FARMERS' PERCEPTION OF THE IMPACT OF NEW GOVERNANCE ARRANGEMENTS ON THE PERFORMANCE OF SELECTED IRRIGATION SYSTEMS IN PUNJAB PROVINCE, PAKISTAN

by

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Abstract

Pakistan being an agrarian economy under arid climate primarily depends on the water resources from Indus river system for irrigation purposes. Irrigated agriculture consumes approximately 88% of total available water in the country. In order to manage the irrigation water in a more effective way, institutional reforms were practiced in the selected irrigation systems under PIDA Act. 1997. The general objective of this study was to evaluate the impacts of these institutional reforms on the overall performance of the irrigation sector under newly developed governing system. This study was conducted in Punjab province on two different irrigation systems namely Farooq irrigation system (FMIS) and 2L irrigation systems (AMIS) and based on the farmers' perception about the performance of their related irrigation systems. Some major indicators such as water delivery services, efficiency of ISF collection, agricultural productivity, participation of farmers in O&M activities, corruption in water delivery services and its reasons were implied to evaluate the performance of irrigation systems. Statistical tools such as Kruskal-Wallis test, chi-square, frequency and percentage have been used to investigate the impressions of the different variables. The questionnaire survey was carried out along with field observations and discussions with farmers and officials as well. The findings shows that FMIS is performing better than the AMIS in terms of water sufficiency with almost 21% better results, participation in O&M with 15% better results, control over corruption with almost 12% better results. Whereas, FMIS is not performing better than the AMIS regarding provision of services such as provision of legal support with almost 18% weak results, political influence as the reason of corruption in water delivery services with almost 15% weak results and efficiency in ISF collection with 16% weak results. A comprehensive policy framework is needed to improve the enforcement system against corruption, monitoring and accountability of the governing bodies and officials so that performance of the Punjab's irrigation sector can be improved.

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List of Abbreviations

AMIS	Agency Managed irrigation System
AWB	Area Water Board
DIPP	Department of Irrigation & Power, Punjab
GWP	Global Water Partnership
GDP	Gross Domestic Product
FIS	Farooq Irrigation System
FMIS	Farmers Managed Irrigation System
FO	Farmer organisation
2LIS	2L irrigation System
IBIS	Indus Basin Irrigation System
Mha	Million hectare
MOE	Ministry of Environment
MWP	Ministry of Water and Power
PIDA	Punjab Irrigation and Drainage Authority
PILDAT	Pakistan Institute of Legislative Development and Transparency
PIM	Participatory Irrigation Management
UNDP	United Nation Development Programme
WUA	Water User Association

CHAPTER 1

INTRODUCTION

1.1 Context

Water is one of the most important life-supporting elements in the global ecological systems. It has particular importance for the arid ecosystems such as the Indus plains in Pakistan. Water resources of Pakistan are serving as driving force in the economic uplift of the country primarily through agriculture. Pakistan has the largest contiguous irrigation system in the world, including the vast Indus Plain, which has long and arrogant history of the advancement in the areas of extension in the command area and improvement in the provision of water services (MWP, 2002).

Agriculture sector consumes approximately 88 per cent of water, as the largest consumer in the country (PILDAT, 2003). Pakistan's irrigated agriculture largely depends on Indus River for its surface water owing to arid climate. The country is water scarce; on per capita basis water availability has been diminishing at a disturbing rate, and has declined from 5,000 m^3 per capita in 1951 to about 1,100 m^3 per capita in 2006, verging on the international scarcity rate. It is estimated to decrease to 700 m^3 by 2025 (MOE, 2008).

Agriculture is the sole largest area and accounts for 24 % of the GDP and employs 48.4 % of the total labour force. About 68 % of population lives in rural areas and is directly or indirectly connected with agriculture for its source of revenue. Over 70% of exports depend on agricultural-based products. Irrigated agriculture provides 90% of food and fiber necessities from approximately 17.14 Mha which is about 80% of the cultivated area. Pakistan's irrigated area has been increased from 8.35 Mha in 1947 to 17.14 Mha in 2000 due to construction of a large number of irrigation mechanisms since independence (PILDAT, 2003).

Punjab has the microcosm status in Pakistan. Surface and groundwater resources make the lifeline of agro-based economy in Punjab. Agriculture is the most important supplier to Punjab's economy, accounting for 28 % of its output and providing job opportunities to more than 40% of its work force. More than 90 % of agricultural output in Punjab comes from 10 Mha of its irrigated land. Irrigation sector has the same strategic and institutional issues as in the rest of Pakistan (DIPP, 2007).

1.2 Rationale of the Study

In most of the Asian countries, where agricultural production largely contributes their national economy, irrigation management is an important concern. However, despite of efforts given to the irrigation development and management, the performance of government managed irrigation sector is not satisfactory (Barker and Molle, 2005). Community-centred institutions can make a difference through self governing capacities of the people. However, there always remains a challenge for these community-centred institutions with the change in country's political and economical circumstances.

Existing Indus irrigation system is basically weir controlled, and it was constructed in the start of the 19th century. However, Pakistan faces key water related issues that have critical social, economic and environmental implications: increasing demand and decreasing water

availability per capita, weakening infrastructure as a result of insufficient operation and maintenance, over-exploitation, discriminatory canal water deliveries, inefficient irrigation service delivery and weak governance, in part due to lack of user contribution and collective actions. As a result, the full potential of irrigation as the key contributor to agricultural development and goals are not being achieved (DIPP, 2007).

Pakistan has a significantly large irrigation sector and it is considered to be a major component in the political economy of the country. Pakistan has gone through changes in macroeconomic, political and social settings; and institutional arrangements for irrigation management in response to these macro changes. The new irrigation policy laid emphasis on participatory approach of irrigation management in the form of transfer of management responsibility from government to users. It even aims to involve private sector in managing public irrigation system, as an alternative approach of irrigation management. Other recent changes in irrigation sector in Pakistan include an increase in irrigation service fee in different surface and groundwater irrigation schemes.

1.3 Statement of problem

Pakistan is becoming a water scarce country due to continuous population growth that results to increased water utilization. So there is a strong need of some strategy to manage valuable water resource more efficiently and carefully to assure water for sustainable development (MWP, 2002). In the most extensive irrigation system, water is one of the most restrictive factors in the agricultural sector development. Prospects for discovering new water sources in these areas are relatively slight, because most of the surface and groundwater resources have already been oppressed. Thus it is important to uncover ways to enlarge agricultural production by careful assessment of existing irrigated system. This approach will not only assist to meet food demands in the future but can also ease competition with other sectors and help to make sure water availability (Ahmad et al., 2008).

Some efforts have been made on institutional decomposition and analyzing institution-performance interaction (Saleth and Dinar, 1999; 2004). However, those studies did not measure the exogenous influencing factor explicitly. Likewise, Lam (1998) analyzed the performance of irrigation sector but did not consider the influence of institutional aspects. The social and political context determines the institutional arrangements which in-turn affects performance. But, institutional similarity does not necessarily assure performance consistency across diverse contexts.

Prior studies have not much focused on the influence of different sorts of policy changes on institutional arrangements for irrigation management and their influence on performance of irrigation systems. The questions regarding design of effective irrigation institutions and proper role of state need to be answered with reference to the changing context. In order to address these critical challenges; it is necessary to analyze interaction of irrigation institutions with economic, social and political changes; and its ultimate effect on performance of irrigation systems.

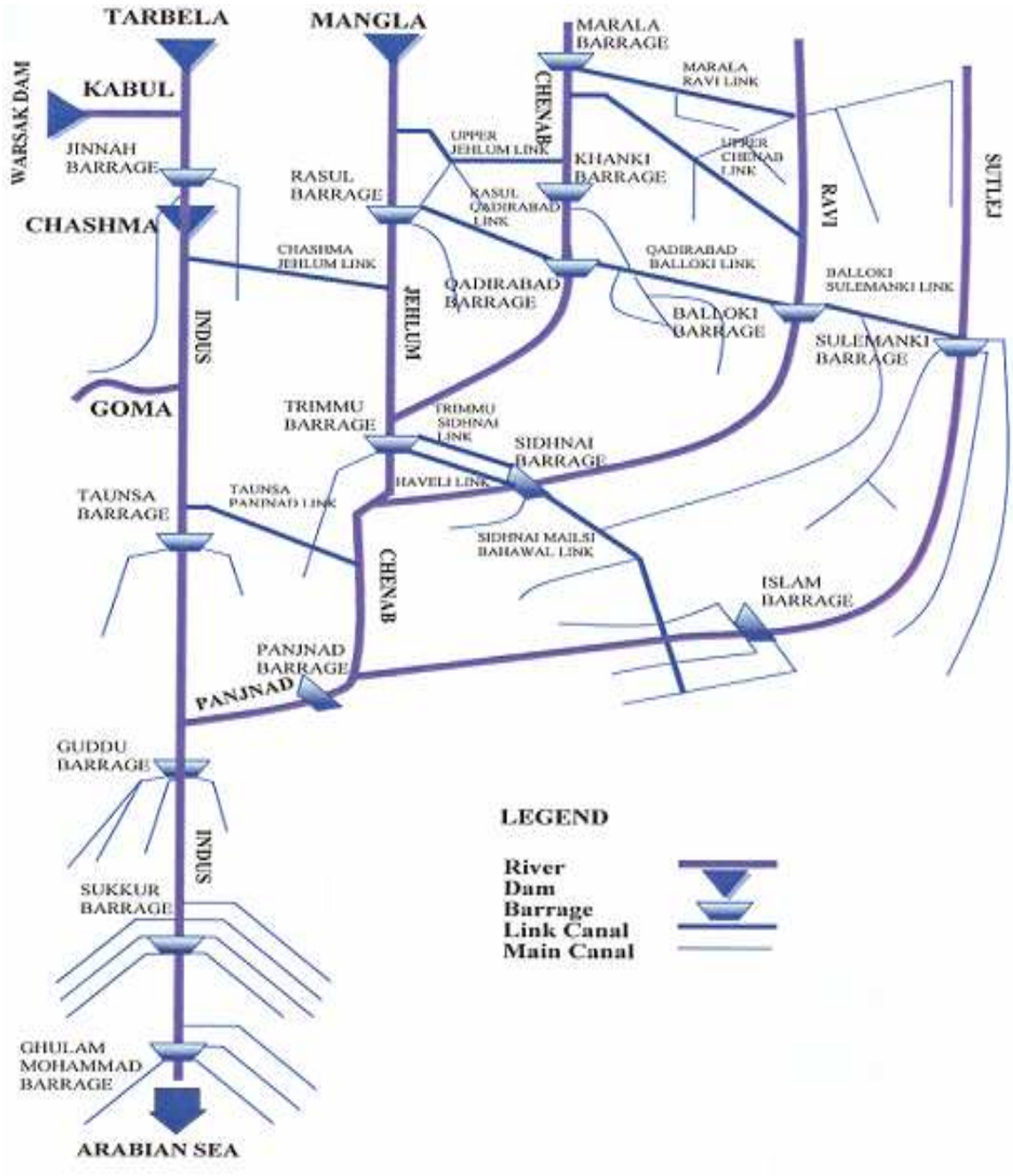

Figure 1.1: Schematic map of the Indus Basin Irrigation System of Pakistan

This will result into policies for managing scarce water resources which contribute to the reduction in poverty and reducing hunger through increased agricultural productivity, and environmental sustainability of water resource management ultimately contributing towards achieving Millennium Development Goals.

1.4 Research Questions

- How water governance system under institutional changes is impacting on the physical availability of water at local level in the irrigation system of Punjab?
- What are the most critical aspects and factors of corruption under governance changes in the irrigation system of Punjab?

1.5 General objective

- To assess the performance of the selected irrigation system as being impacted upon under overall governance changes in the irrigation sector of Punjab

The specific objectives of this study are:

- To assess the impact of institutional reforms on the physical availability of water in the overall performance of Punjab's irrigation system
- To investigate the levels and factors of corruption as being impacted upon under overall governance changes in the irrigation sector of Punjab
- To suggest some policy recommendations regarding mechanisms of good governance in the irrigation system of Punjab

1.6 Scope of the Study

In this study, a comparison is made between two different farmers-managed and agency-managed irrigation schemes in the irrigation system of Punjab with a special intention to investigate the performance of the irrigation system under newly developed institutional arrangements under PIDA Act. 1997. These proposed irrigation schemes are the part of Indus irrigation system. This study has been carried out in the plains of the Punjab province of Pakistan and based on the perception of the farmers. The results of this research study may be generalized to the other parts of irrigation system within Punjab province.

The results of this study can be helpful for the Irrigation Department of Punjab and Punjab Irrigation and Drainage Authority in order to improve the performance of irrigation system and for Anti-corruption Department to formulate necessary policy measures in order to reduce the corruption at local level. Additionally, the outcomes of this research study may be useful for on-farm water management division of Agriculture Department of Punjab to investigate the water delivery services at water channel level to take further decision for further improvement in the network of water channels at farm levels. It will also be helpful for the decision makers in order to make effective policies and measures to reduce the corruption and to improve the participation of water users in the local irrigation system. This study will also contribute to improve the water governance from water development

to water management that will ultimately influence the agricultural productivity and will lead to reduce the poverty level in Pakistan.

1.7 Limitations of the study

This study provides various insight information about the governance related impacts on the overall performance of the irrigation system under institutional arrangements through PIDA Act. 1997. However, this study has some limitations such as;

- The sample size used in the questionnaire survey is not calculated according to the total size of population in the both irrigation system due to limited time and lack of financial support for research from the donor.

- This study is based primarily on the perception of the farmers about the performance of their related irrigation systems. However, some observation and discussion with key informants and official have also been implied to find out the actual prospects.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Definitions and some concepts

2.1.1 Water Governance

Since the Dublin conference in 1992, an international campaign had been started to develop a consensus on water governance. This concept was reinforced by number of agreements like 2000 World Water Forum in Hague, the GWP Framework for Actions in 2000, the 2000 Hague Ministerial Declaration, the Bonn 2001 Freshwater Conference, and in the UN 2000 Millennium Assembly. In the prior literature, the most commonly used definition of water governance is given by the Rogers and Hall (2003)

"Water governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society".

It incorporates many of the ideas that make governance such a rich concept. It endorses a range of actors and agents to manage the water resource which is much broader than government. The concept of water governance covers a range of outcomes of water resources as well as its delivery services at various levels of society which make it broader than the management functions of individual authorities. It implies unique concern for the marginal groups in the governance systems. It mediates the access of society to water through recognizing actors and agents, agency and power, and resources through defining necessary mechanisms and processes at different hierarchy of society.

This definition of water governance supports to distinguish between government, governance and management. Government implies the formal structures through which the state runs its water related affairs while the management comprises the allocation and delivery of water resource via recognizing actual mechanisms and processes. Governance includes both government and management which encompass peoples' access to water.

2.1.2 Water user association (WUA)

Water user association is a participatory organization and farmers-based that manages the local irrigation water. It is supposed to be elected by the local farmers. Water user associations (WUAs) are playing an important role in the effective management and dealt with the raising efficiency of irrigation along with the rising incomes, and serving deprived farmers (Huang et al., 2008).

2.1.3 Social Capital

The concept of "social capital" has been defined by number of scholars in various perspectives. Coleman (1990) stated that "Social capital is defined by its function, it is not a single entity, but a variety of different entities having characteristics in common: they all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure".

World Bank (1999) defined the social capital as

"Social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together."

