesis. Figure 8.1 shows summary of conclusions by ranking various indicators on the basis of land distribution in the various study locations. Green colour of the boxes represents the best performing indicators while yellow delineates second and red exhibits minimum gains in a certain area.

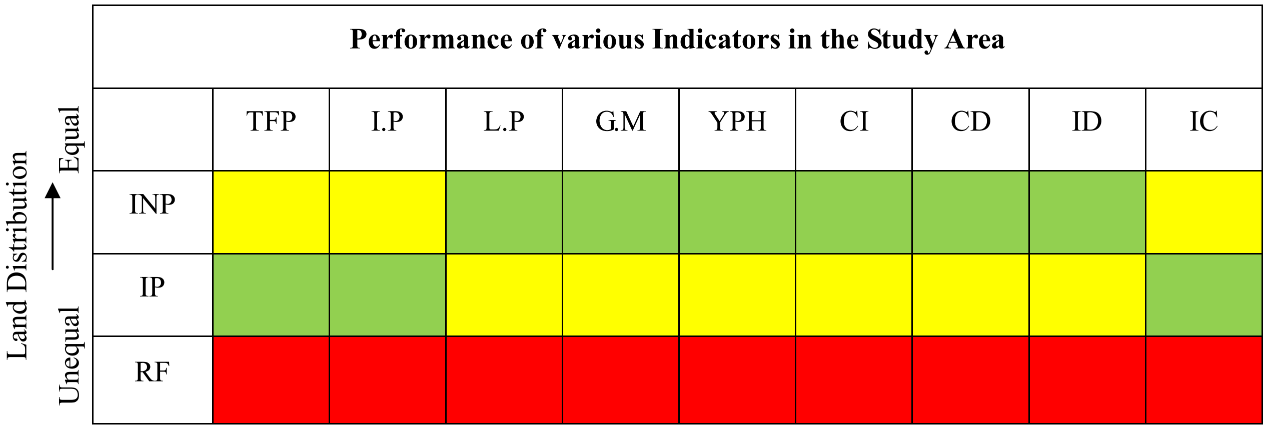


Figure 8.1- Ranking of Indicators with Reference to Land distribution

INP= Irrigated Non Perennial Area, IP= Irrigated perennial Area, RF= Rainfed Area,

TFP= Total factor productivity, I.P= Irrigation productivity, L.P=Labour productivity,

G.M= Gross margins, C.I= Cropping intensity, C.D= Crop diversity, I.D= Income distribution,

I.C= Institutional credit

Green color represents best amongst all others

Yellow shows second position

Red delineates least efficiency

If the rainfed area is ignored for a short while then it can be seen that results are mixed within irrigated areas concerning performance of different indicators. But it is evident from the figure that more numbers of results are in favour of irrigated non-perennial area as compared to irrigated perennial area. Cheaper irrigation makes the difference in case of total factor productivity and irrigation productivity and it is also noteworthy that formal institutions, perhaps, trust more in irrigated perennial farmers for credit delivery.

2- A second strand of the work was to analyze performance differentials of smaller and larger farms in each study location to contribute to the debate, whether small farms are more productive than large farms or vice versa. The following conclusions were obtained, a- A comparison between farm size categories based on level of cropping intensity was undertaken. It was found that cropping intensity on small farms of every study location was higher than large farms. Furthermore, small farms of overall study area also excel in cropping intensity as compared to large farms. However, crop diversity was found higher at large farms in all of the study locations.

b- The view of overall input use proved that large farms were more input intensive than smaller ones but gross margins displayed a different scenario. Smaller farms always had greater gross margins per unit of land than larger farms in each area. It is concluded that family workers make a difference in each area. As far as the rainfed area is concerned, gross margins of the larger farms were found to be negative due to the absence of rainfall in the survey year. Nevertheless, rainfed farmers irrigated their lands with tubewells but they had to rely on rainfall. Unavailability of irrigation infrastructure diverted their attention towards non-farm income which was found higher than in both other irrigated areas.

