

# Transformation or degradation: transition from *karez* to tubewell irrigation and its implications for power relations and social structure in Balochistan, Pakistan

H. Jamali\* and M. Hufty\*

Draft Paper Presented at the  
13th IASC Biennial International Conference, 10-14 January 2011  
“Sustaining Commons: Sustaining Our Future”

## ABSTRACT

The underground water level in the south-western province of Balochistan, Pakistan, has been declining at an accelerated rate, seriously affecting the *karez* irrigation, a traditional system of tapping underground water. One of the reasons for the declining underground water level is a rapid increase in the number of tubewells that are subsidized by the provincial government through the support of international donors to promote extensive agriculture on marginal lands. This ‘transition’ from *karez* to tubewell system has seriously disrupted the traditional institutions for managing the common-pool resource (CPR) of underground water and affected the livelihoods of subsistence farmers and pastoralists relying on *karez* irrigation. On the other hand, a small number of powerful people at the local level have benefited from the tubewells through growing water-intensive crops such as apples in line with the export-oriented policy of the provincial government. Although little work has been done on this issue, Mustafa and Qazi (2008) suggest that this transition was neither necessary nor beneficial and was simply the result of a policy choice. However, their results need further explanation. We propose an explanation that combines the political ecology approach with the theory of CPRs to explore how the ideology of development (promoting a technical and economic transformation of the society) and changing power relations at different scales have contributed towards the development of this policy and towards changes in institutional arrangements, social relations and distribution of resources. At this stage this preliminary paper presents the case and our main hypothesis.

Key words: *Groundwater, Institutions, Political Ecology, CPR, Balochistan*

---

\* Graduate Institute of International and Development Studies, Geneva, Switzerland  
Corresponding author: hameedullah.jamali@graduateinstitute.ch

## 1. INTRODUCTION

The semi-arid highland areas of Balochistan (Figure 1) in south-western part of Pakistan are undergoing a transition from *karez*<sup>1</sup> irrigation system, an ancient way of tapping groundwater (Figure 2), to electric and diesel-powered tubewells. This transition has not been without profound effects on livelihoods, power relations and water distribution and above all social and community cohesion built around these resources (van Steenberg 1995). Although little research has been done on this issue, Mustafa and Qazi (2008) suggest that this transition was neither necessary nor beneficial and was simply the result of a policy choice by the Balochistan provincial government. However, this paper attempts to understand the overall process starting from the effects of this transition on livelihoods, social relations, water distribution and governance processes at the local level. It traces the process back to the prevalent development paradigms and associated discourses at that time and their effects on the policy process. We present a holistic approach to critically analyse the policy and governance processes of the entire resource system embedded in wider social, political, natural and economic contexts. The local context is studied beyond the physical boundaries of the resource under analysis, encompassing the very intellectual paradigm that influences the formal state-devised policies as well as the local norms governing the resource system.

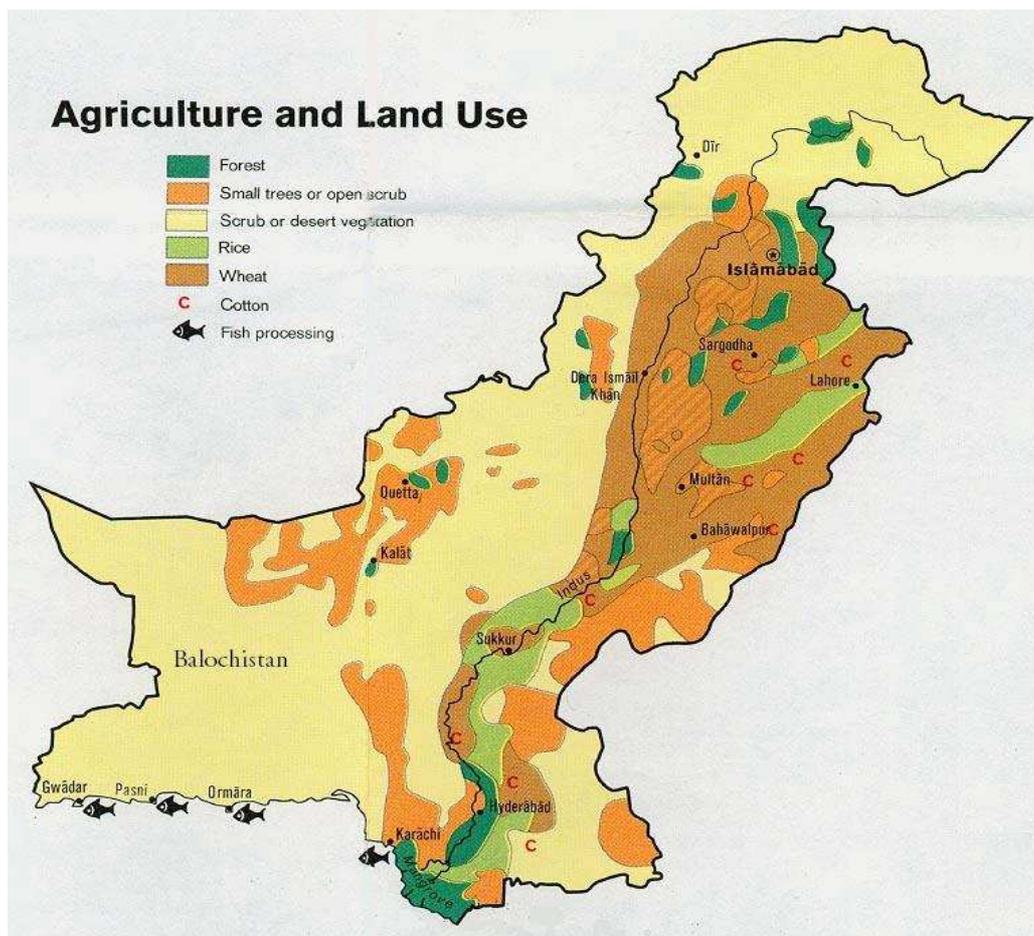


Figure 1: map of Pakistan showing agriculture land use

<sup>1</sup> *Karez* system is also known as *galleria* in Spain, *qanat* in Middle East and *foggara/khattra* in North Africa (Lightfoot 1996)

This paper is work in progress and will be complemented by some theoretical and empirical work. By forwarding this approach, however, we acknowledge that measurement is never neutral; all people have their pre-conceptions, misconceptions and ideologies (Stocking quoted in Blaikie and Brookfield 1987). Further, selecting an issue for research and preferring one methodology over the other is also a subjective decision from the beginning.