There is no doubt that research considers the concept of strong social capital as social trust and affiliated social networks and correlates it with diverse and enviable policy outcomes. Putnam (2000) stated that social capital has "forceful, even quantifiable effects on many different aspects of our lives" and it is more than "warm, cuddly feelings or frissons of community pride". Putnam, (1995) mentioned the quantifiable effects of social capital that include less ratio of crimes, less corruption and effective government.

While studying the impact of social capital on the performance of irrigation systems, Lam, (1998) argued that high level of mutual trust among water users has a close association with the efficient performance of the irrigation system. He believes that performance of the irrigation systems can be enhanced by improving the mutual trust among water users as it counter the irrigators through offering different incentives to free-riders and to some others who do not act upon the operational rules in the water sector. In his study to measure the levels of mutual trust; as an indicator of mutual trust, Lam used different degrees to which verbal promises were used by water users. He gave high weight to the degree of verbal promises with high level of mutual trust among irrigators. However, there is no any standard rule to measure the mutual trust in concrete values. In turn, there are three main standards to evaluate the performance of the irrigation system; physical condition of the infrastructure, water delivery services and agricultural production.

There are various local institutions in farm communities that have a significant contribution to develop the social networks of interactions in the favour of their personal as well as collective remunerations. These social networks contribute to develop some rules, norm and operational framework through these institutions that are for their own benefits. Similarly, these institutions constitute the water user organizations and draw rules and regulations, management committee, regular annual meetings, level of association, responsibilities to be performed by different actors and water users that support to develop an environment of trust towards the ownership of water resources by community, resource mobilization, acquisition, allocation and distribution of water for irrigation. All these activities constitute the cognitive social capital in the irrigation systems managing by the water users (Pradhan, 2000).

2.1.4 Corruption

It is critical to consider that there is no any comprehensive definition of corruption in literature. A common definition of public corruption is “the illegal or misuse of public office for private gain”. Indeed, misuse implies, typically a legal standard. The concept of corruption would capture number of activities, for example; the illegal sale of public entity by government officials, kickbacks in public procurement, bribery and embezzlement of government funds in water sector. A comparatively implicit definition of corruption is given by UNDP, (2004) as corruption is;

“The misuse of public power, office or authority for private benefit – through bribery, extortion, influence peddling, nepotism, fraud, speed money or embezzlement”.

Although corruption is often considered a sin of government and public servants, it also prevails in the private sector. However, corruption is the most persistent and least confronted challenge in the irrigation systems of developing countries, especially in the South Asian countries. It remains at its high extent in the delivery services for irrigation water by public institutions that ultimately decrease the equitable distribution and sustainable development of irrigation system in the region (Davis, 2003).

Indus basin river system in Punjab is a gravity based system, where outlet (*mogha*) tempering and some other ways of water theft are common which reduce the flow of water to the downstream command areas (Van der Velde and Tirimizi, 1999). In the same context, Rinaudo (2002) illustrated in his research work in the irrigation system of Punjab that corruption can determine illegal allocation of irrigation water in a government-managed large canal irrigation system of Indus basin. The socio-economic conditions of the farmers who found to be engaged in the illegal allocation of water for irrigation have been analyzed using socio-economic and hydraulic field data collected from the 420 canal outlets from the southern Punjab irrigation system of Pakistan. It was investigated that corruption does not occur only by the economically and politically strong water users but other lower social elements of the rural society are also involved.

Corruption should be analyzed within the agenda of improved governance and institutional implications. It is critical to endorse the rule of law, protection of property rights, political rivalry, participation and transparency in general and in political processes of water delivery systems.

2.2 Irrigation governance in Asia and global context

In the global context, water institutions have been undergoing changes unprecedently and it has been shown that these changes in the water institutions have been followed by same patterns and trends. Saleth and Dinar (2000) stated that changes in the water institutions take place due to some factors such as endogenous and exogenous that work collectively to provide cost of opportunity in the institutional changes as well as equivalent to the transaction cost.

While describing the Asian irrigation water projects in the past few decades, various critical issues have been observed like adequacy arrangements in the institutions, lower participation of farmers (Easter, 2000). Agriculture is the backbone of national economy for many developing countries, which make the water sector much critical to develop crop productivity for the Asian countries. Despite having various efforts, the irrigation sector has been shown unsatisfactory performance in the development of Asian countries (Barker and Molle, 2005).

The bureaucratic approaches in the national irrigation systems contributes significant role for operation and maintenance procedure which have been failed to chaise efficient performance at higher level (Chambers, 1988). It is necessary to make improvement in the structure of government agencies for appropriate management of irrigation system. Many developing countries have been started to adopt irrigation management transfer through handing over the responsibilities to water users at local level (Vermillion, 1991; Helmi, 2000; Shah et al., 2000).

The government managed irrigation systems have been found inefficient performance than the farmers managed irrigation system (Lam, 1998; Shivakoti and Ostrom, 2002). According to some empirical evidence, farmer managed irrigation system contributing higher agricultural productivity and higher income to the farmers (Shivakoti and Ostrom, 1993). Moreover, the effectiveness of organizations have been shown efficient in the user managed irrigation systems than the systems controlled by non-users (Shivakoti, 1992) resulting poor implication of diverse rules, regulation, responsibilities and roles in the policy of irrigation system.

Some studies revealed the importance of power among state and society as the key potential for the development in several collective action domains (Evans, 1996). In the Asian countries, positive impacts have recorded on the relationship among state, institutions and local water users in a good manners leading to better performance of irrigation schemes (Moore, 1989 and Lam, 1996). The roles and responsibility of state in irrigation management plays an important role in the agricultural sectoral development.

In case of farmer managed irrigation system (FMIS), institutional aspects have been needed for the proper and effective performance (Shivakoti, 1995). Although, the policy related problems occur to increase the irrigation effectiveness by proper development of the physical components such as infrastructure development of the farmer managed irrigation system considerably ranging from proper improvement in the productivity of the agricultural crops (Joshi et al., 1998); Where as, existing organizations have not been shown any betterment in the development of physical capital of the irrigation systems.

People involvement and participation in irrigation system in Thailand integrated conventional practices and native managerial rules promote the management of irrigation system to proper mobilization of local resources as well as operation and maintenance, while the changes in the economic development patterns, the trends to mobilize the resources have also been changed; wishing to paying cash rather than contributing labour in operation and maintenance of the system (Shivakoti, 2000).

Some scholars argue that socio- economic and political development in most part in Asia has contributed a lot towards new trends in irrigation management (Moore, 1993). Fast growing economy has not only changed the mode of water delivery but also broader the vision under water irrigation, as now, the focus is not only assuring water delivery but the irrigation system also looks towards ensuring pollution control measures along with water related conflict resolutions (Lam, 1998; 2001). Moreover, this situation has changed the cost benefit determinants of different stakeholders in irrigation setup due to the fact that agriculture is becoming less productive. From farmer point of view, contributing to the irrigation system has become less benefited and in most part of Asia, their collective action is missing new urban farm land. Similarly, with the economical development and governments more investment in other sectors of economy like in industries has also lower the government interest in irrigation development investment.

2.3 Frameworks and Approaches to analyze the irrigation performance

The changing trends in the institutions of global water sector has been reviewed by the Saleth and Dinar (2000) that deals with the analysis of the institutions based on the three pillars such as water administration, water law and water policy within nationwide water economies and resources. However, this argument has also been supported by some other analyst and managers of water resource and they stated the law, policy and administration as the focal point for the analysis of water institutions (Bandaragoda and Firdausi 1992). In contrast, social patterns of adopting new institutional changes must be considered that is beyond the practices of international organizations, government bureaucracies and regulatory systems. The process of institutional analysis must be enclosed the civil society institutions, exchange institutions, religions, businesses and social movements that would come up with more effective outcomes of institutional analysis under changing context of social adaptations.

An analytical framework has been developed by Saleth and Dinar (1999) to categorize the different levels of inter-linkages within water institutions and obviously, their interaction under the performance network of water sector. They investigated the different institutional layers of linkages under this analytical framework by using the perception-based data and then identified the contribution of economic factors in the changing process of water institutions and how, these economic factors build a political pressure on bureaucracy to undergo the institutional change in national water sector. However, Royal Haskoning, (2003) introduced a model to analyze the water institutions in a different perspective of involving different dimensions that have direct influence of the performance of water institutions as shown in figure 2.1. This model is more comprehensive to analyze the water institutions in order to improve water governance through enhancing the performance of water institutions.

Saleth and Dinar (2004) argued that the institutional change is economically more profitable in terms of improvement in the performance of water institutions as transaction cost of institutional change is low that gives a “welfare theoretic logic” in order to initiate the process of change in the arrangements of water governing institutions. After that, most of the efforts have been made for the structural decomposition of the water institutions and to evaluate the performance of the institutions under changing context of governing bodies. However, these studies are lacking, in terms of measuring the factors influencing exogenously that indeed, affect the performance of the water institutions.

While analyzing the perception of an economist North (1990) principally, institutions influence performance of society at different levels of national economy for example, at individual, household, organization and at country level through effecting on exchange cost of transactions and productivity by institutions. Technology would also have a critical role while determining the renovation and transaction cost of water institutions. However, it is significant to categorize the various rules and responsibilities from different actors of an organization while regulating the analysis of water institutions.

The current framework of institutions performs only the obligatory services that do not cover the sufficient circumstances of service provision for the improvement in performance of institutions. According to the definition of institutions given by North (1990) institutions are the “framework within which human interaction takes place”. This definition of institutions gives the idea of two-way interaction in society. While, “transaction cost

theory" determines that the performance of the institutions rely upon the cost of enforcement of law. So, it is also necessary to overview the feasibility for enforcement cost of formal rules and regulations by the institutions in order to enhance the performance of water institutions.

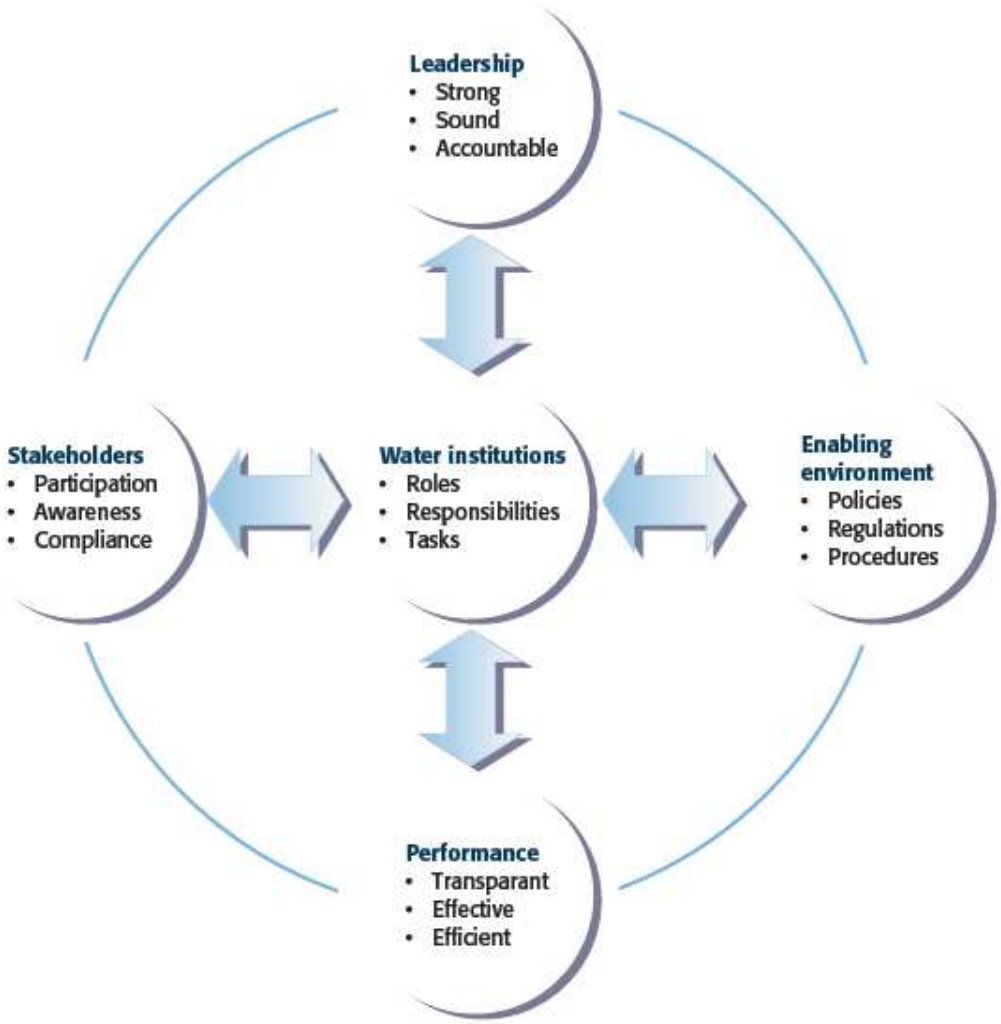

Figure: 2.1 Different dimensions of water institutions for good water governance

Some other scholars have conducted studies on water resource management with major focus on analyzing the institutional aspects to measure the performance of water institutions. The institutional framework given by Bandaragoda (2000) is comparatively more comprehensive than the previous studies on institutional analysis of water sector. This framework covers a range of rules and regulations, norms, local practices, organizations that collectively configure the human actions to manage the water resource in an effective way. The key objective of this study was to identify the necessary institutional arrangement through restructuring the institutions and to provide the possible course of actions to improve the management of water resource. However, this institutional framework is also limited to the institutional arrangements with specific circumstances and

does not analyze the previous dynamics of institutional arrangements. The positive aspect of this institutional framework is the provision of some necessary strategies for institutional changes in future.

Water as a common pool resource has a manifold utilization that may exert worse pressure on the water within a context of river basin and thus scarcity of water resource give a reason for restructuring the institutions governing water resource through necessary institutional reforms. An alternative framework for institutional analysis was projected, particularly for integrated water resource management (IWRM) institutions. This analytical framework focused on the transparency of policy procedures by state, different modes for the provision of water services and conditions of favourable environment for collective actions for water resource management in the broader context of river basin, furthermore, it does also analyze its implications for the improvement in the rural status of livelihood at a sustainable rate. While discussing the methodological aspects of analytical framework, various issues regarding scope of institutional analysis, collective actions and different levels of water use by multiple users, various scale of water management within river basin context have been considered (Kurian, 2004).

Florensa (2004) analyzed the institutional change with a different analytical framework and proposed that process of institutional change follow a logical sequence under a series of time factors. According to the hypothesis of author, at first, individuals do perceive the changing patterns of existing institutions, secondly, they choice the mode of changes in institutions according to their perception, at third, they do invest time and devote their resources in order to implement those selected changes in institutions and finally, they try to make it sure about the sustainability of changes in institutions after implementation. In this study of institutional analysis, author suggests that the process of institutional analysis would be start from the "unstable equilibrium" situation of institutions. During the process of analyzing the institutional change, at a specific instance, the formal and informal set of institutions would comprise the (*ex ante*) Status Quo that leads to effective analysis of institutional change. However, (Ostrom, 1990 and Ostrom et al., 1994) advocated in their study that the projected analytical framework was the revised version of the "Institutional Analysis and Development framework".