c- Total factor productivity was higher at smaller farms in both irrigated areas and overall study area while it was higher at medium farms in rainfed area. Moreover, labour productivity was lowest on smaller farms and was highest on larger ones once again the trend was similar in both irrigated areas and overall area. This means that smaller farms put in more labour than large and medium size farms, and produce more in the form of greater gross margins and higher yield per unit area. But rainfed farmer deviated from the general trend with minimum labour productivity at large farms and maximum at small farms. Moreover, irrigation productivity was higher at smaller farms in irrigated perennial area. It was higher on medium farms of Irrigated non-perennial and rainfed farms where farmers had to rely on pumped water for six months and one year respectively.

d- The results of credit availability showed that higher percentage of large farmers was bestowed with institutional credit as compared to other farm size categories in irrigated areas. While large and medium farmers of rainfed area did not obtain institutional credit.

So, results helped to arrive at a simple conclusion: Performance and outcomes of the smaller farms are better than of larger farms but in some cases the results of rainfed area were entirely different from both irrigated areas. It unveils that lack of irrigation infrastructure which makes water availability more expensive and above all skewed land distribution also has its role in this area for deviating results from other areas. However, it must be kept in mind that the smaller farms must be above a certain of optimum minimum size. Subsistence or below subsistence level can not produce more than family requirement.

3- Inverse relationship between farm size and productivity was not only proved but it was confirmed with two different analytical measures i.e. a) with simple mathematics and b) econometric models. Though, the existence of the IR was weak, it did play a role in each study area. Prevalence of marginal land holdings in the study area might have disturbed the strong existence of inverse relationship. Labour based hypothesis regarding inverse relationship of previous studies have been reaffirmed that more intensive labour produce higher yield per unit area (Unal 2008, Benjamine 1995, Sen 1981).

4- The lack of public irrigation infrastructure was considered as a great deprivation for the rainfed farmers. Regardless of overall area as well as farm size analysis both irrigated areas were found ahead of rainfed area whether it was matter of labour or material inputs. However, irrigation costs on the large farms category was highest in rainfed farms.

5- It can also be concluded that rainfed farmers had the lowest productivity and earned least profits, minimum farm income share and attained lowest institutional credit as compared to both irrigated areas.

8.2- Recommendations

The study reveals that several factors are important for successful agricultural production but most important of them are land and water. Any kind of disorder in these factors would hamper agriculture productivity and consequently lead to undernourishment, food security at risk and augment poverty in the concerned areas. So, the study helps to recommend the following points for the future scope i.e.

1- Since the superiority of the area (INPA) with better land distribution has been proven. Therefore, it is direly needed to promulgate and implement redistributive land reforms in Pakistan. But it must be implemented with full political will and should not be utilized to victimize political rivals like previous reforms in 1970s. It's also a matter of serious brainstorming to arrive at some possible optimal farm size which could produce more without keeping fallow or keeping minimum portions of land for retaining fertility of lands intact. Land reforms would help to break big estates which have distorted the balance of land distribution making it highly skewed. According to the World Bank (2002) two percent of households own more than 40 acres of land and control 44 percent of land area of Pakistan. Collectively, large and very large farmers control 66 percent of agricultural land which is a dilemma.

2- The existence of inverse relationship and virtual superiority of small farms have been proven by the study. So, it is reiterated that like in China, Japan, Taiwan and South Korea larger estates should be dissolved into smaller workable farms to achieve higher yields and to provide more employment to the people in a land scarce and labour abundant countries like Pakistan. In addition, irrigated non-perennial area where land distribution was found more equitable as compared to others, the farm income as well as labour man days investment was, also, observed higher than other areas. It, strongly, implies that rational and wise distribution of land will not only help to produce exportable surpluses but it will also reduce rural to urban migration by employing indigenous labour force in the agriculture sector which may also boost agro-based industries with agricultural multiplier effect.