## 2. BACKGROUND

The research area is located in the arid highland ecosystems of Balochistan characterised by cold winters and hot summers (Chaudhry 2000). Average minimum temperature ranges from 8-15 °C while average maximum temperature ranges from 24 – 31°C. Average rainfall is 200-280 mm per year; 70% of which occurs from January to April. Surface water is also very low due to high evaporation rates (IUCN 2006). Rivers also flow from the hills but most of the rainwater from hills is lost due to sandy soils and lack of storage dams. Total cultivated land is 2.09 million hectares (6% of the geographical area of Balochistan) of which only 0.58 m hectares is irrigated by perennial water sources. The rest is rain fed and spate irrigated locally known as *khushkaba* and *sailaba* respectively (Government of Balochistan and IUCN 2000). Groundwater irrigated area increased from 22% in 1989 to 34.5% in 1998 and tubewells accounted for about 22.8% (Chaudhry 2000).

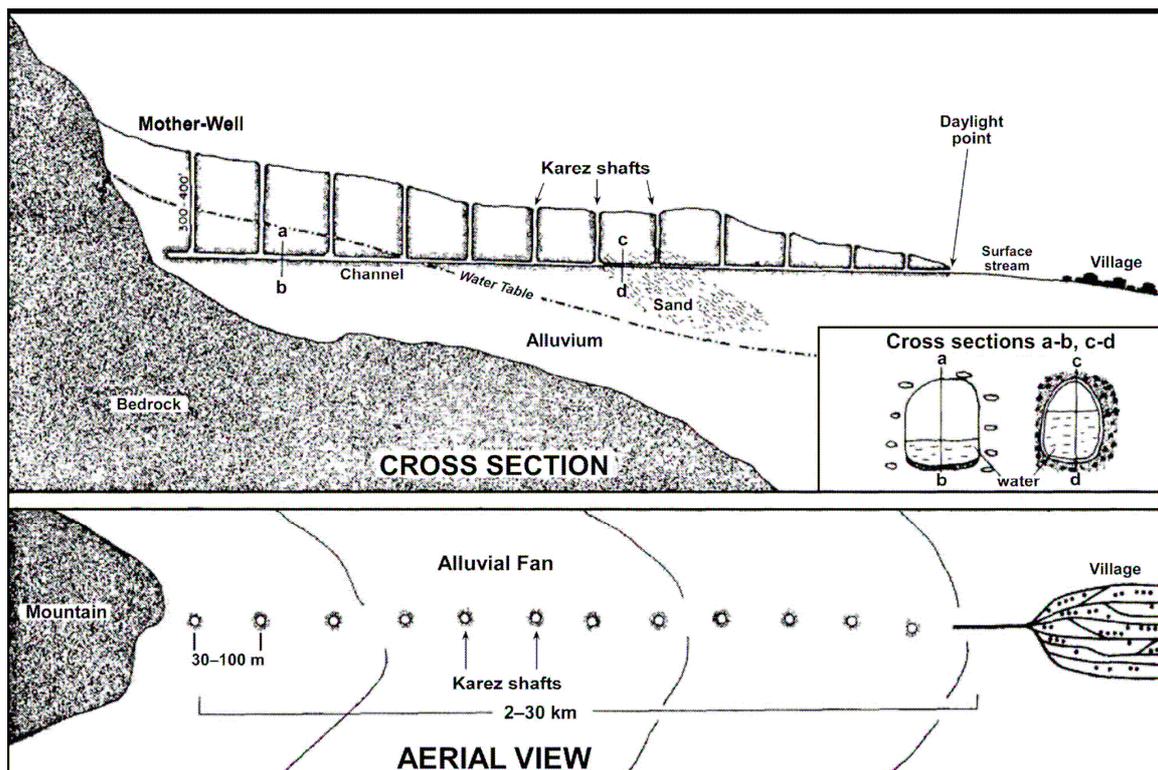


Figure 2: Schematic diagram of *karez* (Source: Mustafa and Qazi 2008)

### **People's Livelihoods**

Balochistan is a semi-arid area, where a large majority of population depends on subsistence farming and livestock for their livelihoods (van Steenberg 1995). The most important economic activity in Balochistan is transhumance based animal husbandry providing major source of livelihood for around 70% of the rural population (*ibid*). Pastoralists depend upon rangelands and forests for feeding their

livestock as well as obtaining wood for fuel. Historically, rangelands in Balochistan have been categorized as common pool resources (CPRs). Traditional governance institutions regulated their use in a relatively sustainable manner through the observation of mutually agreed upon rules and cultural norms. *Karez* has been an important component of rural population livelihoods, providing water for drinking and for cultivating subsistence crops. Settled agriculture is also practiced at the valley bottoms by applying traditional water-harvesting systems of *sailaba* and *khushkaba*, dug wells and *karez*s (van Steenberg 1997). Crops grown include apricot, cherry, grapes, pomegranate, wheat, potato, and sunflower.

In the past, traditional governance structures regulated the use of groundwater in a relatively sustainable manner through the observation of mutually agreed upon rules and cultural norms in the highlands of Balochistan. These methods were also incorporated into the water rights structure of the colonial state as the British government adopted a policy of minimal interference with the local tribal norms as long as its strategic objectives in the neighbouring Afghanistan were not threatened.