In a critical perspective of the analytical institutional framework, it covers almost an absolute image of all the key variables configuring the state of affairs that is faced by the actors. It gives an impression that how, actors face the substantial and materialistic circumstances of the existing institutional structure and how, different attributes of concerned actors influence under this particular circumstances within the passage of time. In the same context, Lam (2001) revealed in his study on analysis the irrigation system of Taiwan in a rapid changing political-economic environment during the recent decade. He reported that local irrigation institutions of Taiwan have undergone changed and evolved new institutions in order to improve the performance of institutions and better water management in the rapidly developing political and economic circumstances.

While reporting the different analytical frameworks of institutional analysis, it would also be constructive to consider the critical division drawn in the New Institutional Economics (NIE) between institutional arrangements (IA's) and institutional environment (IE). Saleth and Dinar (2000) in their study on "institutional analysis" include the concepts of institutional environment (IE) and institutional arrangements (IA's). The only missing concept of their study was the operational aspects of IE such as watchmen of irrigation

department to monitor the irrigation water and infrastructure, which is sometimes intimately, interrelate with the IA's of the water sector. In contrast, North (1990) argued that Institutional Arrangements (IA's) are the framework through which humans interact with each other as it may contains water user associations (WUAs) and rules-in-use etc. While discussing the institutional environment (IE), it may include different institutions and organizations at various levels of water management that relate with the water policy, water resource, state and rules and regulations etc.

In the broader context of institutional analysis, the argument proposed by Shah (2005) is most relevant. He suggested that water economies of different levels of its formalization under particular circumstances of national economy of the country should be considered while analyzing the water institutions. The performance of the water institutions based on the overall economic development of that particular country.

2.4 Participation in Irrigation Management

Scholar defined participation as the involvement of people in different areas of irrigation management, moreover, famer's participation in irrigation management is very vital for the sustainability of irrigation setup because of this factor developing countries are enhance their focus on PIM and IMT as in irrigation water and infrastructure development and management, the role of farmer as an individual and in collective is equally important that enhance the system efficiency and performance which leads to sustainability.

Direct interests, solidarity, trust, expectations, awareness are the major component of participation, thus, when participation in irrigation system increased, it increases the people control over resources. Farmer's participation can be fruitful in identifying problem area, solution to problem and decision making. They can be as effective in monitoring and evolution of the system delivery in context to demand and supply of water. Similarly, physical involvement of farmers in very vital in irrigation setup but in his point of view, the role of user development organizations are very important, these motivate farmers to participate in irrigation activities and promote sense of responsibilities among them.

Further, the participation in irrigation set up is very important as it not only ensure the sustainability of the irrigated plans and policies as it ensures the farmers participation at all stages of planning and implementations but it also makes the irrigation cost effective for government as through participation and sharing of responsibilities cost is reduced. Same time, participation, enhance , performance, service quality in O&M and also promote self sufficiency of the farmer along with the sustainability of the system.

At global level, there are thousands of irrigated systems exits that are being managed by local people and people are working at different levels but the major problem identified in these systems is the lack of ownership therefore, there is a strong need to develop a strong sense of ownership among the people who are managing these system. Scholars believe that through involving these local people at all stages of the planning process; from problem identification to till project implementation.

2.5 Efficiency of physical water supply

Efficiency of physical water supplies in the Indus irrigation system has an important concern. However, irrigation system of Punjab as being the part of IBIS has only 35-40% delivery efficiency from the canal head to the crop root zone due to the age and the poor maintenance (Tarar, 1995). This has been advocated as the main reason for the low water supply at the end users of the canal system. Further, accurate and reliable informations are not available on the distribution of irrigation water in the various parts of canal commands. It is considered as the major constraint for the efficient management of the scarce water resource (Ahmad et al., 2004). Almost, 20-30% daily fluctuations have been reported in the discharge of irrigation canals within irrigation system of Punjab (Sarwar et al., 1997).

Current informations point towards the deprived performance of the Punjab's irrigation system. The main causes of the poor performance of the irrigation system of Punjab include an inadequate institutional capacity, insufficient database fro planning and mechanisms for the development of large irrigation projects, poor quality of construction, design mistakes and intractability of institutional, technical and socioeconomic aspects (David, 2004).

Irrigation water is distributed among farmers through a rotational turn system known as "*warabandi*" that normally based on the fixed seven days. It means that farmers is permitted to use the entire flow of water from the outlet once in a weak for the time allocated by the department according to his size of land holding. It is very difficult to irrigate the entire land size due to the insufficient allocation of water (Qureshi et al., 2008). In this research study, various parameters have been used to investigate the physical water supply of water for irrigation such as water sufficiency, water delivery and its related problems and agricultural productivity.

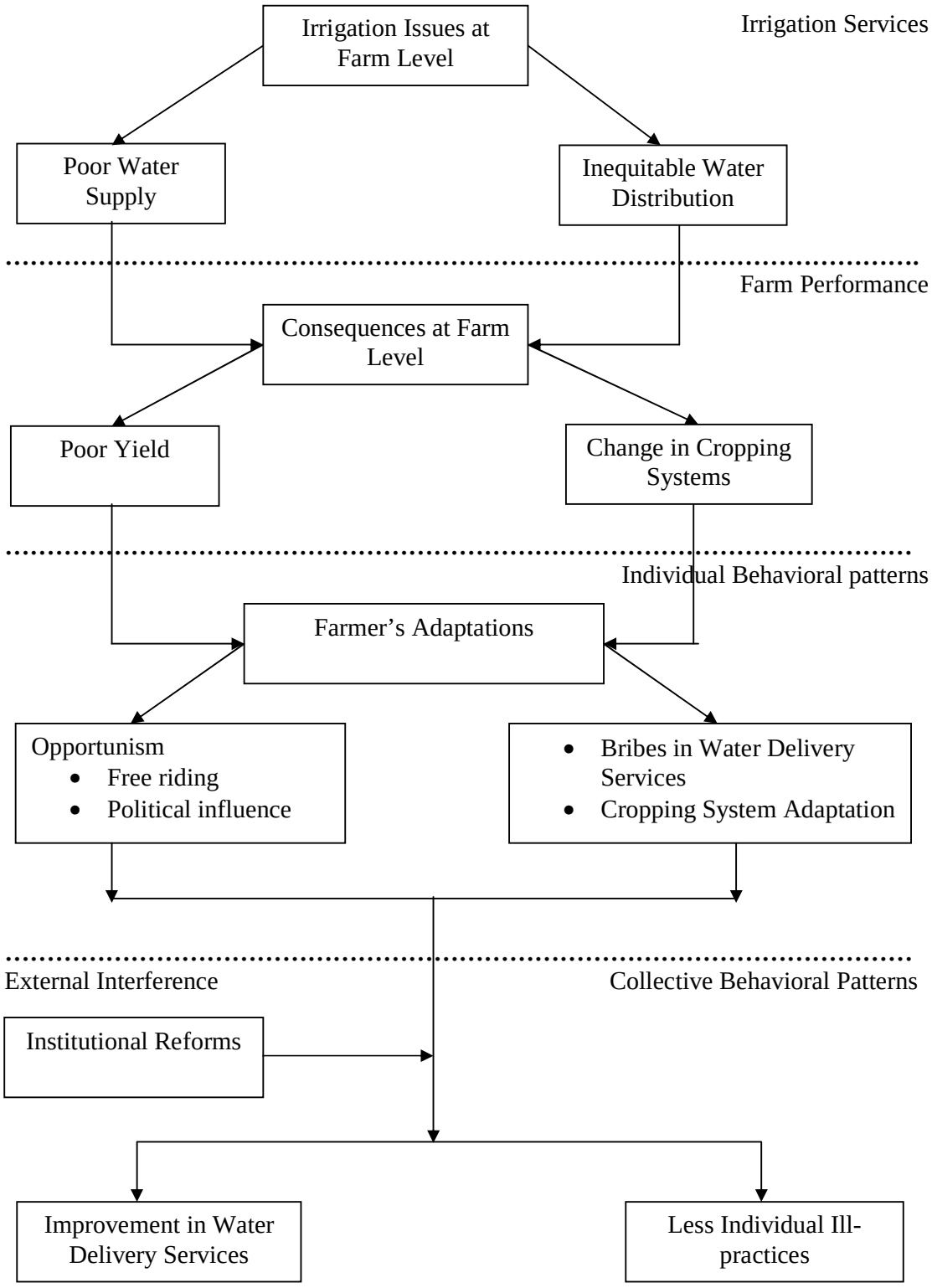

Figure 2.2: Conceptual Framework

Pakistan' irrigation system is the largest irrigation system in the world that has a long history of its development with a major focus to extend its command area. As described in the figure 2.2, there are numerous issues in this irrigation system that are lowering its overall performance particularly at farm level such as poor water supply and inequitable water distribution. Insufficient water delivery services cause different consequences at farm level such as poor crop productivity and change in the cropping systems. Under this situation, farmers are used to adopt cropping system according to the available water supplies. Additionally, farmers are used to adopt some ill-practices such as free riding, paying bribes and using political powers in order to get better water supplies. In order to overcome these issues and to improve the overall performance, Government of Pakistan has been introduced institutional reforms in the irrigation sector. The institutional reforms will improve the water delivery and lower the level of ill-practices in the irrigation sector of Pakistan.

CHAPTER 3

METHODOLOGY

The research chapter provides the reader with overview of the methodology used to conduct this research. This chapter includes description of study area, reasons behind its selection, sample size and data collection methods and data analysis techniques.

3.1 Selection of the Study Area

In general, this comparative study aimed to analyze the impact of the adoption new governance changes in the irrigation institutions through PIDA Act. 1997. At initial, institutional reforms have been implemented in few irrigation schemes of IBIS through a pilot project, funded by Japan. However, irrigation system is managed and operated by farmers through different institutional structures like Farmer's organizations (FOs) and water user associations (WUAs).

In Punjab province, irrigation system of Faisalabad Zone has been transferred to farmers to operate and manage the irrigation water by their own capacities. So, one irrigation scheme called as "Farooq irrigation scheme" is selected as a study area from Faisalabad zone, where irrigation management transfer (IMT) has been implemented and called as farmers-managed irrigation system (FMIS). While, a second irrigation scheme is selected from the agency-managed irrigation system (AMIS) in district Pakpattan, in order to compare the impact of institutional changes on the performance of irrigation sector. This agency-managed irrigation scheme is called as "2L irrigation scheme". Farooq irrigation scheme and 2L irrigation scheme both are part of IBIS and located within Punjab province.

3.2 Research Design

The type of research is an analytical evaluation type and research design is based primarily on a case study of the area, where two irrigation schemes are being implemented for the comparison. The research relies on both qualitative and qualitative data collected from primary and secondary sources.

3.3 Data collection methods

The research has been based on primary survey using questionnaire to collect a combination of qualitative and quantitative type of data; therefore bulk of primary data is collected from questionnaire whereas secondary data has been collected from district irrigation department office and district agriculture offices.

3.3.1 Primary Data Collection

Primary data for this research study has been collected through employing different techniques such as household's surveys, survey from key informants, observations, farmer's group discussions and some discussions with the officials from the both irrigation systems during the field survey.

i. Household Question Survey

Major part of data has been collected from this questionnaire. The questionnaire is contained both open ended and close end questions that would be asked from the farmers who are either belong to the area where the irrigated schemes have been implement or to the areas without them for comparison. The sets of questions are mostly related to farmers problems, institutional problems, benefits of the new system, farmer' participation.

ii. Key informant interviews

Semi-structure interviews have been conducted from the key informants from different fall in the study area. The old farmers with knowledge of old and new system, member of WUA or FO organization have been selected as key informants and they are questioned regarding the efficiency issue, local farmer participation, problems and benefit of the new system.

iii. Observation

Observation technique is used to get the overview of the existing situation of the canals, head, tails and any discrepancy in the system. Photograph has been taken especially of the issue of O&M of canals and water theft through *mogha* (outlet) damaging and some other ways.

iv. Farmers' group discussion

Focal group discussion has been carried out with the group of farmers belong to one head or tail or drawing water from the same point. Discussion is mainly focus on the corruption in the system, problem faced by them and their participation in the system. The points are recoded and have been incorporated in the research study.

3.3.2 Secondary Data Collection

Research has been used scholarly work done before go through literature review of journal articles and web sources regarding the performance of the irrigation system based on participation and corruption and their measuring indicators. Further, the secondary data has been collected from different organizations working in the field of irrigation. Farmer's data, technical data about canal irrigation system, policy documents and procedures have been collected from the regional office of PIDA and district irrigation Department of Faisalabad and from District irrigation Department of Pakpattan.

3.4 Sample design

In this study, total numbers of 73 respondents have been surveyed during field visit. Accidental random sampling technique has been implied, mainly because of the large study area and less time. Further, 38 samples have been collected from the FMIS and 35 sample size have been collected from the entire command area of AMIS. Then each bulk sample size is categorized into three different classes such as head, middle and tail region.

3.4.1 Distribution of the respondents

The respondents have been selected randomly from the commands of two different irrigation schemes, namely, FIS and 2LIS. The distribution of samples and their proportion in both canal commands is shown in table 5.1.

Table 3.1: Irrigation scheme wise distribution of respondents

Irrigation schemes	Size of the samples	%
FIS (FMIS)	38	52.05
2LIS (AMIS)	35	47.95
Total	73	100

It has been shown that the samples are almost equally distributed among the commands of both irrigation schemes. However, there is a slender variation in the sample size: as 3 extra samples have been taken from the tail region of FMIS.

3.4.2 Location wise classification of respondents

In order to make a comprehensive analysis, both of the irrigation systems have been further categorized into three different parts namely as head, middle and tail. This classification has been processed based on the number of outlets due to various characteristics on different parts of canal systems. The total number of outlets of each irrigation canal has been divided into three equal categories. The first category from the start of canal is named as head, second as middle and third as tail at the end of canal.

Table 3.2: Location wise classification of respondents

Location	Location (FIS)		Location (2LIS)		Total	
	Frequency	%	Frequency	%	Frequency	%
Head	12	31.57	12	34.28	24	32.87
Middle	13	34.21	13	37.14	26	35.61
Tail	13	34.21	10	28.57	23	31.50
Total	38	100	35	100	73	100

Further, instead of a slight difference of sample size from tail region, equal sample sizes have been selected from the all three different regions of the both irrigation systems. Three additional representations have been taken from the tail regions of FIS with the fact that this is the most deprived region in the entire command of any irrigation system.

3.5 Data processing and analysis

All the data from the questionnaires and other sources have been compiled and then analyzed using Microsoft Excel and Statistical Package for Social Science (SPSS) software. Following are the description of the methods that would be used in data analysis.

3.5.1 Quantitative data analysis

i. Descriptive statistics

Different types of descriptive statistical method has been used to formulate percentage, frequency, average, and mean, cross tabulation was employed to analyze the impact on the people. Whereas various statistical diagrams such as bar chart has been used for graphic presentation of data.

ii. Analytical statistics

Analytical Statistical Method like Chi-Square test has been used to explore the relationship between various defined variables to analyze the impact.

- ***Chi-square***

Chi-square test has been employed to test statistical difference of social characteristics of household members on gender, education, occupation, income type.

- ***Kruskal-Wallis (H test)***

H test has been used to compare the difference between two set of group data. This technique helped in effective comparison between the area with and without PIDA institutional reforms.

3.5.2 Qualitative data analysis

This study has been employed qualitative analysis by using qualitative statements that would be helpful in identifying the problems and issues of the affected community members.

