Pakistan Geographical Review, Vol. 61, No. 1, June 2006, PP 1-20

Housing and Environment: A Study of Spatial Disparities in Sindh

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Abstract

According to 1998 Population and Housing Census of Pakistan, there were over 19.3 million housing units in the country as compared to 12.6 million enumerated in 1980, showing an increase of 53.2 percent. The housing and construction sector remained neglected in the past which resulted in housing backlog of over 4.3 million units. In order to make up the backlog and meet the shortfall in the next 20 years, the overall housing production has to be raised to 500,000 housing units per annum.The present study covers housing ownership and housing facilities in the province of Sindh, Pakistan. Sindh, the second largest province in terms of population and third in terms of area of Pakistan also known as the revenue engine of Pakistan must focus its attention on this sector as houseless ness can cause reverse gear in the engine.

Introduction

A house and a home is a basic need of human beings. People construct **houses** primarily as dwelling-spaces for human habitation and pets and for fostering an environment of security and privacy. Such dwellings generally feature enclosing walls and a roof to protect against precipitation, wind, heat, cold and intruders Satisfactory housing and a supportive physical and social environment are essential to sustain human living. The progression of households through the life cycle and the changes that occur within households generate different needs for housing space at different times (Clark et al. 2000). Housing plays other roles in household wealth such as being a “protector” and a “cultivator” (Xiao, 2001).

There is a growing recognition of the importance of studying wealth distribution globally, as well as in developing and transition economies. Understanding the distribution of wealth is important in its own right as an indicator of social cohesion. The stock of available assets also determines the ability of households to withstand shocks and inequality in its distribution is linked to intergenerational transmission of poverty. Even in rich countries with diversified portfolios, housing represents the largest part of household wealth. From analysis of the balance sheets of a number of rich countries one can infer that housing accounts for an average of 35 to 45 per cent of total household wealth. In developing countries housing accounts for a similarly large share (Subramaniam and Jayaraj 2006).

According to 1998 Population and Housing Census of Pakistan, there were over 19.3 million housing units in the country as compared to 12.6 million enumerated in 1980, i.e. an increase of 53.2 percent. The housing and construction sector remained neglected in the past which resulted in housing backlog of over 4.3 million units. In order to make up the backlog and meet the shortfall in the next 20 years, the overall housing production has to be raised to 500,000 housing units per annum. (GoP, 2002).ES

The present study covers housing ownership and housing facilities in the province of Sindh, Pakistan. Sindh, the second largest province in terms of population and third in terms of area of Pakistan, is also known as the 'revenue engine' of Pakistan. The provincial revenue collections by the end of March 2003 was Rs. 8.1 billion showing an increase of only 3% compared to the provincial receipts collected by March 2002.

The overall social sector expenditure for the 3rd quarter was Rs. 13.56 billion, which was 11% higher than that of the last year's (2002) 3rd quarter expenditures. Economic services include: Agriculture and Food; Irrigation; Land Reclamation; Rural Development; Industries and Transport Departments. The overall budgetary outlay was increased by 15% and the 3rd quarter expenditure on economic services had increased by 38%. The expenditure on Irrigation was Rs. 1.13 billion; on Land Reclamation it was Rs. 1.05 billion where as the expenditure under Rural Development was Rs. 2.42 billion. (GoS, 2003).

Selection of Indicators

In the study of housing, it is essential, at the very outset, to define a house. A house may be anything ranging from a multi-storied building, a bungalow, a flat or even a room or a shack. Home was also characterized as a place of total privacy where one could do as one pleased without disturbances from the outside world (Dupuis and Thorns, 1998).

