



Regional Discrepancies: Transformation of the Subsistence Livelihoods in the Cholistan Desert Region

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Abstract

The Cholistan dessert is hot and dry region with two distinguished regions of Lesser and Greater Cholistan. The Lesser Cholistan is rapidly developed due to development in agriculture, infrastructure, mechanization, transfer of technology and land allotment policy. The Greater Cholistan region is least developed due to subsistence agriculture system, frequent natural hazards and epidemics outburst in the recent times. The study explores the basic causes of this discrepancies in the development of these two desert regions. The impacts of population growth, natural hazards, epidemics, modern technology, mechanization and land allotment policy are associated with transformation of subsistence livelihoods. It was found that the inhabitants of Lesser Cholistan has better adaptability capacity than Greater Cholistan due to prevailing opportunities in the policy and access to modern technology as well as least affected by natural hazards and epidemics in this desert region.

Key Words: Cholistan Desert Region, Greater & Lesser Cholistan Regions, Regional Discrepancies, Subsistence Livelihoods, Transformation

Introduction

The Cholistan desert geographically is located at 27°42'00'' - 29° 45'00'' N latitude and 69°57' 30'' - 72° 52' 30'' E longitude in southern region of the Punjab Province. It is spread over in the three districts i.e. Bahawalnagar, Bahawalpur and Rahim Yar Khan with the covered area of 26100 Sq. Km (Akhter & Arshad, 2006; Malik & Ali, 2017). Geologically, the Cholistan desert region formation started 542 million years ago in Cambrian period which completed with the formation of Himalayas and vanishing of the Tethys Sea in Miocene Epoch 23 years ago (Pithawala, 1978). This region was once part and parcel of Indus Valley Civilization. Almost 400 settlements of different sizes were flourish along the river Hakra side six thousand years ago. The river Hakra shrivelled three thousand years ago and thus diminished the settlements (Mughal, 1982; Mumtaz, 1982). Cholistan is typical a sandy desert region with dry and hot climatic characteristics. Relatively small portion (2800 Sq. Km) of the total area is irrigated which is called Lesser Cholistan (Ali, Chaudhry, & Farooq, 2009; Qureshi & Bhatti, 2005). The remaining is arid rangelands (26100 sq.km) called Greater Cholistan with typical hot desert scenario. Both regions are interconnected due to tribal and land tenancy system with the seasonal transhumance migration (Akbar, Khan, & Arshad, 1996; Arshad, Hassan, Ashraf, Noureen, & Moazzam, 2008; Malik & Ali, 2017).

The main economic activities of the inhabitants of Cholistan desert are subsistence agricultural with farming and livestock keeping. With the passage of time, the of population growth, natural hazards, epidemics, modern technology, mechanization and policy modified these subsistence livelihoods structure and ultimately the development in this region (Adeel & Safriel, 2008; Kavandi Habib, Heshmati, & Siroosi, 2014). However, this transformation of livelihoods is uneven in both regions and creates regional discrepancies in the form of developmental processes. (Adams, 2016; Higgins, 2017; Pelling, O'Brien, & Matyas, 2015). The present study is an attempt to understand the basic causes of this regional disparities and compare the overall developmental process in these two regions.

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The inhabitants and their subsistence livelihoods in Cholistan desert region are mostly dependent on scarce natural resources most importantly rangeland and water (Geyh & Ploethner, 1995; Hameed et al., 2011). The subsistence agriculture livelihoods of framing, livestock rearing, and other related livelihoods are directly dependent on the water sources e.g. *Toba* which are solely dependent on the rainfall distribution (Ahmad, 2008, 2010). These natural resources are exposed too many natural threats and modern challenges and thus their livelihoods. The population growth, natural hazards, epidemics, modern technology, mechanization and policy trigger changes in the transformation of livelihoods which also changes the socioeconomic conditions in Cholistan desert region. This transformation is directly affecting the social, economic, common property resource management system which is based on traditional knowledge (Alam et al., 2016; Korah, Nunbogu, & Akanbang, 2018; Malik & Ali, 2017; Tabuchi, Thisse, & Zhu, 2018). The modern innovations in agriculture mechanization subdue the traditional practices. The inhabitants adopted the transformation of livelihoods for short term economic benefits on the cost of their traditional and sustainable system (Higgins, 2017; Kilawe, Mertz, Birch-Thomsen, & Maliondo, 2018; Malik & Ali, 2017; Tabuchi et al., 2018). The impacts on the transformation of subsistence livelihoods are almost in contrast comparing the Lesser and Greater Cholistan desert regions. The transformation both in socioeconomic and physical conditions in the Cholistan desert are pushing the marginalized communities of the Greater Cholistan desert region towards vulnerability while affluence and development prevail in the Lesser Cholistan region.