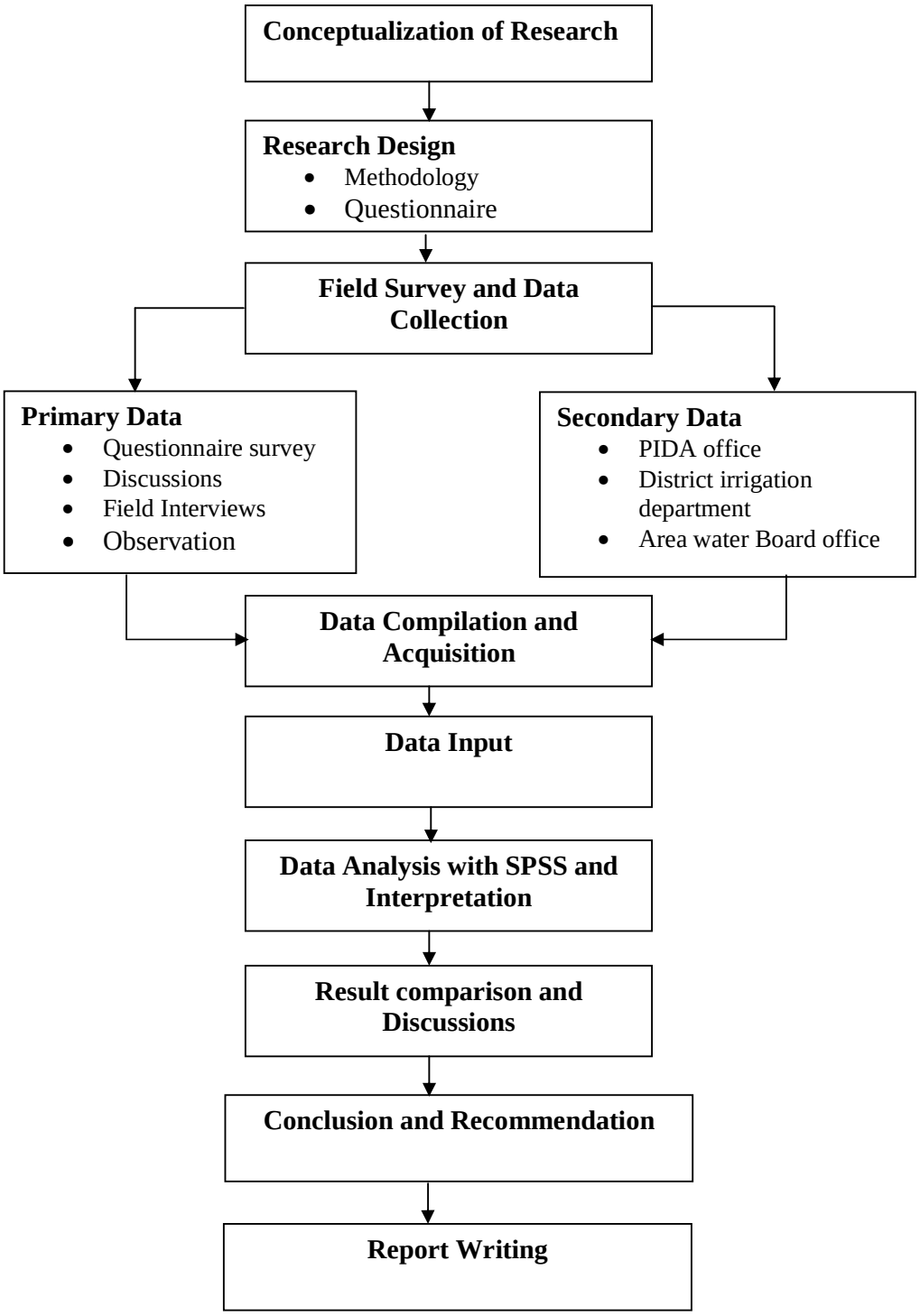

Figure: 3.1 Flow diagram of research steps

CHAPTER 4

STUDY AREA PROFILE AND SOCIO-ECONOMIC SITUATIONS

4.1 Background

This research study was carried out in the Indus basin irrigation system (IBIS). The Indus basin irrigation system of Pakistan is the most extensive irrigation system in the world which developed over the last 140 years. It stretches from the Himalayan Mountains in the north of the country to the alluvial plains of Sindh province in the south of the country passing through the Punjab province. The total estimated command area of Indus basin is 944,574 km^2. The most of the Indus plains have deep alluvial characteristics which have been developed through the continuous deposition by the Indus River and its side tributaries such as Sutlej, Ravi, Chenab and Jhelum. These alluvial plains cover an area of 207,200 km^2 of the entire Indus plains.

Indus river system is comprised of three western rivers and three eastern rivers. Western river system includes Indus, Jhelum and Chenab while eastern river system includes Sutlej, Beas and Ravi. According to the "Indus Treaty" signed in 1960 between Pakistan and India, World Bank assigned rights to India to take the control of eastern rivers' flows whereas, Pakistan has been given rights to control the flows of western rivers of the Indus basin. The Indus basin irrigation system is comprised of 3 dams, 19 headwork's and barrages and 12 link canals between rivers. In addition to it, IBIS system includes main canals, branch canals, distributaries and minors with length of 4230, 6835, 25874 and 19189 kilometers respectively. There are 135,000 watercourses in this system at field level.

Water resources mostly result from glacier melting from the upper Indus basin and precipitation in the form of rainfall and snow. The IBIS is situated in arid to semi-arid region of the Pakistan with annual average rainfall varying from 90 mm to 230 mm and annual average temperature varies from $14C^0$ to $49C^0$ in different seasons. Evaporation rate is also very high as compared to rate of precipitation due to arid and hot climate in the Indus plains.

Irrigated agriculture is the main source to boost up the economy in the Indus plains of Pakistan. So, full irrigation potential would be the main contributor to agricultural development in the country. The population of Pakistan is increasing gradually with 2.7 percent annually. According to the Federal Statistics of Pakistan, the population of the country was more than 164 millions in 2008.

Government of Pakistan has been making efforts since 1995 to reforming the century aged irrigation system by linking beneficiaries (water users) at different units of irrigation management. The foremost purposes of institutional reforms are, to get better operation and maintenance of irrigation sector, to make balance in revenue and expenditure, to maintain reasonable drainage system and to enhance crop production through efficient use of water (Lashari et al., 2003).

Figure 4.1: Indus Basin Irrigation system of Pakistan with Punjab province

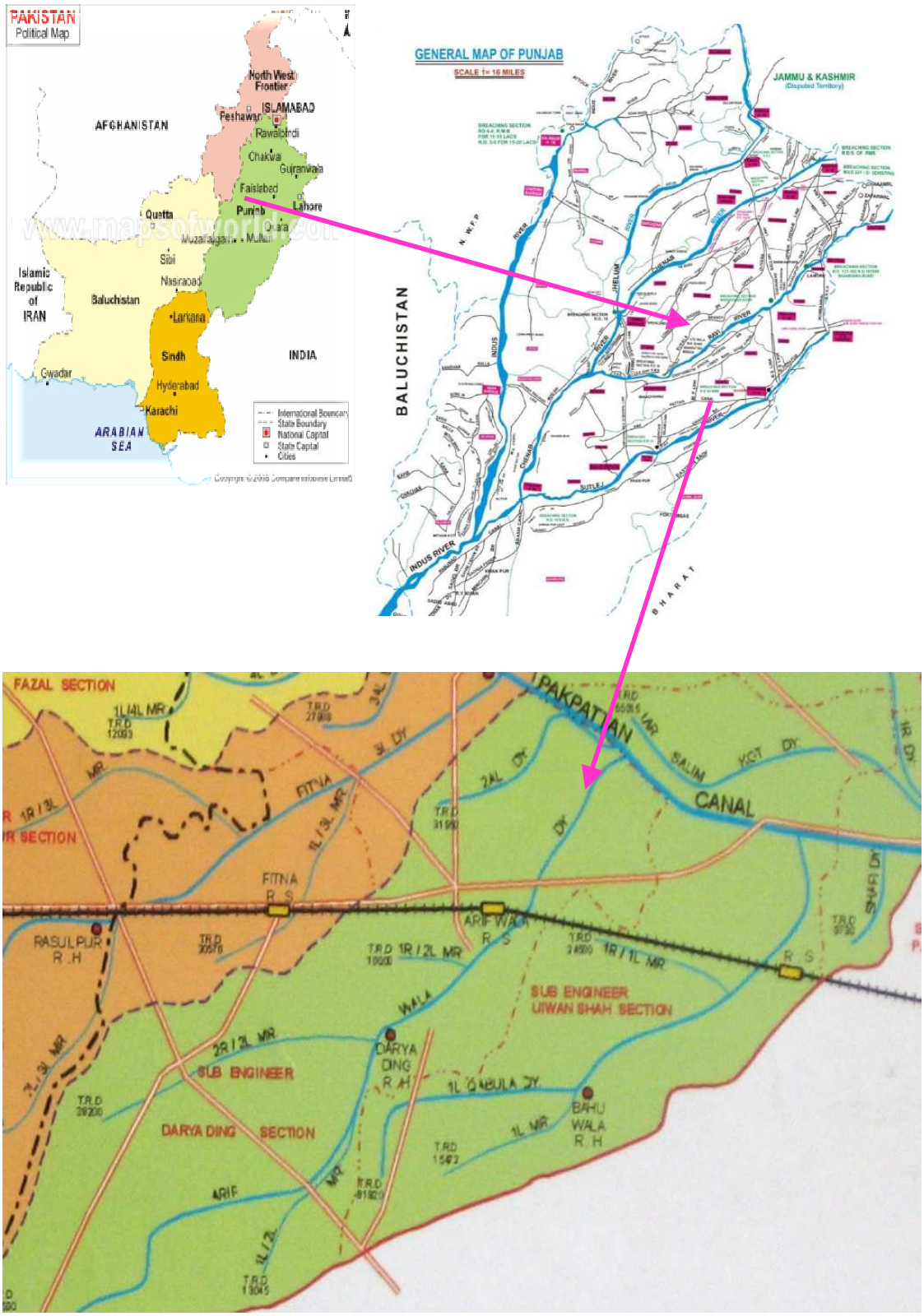

Figure 4.2: Map of the study area showing FMIS at right side and AMIS at below

Farooq irrigation scheme (FIS) is a FMIS and part of Lower Chenab Canal (LCC east) circle. It is situated near Samundary city and takes its discharge from Burala branch canal and lies about 40 km from Faisalabad. It lies between longitude 30^0 59' to 31^0 03' North and latitude 72^0 53' to 72^0 58' East within the command of Ravi and Chenab rivers. It has very long history of development as it was constructed in 1898 during Britain colonial ruling in the Subcontinent. The total discharge of this distributory is 45.22 cusecs. There are 30 outlets in this irrigation system providing water 12,545 hectares. The total length of this scheme is 12 kilometers.

2L irrigation scheme (2LIS) is an AMIS and part of Eastern Bar Division of Pakpattan Canal. It lies near sub-division (tehsil) Arifwala of district Pakpattan near Sutlej River. It is also a century old irrigation system and constructed during Britain regime in the Subcontinent. It lies between longitude 30^0 10' to 30^0 21' North and latitude 72^0 56' to 72^0 06' East within the command of Sutlej and Ravi rivers. The total discharge of this distributory is 104.55 cusecs. There are 68 outlets in this irrigation system providing water more than 23,000 hectares approximately. The total length of this scheme is 26 kilometers.

4.2 Climate

The climatic conditions have high seasonal fluctuations throughout the year. There are four clear seasons in a year such as winter, summer, spring and autumn. Mean day temperature during winter season varies from 15 to 27 degree centigrade while during winter nights, sometimes, it may decreased down to freezing point. During dry winter nights, fog occurs that damage crops but it happens occasionally. The summer temperature ranges between 32 and 45 degree centigrade in average. The minimum summer temperature is about 21 degree centigrade. The average annual rainfall is about 200 mm but most of the rains occur during monsoon during July and August months.

4.3 Soils and topography

The soils of Farooq irrigation system are characterized by predominately from medium textured to moderately texture in the entire study area in average. Soils are fertile and productive with little organic matter contents and can be classified into two major groups such as normal and saline sodic soils. Normally, there is accumulation of lime below 1 meter. This is the main reason that underground water in some patches of the study area is salty. Farmers have to apply Gypsum and some other treatments to underground water before its use for irrigation. Whereas, the soils of the 2L irrigation system is featured by silty and clayey loams predominately with high productive potentials.

Farooq distributory is situated in the commands of Chenab and Ravi rivers. This area is also known as "Rachna Doab". Whereas, 2L distributory is situated in the commands of Sutlej and Ravi rivers, generally known as "Bari Doab". Topographically, most of the study area is flat with alluvial deposits by Indus river system. The topographic gradient of this area is 0.20 meter per kilometer in average with a specific direction to south west. Surface drainage of the study area is slow due to the flat gradient.

4.4 Land use patterns and agriculture

The major land use of the study area is agriculture as most of the area is lie under crop cover. Rural settlements are scattered into different organized villages and some other

small houses away from villages with lack of basic facilities. Agriculture is the major occupation of the local villagers. Sugarcane, maize, wheat and rice are the main cash crops of the area in the FIS whereas; cotton, potato, wheat, maize and vegetables are the main cash crops in the 2LIS. Citrus and guava gardens are also there in some parts of the study area as an additional source of income.

4.5 General information

Table 4.1: general informations about the FIS and 2LIS

Variables	FIS	Distribution	2LIS	Distribution
Average age of respondents	44.63 (9.057*)	28-65 years	43.26 (9.817*)	23-65 years
Gender ratio	52:48		52:48	
Land holding size in hectares	3.74	1.21-9.71	5.88	0.40-21.86
Near local market	Samundary		Arifwala	

Source: Author's field survey, 2009
Note: *= Standard deviation

The average age of the respondents is noted as 44 years in both of the irrigation systems. The age of the farmers in FIS ranges between 28-65 years that highlighted that most of the farmers were young and had potential to perform their activities efficiently. Gender ratio was found as 52:48 that was also same in both irrigation systems with slightly higher proportion of male counts. Most of the farmers are small with 5 acres land holding size in average.

4.6 Occupational (livelihood) features of farmers

Table 4.2: Occupational (livelihood) features of the respondents

Type of occupation	FIS (FMIS)		2LIS (AMIS)		Total	
	Frequency	%	Frequency	%	Frequency	%
Agriculture	24	63.2	21	60.0	45	61.64
Service	6	15.8	3	8.6	9	12.32
Business	7	18.4	6	17.1	13	17.80
Labour	1	2.6	5	14.3	6	08.21
Total	38	100	35	100	73	100

Source: Author's field survey, 2009

On analysis of the samples, it is reported that 61.64% farmers are doing agriculture as a full-time job whereas; remaining 38% farmers are engaged in other occupations like service, business and labour. These farmers are engaged in farming as part-time. It is also remarkable that in Farooq irrigation system (FIS), more percentage of the respondents are engaged in part-time agriculture than the 2LIS irrigation system, whereas, 14.3% farmers are engaged in labour that was higher than the FIS.