3- Study location with better land distribution also exhibited better income distribution than other comparative areas. It means better land distribution as a result of redistributive land reforms can help to alleviate poverty and bring food security.

4- The importance of irrigation can not be denied due to fact that total factor productivity was higher in IPA which was one of the most important indicators to assess performance of various study location. It is suggested that better management of water resources would help to cater year round irrigation in agriculture sector and its combination with better land distribution will uplift living standard of rural population.

5- The results of the whole study show that rainfed area was far behind both other irrigated areas in every respect. Whether it concerned input expenditures or final outcomes in the form of gross margins, farm productivity etc. it is strongly recommended to cater for water by digging new channels where the terrain is friendly for this purpose. These new canals can easily be fed by diverting some of the huge amounts of water falling in to the Arabian Sea from the Indus by the construction of new dams.

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APPENDICES

Appendix 3.1

Monthly, Mean Temperature and Precipitation Gujrat (1961-1990)

Month	**Mean Temperature ©**		**Rainfall (mm)**
	Max	**Mini**	
January	20	5	34
February	22	8	50
March	27	13	61
April	33	18	37
May	38	22	32
June	41	26	52
July	36	26	237
August	34	25	221
September	35	23	78
October	33	17	12
November	28	10	10
December	22	6	30
Annual	31	16	853

Monthly, Mean Temperature and Precipitation MBD (1961-1990)

Monthly	**Mean Temperature ©**		**Rainfall**
	Maximum	**Minimum**	**mm**
January	20	4	13
February	22	7	23
March	27	12	35
April	34	18	30
May	39	22	21
June	42	27	23
July	38	27	108
August	36	26	129
September	36	24	26
October	34	17	8
November	28	10	6
December	21	5	13
Annual	31	16	435

Source: JBIC and IWMI 2007, 2007a

Appendix 3.2

Percentage of Employed Population by Sector in District Gujrat & MBD

District Gujrat	**Areas**		
Sectors	**Overall**	**Rural**	**Urban**
Agriculture, Forestry and Fishing	29	41	6
Manufacturing	8	5	15
Electricity, Gas and Water	0.3	0.3	0.2
Construction	31	33	27
Wholesale and Retail Trade, Restaurants and Hotels	10	6	18
Transport, Storage and Communication	4	4	5
Financing, Insurance, Real Estate and Business Services	2	1	4
Community, Social and Personal services	13	8	21
Others	3	2	4
District M.B.D			
Agriculture, Forestry and Fishing	40	44	14
Manufacturing	4	4	7
Electricity, Gas and Water	0.2	0.2	0.3
Construction	37	37	31
Wholesale and Retail Trade, Restaurants and Hotels	6	4	19
Transport, Storage and Communication	2	2	4
Financing, Insurance, Real Estate and Business Services	1	0.6	5
Community, social and Personal services	8	7	17
Others	2	1	2

Source: JBIC and IWMI 2007

Appendix 3.3-

Numbers and Area of ownership holdings in District Gujrat & M.B.D

Gujrat				
Farm Size(Acres)	**Number**	**Percent**	**Area (Acres)**	**Percent**
Under 5	122,530	80	202,447	42
5 to less than 12.5	25,544	17	181,648	37
12.5 less than 25	3,739	2	60,797	12
25 less than 50	1,010	1	29,918	6
50 and above	188	0	11,651	2
M.B.D				
Under 5	36979	52	83462	17
5-12.5	25126	35	190136	39
12.5-25	7072	10	120786	25
25-50	1886	3	59585	12
50 and above	410	1	33257	7

Source: Government of Punjab 2000

Number and Area of Farms by Size of Farm in District Gujrat & M.B.D

Gujrat				
Farm Size	**Number**	**Percent**	**Area (Acres)**	**Percent**
Under 5	33092	47	78426	16
5-12.5	27716	39	210604	43
12.5-25	7744	11	130653	27
25-50	1539	2	50064	10
50 and above	248	0	20822	4
M.B.D				
Under 5	111328	79	194179	42
5 to less than 12.5	25482	18	180922	39
12.5 less than 25	3325	2	54835	12
25 less than 50	868	1	25269	5
50 and above	134	0	7768	2