Research Methodology

The Cholistan desert has regional discrepancies in their development due to differences in transformation of the subsistence livelihoods in this region. The discrepancies in the development of the Lesser and Greater Cholistan is studied in four major phases. In the first phase of the study, the structure of the subsistence livelihoods along with the modern and/or modified livelihoods in the regions are studied. In the second phase of the study, the impact of population growth, natural hazards, epidemics, modern technology, mechanization and policy on the regional development of the Lesser and Greater Cholistan is studied. The split indicators of the impacts and development are combined in the third phase of the study. In the final phase of the study, the disparities between the Lesser and Greater Cholistan in the development are studied.

The primary data regarding livelihoods, socioeconomic conditions, natural hazards, land allotment policy, and overall developmental process is collected through field survey. Cholistan is a dessert region consisted of the Lesser and Greater Cholistan desert regions (Figure 01). The Lesser Cholistan is thickly populated (almost 70% of the total population share) while the Greater Cholistan has scattered population. Based on the 2017 Census data, a semi structured questionnaire survey of 1000 respondents from 30 sample settlement is conducted with stratified random sampling method through transit walk (Malik & Ali, 2017). The combined result of a settlement is verified from the community’s elders, numberdar, village & union councillors, clans’ heads and officials from Cholistan Development Authority (CDA). The secondary data about population, natural hazards, soil, agriculture, irrigation, land allotment policy and developmental projects are collected from Pakistan Bureau of Statistics, Pakistan Meteorological Department, Geological & Soil Survey of Pakistan, Agriculture & Irrigation Department of Punjab; and CDA.

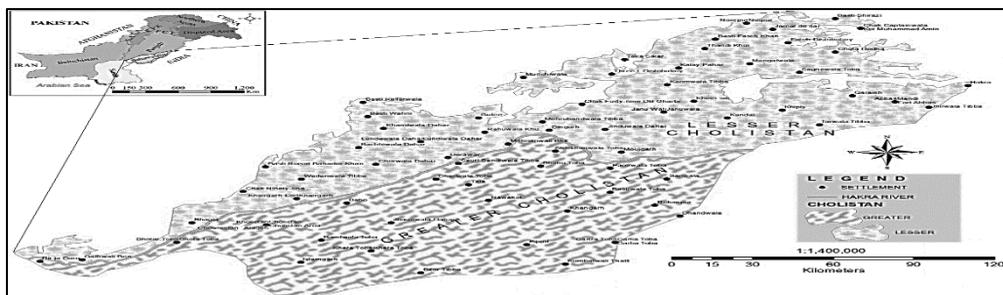


Figure 1: Cholistan Desert Region - Source: Modified after (Malik & Ali, 2017)

All the numerical, nominal and ordinal data about different responses from different sources are statistically normalized and converted to range of +4 to -4 (Equation 01). The direct proportionality relationship (positive domain) is calculated through Equation 01a while inverse proportionality relationship (negative domain) is calculated through Equation 01b. The temporal change in number and productivity of livelihoods are recorded. The change in sub indicators of socioeconomic conditions and/or development (housing, literacy, income, civic utilities & services, social security etc.) for each sample settlement is calculated and converted to an average value with equal weightage. The change in population growth, the frequency and intensity of natural hazards & epidemics, the intervention of modern technology & mechanization with their impacts on productivity and implications of land allotment policy in each sample settlement are ranked. The association of the development with impacts of the selected variables is analysed through statistical regression model (Equation 02). The regression analysis are plotted on the scattered graphs to verify the results. The independent variables (x) are: population growth, hazards & epidemics, technology & mechanization land allotment policy while development is considered as dependent variable (y). The normalized properties are plotted on scattered diagram, which provide matrix view of all properties. The score of development was plotted on x-axes and the rest of all properties on y-axes which shows regional disparities in the Cholistan desert region.