4.7 Education level of farmers

Table 4.3: Educational level of the farmers

Education level	FIS (FMIS)		2LIS (AMIS)		Total	
	Frequency	%	Frequency	%	Frequency	%
Illiterate	15	39.5	13	37.1	28	38.35
Primary	10	26.3	12	34.3	22	30.13
Secondary	9	23.7	7	20.0	16	21.91
Higher	4	10.5	3	8.6	7	09.58
Total	38	100.0	35	100.0	73	100.0

Source: Author's field survey, 2009

One of the significant factors that influence the farmers in their irrigation behaviour is their level of education. In order to analyze the literacy level of the farmers in detail, it is categorized into 4 different levels based on their education. On analysis, it has been found that there is a significant difference between Farooq and 2L irrigation systems in terms of literacy levels of farmers. In case of Farooq irrigation system, the illiterate group consists of 39.5% that is higher than the level of illiteracy in 2L irrigation system with 37.1%. It is found that more respondents belong to the primary level of education in 2L command area with 34.3% than Farooq with 26.3% educational level. However, in case of secondary and higher levels of literacy, Farooq irrigation system is leading the 2L irrigation system that can show a good implication in terms of farmer's participation in irrigation management activities.

4.8 Classification of the farmers by operational farm size

Table 4.4: Classification of the farmers by operational farm size

Type of farmers	FIS (FMIS)		2LIS (AMIS)		Overall	
	Frequency	%	Frequency	%	Total	%
Small (=<2.02 ha)	22	57.9	9	25.7	31	42.46
Medium (2.02-5.06 ha)	10	26.3	12	34.3	22	30.13
Large (>5.06 ha)	6	15.8	14	40.0	20	27.39
Total	38	100.0	35	100.0	73	100

Source: Author's field survey, 2009

The size of operated land by farmers within the command area is also an influencing factor that effects the involvement of the farmers in irrigation system management activities. For this, farmers were classified into three different categories based on their operating land holding size such as, small, medium and large farmers. A significant difference is noted between Farooq and 2L irrigation system in this regard. Farooq irrigation system has higher proportion of small farmers with almost 60% of total respondents whereas; 2L irrigation system has higher proportion of large farmers with 40% of total respondents in the command area. While reporting to the medium farmers, 2L irrigation system has also a leading feature with 34.3%. In the Farooq irrigation system, most of the farmers are

engaged with subsistent agriculture in contrast with 2L irrigation system where, majority of the farmers are engaged in commercial agriculture.

4.9 Ethnicity /caste of farmers

Table 4.5: Ethnicity/caste of the farmers

Ethnicity/ caste	Total HH	Percentage of HH	Coverage area (ha)	% of covered area
Arain	24	32	78.94	22
Gujar	16	23	100.80	28
Rana	12	17	68.42	19
Baloch	7	9	57.48	16
Other	14	19	53.84	15
Total	73	100	359.51	100

Source: Author's field survey, 2009

The ethnology of the population consists of several costs. Arain is the most leading cost with 32% households and covering 195 acres operational land whereas; Gujjar comprised of 16% households with 249 operational lands. The rest of the ethnic groups include Baloch, Rana, Perehar and others covering 17, 9 and 19% of households respectively. The cast related to others are Bhatti, Machi and Pathan etc. Among all of the ethnic groups, Rana, Gujjar and Arain are the advantaged groups and owned more operational lands with compared to the other groups.

CHAPTER 5

INSTITUTIONAL REFORMS AND PHYSICAL AVAILABILITY OF WATER

There are numerous components of irrigation sector that express the overall performance of the institutions in irrigation sector. In this study, the performance of the irrigation sector has been measured based on defining different parameters like water delivery services, water sufficiency, efficiency in the collection of water charges, participation of farmers in operation and maintenance activities, crop productivity and consequences of water insufficiency etc. After institutional restructuring in irrigation sector, farmers' participation has been increased at various levels of water management. In this comparative study between FMIS and AMIS, level of participation has been measured only at O&M stage; reason advocated here that AMIS has participation of farmers only at O&M level.

It is important to present some details about the respondents in terms of their response to different levels of considerations such as participation in irrigation system and reliability of water delivery services at different locations of the irrigation systems. The contribution of farmers and their satisfaction level on the water delivery services and related problems in irrigation management system can be linked with the overall performance of that irrigation system. In this way, the impact of governance changes through institutional reforms in irrigation management system can be investigated.

5.1 Water sufficiency

In the FIS and 2LIS, water supply is not sufficient in order to meet the crop prerequisite. Water discharge variation has been practiced in the period of crop cultivation. The allocation of water in the command area and other water management services have been observed as successfully performing by the communities, but the physical and economics feature are being the key restriction. The stipulation of irrigation services has been appraised in terms of sufficiency of water availability. It has been observed that the organizational system and rules were performing effectively.

Questionnaire has been implied to get farmers vision about the irrigation water concerned matter. The farmer have been inquired to rate their satisfaction level as virtually no water, very insufficient, not so sufficient and very sufficient. Farmers from both irrigation systems articulated their view about the water sufficiency. From table 5.3, it exposes that most of the head end farmers are receiving sufficient water whereas the majority of the tail end farmers are not found satisfied with water sufficiency. It has been found that the trend of water sufficiency is declining order from head to tail ends.

In order to concern with the water sufficiency for irrigation, it has been found that 58% respondents are getting very sufficient supply of water at the head region whereas; only 8% farmers are getting very sufficient water both at middle as well as at tail region of FIS. In case of FIS' command, 5% farmers have been found deprived from getting sufficient amount of irrigation water whereas; an entirely different situation of water sufficiency for irrigation has been noted in case of 2LIS. Only 3% farmers are getting sufficient water and 40% farmers are getting very insufficient irrigation water in 2LIS. It is remarkable here that 8% farmers from the tail region of FIS are virtually not getting irrigation water in contrast with 2LIS where, 40% farmers from tail region are not getting water virtually.

Almost 45% farmers responded that they are not getting so sufficient amount of irrigation water in both of the irrigation systems (FIS and 2LIS).

Table 5.1: Water sufficiency at different regions of FIS and 2LIS

Water sufficiency	FIS (FMIS)			Overall	2LIS (AMSI)			Overall
	Head	Middle	Tail		Head	Middle	Tail	
Virtually no water	1	0	1	2	0	0	4	4
%	8	0	8	5	0	0	40	11
Very insufficient	1	4	5	10	4	7	3	14
%	8	31	38	26	33	54	30	40
Not so sufficient	3	8	6	17	7	6	3	16
%	25	62	46	45	58	46	30	46
Sufficient	7	1	1	9	1	0	0	1
%	58	8	8	24	8	0	0	3
Total	12	13	13	38	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS= Chi-square value=14.108 df=6, P=0.028
2LIS= Chi-square value=13.882 df=6 P=0.031

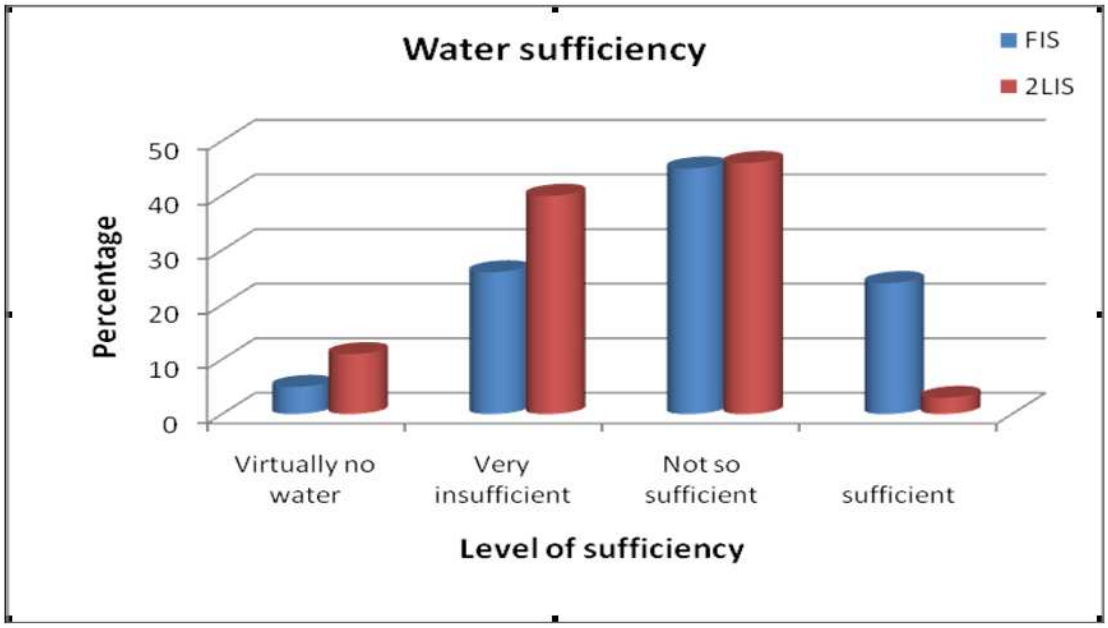

Figure 5.1: Water sufficiency at different regions of FIS and 2LIS

5.2 Consequences of water insufficiency at different reaches

Farmers have been asked about the consequences particularly in case, when they are getting insufficient amount of water for irrigation. Kruskal-wallis test has been employed in order to analyze the response of farmers regarding different consequences of insufficient supply of water at different regions of the both canal commands. It has been noted that the mean rank value for less yield is 27.92 at the head region followed by 16.04 and 15.19 at

middle and tail regions respectively in FIS. A significant result has been observed while analyzing the response of farmers regarding change in cropping pattern with mean rank value 17.46, 24.85 and 16.04 at head, middle and tail regions respectively in case of FIS.

Table 5.2: Consequences of water insufficiency at different reaches

	Various consequences	Location (Mean rank)			Kruskal-wallis (h-test)
		Head	Middle	Tail	
FIS	Less yield	27.92	16.04	15.19	χ^2 =10.989; P=0.004; *
	Less area planted	22.92	17.92	17.92	χ^2 =1.836; P=0.399; ns
	Crop pattern change	17.46	24.85	16.04	χ^2 =5.111; P=0.078; **
	Land degradation	17.92	19.77	20.69	χ^2 =.439; P=0.803; ns
	Fertility loss	25.83	18.27	14.88	χ^2 =7.083; P=0.029; *
2LIS	Less yield	15.33	15.73	24.15	χ^2 =5.408; P=0.067;**
	Less area planted	13.54	19.96	20.80	χ^2 =3.760; P=0.153;ns
	Crop pattern change	15.25	18.08	21.20	χ^2 =2.037; P=0.361;ns
	Land degradation	19.50	18.96	14.95	χ^2 =1.425; P=0.491;ns
	Fertility loss	19.92	19.85	13.30	χ^2 =3.323; P=0.190;ns

Source: Author's field survey, 2009

Note: ns= non-significant, *= Significant at 5% significance level
**= Significant at 10% significance level Df=2

In case of 2LIS, most of the mentioned consequences have been shown non-significant results at different locations of canal command. Only less yield as an indicator of insufficient supply of irrigation water has been shown significant result throughout the canal command of 2LIS. The mean rank value for less yield was found higher as 24.15 at the tail region in contrast with the other locations of the canal. It has been clearly seen from the table 5.4 that farmers from tail region of 2LIS were experiencing more negative impacts of water insufficiency than the farmers from head and middle regions in terms of change in cropping pattern, less yield and cultivating less area.

5.3 Level of water delivery problems at the different regions of FIS and 2LIS

It has been also inquired from the farmers about their level of water delivery problems from both of the irrigation commands (FIS and 2LIS). A significant result has been noted for water delivery problems faced by farmers from different reaches of FIS. Almost 50% tail-ender farmers have been facing very high level of water delivery problems whereas, 42% farmers from the head region have been facing very low delivery problems. Overall, 46% farmers are facing high level of water delivery problems and 54% farmers are facing low level of water delivery problems.

Table 5.3: Level of water delivery problems at the different regions of FIS and 2LIS

Water delivery problem	FIS (FMIS)			Overall	2LIS (AMIS)			Overall
	Head	Middle	Tail		Head	Middle	Tail	
Very high	1	2	5	8	1	3	4	8
%	8	15	50	23	8	23	40	23
High	3	4	1	8	1	3	1	5
%	25	31	10	23	8	23	10	14
Low	3	6	3	12	3	4	3	10
%	25	46	30	34	25	31	30	29
Very low	5	1	1	7	7	3	2	12
%	42	8	10	20	58	23	20	34
Total	12	13	10	35	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS: Chi square=10.942 DF=6 P=0.090
2LIS: Chi square=6.701 DF=6 P=0.349

While mentioning the water delivery problems facing by the farmers of 2LIS, it has been noted that 40% farmers from the tail regions have been facing very high level of problems and 20% farmers from the same region have been facing very low level of problems at the delivery stage of irrigation system. It is also important to mention here that 58% farmers from the head reach have been facing very low level of water delivery problems in 2LIS.

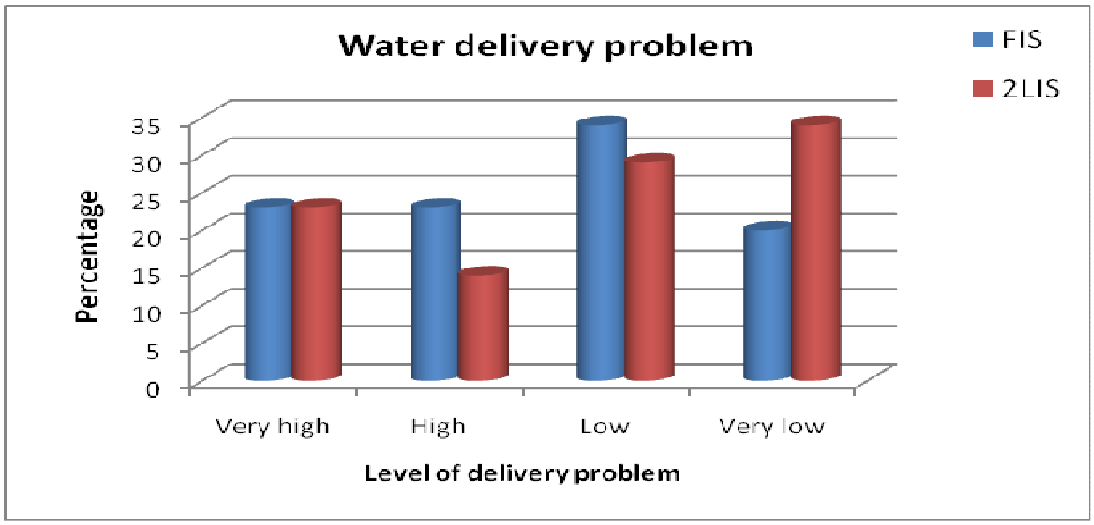

Figure 5.2: Level of water delivery problems at the different regions of FIS and 2LIS

5.4 Reason of inefficient water delivery at different levels of canal commands

Inefficiency in water delivery is a phenomenon caused by numerous reasons that varies at different locations of canal. Farmers have been asked about these reasons such as unscheduled canal closure, cut at head area, water theft by other farmers and change in the design of outlets as can be see in table 5.4. According to the perception of farmers, it has been seen that most of the farmer were agree on two reasons (Unscheduled canal closure

and Design of outlet) of inefficiency in water delivery and they have been shown almost same opinion along different locations of canal in case of FIS. Whereas, in case of cut at head region and water theft by other farmers, farmers showed different opinions at different locations but farmers at tail regions, they complained more about these two reasons of inefficient water delivery in FIS. It has been also noted that in FIS (FMIS), there is not any comprehensive and strict enforcement system to control over these reasons of inefficient water delivery.

However, farmers have different opinions about the reasons of inefficient water delivery of irrigation water in 2LIS. Most of the farmers from tail region have been found to be reported about cut at head region, water theft and change in the design of outlets in case of 2LIS.