Twelve variables (Table 1) pertaining to housing and environmental conditions have been chosen. The first three variables pertain to the provision of houses to the relevant group of population, the proportion of people facing problems of varying degrees of seriousness respectively in the housing sector. .Variables 4 & 5 relate to the number of houses falling below a certain general quality. The other four variables (6 to 9) pertain to the facilities essential for the proper maintenance of internal housing environment. In the absence of data on measures of air or water pollution, we have had to make do with variables relating to availability of electricity, tap water, fuel source for cooking. Variables 9 to 12 i.e. number of post offices to population density, high type road to total area of the district, high type road to total population and high type road to total road network are external facilities which enhance residential location and choice.

The Population Census Organization of Pakistan defines a Housing Unit as a separate and independent place of abode (PCR 2000). The significance of housing and environment as a social indicator cannot be disputed. No doubt, it is an economic good and an investment asset but its significance as a social service outweighs all other aspects. It recognizes that for any number of interrelated reasons associated with housing (location, standard, tenure, poverty, welfare dependency, poor health or any other reasons) people may be disadvantaged in ways that prevent them from participating within and enjoying the opportunities experienced by mainstream society (Walker, et al., 2003). Ambrose, (2001) claims that besides physical environment a range of other factors affect health and wellbeing. This supports the fact that the physical environment is of great significance in the quality of life of human beings.

The United Nations department of economic and social affairs explains in Agenda 2004 that the overall human settlement objective is to improve the social, economic and environmental quality of human settlements and the living and working environments of all people, in particular the urban and rural poor. Such improvement should be based on technical cooperation activities, partnerships among the public, private and community sectors and participation in the decision-making process by community groups and special interest groups such as women, the elderly and the disabled.

The ownership of a house not only enhances economic standards but also lends an aura of social status to its owner. Homeownership can protect homeowners against inflation in the long run (Xiao et al, 2003). Home ownership is known to have a hold up effect on moving

behavior (Speare et al. 1975; Clark and Dieleman 1996; Van Leuvensteijn and Koning 2000; Helderman et al. 2004). Owning a home can be seen as a specific local tie that can be described as having capital or location-specific advantages (Bartel 1979; Davanzo 1981; Fischer and Malmberg 2001).

The desire for space is a critical factor in housing decisions. The need and desire for additional space, as households increase in size through marriage and the addition of children, are important factors that generate moves to larger houses. In addition, as household members progress in their careers and earn more money, they tend to purchase more luxurious and spacious houses (Bochel et al. 1999).

Safety and sufficient shelter from the elements are basic requirements for survival; therefore, a study of houseless ness is essential as it reflects the crass inequality between the well-off and destitute sections of the population. The study of houseless ness is also essential in the broader spectrum of the study of social and economic inequalities because it throws light on the accompanying social evils of houseless ness e.g. social evils associated with residence in slums and squatter settlements, beginning from illegal occupation of land to drug addiction, prostitution and engagement in counter legal or 'shady' activities. Homelessness is considered to be an important pathway to incarceration among the mentally ill (Lamb and Weinberger, 2001). The vulnerability of the homeless mentally ill also increases their risk of being the victims of crime (Dennis and Steadman, 1991). They are easier targets for offenders (Markowitz, 2006).

Houses to total population indicates the actual shortage of houses in any region, while houseless ness patterns reveal the duel nature of the capability of the housing industry to keep pace with the rapid increase of population, the streams of migrants, the eviction of slum dwellers or even the presence of wandering tribes, who refuse to be burdened with the responsibility of owning and maintaining houses.