$$X_{New} = \frac{x - \mu}{\sigma} \quad \text{(Eq. 01)}$$

$$\text{Or } X_{New} = \frac{x - x_{Min.}}{x_{Max.} - x_{Min.}}$$

$$r_{ij} = a + \frac{\max\{X_{ij}\} - X_{ij}}{\max\{X_{ij}\} - \min\{X_{ij}\}} (b - a) \quad \text{(Eq. 01a)}$$

$$r_{ij} = a + \frac{X_{ij} - \min\{X_{ij}\}}{\max\{X_{ij}\} - \min\{X_{ij}\}} (b - a) \quad \text{(Eq. 01b)}$$

μ = mean value of the variables; σ = standard deviation; $x_{Min.}$ = variable minimum value; $x_{Max.}$ = variable maximum value.

$$y = \alpha + \beta x \quad \dots \text{(Eq. 02)}$$

y = dependent variable; x = independent variables; β = with a slope line of y intercept α .

The simplified equation for the simple linear regression analysis (Equation 02a)

$$r_{xy} = \frac{\bar{xy} - \bar{x} \bar{y}}{\sqrt{(\bar{x}^2 - \bar{x}^2)(\bar{y}^2 - \bar{y}^2)}} \quad \dots \text{(Eq. 02a)}$$

r_{xy} = the standardized data points with the slope of regression line.

Structure of Subsistence Livelihoods

The nomadic rearing of livestock is the most common production system adopted by the inhabitants of Cholistan desert region. In the most cases, the option of a specific livelihood is essentiality rather than preference. In the Greater Cholistan, the only source of water are *Tobas*, *Kunds* or wells around which all activities are centred. In the Lesser Cholistan region the irrigated areas are cultivable. Recently, at the average the CDA had allotted a piece of 12.5 acres of land to each household in the Cholistan region. The political and social system follows the traditional tribe's clan system. The traditional livelihoods are animal husbandry, agriculture, hunting, lumbering, herbs & shrubs extraction, and honey collection etc. Agriculture, pastoralism, service and business are four main occupations with 70, 16, 8 and 6 percentage of the share, respectively. The structure of subsistence livelihoods can be summarized as follow.

Livelihood	Agriculture	Pastoralism	Services	Businesses
Lesser Cholistan	Irrigated land, mechanization and very high production farming system	Mechanized dairy farming	Public/private servants; labour/daily wages jobs	Livestock and their associated by products; and Commercial activities
	Mechanized tilling in canal and tube-well irrigated area; aquaculture; poultry farming; jeep rally; and honey bee			

Greater Cholistan	Rain-fed farming with low production capacity	Production of milk, meat, wool, hair, and by-products those are skins, bones, manure etc.	private servants; labour/daily wages jobs	Livestock and their associated by products
Additional source of livelihoods: woodcutting for fuel; Khar harvesting; handicraft; wild hunting; wool collection; wild plants collection; natural fruit collection; cottage and household manufacturing of agriculture products and wood crafting				

Transformation of Subsistence Livelihoods

The region of Cholistan desert is vulnerable to natural and anthropogenic hazards which change their livelihoods. In the Greater Cholistan, a severe dry climate and precipitation instability caused drought spells which affected the land, human, livestock, wealth & economy, and ultimately development & prosperity. Drought, epidemics, and technologies not only stress the common natural resources management system but also endanger their jobs and traditional skills of their livelihoods. Conventionally, the interdunal and small areas in the irrigated areas on the boundary serve as grazing land for their livestock on desert flora. In the Cholistan desert, poverty is experienced by most of the residents. In the Lesser Cholistan desert region, the transformation in subsistence livelihood is not systematic. Although the pace is very fast and vigorous. Agriculture mechanization and innovation in technologies are productive support but obviously minimizing labour work.