Table 5.4: Reason of inefficient water delivery at different levels of canal commands

	Different reasons	Location wise (Mean rank)			Kruskal-wallis (h-test)
		Head	Middle	Tail	
FIS	Unscheduled canal closure	22.17	20.08	16.46	χ^2 =1.846; P=0.397; ns
	Cut at head area	10.00	19.88	27.88	χ^2 =17.361; P= 0.000; *
	Water theft	11.88	19.46	26.58	χ^2 =11.848; P=0.003; *
	Design of outlet	19.54	20.69	18.27	χ^2 =0.334; P=0.846; ns
2LIS	Unscheduled canal closure	17.88	25.12	8.90	χ^2 =15.116; P=0.001; *
	Cut at head area	19.33	12.77	23.20	χ^2 =6.600; P=0.037; *
	Water theft	20.67	13.65	20.45	χ^2 =4.243; P=0.120; ns
	Design of outlet	11.21	18.23	25.85	χ^2 =12.305 ; P=0.002; ns

Source: Author's field survey, 2009

Note: ns= non-significant, *= Significant at 5% significance level, DF= 2

5.5 Crop productivity

Farmers showed different responses while describing their crop productivity in both irrigation systems. According to response of the 42% farmers, their crop productivity has been increasing due to the improvement in water delivery after reform whereas; 44.7% farmers have been responded that there is no change in crop productivity after the institutional reforms in the FIS. According to some other farmers from FIS counted 13.2%, their crop productivity has been decreasing due to the inefficient provision of irrigation water after institutional reforms. Water supply is not the only factor influencing the crop productivity. As, there are several other factors that affect on the crop productivity such as timely availability of farm-inputs, credit availability with easy conditions, sharing of farm-technology with other farmers, access to market, support price of farm product and ultimately weather conditions.

Table 5.5: Response of farmers on crop productivity of FIS and 2LIS

Crop productivity	FIS (FMIS)		2LIS (AMIS)		Total	
	Frequency	%	Frequency	%	Frequency	%
Increasing	16	42.1	6	17.1	22	29.6
Decreasing	5	13.2	15	42.9	20	28.05
No change	17	44.7	14	40.0	31	42.35
Total	38	100.0	35	100.0	73	100

Source: Author's field survey, 2009

On the other hand, only 17.1% farmers responded that their crop productivity has been increasing. It is also remarkable here that according to 42.9% farmers, their crop productivity has been decreasing whereas; 40% farmers responded that there is no any change in the crop productivity. Overall, 42.35% farmers observed that there is not any specific change in the production of their crops in last few years.

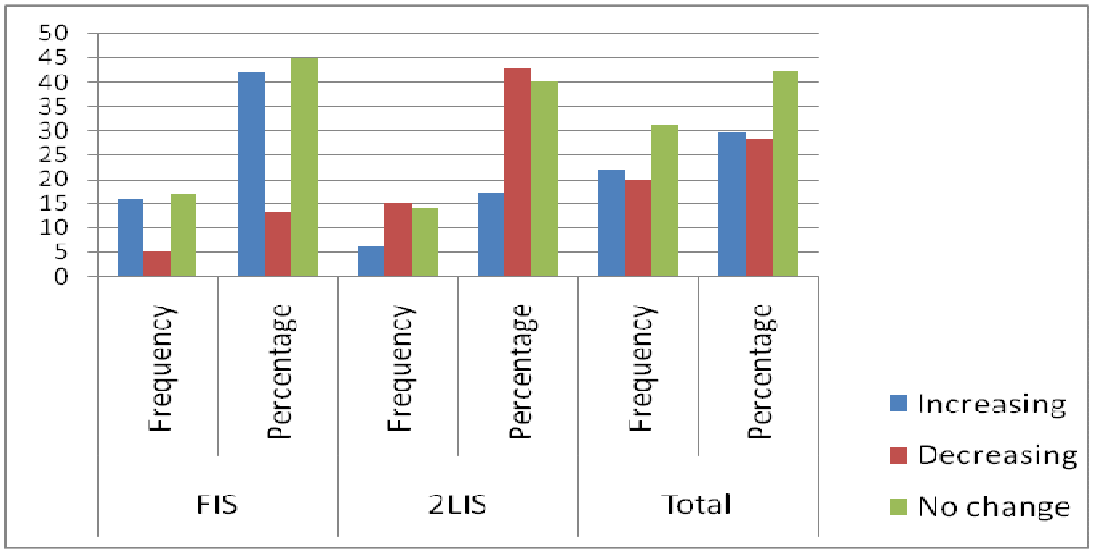

Figure 5.3: Response of farmers on crop productivity of FIS and 2LIS

5.6 Efficiency of institutions for collection of water charges

Collection of irrigation service fee (ISF) is a major component in the efficient and sustainable performance of any irrigation system. In the Farooq irrigation system (FIS), 68.6% farmers have been responded that collection of ISF is efficient. So, most of the farmers are paying their ISF at proper time and on the other hand, WUAs are also efficient to collect the ISF from farmers. It has also been noted that 31.4% farmers are not agree that the system of ISF collection under WUAs is working efficiently.

Table 5.6: Efficiency of institutions for collection of water charges in FIS and 2LIS

Efficiency of ISF collection	Location (FIS)			Overall	Location (2LIS)			Overall
	Head	Middle	Tail		Head	Middle	Tail	
Highly efficient	4	3	2	9	5	5	4	14
%	33.3	23.1	20	25.7	41.7	38.5	40	40
Efficient	4	6	5	15	5	5	5	15
%	33.3	46.2	50	42.9	41.7	38.5	50	42.9
Not so efficient	2	2	2	6	1	2	1	4
%	16.7	15.4	20	17.1	8.3	15.4	10	11.4
Totally inefficient	2	2	1	5	1	1	0	2
%	16.7	15.4	10	14.3	8.3	7.7	0	5.7
Total	12	13	10	35	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS=Chi square =1.099 Df=6 p=0.982
2LIS=Chi square =1.299 Df=6 P=0.972

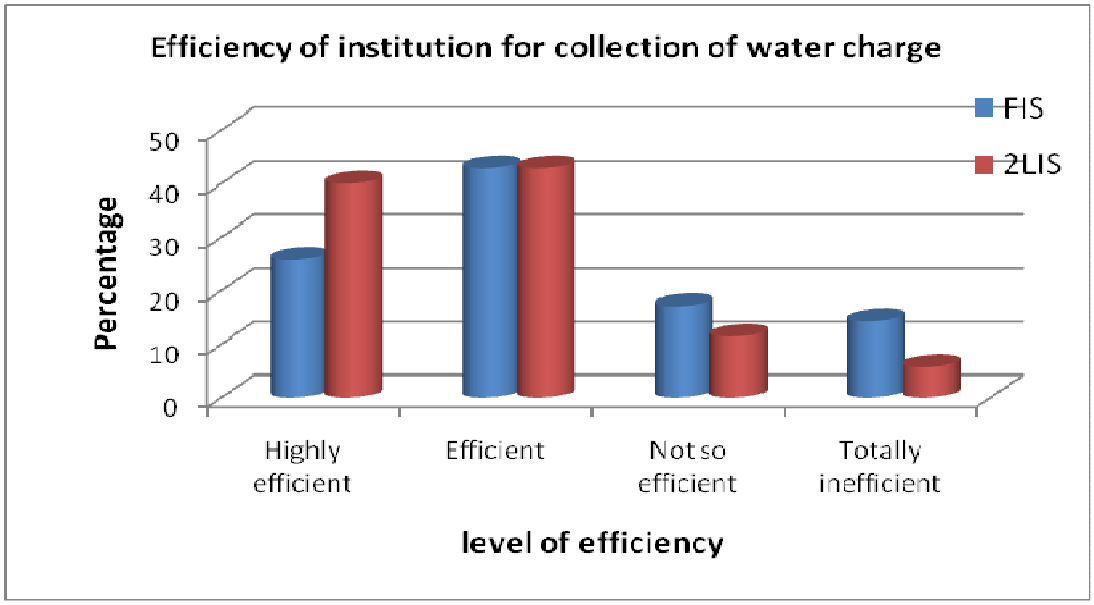

Figure 5.4: Efficiency of institutions for collection of water charges

However, in case of 2L irrigation system (2LIS), system for the collection ISF is working better and efficiently than the FIS. Almost, 83% farmers favoured that the system for ISF collection by government is working efficiently. It has been also found that there is no any significant difference among the responses of farmers from head and middle regions in order to describe the efficiency of ISF collection. Only 10% farmers from the tail region describes that system for ISF collection is not giving efficient performance. Irrigation department has better enforcement system for the collection of water charges from farmers

than the farmers-managed irrigation system. In farmers-managed irrigation system, chairmen of WUAs have been noted to give relaxation in the collection of ISF in terms of extension in deadline to submit ISF. It has been also found that system of ISF collection under WUAs is not transparent and efficient in FIS.

5.7 Farmers participation in the operation and maintenance of irrigation system

In the FIS, it has been noted that 22.2% farmers are highly participating in the O&M related activities and 38.9% farmers are fairly participating in different operation and maintenance related activities. However, 11% farmers have been found to be not participating in these activities at all. It is also important finding here that 90.9% participants in the O&M activities are belonged to the tail region whereas, 64.1% farmers are not participating regularly from the head and middle regions of the FIS.

Table 5.7: Farmers' participation in the O&M activities in FIS and 2LIS

participation in O&M	Location (FIS)			Overall	Location (2LIS)			Overall
	Head	Middle	Tail		Head	Middle	Tail	
Highly	1	1	6	8	2	2	2	6
%	8.3	7.7	54.5	22.2	16.7	15.4	20	17.1
Fairly	3	7	4	14	2	6	2	10
%	25	53.8	36.4	38.9	16.7	46.2	20	28.6
Not much	4	4	1	9	6	3	5	14
%	33.3	30.8	9.1	25	50	23.1	50	40
Not at all	4	1	0	5	2	2	1	5
%	33.3	7.7	0	13.9	16.7	15.4	10	14.3
Total	12	13	11	36	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS: Chi-square=15.583 Df=6 P=0.016
2LIS: Chi-square=4.000 Df=6 P=0.677

The situation is entirely different in case of 2LIS while describing the participation of farmers in the O&M related activities. It has been calculated that only 17.1% famers are highly participating while 28.6% farmers are participating fairly in the O&M related activities. It has been also found that 40% farmers are not participating with full devotion. Farmers from tail region have been found more willing to participate than the farmers from head and middle regions of FIS. However, there is not any remarkable difference found in the case of famers who are not participating at all in the O&M activities in both of the irrigation systems (FIS and 2LIS).

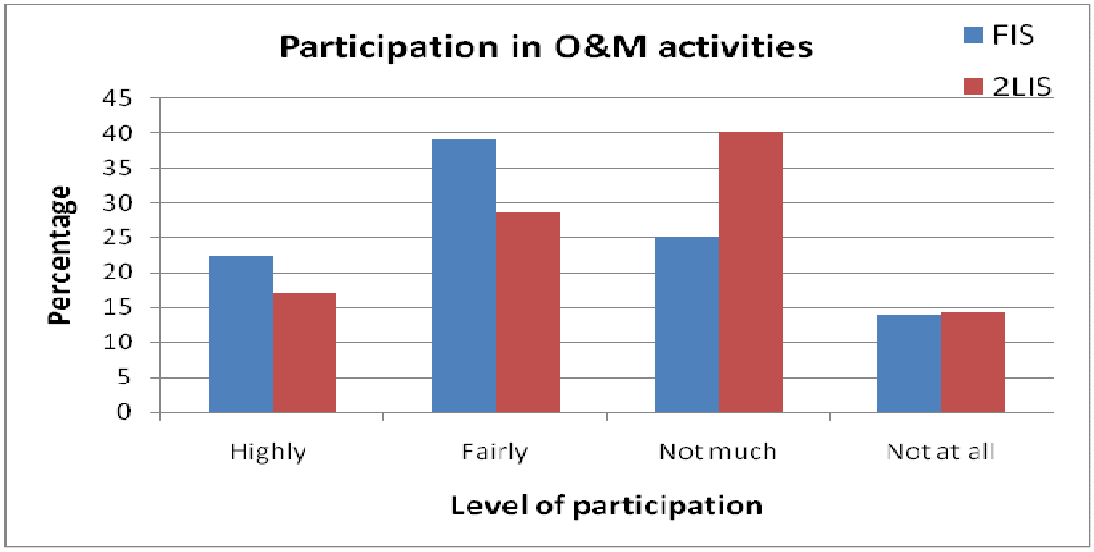

Figure 5.5: Farmer' participation in the O&M activities in FIS and 2LIS

5.8 Observations and Discussions

In order to make a comprehensive analysis, both of the irrigation systems have been further categorized into three different parts namely as head, middle and tail. Water sufficiency is the main factor which demonstrates how reliable water delivery service is offer to the farmers in the both irrigation system. It has been found that tail end farmers are not having good services from the irrigation scheme as compared to head and middle farmers. A significant result has been noted for water delivery problems faced by farmers from different reaches of FIS. Based on the discussions with farmers, key informants and area water board (AWB) officials, it has been come to know that farmers are more aware and confident to manage the irrigation system as the result of institutional reforms. Overall, in FIS, water delivery services have been slightly improved, farmers are facing less problems and water sufficiency is comparatively better than the 2LIS. However, it has been informed by the officials that less efficiency and transparency have been practiced in the process of ISF collection. Some farmers have been also reported that they are unable to complaint in courts and police stations against their irrigation related problems, as all the rights to take decisions and conflict resolutions have been given to the chairmen of WUAs and they show biasness.

In the irrigation system of Punjab, conveyance efficiency ranges between 35-40%. There are certain losses of canal irrigation water such as seepage, evaporation and infiltration during its conveyance due to earthen made canals. Farmers with little literacy have been found unaware about these technical losses in irrigation water. So, describing about the canal water sufficiency for irrigation, these technical losses have not been considered.

CHAPTER 6

FACTORS INFLUENCING CORRUPTION IN IRRIGATION MANAGEMENT INSTITUTIONS

During the last decade, institutional reforms have been practiced in irrigation sector in order to improve the performance of institutions and to enhance economic stability. Corruption has been found a leading factor that hinders the performance of institutions providing irrigation water to famers particularly at the stage of delivery of water services at canal level. It has also been a least addressed challenge as it was very critical to quantify and explore the ways, patterns and reasons of corruption in irrigation sector. Different parameters have been implied in order to measure the levels of corruption and its relationship with the performance of institutions.

6.1 Farmers' perception on corruption in water delivery services in irrigation

Farmers have been inquired their perception about the corruption in the water delivery services in their respective irrigation systems. In case of FIS, 36.8% farmers argued that corruption is increasing in the process of water delivery as seen in table 6.1. It has been noted that 18.4% farmers responded that there was no change in the corruption after institutional reforms in FIS. About 31.6% farmers are not willing to talk about the facts regarding corruption during delivery of irrigation water in their irrigation system. It has been noted that most of the farmers are hesitating to talk about corruption issue related with other farmers. According to the results shown in the table, it is clear that corruption is increasing in the water delivery services in FIS.

Table 6.1: Perception of farmers on corruption in water delivery services

Perception on corruption	**FIS (FMIS)**		**2LIS (AMIS)**		**Total**	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Increasing	14	36.8	17	48.6	31	42.7
Decreasing	5	13.2	4	11.4	9	12.3
No change	7	18.4	6	17.1	13	17.75
Don't know	12	31.6	8	22.9	20	27.25
Total	38	100	35	100	73	100

Source: Author's field survey, 2009

In case of 2LIS, the proportion of farmers has been found high with response that corruption is increasing during water delivery services. It has been showed that 42% farmers supported this statement in contrast of FIS where, 36.8% farmers supported the statement that corruption was increasing. In the 2LIS, farmers have been found slightly more open to talk about facts of corruption with 27.25% response.