Source: Government of Punjab 2000

Appendix 3.4

Per Capita Net Production of Total Food (grams per day)

Districts	Wheat	Rice	Maize	Cereals	Tubers	Pulses	Fruits	Vegeta-	Oilseed	Sugar	Milk	Poul-	Fish	Eggs
Gujrat	235	56	2	293	1	3	16	49	1	18	380	6	0	5
M.B.D	552	189	7	748	30	3	110	121	4	256	915	4	0	4

Source: World Food Program and Sustainable Development Policy Institute 2004

Appendix 3.5

Food Availability and Food Security in Gujrat and Mandi Bahauddin Districts

	Food Availability	**Food Insecurity**		**Malnourished children(>5 years)**	**Landless labour**	
		National Ranking*	**Provincial Ranking***	**Percent**	**National Ranking***	**Provincial Ranking***
Gujrat	high deficit	86	14	32	75	14
M.B.D	surplus Production	118	34	26	78	17

Source: World Food Program and Sustainable Development Policy Institute 2004

Ranking= National ranking was from 1-120 and provincial ranking was from 1-35 (Punjab, No of districts-35) 1 being the worst and 120 the best.

Appendix 3.6

Cropping Pattern of Overall Study Area

	RICE	CORR	WHE	SUGC	JAWAR	BARS	BAJRA	PUL	LUC	MFDR	MONG	TOTAL
Total	21	1	35	5	13	13	8	1	2	1	0	100
Small	14	1	39	3	16	13	11	1	1	1	0	100
Medium	25	1	33	4	12	13	7	1	2	1	0	100
Large	29	1	32	8	10	12	3	0	4	1	0	100

Cropping Pattern of Irrigated Perennial Area

	RICE	CORR	WHE	SUGC	JAWAR	BARS	BAJRA	PUL	LUC	MFDR	MONG	TOTAL
Total	21	1	35	4	17	12	5	0	3	1	0	100
Small	13	0	37	3	22	14	6	0	2	2	0	100
Medium	23	1	34	5	15	12	7	0	3	1	0	100
Large	29	1	33	6	12	11	3	0	4	1	0	100

Continue---

Continue—

Cropping Pattern of Irrigated Non Perennial Area

	RICE	CORR	WHE	SUGC	JAWAR	BARS	BAJRA	PUL	LUC	MFDR	MONG	TOTAL
Total	31	1	31	7	11	14	2	0	3	0	0	100
Small	30	2	33	5	15	12	0	0	2	0	0	100
Medium	32	1	31	6	11	15	2	0	2	0	0	100
Large	30	1	29	10	9	13	2	0	4	0	0	100

Cropping Pattern of Rainfed Area

	RICE	CORR	WHE	SUGC	JAWAR	BARS	BAJRA	PUL	LUC	MFDR	MONG	TOTAL
Total	11	0	42	2	7	13	21	3	0	1	0	100
Small	7	0	43	2	9	14	22	2	0	1	0	100
Medium	19	0	36	1	5	11	21	6	0	0	0	100
Large	21	0	50	4	2	7	13	0	0	0	2	100

Note: Cotton, Chilies, Onion and winter fodder altogether constitute less than0.5 % of the area, deleted

CORR=coarse rice, WHE=wheat, SUGC=Sugercane, BARS=barseen, PUL=pulses, LUC=lucern, MFDR=maize fodder

Appendix 3.7

Crop Priority of Overall Area (%)

	RICE	COT	CORR	SUGC	MFDR	MONG	BAJRA	JAWAR	PULS	WHE	LUC	BARS	ONIO	MFDR	TOB
Total	65	1	4	36	4	1	35	75	3	91	27	80	0	1	2
Small	41	0	3	21	2	1	34	63	3	84	13	69	1	2	1
Medium	77	1	5	38	3	1	39	79	4	94	31	86	0	0	3
Large	90	2	7	59	10	1	33	92	0	99	46	91	0	0	5