The statistical analysis of the transformation of the subsistence livelihoods shows that the seven percent of the total respondents are engaged in modern livelihoods, mostly in the Lesser Cholistan dessert region. The modern technology, mechanization and most importantly the innovation provide new opportunities of livelihoods aqua culture, apiculture/honey bee, poultry farming tourism and Desert race rallies. Along the canal irrigation system in the Lesser Cholistan dessert region, the poultry farming is transformed from subsistence household activity which is the major source of cash income for the farmer. Wild honey collection was once traditional subsistence livelihood in the Greater Cholistan desert region. However, the transformation occurred and honey beekeeping is started at farmer level which is now converted to well commercialize apiculture activity in the Lesser Cholistan desert region. With the availability of the irrigation water, aquaculture is developed for fish farming in the Lesser Cholistan desert region.

Before 1945, the Cholistan desert was *Shahi Shikargah* and private property of the Bahawalpur State with the total area 1265 Sq. Km. The Government introduced different land allotment schemes in 1950, 1959, 1970, 1977, 2000, 2005 and 2010. The total land of 1199 Sq. Km was distributed among 20846 allotted persons. The dwellers of Cholistan had de jure right of using it as pasture and woodland. This land allotment policy as well as the mechanization adversely affected the development in Greater Cholistan. It utilizing the land resources up to its threshold level, affecting transhumance activities and decreasing opportunities for labour and daily-wagers. The most obvious result of this contrast development and transformation of livelihoods is the discrepancies in the population growth rate of the both regions of Cholistan desert. Based on the all censuses data, the Lesser Cholistan has rapidly increasing population growth rate while the Greater Cholistan has almost constant and/or negligible growth rate in the selected sample settlements.

Comparison of Regional Disparities

The comparison of regional disparities in the development shows that the Lesser and Greater Cholistan desert regions had totally contrasting characteristics. The local community of the Lesser Cholistan had adopted with the population growth, natural hazards, change in technology & mechanization and land policies interventions. The indicators of physical development, agriculture mechanization, settlement growth, use of modern technologies, industrial livestock and poultry farming indicate the development in transformation of livelihoods in the Lesser Cholistan. The natural hazards, lack of any policy, trend of migration, population decrease and adaptation of new livelihoods shows that the adaption process is setback and almost no development occurred in the Greater Cholistan region.

The averages of the distances to various civic services are calculated of the sample settlements. The comparison shows a contrast results for the Lesser and Greater Cholistan dessert regions. The residents of the Greater Cholistan dessert region faces great difficulty to all these civic services while in the Lesser Cholistan desert region the situation is much more comfortable. The associated labour, discomfort, economic cost, mortality & morbidity and negative social impacts of this situation is reflected in the overall socioeconomic conditions of this region (Table 01).

Table 1: Access to various Civic Services in the Cholistan Desert Region
(Average Distance in Miles)

S.No	Civic Services	Lesser Cholistan	Greater Cholistan
1.	Public Transport	7.49	15.54
2.	Dairy Product Market	3.23	3.12
3.	Agriculture community market	9.93	46.60
4.	Retail Outlets	6.23	31.07
5.	Livestock Market	15.54	34.18
6.	Boys' Primary School	1.86	6.21
7.	Girls' Primary School	4.57	7.46
8.	Boys' Secondary School	7.15	18.77
9.	Girls' Secondary School	9.44	22.06
10.	Basic Medical Centre	6.68	32.37
11.	Pharmacy Store	10.07	32.31
12.	Basic Veterinary Centre	7.77	34.80
13.	Banks	9.32	49.71

Source: Field Data, 2017

The socioeconomic indicators like size of household, average age, experience of farming, experience of livestock rearing, duration of formal education, percentage of school attendant population, literacy ratios, and type of family in the sample villages shows total contrast conditions in the Lesser and Greater Cholistan dessert regions. Comparatively, the characteristics associated with subsistence livelihoods are at their peak in the Greater Cholistan desert region while characteristics associated with the accessibility to civic utilities and services are well off in the Lesser Cholistan desert region. In the Greater Cholistan dessert region, the characteristics like bigger household size, much higher experience of farming & livestock rearing, high proportion of joint family system and low literacy ratios indicate that the socioeconomic conditions are least affected by this transformation. The situation of socioeconomic condition is totally changed and indicate the transformation well off the conditions in the Lesser Cholistan desert region. The small household size, commercial farming experience, high proportion of nuclear family system and high literacy ratios shows the well-off conditions in the Lesser Cholistan desert region (Table 2).