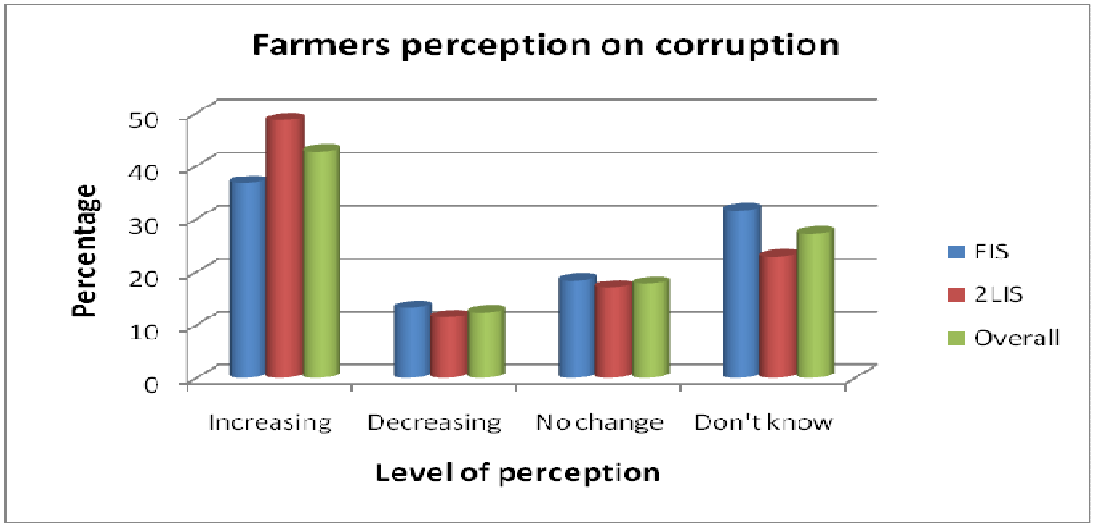

Figure 6.1: Perception of farmers on corruption in water delivery services

6.2 Major reasons of corruption in the water delivery services

There are number of reasons that influence the staff of irrigation sector as well as farmers to be engage in corruption. It has been inquired from the farmers about their perception on the possible causes of corruption in their respective irrigation systems. Lower water delivery and political influence have been found as the two main reasons of corruption in FIS with 31.6% response each. Third most influencing reason of corruption is the lack of enforcement system against corruption with 26.3% response. It is also remarkable here that political influence has been found highest at the head region whereas, lower water delivery has been found highest at tail region as the major reasons of corruption while delivery of water services in FIS.

Table 6.2: Major reasons of the corruption in water delivery services in irrigation

Reasons of corruption	Location (FIS)			Overall	Location (2LIS)			Overall
	Head	Middle	Tail		Head	Middle	Tail	
Lower water delivery services	3	2	7	12	3	4	8	15
%	25	15.4	53.8	31.6	25	30.8	80	42.9
Political influences	7	3	2	12	2	3	1	6
%	58.3	23.1	15.4	31.6	16.7	23.1	10	17.1
Salaries are too low	0	3	1	4	6	2	0	8
%	0	23.1	7.7	10.5	50	15.4	0	22.9
Lack of enforcement system	2	5	3	10	1	4	1	6
%	16.7	38.5	23.1	26.3	8.3	30.8	10	17.1
Total	12	13	13	38	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS: Chi-square=11.895 DF=6 P=0.064

2LIS: Chi-square=13.841 DF= 6 P=0.031

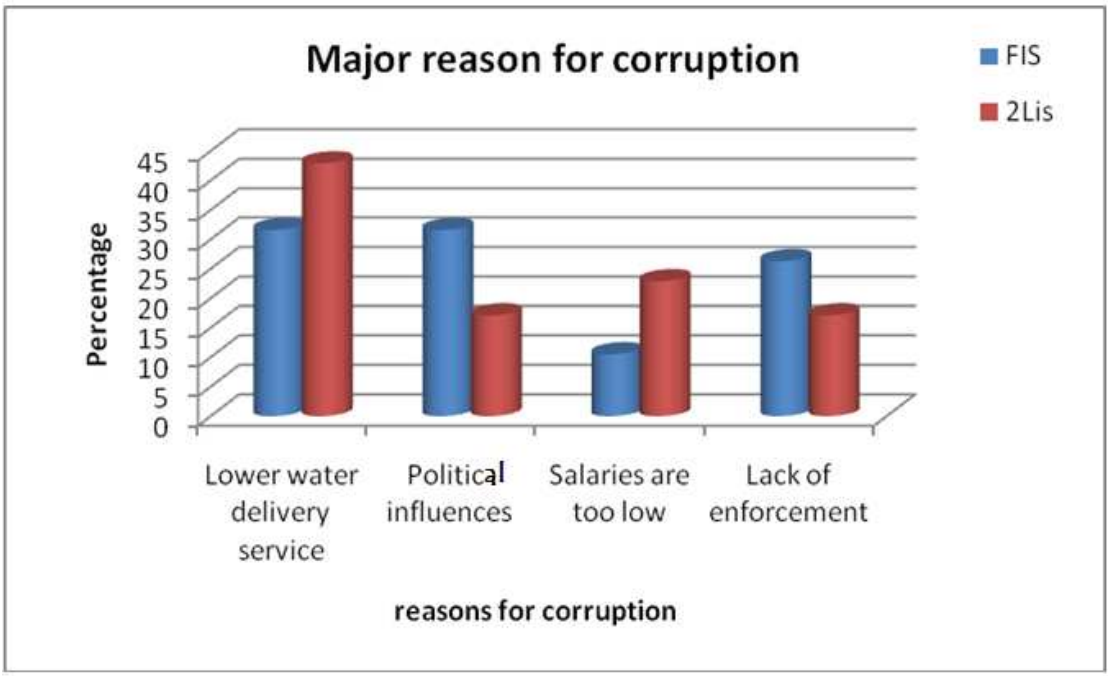

Figure 6.2: Major reasons of the corruption in water delivery services in irrigation

It has been noted in 2LIS that lower water delivery of water services is the most influencing reason of corruption with 42.9% response whereas, too low salaries is the second most important reason of corruption with 22.9% response. Lack of enforcement system has been found as the third most important reason of corruption according to the perception of farmers regarding corruption in the water delivery services in 2LIS. It is also mentionable here that according to the 80% farmers from tail region of 2LIS, lower water delivery is the only reason of corruption as seen in table 6.2. Farmers from tail region are most deprived from proper water delivery at their outlets, so, they have to pay bribes to staff of irrigation department in order to get water for irrigation.

6.3 Satisfaction of farmers on the performance of institutions

Most of the farmers from Farooq irrigation system (FIS) have been shown their positive response regarding their satisfaction on the performance of institutions providing water services. It has been noted that 26.3% farmers responded their highly satisfaction on the institutional performance whereas 13% farmers responded that they are not satisfied. Overall, 57.9% farmers have been found to be satisfied on the performance of water user associations (WUAs) and farmer organizations (FOs). Majority of the farmers from tail region are to be either virtually satisfied or not satisfied from the performance of the water service providing institutions in FIS.

Table 6.3: Satisfaction of farmers on the performance of institution

Farmers satisfaction	Location			Overall	Location			Overall
	FIS (FMIS)				2LIS (AMIS)			
	Head	Middle	Tail		Head	Middle	Total	
Strongly satisfied	3	6	1	10	4	2	0	6
%	25	46.2	7.7	26.3	33.3	15.4	0	17.1
Satisfied	5	4	3	12	2	4	2	8
%	41.7	30.8	23.1	31.6	16.7	30.8	20	22.9
Virtually satisfied	3	2	6	11	2	2	5	9
%	25	15.4	46.2	28.9	16.7	15.4	50	25.7
Not satisfied	1	1	3	5	4	5	3	12
%	8.3	7.7	23.1	13.2	33.3	38.5	30	34.3
Total	12	13	13	38	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS: Chi square=8.052 Df=6 P=0.234
2LIS: Chi square=7.504 Df=6 P=0.2770

In case of 2LIS, most of the farmers have been found to be not satisfied from the government institutions of water sector. As, it has been shown in the table 6.3, that 34.3% farmers are not satisfied whereas, 25.7% farmers are virtually satisfied on the performance of water services providing institutions in 2LIS. It is also remarkable that farmers from tail and middle region showed more unsatisfied response than the head region due to the lower water delivery at the tail reach of 2LIS.

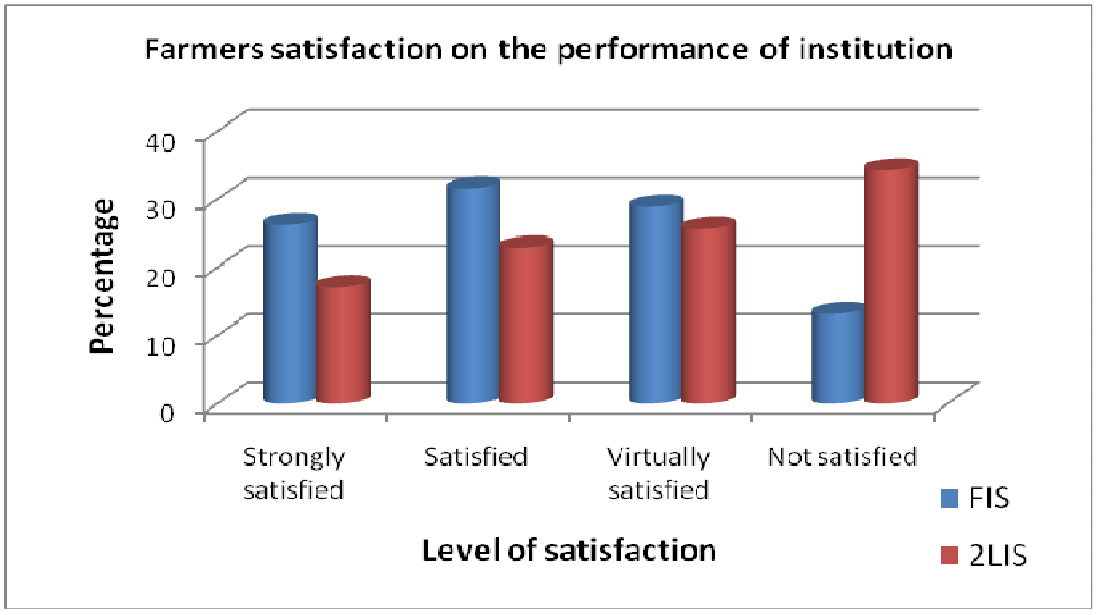

Figure 6.3: Satisfaction of farmers on the performance of institution

6.4 Farmers' relationships with institutions

Farmers of FIS have been expressed their good relations with WUAs and FOs with 15.8% response followed by 50% good relationship. Farmers from tail regions have better relations with institutions than the head and middle regions. Whereas, 34.4% farmers have been responded that they do not have good relationships with institutions. While describing the farmers' relationships with the water services providing institutions, it has been noted that 45.7% farmers have good relationships whereas, 54.3% farmers have poor relationships in 2LIS.

Table 6.4: Farmers' relationship with water services providing institutions

Farmers relationship with farmers	FIS (FMIS)			Overall	2LIS (AMIS)			Overall
	Location				Location			
	Head	Middle	Tail		Head	Middle	Total	
Very good	1	2	3	6	1	1	2	4
%	8.3	15.4	23.1	15.8	8.3	7.7	20	11.4
Good	6	6	7	19	5	3	4	12
%	50	46.2	53.8	50	41.7	23.1	40	34.3
Somewhat bad	4	5	2	11	5	8	3	16
%	33.3	38.5	15.4	28.9	41.7	61.5	30	45.7
Very poor	1	0	1	2	1	1	1	3
%	8	0	7.7	5.3	8.3	7.7	10	8.6
Total	12	13	13	38	12	13	10	35
%	100	100	100	100	100	100	100	100

Source: Author's field survey, 2009

FIS: Chi-square=2.996 Df=6 P=0.809
2LIS: Chi-square=3.295 Df=6 P=0.771

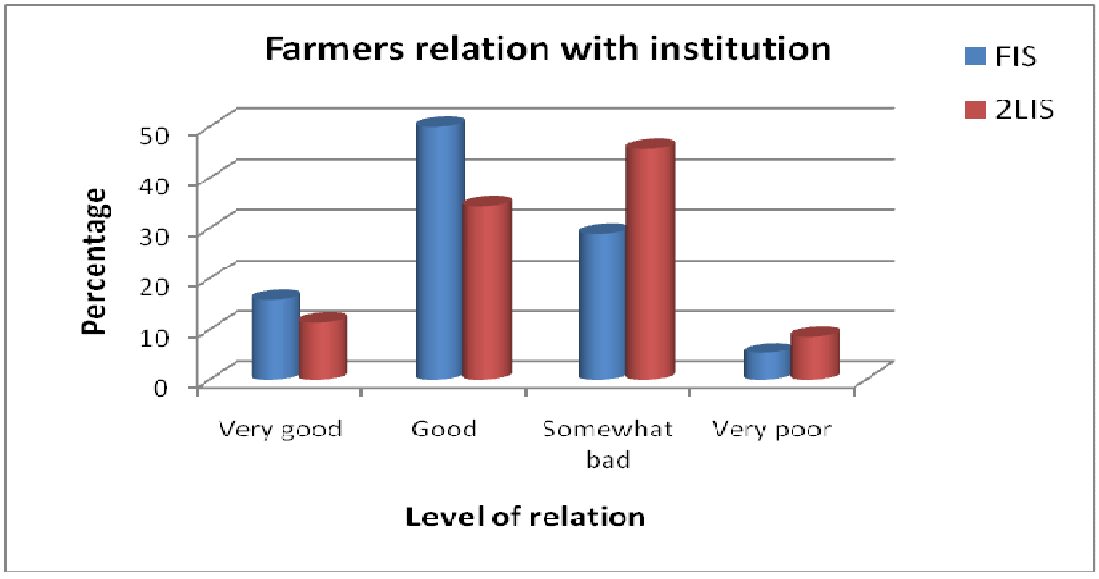

Figure 6.4: Farmers' relationship with water services providing institutions

6.5 Provision of various services by the water management institutions

In addition to the provision of water for irrigation to the farmers, there are some other supporting services come under the command of institutions. These services provide a basement to establish mutual trust and respect among stakeholders in any irrigation system. According to the results shown in table 6.5, it has been clearly mentioned that farmers-managed irrigation system has highlighted better performance regarding provision of additional services to the farmers than the agency-managed irrigation system.