In many parts of the province, groundwater is the only source of irrigation and large parts of the province remain uncultivated due to insufficient surface water and mountainous terrain. Dugwells and the traditional system of *karez* have been used for millennia to exploit the groundwater for drinking and subsistence agriculture. *Karez* is a chain of wells connected through an underground tunnel to convey water from mother well<sup>2</sup> over a distance of about 500-3000 meters (van Steenberg and Oliemans 2002). Because of their physical make up, this being labour and cost intensive<sup>3</sup>, *karez*s inherently are a shared irrigation system beyond the physical and financial capacity of an individual farmer. The water from the *karez*, then, becomes a shared resource or common property where a shareholder is entitled for the full flow for a fixed time ranging from 7-30 days depending upon the cropping pattern (Mustafa and Qazi 2008). The amount of water share is linked with the investment by the shareholder in the form of labour (a capital almost equally available with every able-bodied person) for development of *karez*. Similarly, the costs of repair and maintenance are also distributed proportionately. A local system comprising shareholders and/or elected committee exists for management, maintenance and dispute settlement. This group or person is known as *Mir-e-Aab* (water leader) or *Rais*. This system also ensures another rule called *Harim*, where no new *karez* or well is allowed to be built within a distance of about 1,500 feet. Land distribution is also associated with *karez* water in an equitable way, such that each shareholder equally shares abundance or shortage of water along the *karez*. This equitable sharing of *benefits* and *costs* is a unique feature of *karez* system that is a defining feature of social organization and power relations in a community (van Steenberg 1995).

### ***The Transformation Process***

Balochistan is considered as the most under-developed province of the country with high poverty levels and ranks the lowest in terms of other development indicators. The state's attitudes and efforts towards agricultural and resource development were

---

<sup>2</sup> Mother well is the main source of water

<sup>3</sup> Apart from few exceptions, new *karez* construction is a thing of history in Balochistan. In 1968-91, a *karez* constructed in Chagai District costed Rs. 2,700,000 (US\$ 120,000) (van Steenberg and Oliemans 2002)

driven by its modernizing agenda. Commercial agriculture promotion was chosen as a viable option for economic development of the area. In 1970s, these steps were supported by electrification and promotion of tubewells in arid areas for cultivation of high-value water-intensive crops such as apples and onions, which are in principle not suitable in a semi-arid area like Balochistan (IUCN 2006). Combined with state-led policies of extensive agriculture on marginal lands through subsidized electricity tariff for tubewells, a period of prosperity and increase in cultivated area was seen as a success story. However, at the same time the ancient *karez* irrigation system was degrading at a very fast pace due to declining underground water tables mainly caused by unprecedented increase in the number of tubewells. Officially approved number of tubewells increased from 2,000 in 1970-71 to 14,000 in 2001-02 in addition to more than 11,000 diesel-powered tubewells (Government of Pakistan 2002).

The introduction of tubewells (operated by electric submersible and diesel pumps) disrupted the equitable sharing mechanism of *karez* as the former is based on private property system. The groundwater, which is a common property, now becomes private property of the tubewell owner who can also sell water to others. Tubewell installation, being a huge financial investment<sup>4</sup> in Balochistan's context, is only affordable by large and wealthy farmers. In addition, it needs a great deal of bureaucratic work and political connections to get formal approval from the provincial Irrigation Department for drilling a bore hole, as well as approval for electricity connection, in areas with electricity connection. In addition, digging a bore hole is very risky because of possibility of failure to find groundwater source. Because of the bureaucratic processes, financial investment and risk factors, it becomes almost impossible for a small farmer to install a tubewell and provides opportunities for a few wealthy farmers to take advantage of this situation.

Previously, *Harim* rule was effective in restricting the number of dugwells and *karez*s in a certain geographical area by defining a certain distance of dugwells and *karez*s and any new construction needed approval and consultations among the committee or *Mir-e-Aab* in the area. In the beginning of tubewell installation during 1960s, there were no such restriction, however, after the Balochistan Groundwater Rights Ordinance in 1978, some restrictions were introduced but were only applied in few areas and proved ineffective. Overall, there was ambiguity in these restrictions and large farmers took advantage of this legal and institutional pluralism. Now, only a few *karez*s are functional in some areas.

Some earlier research also viewed *karez* irrigation as an inefficient irrigation system. For example, a donor-funded study by Kemper et al. (1979) showed that twenty-four hour flow from *karez*s was a waste of water in an arid area like Balochistan. Seasonal variations and high seepage losses were also seen as problematic (Kahlowan and Hamilton 1994). Moreover, a technical report by WAPDA (1977) suggested replacing functioning *karez*s by tubewells in Mastung district of Balochistan for efficient use of groundwater during summer, a peak period for growing high-value crops.

---

<sup>4</sup> The cost of installation of a tubewell is about US\$ 25,000 (van Steenberg and Oliemans 2002)

### **Groundwater Policy**

Groundwater is the only source of irrigation in many parts of Balochistan. In the past, groundwater was extracted using animal-driven Persian wheels<sup>5</sup> for lifting water from shallow wells and *karez*s. From 1960s to 1980s, the Pakistani Government adopted a policy of private tubewell development for controlling water logging and salinity in other parts of the country, and for promoting agriculture in Balochistan. This policy was supported to increase private groundwater exploitation by providing subsidized electricity at about 60% lower rates in addition to free water pumps and soft-term loans for tubewell installation in Balochistan (Johnson 1989). In late 1980s, most of the subsidies were stopped except the subsidized electricity for tubewells, which had direct repercussions for groundwater mining in Balochistan. Groundwater policy was geared towards providing subsidies while at the same time regulation has been very weak from the beginning due to ambiguities between provincial and federal governments and the low involvement of local representatives in policy formulation and implementation (van Steenberg and Oliemans 2002). The weak regulation and monitoring mechanisms and subsidized electricity resulted in legal and institutional pluralism causing over-exploitation of groundwater by private tubewell owners. During this period, groundwater was seen as an unlimited and potential source for commercial agriculture by both the policy makers and general public. Although *karez*s functioned in a non-mechanized way, these provided consistent amounts of water throughout the year. However, water was mostly utilised in a three-month peak summer period for growing high value vegetables and fruits while the water flowing out in winter was seen as wastage. Tubewells, on the other hand, were considered as useful in controlling the flow of water as opposed to *karez*s. The provincial government also provided subsidized electricity and technical support for dugwell development in addition to tubewells. Apparently, this policy resulted in over-exploitation of confined aquifers, seriously affecting groundwater levels and ultimately, the *karez* system started collapsing in many areas despite several efforts by *karez* shareholders. In addition, it was mostly the wealthy *karez* shareholders who installed tubewells, making it a costly affair and unfeasible for remaining shareholders to bear the high maintenance cost of *karez*s (van Steenberg and Oliemans 2002).