Table 2. Comparison of Socioeconomic Conditions in the Cholistan Desert Region

S.No	Indicators	Greater Cholistan	Lesser Cholistan
1	Size of Household (Average)	6.50	5.60
2	Average Age (Years)	48.80	55.20
3	Experience of Farming (Years)	24.10	16.00
4	Experience of Livestock Rearing (Years)	29.90	40.10
5a	Duration of Formal Education (Years)	5.50	2.50
5b	School attendant population (%)	25.30	10.00
5c	Literate Population (%)	27.80	8.00
5d	Religious Education %	50.20	33.80
5e	Illiterate Population (%)	22.20	58.00
6a	Nuclear Family (%)	31.90	68.10
6b	Joint Family (%)	68.10	31.90

Source: Field Data, 2017

The data normalization in the negative and positive domain regarding combine indicators of development and selected indicators show the comparative socio-economic conditions of the Lesser and Greater Cholistan regions. The combined impacts of the indicators on the characteristics of development shows that the Lesser Cholistan region has very high positive domain scores regarding each indicator which reflect the affluence and development while the Greater Cholistan region prevail poverty and serious challenges in their transformation of livelihoods (Table 03). In the Lesser Cholistan desert region, the association of population growth, hazards & epidemics, technology & mechanization and land allotment policy with the development are: $y = 0.6415x + 1.5409$; $y = 0.3962x + 1.3145$; $y = 0.8208x - 0.0629$; and $y = 0.7736x + 0.2013$, respectively (Figure 2). It shows strong association in the positive domain area where population has greater association and technology & mechanization has least association values. In the Greater Cholistan desert region, the association of population growth, hazards & epidemics, technology & mechanization and land allotment policy with the development are: $y = 1.478x + 2.0769$ $y = 0.7967x - 0.5385$ $y = 0.7363x - 1.0769$ $y = 0.3462x - 1.4615$, respectively (Figure 03). It shows strong association in the negative domain area where population has greater association and land allotment policy has least association values.

Table 3: Normalized Score of Selected Indicators

	Settlement	Dev.	Population	Hazards & Epidemics	Technology & Mechanization	Land Allotment Policy
Lesser Cholistan	92/1-L	2	2	0	2	1
	144/5-R	3	2	1	2	1
	Bhagla	3	3	3	3	3
	Derawar	4	4	3	4	3
	Chanan pir	3	4	3	3	3
	Dingarh	4	4	3	2	3
	Chapoo	2	3	1	3	3
	Moujgarh	3	4	3	3	3
	Janu wali	3	4	3	1	3
	Kheer Sar	3	4	3	2	3
	Kandai	3	3	3	3	3
	Khipli	2	2	-1	0	1
	325/HR	1	1	-2	-1	-3
	Marrot	3	4	3	2	3
	Kali Dhari	2	3	3	3	1
	Jam Sar	3	3	1	3	2
	Kalay Pahar	1	3	3	3	3
	Ladam Sar	2	3	1	3	2
Jogiat Pir	3	4	3	3	3	
Thandi Khoi	1	3	3	3	3	
Jamal De Sar	3	4	3	2	2	
Average	3	3	2	2	2	
Greater Cholistan	Chota Ghania	-1	1	-2	-2	-2
	Islamgarh	1	3	1	1	-3
	Majajywala	0	2	-2	-2	-1
	Khairgarh	-2	-1	-1	-4	-3
	Panjkot	-1	1	0	-2	0
	Bijnote	-1	1	-2	-2	0
	Khargarh	-3	-2	-2	-2	-2
	Nawankot	-4	-4	-4	-4	-3
	Rukanpur	-3	-3	-4	-3	-4
Average	-2	0	-2	-2	-2	