The study of housing congestion is also important in the study of housing and environment because varying degrees of congestion are a reflection of manifestation of poverty at different levels. Housing congestion is often a cause of juvenile delinquency and other social evils (Burke, 2004). Air pollution has been consistently linked with substantial burdens of ill-health in developed and developing countries (Schwartz 1994; WHO 1999; Bruce et al., 2000; Smith, 2000). Most recently, as part of the Comparative Risk Assessment (CRA) project of the World Health Organization (WHO), Geneva, the global and regional burdens of diseases (death, illness, injury, lost life years, and years lost to disability) by age, sex, and 14 world regions were calculated for a range of risk factors, including indoor and outdoor air pollution (WHO 2002). Some studies have indicated that the air quality of a residential home varies in relation to outdoor air quality (Yousufzai et al 2002; Jones et al., 2000; Lee et al., 1999) Many studies have found that the concentrations of suspended particulate matter were higher indoors than outdoors when there were sources of indoor particulate in domestic homes (Jones et al., 2000; Chao et al., 1998; Kamens et al., 1991) Incremental concentrations of fine particles were attributed to tobacco smoking and operation of gas stoves for cooking. That the exposure-response relationships have been derived for outdoor air pollution in urban situations, where the chief source of particulates is fossil fuel burning, however, raises a number of questions about their suitability for application indoors mainly with rural populations relying on biomass fuels. In addition, some of the studies rely mostly on developed-country studies. These characteristics raise several important questions (many of these same problems plague attempts to calculate impacts of outdoor air pollution in developing countries from epidemiologic results in developed countries (Cohen et al. 2003). Differences in pollutant mix due to different sources, i.e. although particulates can be used as an indicator of hazard in both cases, biomass fuels as commonly used in LDC households produce relatively more organic compounds (e.g., benzene, formaldehyde, 1,3-

butadiene, polyaromatic hydrocarbons) and fossil fuels more sulfur oxides (Smith and Mehta, 2003). Excessive housing congestion is a major cause of indoor pollution and studies indicate that indoor air quality directly affect health, thus high rates, of room congestion are not favorable for human health (Burke, 2004).

Housing congestion is also a reflection of the effect of economy on social condition, e.g. congestion maybe due to the inability to pay high rents. However, the phenomenon of crowding though many may view as physical; social density does necessarily incorporate geographical dimension. It takes into account various effects such as the 'physical effect' or the 'household effect', size of family, and characteristics of members of the society in the broader framework of living space. However, physical crowding does not get transformed into social crowding under conditions of strong social ties, only (Kulkarni, 1984). The phenomenon of social crowding is related to the perception of environment by an individual or a group or a section of society, and is largely the subjective feeling and assessment of the environment by the concerned person; but since social density is difficult to quantify physical crowding has been taken as its surrogate in order to highlight its social significance. Excessive crowding has been found to have a deteriorative impact not only on conditions of health and education but to a large extent on distortion of social and psychological values as well, especially of children. It not only makes children devoid of a sense of individuality and self-sufficiency, but even among adults, it often causes irritability and flashes of violence. Above all, housing congestion leads people to move out to the streets, thus causing a breakup of fragile family ties.

The physical quality of houses, as implied in the variable on 'pucca' houses, has been selected as a surrogate for all other aspects of physical quality because in no other field of social and economic research does the issue of basic information produce as much debate and wringing of hands as in the case of housing. The study of physical quality of houses is essential because in the absence of data pertaining to the conditions of the internal environment, this information may provide some idea as to the level of socio-economic status of the owners or dwellers of the house. Williams (1993) and Shiller and Weiss (2000) present evidence that when people do not have a stake in their home's value, they do not expend much effort on care, which then leads to increased degradation of physical structure.

The physical quality of houses has been categorised on the basis of material used in the construction of roofs and walls. Based on the types of building materials used, two types of houses `kuccha` and 'pucca' can be identified. The former has walls made of grass, leaves, reeds or bamboo, etc., while the latter type is one which has walls made mainly of burnt bricks, G.I, sheets or other metal sheets, stone, cement, concrete, RBC and RCC, etc (GoP, 1998). Thus, from a perusal of the list of building materials used in the two categories of houses, no ambiguity as to the cost of construction of houses is left. Pucca houses being an indication of well-to-do living standards, the spatial measurement of which displays the disparity in levels of housing conditions, although, house types based on materials and the nature of the physical environment, development and invention of scientific gadgets to overcome extremes of climatic hazards, the excuse of poor housing due to non-availability of raw materials is unjustified. However, it is an established fact that the house type is a function of economic status, which to a large extent also corresponds to its social status.