### **3. THEORETICAL FRAMEWORK**

From the above description, we will analyse what aspects of this case study can be better explained through applying different theories. The proposed method is in contrast to the usual practice of applying a certain preconceived theory to the case study, which may result in a narrow view of the issue being investigated. Our open-ended approach would be finding theories that can provide valuable explanations rather than coming from fixed and predetermined theoretical background. However, this also does not mean that we would start our research without any theoretical background.

Vayda and Walters (1999) warn against bringing any theories and models and priori assumptions about scales of analysis without a careful analysis of events by applying bottom-up approach. Their approach, 'event ecology', as they label it, states that it is important to analyse causes and consequences and other specific questions to be addressed before applying any theory. Theory, they argue, needs to be applied

---

<sup>5</sup> Also known as water wheel

to find out its merits and not the other way round. However, this open-ended approach has some limitations, and needs to be complemented by a 'political' approach. We propose to use elements of several theoretical approaches related to public policy, institutions and the human-nature relations: sustainable livelihoods framework, political ecology, CPR analysis, and the advocacy coalition framework.

### ***Sustainable Livelihoods Framework (SLF)***

After pioneering work by a number of prominent researchers (Chambers and Conway 1992; Scoones 1998; Carney 2003; Ashley and Carney 1999), SLF emerged as a promising framework to analyse people's livelihood strategies. SLF helps not only to understand the nature of poverty but also explains the links between different aspects of people's livelihoods. It depicts the nature of complex and changing institutions and identifies key constraints and challenges people face while developing livelihood strategies. Livelihoods thinking identified key resources or 'capitals' (natural, economic, human and social) on which people depend for their survival. The framework will be helpful in understanding the complexity and institutional processes related to livelihoods. People engage in numerous kinds of activities and utilise a variety of their 'capitals' to build their livelihood strategies. The framework also provides practical entry points for participatory methods to understand complex local realities. This method would provide useful information about the importance of *karezes* in people's livelihoods and social relations in the research area.

### ***Development Ideologies and their Transmission***

The prevalent development paradigm during the 1970s and onwards were based on economic growth as a key strategy for development of poor countries and was supported by international donors. The problem of 'backwardness' and 'poverty' in Balochistan were portrayed in such a way that the most favourable solution was prescribed as economic growth through the promotion of intensive agriculture and high-value crops based on the utilisation of groundwater by the new technology of mechanised tubewells. Export of agriculture produce was envisioned as the prime strategy for prosperity of the province and for increased incomes for poor farmers.

This development paradigm is transmitted and internalized through discourses. Therefore, it is important to analyze the process of how prevalent development ideologies, their transmission through discourses and their influence on public policies to understand the origins of development policies. The dominant concepts of 'development' are not simply imposed through formal policies in a top-down manner, but are contested, transmitted and implemented through various formal and informal means of communications. In this process, these concepts and discourses are not simply imposed but also internalised by its subjects (or rejected and resisted). Here, we adhere to the Foucaultian version of discourse where these are heavily influenced by systems of power which makes people subjects by control and dependence as well as by self-knowledge and identity (Foucault 1982). Both meanings of power are important here as both play a part: state's power to control over resources and lives of people (governmentality) as well as the subjectivity of people by a self-knowledge that is heavily influenced by ideologies and discourses of development. This can be evident by a number of people defining themselves as 'poor'. In our case study, however, this power is held by politicians, policy makers and experts.

### ***Public Policy Formulation***

After analysing how prevalent development ideologies and associated discourses affect policy-makers worldview and policy formation, the next step would be to understand policy formation process at different levels of government in order to identify major actors and processes involved in this process. The study of government institutions (legislatures, courts and administrative agencies), interest groups and media is needed to understand how policies are formulated, implemented and their effects on people. Sabatier (1988) argues that political process of policy formation is affected by several factors or groups operating simultaneously at various stages. The advocacy coalition framework (ACF) developed by Sabatier (1988, 1991) and later applied by Sabatier and Jenkins-Smith (1993) states that policy formation occurs not only in government; unorganized groups can also influence policies through forming coalitions built around shared beliefs. These 'subsystems' can include 'public and private organizations who are actively concerned with a policy problem' (Sabatier 1988: 131). To achieve shared goals, coalition members act in a coordinated way 'to manipulate the rules of various governmental institutions' (Sabatier 1991: 153).

Because ACF underscores the role of information and learning in policy change process, it is very relevant in our case study as we are analysing how dominant development ideologies and associated discourses affect policy formation. ACF would be applied to analyse the groundwater development policy in general and tubewell policy in particular. Policy development process would be analysed to understand how this process was influenced by dominant development paradigms and narratives of 'success stories' in other areas.

### ***Political Ecology***

The complexity of human-environment relations and effects of broader political, economic and social factors can be explained by applying a political ecology approach in a holistic way. In their foundational text, Blaikie and Brookfield (1987: 17) define this approach as combining 'the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself.' The PE approach explains that numerous environmental changes have political aspects and need not to be seen as neutral. Costs and benefits of environmental change are distributed unequally; political, economic and social factors play a major role in distribution of costs and benefits. Further, this unequal distribution reinforces existing social and economic inequalities. These ultimately change power relations and affect institutions that govern key livelihood resources.