Crop Priority of Irrigated Perennial Area (%)

	RICE	COT	CORR	SUGC	MFDR	MONG	BAJRA	JAWAR	PULS	WHE	LUC	BARS	ONIO	MFDR	TOB
Total	64	1	3	40	7	0	37	85	0	90	33	79	0	1	3
Small	40	0	1	25	2	0	31	80	0	84	18	71	0	2	1
Medium	72	3	4	42	4	0	44	82	0	92	40	82	0	0	3
Large	91	2	5	63	16	0	36	95	0	98	48	89	0	0	5

Continue--

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Crop Priority of irrigated Non Perennial Area (%)

	RICE	COT	CORR	SUGC	MFDR	MONG	BAJRA	JAWAR	PULS	WHE	LUC	BARS	ONIO	MFDR	TOB
Total	94	1	9	45	2	0	19	92	0	97	35	91	1	0	3
Small	90	0	10	38	0	0	3	86	0	93	28	83	3	0	0
Medium	96	0	8	38	2	0	23	90	0	98	27	92	0	0	4
Large	95	2	10	57	2	0	26	98	0	100	50	95	0	0	5

Crop Priority of Rainfed Area (%)

	RICE	COT	CORR	SUGC	MFDR	MONG	BAJRA	JAWAR	PULS	WHE	LUC	BARS	ONIO	MFDR	TOB
Total	29	0	1	14	2	3	52	33	12	85	1	68	0	1	0
Small	20	0	2	8	3	2	51	29	9	82	0	62	0	2	0
Medium	50	0	0	25	0	5	55	40	25	90	5	85	0	0	0
Large	57	0	0	43	0	14	57	43	0	100	0	86	0	0	0

COT=cotton, CORS=coarse rice, SUGR=sugarcane, MFDR=maize fodder, PULS= pulses, WHE=wheat, LUC=lucern, TOB= tobacco

Appendix 6.1

Credit Availability with Respect to Farm Size

	Total		Small		Medium		Large	
	No Credit	Credit	No Credit	Credit	No Credit	Credit	No Credit	Credit
Overall	29.25	70.75	29.05	70.95	30.71	69.29	27.62	72.38
Irrigated Perennial	24.88	75.12	23.53	76.47	25.00	75.00	26.79	73.21
Irrigated Non Perennial	32.77	67.23	27.59	72.41	39.58	60.42	28.57	71.43
Rainfed	34.78	65.22	36.92	63.08	30.00	70.00	28.57	71.43

Appendix 6.1 A

Institutional and Non-Institutional Credit Availability with Respect to Farm Size (Percent Households)

	Total			Small			Medium			Large		
	No Credit	Inst.Cred	N.I.Cred	No Credit	Inst.Cred	N.I.Cred	No Credit	Inst.Cred	N.I.Cred	No Credit	Inst.Cred	N.I.Cred
Overall	29.25	14.39	64.15	29.05	6.15	67.60	30.71	17.14	65.00	27.62	25.71	58.10
Irrigated Perennial	24.88	20.66	66.20	23.53	8.24	71.76	25.00	23.61	68.06	26.79	35.71	55.36
Irrigated Non Perennial	32.77	14.29	61.34	27.59	10.34	68.97	39.58	14.58	58.33	28.57	16.67	59.52
Rainfed	34.78	1.09	64.13	36.92	1.54	61.54	30.00	0.00	70.00	28.57	0.00	71.43

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N.I. Credit = Non-institutional credit

Inst.Credit = Institutional credit

No Credit: Neither institutional nor non-institutional credit was taken by households

Institutional Credit: Credit taken from banks and cooperatives

Non-Institutional Credit: Credit taken from friends, relatives, non-relatives, traders and dealers etc.