Table 6.5: Provision of various services by the water services providing institutions

Provision of services	Farmer Response	FIS (FMIS)		2LIS (AMIS)	
		Frequency	%	Frequency	%
Sense of ownership	Yes	30	78.9	10	28.6
	No	8	21.1	25	71.6
Self respect	Yes	26	68.4	10	28.6
	No	12	31.6	25	71.4
Legal support	Yes	17	44.7	22	62.9
	No	21	55.3	13	37.1
Moral support	Yes	24	63.2	9	25.7
	No	14	36.8	26	74.3
Corruption control	Yes	16	42.1	8	22.9
	No	22	57.9	27	77.1
Conflict resolution	Yes	23	60.5	9	25.7
	No	15	39.5	26	74.3

Source: Author's field survey, 2009

6.6 Observations and Discussion

During the field survey, some discussions have been also made with some key informants and farmers regarding their opinions and experiences about corruption and different aspects of the performance of irrigation institutions. It has been observed that the ways and patterns of corruption were different from the 2LIS as; governing system has been changed due to the institutional reforms. Famers have been engaged to manage, operate and take care of the Farooq irrigation system. Based on the discussion with farmers and officers of area water board (AWB), it is investigated that most of the farmers in the cabinet of WUAs (at water channel level) and FOs (at canal level) are belonged to the political backgrounds and some others are large farmers. This is the main reason advocated causing political influence on the small and poor farmers at different regions of the FIS. Political influence and free-riding of irrigation water have been found to go side by side.

In case of 2L irrigation system (2LIS), it has been clear from the data analysis that tail-enders have been more deprived from proper water services than the head and middle regions of both irrigation systems (FIS and 2LIS). Based on the insufficiency of water at tail region, farmers have been found more engaged in paying bribe to the lower staff of irrigation department in order to get more water in case of 2LIS. It has also been noted that water users' particularly small farmers have nothing to do but to pay bribes to lower officials to get water for irrigation as it was difficult for them to afford and approach to the higher level of administration. It is also interesting that farmers have been experienced to pay different types of bribes such as cash, cereals, fodder and even petrol for their motor

bikes. Corruption has become an endemic part of irrigation system and causing inadequate water deliveries.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

This comparative study has been carried out in the Indus basin irrigation system (IBIS) within Punjab province of Pakistan. Two different irrigation management systems (FMIS and AMIS) have been selected in order to analyze the impact of institutional reforms on the overall performance of the farmers-managed irrigation system. Conclusions have been drawn based on the findings from data analysis in previous chapters, field observations and discussions with farmers and officials.

The results about the physical availability of water are based on the farmers' perception. According to data analysis, farmers-managed irrigation system is providing more sufficient amount of water for irrigation than the agency-managed irrigation system. As, 24% farmers are getting very sufficient amount of water in farmers-managed irrigation system against agency-managed irrigation system where only 3% farmers are getting very sufficient amount of water for irrigation. Tail farmers of AMIS are suffering more from the insufficient supply of irrigation water and getting less yield than the FMIS. Almost 40% farmers are getting insufficient amount of water in AMIS that is higher than the FMIS where 26% farmers are getting insufficient amount of water. So, FMIS is found to be performing more efficiently in terms of providing more sufficient amount of water than the AMIS.

It is concluded that 46% farmers are facing high level of problems regarding water delivery in farmers-managed irrigation system that is found to be higher than the agency managed irrigation system where 37% farmers are facing high level of problem during delivery of irrigation water. There are various reasons for inefficient water delivery but the stronger reasons causing water delivery problems are unscheduled canal closure, water theft and change in the design of outlet in FMIS. Unscheduled canal closure is not under the control of WUAs but in case of water theft and illegal change in the design of outlet, farmers having political influence and members of the cabinet of WUAs have been involved more than the common farmers. It is also concluded that the governing system of WUAs are not efficient due to lack of effective enforcement system as in case of agency-managed irrigation system.

A better performance regarding operation and maintenance activities has been noted in the FMIS than the AMIS. About 60% farmers are participating in O&M activities in FMIS whereas in case of AMIS, 45% farmers have been reported to be properly participating in O&M activities. Farmers from the tail region have been found to be shown more willingness and devotion to participate in O&M activities than the head regions. Regarding efficiency of the ISF collection system under WUAs, FMIS has been concluded less efficient than the AMIS due to lack of proper check and balance and mismanagement of the collected money.

In case of FMIS, farmers have been found to be more careful while talking about corruption in the water delivery of their irrigation system than the agency-managed irrigation system where farmers have been found to be very open to respond on corruption during water delivery. It has been concluded that FMIS is performing comparatively better

than the AMIS by reducing the chances of paying bribes to get better water delivery services.

Even then, 36.8% farmers argued that corruption has been increased in FMIS after the institutional reforms. Three main factors have been pointed out by the farmers such as low water delivery, political influence and lack of effective enforcement system as being the major reasons for corruption in the farmers-managed irrigation system. It has been concluded that the low water delivery services at the downstream side have been caused by the political influence at the upstream side of FMIS as; it has been observed that many of the large farmers with political affiliations have their agricultural lands at the head region of farmers-managed irrigation system. It has also been concluded that WUAs and FO have not any effective enforcement system against these free-rider due to political influence. Small and poor farmers are the most deprived stakeholders of farmers managed irrigation system.

It has been concluded that farmers are getting comparatively better services from WUAs and FO such as sense of ownership, moral support, self respect and conflict resolution after the institutional reforms in FMIS than the AMIS. It has been found that FMIS is not providing efficient services regarding legal support and control over corruptions due to lack of strict policy framework in order to take proper measures to improve the lacking dimensions. Farmers of the FMIS can not register their complaints about their irrigation related problems direct to courts and police stations like in AMIS.

7.2 Recommendations

This study has been carried out with a major focus to analyze the performance of the irrigation sector under newly established governing system through institutional reforms under PIDA Act, 1997. For this purpose, indicators have been developed like water delivery services, problems in water delivery services, participation of farmers in O&M activities, ISF collection, agricultural productivity, corruption in water delivery services etc. This research has been conducted at local level of irrigation sector.

Recommendations for policy makers

In order to reduce the political influence in the local governing system of WUAs and FO, some amendments needed in the election criteria to elect the chairperson of WUA and other members by the area water board (AWB) and Punjab irrigation and drainage authority (PIDA). Political leaders like ex-members of provincial assembly and other large land holders should be discouraged to take part in the election. Prior election nomination and selection of the candidates should be based on their performance in the previous tenure. Preferably, the president of the FO should be chosen from the tail region in order to improve the water delivery throughout the canal. Small and common farmers should be encouraged to be part of the cabinet of WUA in order to minimize the political disparity among farmers.

The emphasis should be given to strengthen the enforcement system and make it more effective against the water theft and illegal change in the size of outlets. The monitoring cell of AWB and PIDA as well should take necessary policy measures against involved actors and should recommend strict penalties and punishments. Additionally, the

monitoring of the canal should be done frequently both in day and night times. As, most of the illegal activities have been reported during night times.

The ISF collection system should be transparent and accountable as well. In order to reduce the delay collection of ISF from some farmers due to biasness and misuse of ISF money by WUAs and FO, there should be an accountability system with a clear legal framework and audit arrangements by higher governing bodies like AWB and PIDA.

Recommendations for further research

This research study is based on the perception of farmers from irrigation system; a further research may be conducted on the actual measurement of parameters such as water sufficiency, crop and farm performances, magnitude of corruption in water delivery and their association with the actual performance of the water supply system.

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Appendix

SURVEY QUESTIONNAIRE

1 Respondent Profile

1.1 General

a) District_____Tehsil_____

b) Name of village _____c) Minor /Distributary _____

c) Water Course Name/Number _____

d) Location of village w.r.t distributary 1- Head 2- Middle 3- Tail

1.2 Personal

a) Name of Respondent _____b) Age (Years) _____

c) Status of respondant 1- Head 2- Spouse

d) Education of the respondent

1) Illitrate 2) Primary 3) Matric and under 4) Higher than matric 5) Higher than batchlor

e) Experience in farming (Years) _____

f) Family Size 1- Adults (18 or above) ___2- Young (8-18) ___ 3- Kids (under 8) ___

1.3 Tenancy status and location of land

a) 1. Owner 2. Tenant 3. Owner-cum-tenant

Area owned _____ (Acres) Area rented-in _____ (Acres)

Total cultivated area _____ (Acres) Total fellow area _____ (acres)

b) How much area is situated at W/C Head___ (acres), Middle___(acres), Tail__(acres)

2 Irrigation management practices

2.1 Irrigation

a) Source of irrigation (Yes/No)

Source	2007		2008	
	Kharif	Rabi	Kharif	Rabi
Surface water				
Tubewell				

b) What is your allotted time for irrigation (warabandi)? _____Minutes/acre

c) Is available canal water supply is sufficient for irrigation?

1) Virtually no water 2) Very insufficient 3) Not so sufficient

4) Just sufficient 5) Very sufficient

d) If water supplies are not sufficient then what may be the consequences?

1) Less yield 2) Less area planted 3) Less crop diversification

4) More land degradation 5) More fertility loss

e) Time required to irrigate one acre (by canal water) _____ Minutes

f) Did you miss turns during the Kharif and Rabi?

1) Never 2) Some times 3) Many times 4) Always

i) Do you have any problem in water delivery at your turn?

1) Yes 2) No

j) If yes, what is the level of your problem during water delivery?

1) Very high 2) High

3) Low 4) Very low

k) What would be the reasons for getting insufficient water?

1) Unscheduled closure of canal 2) Cut at head area

3) Water theft 4) Change in the design of outlet

l) Have you been involved in any dispute/complaint regarding irrigation during last two years?

1) Yes (Nos ____) 2) No (Nos ____)

m) How many of these been solved uptil now? _____ Nos

2.2 Participatory Irrigation Management

a) What is the overall condition of the Distributary?

1) Very good 2) Good 3) Worst 4) Very worst

b) Do you think that you have some responsibility for operation and maintenance of the irrigation facilities?

1) Yes 2) No

c) Do you participate in cleaning/maintaining water course?

1) Always 2) Some times 3) Never

d) If yes, specify

1) Individually clean 2) Joint operation 3) Through WUA 4) All options

e) How many times you clean/ maintain W/C annually?

1) Once a year 2) Twice a year 3) Thrice a year 4) Four times a year

f) Are you satisfied with the maintenance of water channel?

1) Highly satisfied 2) Satisfied 3) Not satisfied 4) Highly dissatisfied

3 Performance of Institutions

a) Are you member of any

Khal Panchayat (WUA) 1- Yes 2- No
If yes position you hold _____

Nehri Panchayat (FO) 1- Yes 2- No
If yes position you hold _____

b) In your opinion what is the most significant aspect of this new system?

1) Aabiana collection 2) Maintenance and management 3) Dispute settlement

4) Participation in management 5) Training 6) Access to information

7) Don't know 8) Any other _____

c) How would you rank adequacy of water supply in your irrigation system?

1) Highly adequate 2) Adequate

3) Virtually adequate 4) Not adequate

d) How would you rank equitability of irrigation water in your irrigation system?

1) Highly equitable 2) Equitable

3) Virtually Equitable 4) Not equitable

4 Functioning of KP (WUA)/Institutions

a) What do you think about the relationship between farmers and WUA/institutions?

1) Very good 2) Good

3) Not good 4) Very bad

b) How much you are willing to participate in WUA activities?

1) Highly 2) Sometimes

3) Seldom 4) Never

c) How KP (WUA)/institutions are performing their activities?

1) Highly efficient 2) Efficient

3) Not much efficient 4) Not functional

d) In your watercourse, do you think that PIDA Reforms improved access to water at tail ends?

1-Yes 2-No

e) Do you think that KP(WUA)/institutions has provided

i) Sense of ownership about the irrigation infrastructure	1- Yes	2- No.
ii) Self respect	1- Yes	2- No.
iii) Legal support	1- Yes	2- No.
iv) Moral support	1- Yes	2- No.
v) Some forms of control on corruption	1- Yes	2- No.

f) Are the farmers' organizations resolving disputes?

(a) About water theft	1- Yes	2- No.
(b) About outlet tempering	1- Yes	2- No.
(c) About warabandi	1- Yes	2- No.

i) Do you think that present system of dispute settlement is better than the previous?

1- Yes 2- No

Give reasons, how? _____

_____

_____

5 Irrigation charges and O&M expenditure

a) How much water charges you are paying per acre _____Rs/acre

b) Is it? 1) Too much 2) Fair 3) Low

c) How much water charges you are willing to pay, if you get more adequate and equitable water services
_____Rs/acre

d) Are you satisfied with the current system of aabiana collection 1=Yes 2=No

e) If no why?

1) No incentives for timely payment 2) Complicated procedure for payment

3) No considerable head and tail differentials 4) Any other _____

f) How du you rank the efficiency of WUA/Institutions for the collection of water charges in your irrigation system?

1) Highly efficient 2) Efficient

3) Not so efficient 4) Not efficient

6 Crop productivity

a) How would you perceive about the productivity of the major farm crops?

1) Increased 2) Decreased 3) No change

b) If increased then what may be the possible reasons?

1) Better water supply 2) More credit available 3) Better access to market

4) Better access to farm inputs 5) Better information 6) Better training

7) Better sharing of farm technology with other farmers

c) If decreased then what may be the possible reasons:

1) Less water availability 2) Less credit available 3) Less access to market

4) Less access to farm inputs 5) Weak sharing of farm technology with other farmers

6) Soil fertility loss or drought 7) Less informations 8) Less training

7 Farm income

a) Is any family member involved in income generating activity other than farming?

1) Yes 2) No

b) Dependency on agriculture _____% (%age of farming income over all income)

c) How would you perceive your farm income?

1) Increased 2) Decreased 3) No change

d) If your farm income is increased then what may be the possible reasons:

1) Better water delivery services 2) Better access to market

3) Better access to farm inputs 4) Less disputes with other farmers

5) Better sharing of farm technology with other farmers

e) If your farm income is decreased then what may be the possible reasons:

1) Less water delivery services 2) Less access to market

3) Less access to farm inputs 4) More disputes with other farmers

5) Less sharing of farm technology with other farmers

8 Corruption

a) How do you perceive about corruption in your irrigation system. It exists

1) So many cases 2) Some cases 3) No case 4) Don't know

b) How do you perceive about corruption in water delivery services?

1) Increased 2) Decreased 3) No change 4) Don't know

c) Are you satisfied with the quality of construction/physical work at water courses and distributory?

1) Highly satisfied 2) Satisfied

3) Somewhat satisfied 4) Not satisfied

d) If you are not satisfied, what would be the possible reasons for poor quality of infrastructure?

1) Inadequate resources 2) Lack of farmer participation 3) Corruption

4) Poor management 5) any other _____

e) Have you any experience or heard of paying bribe to get authorized part of services

1) Yes 2) No

f) If yes, then how many times per year _____No.

g) Have you any experience or heard of paying bribe to get extra part of services

1) Yes 2) No

h) If yes, then how many times per year _____No.

i) Do you perceive that institutions providing water services are corrupt?

1) Yes 2) No

j) If yes, who is more responsible?

1) Officials 2) Lower staff 3) Farmers themselves 4) Don't know

k) Would you say that institutions are committed to reduce corruption?

1) Yes 2) No

l) If yes, are they efficient regarding control over corruption?

1) Yes 2) No

m) According to your view, what are the major reasons of corruption?

1) Lower water delivery services 2) Political influence

4) Salaries are too low 5) Lack of enforcement system

n) In you view how we can reduce corruption in our irrigation system.

1. Should fight against corruption
2. WUA/institutions can play an important role
3. Farmers themselves
4. Any other way _____

o) Comments and suggestions of the respondent for the improvement of system.

1. _____

2. _____

3. _____

4. _____

5. _____

Picture 1: Author's discussion with farmers

Picture 2: Author's discussion with officials of PIDA at Faisalabad office

Picture 3: Outlet tempering and change in the design of outlet

Picture 4: Water theft and canal bank cut

Picture 5: Operation and maintenance condition of water channels