Complexity of human-environment relations needs analysis of outcomes and process at one scale influenced by processes at different scales. In other words, ecological and social change at particular places needs to be considered as outcomes emerging from interactions of political and economic process at different scales (Blaikie and Brookfield 1987). Therefore, a given scale needs to be regarded as a social construction (Kelly 1997; Marston 2000; Delaney and Leitner 1997; Lefebvre 1991) resulting from various interactions of knowledge, space, nature and other scales. The observer bias is minimized in this view. Further, scale may still mean a specific area where human-environment interactions take place. Yet, place

may not be an isolated physical space but a dimension of historical and contemporary connections (Paulson and Gezon 2005). Considering scale as a place does not necessarily mean static but also changing and transforming overtime as a result of historic and continuous interactions. Therefore, scale, even explained as a place can also be regarded as made, negotiated and transformed as a result of people's interactions with environment in times and places. The scale of analysis may also depend on the issue being investigated (Blaikie and Brookfield 1987) and researchers face the challenge of choosing appropriate scale for analysis and ways to move between scales (Paulson and Gezon 2005) as there are political and practical implications for this choice.

### *Institutions and Power Relations*

After Commons (1934), we define institution as 'recurrent systems of social norms which guide and sanction the actions of individuals and groups' (Hufty 2007). We specifically use the word 'recurrent' to indicate that institutions, while generally stable, change through the governance process. Secondly, in using the word 'guide,' we mean that institutions not only constrain human behavior but also enable coordination, cooperation, and shared strategies (Ostrom 1990). However, we distinguish institutions from organisations which can be defined as players or 'groups of individuals bound together by some common purpose to achieve objectives' (North 1990: 5). Institutions such as marriage, local customs and rules to access a certain resource may not have organisational manifestation but are present and play important role in social relations and livelihoods outcomes.

The proposed theoretical framework emphasizes two major roles of institutions in the governance of natural resources:

- *Institutions that determine access to resources.* Examination of these institutions is important to understand both the existing livelihoods patterns of actors and the resources upon which they depend. These include, for example, natural resource management regulations and property rights.
- *Institutions that regulate access to and the functioning of decision-making processes.* For example, the rules that determine who has the right to make decisions for the community.

Studying these two classes of institutions together allows one to consider not only existing institutions in their current form, but also how existing institutions are modified. This means considering not only institutions, but more specifically the role of power relations in the governance processes through which institutions themselves are constructed and implemented. In each of these types of institutions, power relations play a fundamental role.

Here we include both formal and informal institutions. Institutional approaches in general have been accused of effacing or subsuming questions of power in a too-narrow focus on institutions (e.g. Agrawal 2005; Robbins 1998). The proposed framework takes an explicitly political view of institutions nuanced by a realistic understanding of power relations. First, it must be understood that 'local populations' are themselves not homogeneous communities. Rather, specific interests, agendas, and inequalities exist between different actors in the local population (Agrawal and

Gibson 1999). The common questions of unequal access and control over resources are often asked in many research areas, few have questioned the effect of power in reproducing the existing inequalities of access and control. The vague treatment of institutions in natural resource governance literature likewise reflects an unwillingness to examine institutions as the internalized rules that reproduce existing inequalities.

In our case study, certain policies were developed and implemented for governance of resources that affected different groups of people differently, benefiting a few powerful groups while negatively affecting the majority of poor farmers. Power relations, external factors, policy development, and local level politics played important role in this situation, and PE approaches can be useful to explain the situation. For example, the new groundwater policy proved to be benefiting a few influential and rich farmers at the cost of decreasing groundwater levels seriously affecting the *karez* system. Some aspects of PE approach explaining power struggles over resources and institutional modifications can be applied to understand this situation. The approach gives equal value in analysis of various local level factors (including local institutions, livelihood patterns, local power inequalities, resource management mechanisms and social relations) as well as external factors (including state policies, market forces, new technologies, discourses and its effects). In addition, it can help in analysing how the politics of implementation of the state policies for regulating resources at local level influences the whole system and livelihoods of people and ultimately the social relations built around these resources. In short, political ecological approaches provide useful explanations and insights about a range of factors at different scales.

PE challenges the dominant interpretation of environmental change by providing explanations that go beyond the common narratives and rhetoric that population growth, self-interest and lack of knowledge of local farmers are the main reasons for natural resource degradation. Looking beyond the local factors, PE provides explanations about power dynamics at local, regional and international scales and 'environmental interests, knowledge and practices of social groups differentiated by race, ethnicity, gender, or other factors' (Paulson and Gezon 2005: 1). Issues of social equality and justice concerning environmental conflicts and natural resources have been at the heart of PE research.

### ***Common-Pool Resource Theory***

A number of definitions emerged for CPR during the last couple of decades. However, we will use the most common definition forwarded by (National Research Council 2002: 18); 'CPR is a valued natural or human made resource or facility that is available to more than one person and subject to degradation as a result of overuse'. As CPRs are subtractable, one person's use affects what is left for the others, and can lead to degradation or even destruction of the resource. Ostrom (1990) argues that communities can manage CPRs effectively without external intervention from the state, because they are more knowledgeable and more vested in the resource, therefore better able to manage it. It should not be assumed that all CPR institutions will always work in all conditions. Instead of having faith in a particular type of property system, the question should be asked what property systems work better under certain conditions and for whom (Ostrom 1986). A number of property rights regimes exist to manage CPRs such as ownership by the

state, private property and community/group ownership. CPRs are different from open access resources where property rights to define the use and regulation are absent (Ostrom 1990).

In CPR theory, institutions are commonly defined as 'rules that people develop to specify dos and don'ts' (National Research Council 2002: 21). In case of common pool resources, rules define access to resources, what can be harvested and who participates in decision making. A CPR may be owned by the state or a local government but users may have different rights to withdraw, manage, and determine resource access to outsiders (Agrawal and Ostrom 2001).

Ostrom (1990) and Dietz et al. (2003) found that a number of conditions are deemed necessary if not sufficient for successful emergence of self-organized institutions; 1) resource must be salient enough for users to invest time and energy; 2) users should have autonomy to devise and change rules; 3) users must be able to engage in direct communication and opportunity to bargain; 4) users are able to monitor and quantify the resource use at low-cost; and 5) rates of change in population, technology, economic and social conditions are moderate. It is, however, also acknowledged that these conditions rarely exist and the challenge is to 'devise institutional arrangements that help to establish such conditions' (Dietz et al. 2003: 1908).