Source: Field Data, 2017

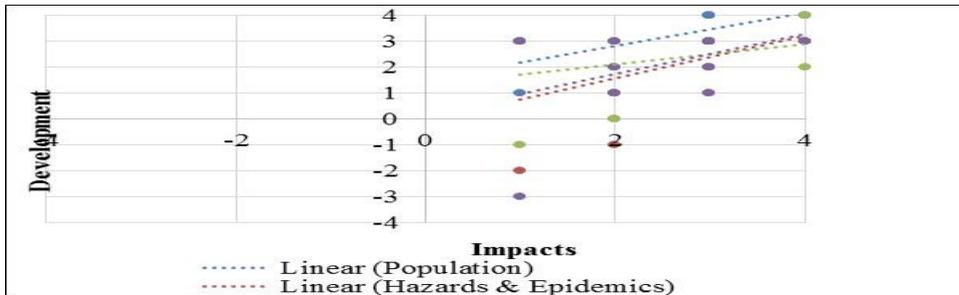


Figure 2: Impacts of Selected Indicators on the Development in the Lesser Cholistan Region (Source: Field Data, 2017)

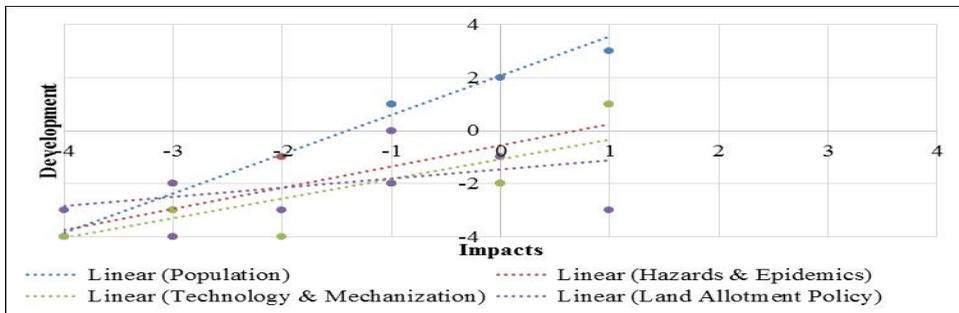


Figure 03: Impacts of Selected Indicators on the Development in the Greater Cholistan Region (Source: Field Data, 2017)

Conclusion

Likewise, the other desert region in the world, the Cholistan desert region is exposed to natural and modern challenges as well as opportunities. The Cholistan desert region is unique of its landownership which has changed with the passage of time through different land allotment policies. The impact of modernization in the form of technology and agriculture mechanization as well as population growth is inevitable and obvious. The natural hazards and epidemics have always affected the poorest of the poor community which is also true in this desert region. The implications of land allotment policy, population growth, natural hazards, epidemics, mechanization and transfer of technology divided the Cholistan desert region into two major regions of more developed and least developed. Although, the basic criteria of distinguish is the distribution of natural resources between these two regions. However, it also follows the same pattern in the development of the regions.

The results show that the Greater and Lesser Cholistan regions have contrasting characteristics in their development due to transformation of subsistence livelihoods. On one side, the transformation in the subsistence livelihoods in the Lesser Cholistan region is producing development in the agriculture and socioeconomic conditions of the region. On the other side, this transformation deteriorated the socioeconomic condition of the inhabitants of Greater Cholistan region. This study explores that the two regions perceive the impacts of land allotment policy, population growth, natural hazards, epidemics, mechanization and transfer of technology in total different manner due to their natural and anthropogenic setup.

The linear regression analysis shows that the population growth has strong positive and negative impact in the Lesser and Greater Cholistan desert regions, respectively. The natural hazards and epidemics has least affected the development in the Lesser Cholistan desert region with positive relationship while severely affected the development in the Greater Cholistan desert region with strong negative association. Based on the nature of the intervention of the technology and mechanization as well as the land allotment policy, it has positive relationship in the Lesser Cholistan desert region while poor association in the Greater Cholistan desert region in the negative domain. Scientifically, this study can be a baseline for streamlining the developmental process in the Cholistan desert region.

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