All users of CPR may not be able to protect their resources successfully due to differentiated power relations, poverty levels and so on (Agrawal 2003). In addition, CPR theorists provide a narrow focus on institutions because some institutions may be more effective than others for different users. Robbins (1998: 412) in his detailed study about authority and power in Rajasthan India, shows how four different kinds of institutions—local state managed pastures, semiprivate community fallow pastures, central-state Forest Department enclosures and semi-sacred village forests—not only are rules for controlling and managing resources but are 'culturally and politically situated authority systems'. However, CPR theorists tend to ignore political aspects and power relations while analysing institutions. In addition, same institutional rules of CPR may have different effects because of differing biophysical, social, economic and cultural contexts. The importance of social, political, economic and physical environment is not emphasized by most CPR theorists (Agrawal 2003; Edwards and Steins 1999). These factors play crucial role in determining how the actors relate to their environment and decision making.

Moreover, this approach pays little attention to the political and external factors of population, markets and state policies and their interaction with 'local institutional arrangements and resource systems' (Agrawal 2001: 1657). These factors may encourage subsistence users to engage in commercial use of the resource to which the existing CPR institutions may not be able to deal with. Furthermore, these aspects are likely to affect power relations as some subgroups may gain differentiated access to resources.

Depending on the biophysical characteristics, different property systems are needed to govern CPRs as there is no single system that works for all CPRs in an efficient, fair and sustainable manner (Ostrom et al. 1999). CPR theory provides detailed explanations about how self-managed institutions evolve and operate and is very

useful to the point when water was shared through *karez* system. In this case study, it can be utilised to analyse the aspects of our research that deal with the institutions built around management and governance of groundwater through *karez* system. By applying CPR theory, we will analyse the evolution, transformation and functioning of institutions for governance and management of groundwater by *karez* system. This system evolved without any external intervention and was successfully managed by its shareholders for many centuries by devising mutually agreed rules.

Additionally, CPR theorists now conclude that inequality of power and income, other institutions, and relationship with the government agencies are key factors (McCay 2002). However, PE has long been advocating the importance of power, authority, state policies and market forces for governance of natural resources. For example McCay (2002: 387, emphasis added) in his critique argues that:

“Community” and its relationship to common-pool resource management is meaningless without further specification, without clearly positioning particular places and peoples within their environments, their histories, their cultures, as well as *regional, national, and global* relations of *wealth and power*.

It can be concluded that the importance of factors such as power, politics, scales, markets and new technologies in analysing human-environment relations has been duly recognized by analysing the recent debates within the sustainable livelihoods and common pool resources by prominent researchers, bringing these two fields closer to what we refer as ‘political ecology’.

#### **4. CASE STUDY ANALYSIS**

By applying the above-mentioned theoretical framework, we now analyse the case study and provide some hypothesis that will be empirically verified on later stages of the research.

##### ***Livelihoods***

The rural farmers have been using traditional irrigation system of *karez* in a relatively sustainable manner to tap groundwater for subsistence agriculture for centuries in the semi-arid highlands of Balochistan. However, the installation of mechanised tubewells through subsidized electricity tariff for promotion of commercial agriculture seriously affected this centuries old system. Due to heavy extraction of water, the quantity of *karez* water started decreasing and ultimately a large number of *karezes* completely dried up. Consequently, the livelihoods of a large number of farmers were heavily affected and institutions built around *karezes* also started vanishing. The groundwater from *karezes*, a common resource shared by its users through socially built institutions, was converted into private property as the owner of the tubewell has the sole ownership rights of tubewell water. It needs to be noted that the resource is still the same but the technology to trap it is different; water was shared in *karez* system but now tubewell owner has exclusive rights to water. Groundwater from *karezes* can be explained as renewable resource as it was flowing for centuries but tubewells installation converted it to a finite resource. This transformed and complex scenario means that we are not only analysing institutions built around *karezes*, but also changes in property system, technological interventions and external influences.

### ***Politics of Water Policy Implementation***

Apart from policy formation, it is also important to understand how this policy was implemented on the ground. How certain groups of people were able to take advantage of the new policy at the expense of thousands of people's livelihoods relying on *karez* system?

Subgroups that use the CPR can differ based on ethnicity, gender, caste, wealth and so on (Ray and Bijarnia 2007; Robbins 1998). Due to differential positions, only people with financial resources could take benefit of new tubewell policy which may reinforce existing inequalities. As mentioned before, there is a long process to get permission for tubewell installation from the provincial Irrigation Department. In addition, tubewell installation involves a significant amount of investment and is also highly risky project because of chances of failure. Poor farmers were in unequal position to take benefit from this policy for many reasons. First, they lack capital to invest in tubewell installation. Second, they do not have political connections to get tubewell installation permission. Third, even if some farmers manage to arrange finances, they may not be able and unwilling to take the risk if the tubewell installation fails because technically it is not sure whether the tubewell can provide water after installation as there is no guarantee that it will hit the aquifer. Some tubewell installations succeed in producing water after many drilling attempts in different areas and some fail altogether despite a number of attempts.

Many development policies provide opportunities to only people with financial resources to invest; same happened in this case, people with resources took benefit by installing tubewells to get more water and cultivate crops that have more economic value. However, the important point is at what cost did this happen. The tubewells installation almost entirely destroyed *karez* system and ultimately livelihoods of many people, converted common property of groundwater into a private property of the tubewell owner. Therefore, this situation seems more complicated than just a simple 'development policy' and needs further investigation because it left profound effects on livelihoods, social and power relations.

As described before, users of a communal management system are seen as trapped in a situation, requiring external intervention to be imposed by the so-called legitimized 'authorities' to help people in need (Ostrom 1999). There might be many cases where resources have degraded but it is also the fact that users of CPRs, for centuries, have devised long-term and sustainable governance mechanisms (McCay and Acheson 1987; Wade 1994; Feeney et al. 1990). State-devised policies to govern and control resources can create problems when they lack monitoring capacity and resources to enforce these policies. In Balochistan, apparently state devised policies replaced the communal governance system but were not applied due to weak monitoring and enforcing capacity. In this pluralist legal and institutional scenario, neither communal nor state governance system was effectively applied and powerful farmers took advantage of this situation by overusing groundwater. Further, 'in many countries, two centuries of colonization followed by state-run development policy that affected some CPRs has produced great resistance to externally imposed institutions' (Ostrom 1999: 281) and Balochistan shares a similar history of colonisation with many countries.

From the above discussion, it is clear that the tubewell policy in Balochistan did not provide equal opportunities to all. Therefore, it can be concluded that tubewells were not suitable in the social-ecological context of Balochistan and that 'development policies and discourses' can have a direct effect on livelihoods, social and power relations of local people.

### ***Development Ideologies and Paradigms***

Both provincial and federal governments identified groundwater development as a key area for Balochistan's prosperity through agriculture promotion. Policy makers were keen in 'turning the arid province into a 'green oasis'' (van Steenberg 1995: 56). New technologies employed for agricultural development in Balochistan were based on resource maximization principle as opposed to the traditional methods advancing an equitable and sustainable use of resources. These kinds of issues identified by 'scientific' studies and funded by the donors interested in 'development' were other factors that helped introduction of tubewells in Balochistan. In addition, better communication and farm-to-market roads facilitated the cultivation of high-value vegetables and fruits.

We do not argue that the development policies and especially the groundwater policy were influenced by people having vested interests in promoting capitalist ideas of growth-led development. Neither do we disagree with the fact that economic growth is an important factor of development and that new technologies disrupt social life of rural people living in harmony with the nature on subsistence farming away from the globalised world. We simply argue that the development ideologies and associated discourses (promoting a technical and economic transformation of society) influence development policies that are implemented without considering socio-ecological contexts, even in geographical areas that are only suitable for subsistence livelihoods. Implementing these kinds of policies may result in unintended outcomes, or simply degrade key livelihood resources. The question about some development strategies need not be what they failed to achieve, instead, what was achieved through their 'side effects'? As James Ferguson (1990) asks what do development projects do besides failing to help poor people? Similar questions arise about development policies and programmes of the state for development of rural people in Balochistan. The tubewell policy not only is likely to fail in the long run but seriously degrading groundwater, a vital source of livelihoods for a large number of people. As Narayanan (2008: 15) states:

The governance challenge regarding natural resource use is to balance the need for economic growth with the demands and aspirations of the differentiated social structure, future generations and the environment.

The rational question arises when development policies and programmes lead to social marginalization or environmental degradation or both. In Balochistan's case, commercial agriculture promotion strategies have contributed to decline in groundwater resources in addition to marginalization of poor farmers relying on *karez* water for their livelihoods.

Common rhetoric that illiteracy, lack of skills and technical knowledge are major hindrances in the development of 'backward' province of Balochistan becomes invalid in this case. In contrast, knowledgeable 'experts' from many fields were

prescribing 'solutions' of 'poverty' and 'backwardness' due to traditional 'unproductive', 'non-scientific' means of production and 'inefficient' use of the available groundwater for their development. The issue here is not lack of knowledge but availability and application of knowledge and expertise. This knowledge and expertise is heavily influenced by the prevalent development ideologies and discourses that are then translated into development policies. The framing of 'poverty' because of 'backwardness' and 'inefficient' use of groundwater equally needs solutions that are 'modern', 'efficient' and 'productive'. Therefore, experts, policy makers, media, farmers and society in general responds not to 'backwardness' or 'poverty' itself but to the social and political construction of these issues (Jones 2002; Berger and Luckmann 1967).

In the social ecological context of Balochistan, livelihood-intensive development rather than growth-intensive development may be more appropriate by enhancing people's valuable 'capitals'. We are not arguing against growth-led development *per se* but because the experiment of intensive agriculture on marginal lands resulted in unsustainable and inequitable results as experienced in Balochistan's case. Livelihood-intensive interventions can involve land security, equitable distribution of water and redistribution of other resources, better health services, education and so on. Instead of following prevalent development ideologies and associated discourses based on economic and technological transformation of society, context specific development is needed in Balochistan.

A better explanation of this kind of situation needs a thorough understating of the context where any development policies are planned to be applied. This context specific knowledge can be better gained by incorporating local knowledge and expertise and mechanisms that promote participation of majority of the people that are supposed to 'benefit' from any such interventions.

## 5. BIBLIOGRAPHY

- Agrawal, A. 2001. Common property institutions and sustainable governance of resources. *World development* 29, no. 10: 1649-1672.
- . 2003. Sustainable Governance of Common-Pool Resources: Context, Methods, and Politics. *Annual Review of Anthropology* 32: 243-262.
- . 2005. *Environmentality: technologies of government and the making of subjects*. Duke University Press.
- Agrawal, A., and E. Ostrom. 2001. Collective action, property rights, and decentralization in resource use in India and Nepal. *Politics & Society* 29, no. 4: 485.
- Agrawal, Arun, and Clark C. Gibson. 1999. Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation. *World Development* 27, no. 4 (April): 629-649.
- Ashley, C, and D Carney. 1999. *Sustainable livelihoods: Lessons from early experience*. DfID.

- Berger, P. L. and T. Luckmann. 1967. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Anchor Books ed. Garden City N.Y: Doubleday.
- Blaikie, Piers M., and H. C. Brookfield. 1987. *Land degradation and society*. Taylor & Francis, June.
- Carney, D. 2003. *Sustainable livelihoods approaches: progress and possibilities for change*. Department for International Development London.
- Chaudhry 2000. Water Management in Baluchistan, Report Prepared for FAO - Pakistan - Development of Research Programme in Irrigation and Drainage, Online version, (<http://www.fao.org/docrep/005/Y3690E/y3690e09.htm>) accessed November 20, 2010.
- Chambers, R. and G. Conway. 1992. Sustainable rural livelihoods: practical concepts for the 21st century. IDS discussion paper, 296. Brighton: IDS.
- Delaney, D., and H. Leitner. 1997. The political construction of scale. *Political Geography* 16, no. 2: 93-98.
- Dietz, T., E. Ostrom, and P. C. Stern. 2003. The struggle to govern the commons. *Science* 302, no. 5652: 1907.
- Edwards, V., and N. Steins. 1999. A framework for analysing contextual factors in common pool resource research. *Journal of environmental policy & planning* 1, no. 3: 205-221.
- Feeny, D., F. Berkes, B. J. McCay, and J. M. Acheson. 1990. The tragedy of the commons: twenty-two years later. *Human ecology* 18, no. 1: 1-19.
- Ferguson, J. 1990. *The anti-politics machine: "development," depoliticization, and bureaucratic power in Lesotho*. Cambridge University Press.
- Foucault, M. 1982. The subject and power. *Critical inquiry* 8, no. 4: 777-795.
- Government of Balochistan and IUCN Pakistan, 2000. Balochistan Conservation Strategy, IUCN Pakistan and Government of Balochistan, Karachi, Pakistan.
- Government of Pakistan, Agricultural Statistics of Pakistan (Islamabad: Agricultural Census Organization of Pakistan, 2002).
- Hufty, Marc. 2007. La gouvernance est-elle un concept opérationnel? Proposition pour un cadre analytique. *Fédéralisme Régionalisme* 7, no. 2.
- IUCN, 2006. Water requirements of major crops for different agro-ecological zones of Balochistan. In: *Water Programme, Balochistan*. (Eds, p. 148 pp. IUNC Pakistan)
- Johnson, R. 1989. Private tube well development in Pakistan's Punjab: Review of

past public programmes/policies and relevant research, Pakistan country paper 1. Lahore: IIMI.

Jones, S. 2002. Social constructionism and the environment: through the quagmire. *Global Environmental Change* 12, no. 4: 247-251.

Kahlow, M. A. and J. R. Hamilton, 1994. Status and Prospects of Karez Irrigation, *Water Resources Bulletin*, Vol 30, No 1, 1994, pp 125–134.

Kelly, P. F. 1997. Globalization, power and the politics of scale in the Philippines. *Geoforum* 28, no. 2: 151-171.

Kemper, W. D. Mazher-ul-Haq, and A. Saeed, *Farm Water Management in Upland Areas of Balochistan* (Fort Collins, CO: Engineering Research Center, Colorado State University, 1979).

Lefebvre, H. 1991. *The production of space*. Wiley-Blackwell.

Lightfoot, DR. 1996. Moroccan khettara: Traditional irrigation and progressive desiccation. *Geoforum* 27: 261-273.

Marston, Sallie A. 2000. The social construction of scale. *Progress in Human Geography* 24, no. 2: 219-242.

McCay, B. J. 2002. Emergence of Institutions for the Commons: Contexts, Situations and Events in National Research Council, Committee on the Human Dimensions of Global Change, E. Ostrom, T. Dietz, N. Dolšak, P. C. Stern, S. Stonich, and E. Weber, editors. *The drama of the commons*. National Academy Press, Washington, D.C., USA.

McCay, B. J., and J. M. Acheson. 1987. *The question of the commons: the culture and ecology of communal resources*. University of Arizona Press Tucson, AZ.

Mustafa, D, and U Qazi. 2008. Karez versus tubewell irrigation: the comparative social acceptability and practicality of sustainable groundwater development in Balochistan, Pakistan. *Contemporary South Asia* 16: 171-195.

Narayanan, N. C. 2008. State, Governance and Natural Resource Conflicts. *State, Natural Resource Conflicts and Challenges to Governance: Where Do We Go from Here?*: 15.

National Research Council, Committee on the Human Dimensions of Global Change, 2002. E. Ostrom, T. Dietz, N. Dolšak, P. C. Stern, S. Stonich, and E. Weber, editors. *The drama of the commons*. National Academy Press, Washington, D.C., USA.

North, D. C. 1990. *Institutions, institutional change, and economic performance*. Cambridge University Press.

Ostrom, E. 1986. An agenda for the study of institutions. *Public Choice* 48, no. 1: 3-25.

- . 1990. *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.
- Ostrom, E., J. Burger, C. B. Field, R. B. Norgaard, and D. Policansky. 1999. Revisiting the commons: local lessons, global challenges. *Science* 284, no. 5412: 278.
- Paulson, S., and L. L. Gezon. 2005. *Political ecology across spaces, scales, and social groups*. Rutgers University Press.
- Ray, S., and M. Bijarnia. 2007. Power relations and institutional outcomes: A case of pastureland development in Semi-arid Rajasthan. *Ecological Economics* 62, no. 2: 360-372.
- Robbins, Paul. 1998. Authority and Environment: Institutional Landscapes in Rajasthan, India. *Annals of the Association of American Geographers* 88, no. 3 (September): 410-435.
- Sabatier, P. A. 1988. An advocacy coalition framework of policy change and the role of policy-oriented learning therein. *Policy sciences* 21, no. 2: 129-168.
- . 1991. Toward better theories of the policy process. *PS: Political Science and Politics* 24, no. 2: 147-156.
- Sabatier, P. A., and H. C. Jenkins-Smith. 1993. *Policy change and learning: An advocacy coalition approach*. Westview Press.
- Scoones, Ian. 1998. *Sustainable Rural Livelihoods: A Framework for Analysis*. Working Paper. Brighton, UK: Institute of Development Studies.
- van Steenbergen, F. 1995. The frontier problem in incipient groundwater management regimes in Balochistan (Pakistan). *Human Ecology* 23: 53-74.
- van Steenbergen, F. 1997. Understanding the sociology of spate irrigation: cases from Balochistan. *Journal of Arid Environments* 35: 349-365.
- van Steenbergen, F., and W. Oliemans. 2002. A review of policies in groundwater management in Pakistan 1950-2000. *Water Policy* 4, no. 4: 323-344.
- Vayda, A. P., and B. B. Walters. 1999. Against political ecology. *Human Ecology* 27, no. 1: 167-179.
- Wade, R. 1994. *Village Republics: Economic Conditions for Collective Action in South India*. San Francisco, CA: ICS Press.
- WAPDA (1977). *Groundwater Investigations in Selected Areas in Balochistan: Mastung (Shirinab-Pishin Basin)*. Preliminary Hydrogeological Report 1, WAPDA Hydrogeology Directorate, Quetta.