One of the physical qualities of housing is its obsolescence, which may be due to poor quality of initial construction, wear and tear due to ageing or inadequate maintenance through misuse, abuse or neglect (Burke, 2004). However, data on obsolescent houses is not available; therefore the fifth variable showing period of construction more than 10 years has been used.

Water is one of the most essential requirements not only for the sustenance of life but also for the maintenance of health and hygiene of the human and physical environment. The

National Environmental Quality Standards (NEQS) are used as a reference point to compare how the average quality of water fairs on various parameters. On most counts (including temperature, pH content, total dissolved solids and biological Oxygen demand), the water is safe (GoP, 2002). The rural areas are still characterized by acute scarcity of water. The main sources of water in rural areas were previously rivers, tanks and wells, but with rapid strides in science and technology tube wells are becoming increasingly common. However, the uneven supply of tap water shows the levels of unequal development of the districts. Similarly, with the constantly increasing and improving pace of living styles and standards, electrification is gaining significance. Electrification is essential not only for household illumination, but also for the performance of agricultural practices, thus, the greater the level of electrification the more developed an area maybe considered and vice-versa.

The consideration of the proportion of `pucca` roads to population as well as to area are important because it has a bearing on the welfare of people in terms of accessibility to other vital services. In this connection the `pucca` or surfaced roads are supposed to give the best service, therefore, they have been taken into consideration in the study of inequalities. The better a district is served by `pucca` roads the more developed it is likely to be. The significance of communication and connectivity on economic, social and cultural factors do not need elucidation, as we realise their benefits in our daily life routines.

Researchers have found many links between land prices, housing prices and construction activity which have recently been documented in data of different countries. Coulson (1999) finds that price increases induce builders to finish accumulated inventory rather than start new units. Bulan, et al (2000) also examine builder reactions to housing prices and finds that price increases lead to a significant increase in the probability that new construction will not take place. The variable, percentage of housing units by period of construction more than 10 years correlates with the above mentioned research in the scenario of Sindh's existing socio-economic profile.

Methodology

Source of Data

The study is based on 1998 Census data at districts level for the province. All data have been collected from the DCR 1998 of 21 districts and some of the other data from FBS publications (GoP, 2001). In the 1998 Census, the Population Census Organization of Pakistan collected wide range of data not collected previously in the history of Pakistan. Due to lack of chemical analysis of water quality, indoor, outdoor air pollution and noise pollution data, environmental study of the area has been discussed theoretically on the basis of previous studies of different regions.

Technique of Measurement of Disparities

In the present study Z-Score Model technique has been used for measurement of disparities in the province and has ranked all districts on the basis of development. Z- Score model is the easiest technique for the study of any type of development and ranking.

Z - Score Additive Model

The identification of broad spatial pattern of inequality requires the derivation of a single indicator or a restricted set of indicators measuring the major dimensions of the concept. The Z-Score Additive Model is an easy method for analysis of inequality and other related studies (Burke, et al. 2006). The derivation of selected variables involves the transformation of data on individual variables into some kind of standard scores. This can be achieved in various ways including conversion into ranking and the standardization of the ranges, but the most common method is to use Z-Score. The Z -Score Model for measurement of inequality has

been used to make assessments based on circumstantial evidences and conditions in the study area. All standards have been selected on the basis of prevalent conditions in the study area. The Model has been arranged in the following steps. For observation 'i' on any variable, the Standard Score (Z_i) is given by:

$$Z_j = \frac{Xi - \overline{X}}{S}$$

Where
X_i is the value for observation (i)
Xi = X Xs

X is the value of variables which have been formulated for the study
Xs is the specific standard for each variable in the study area (i.e. the highest value of the variable)

$\overline{X}$ is the mean of the specific standards

$$\overline{X} = \frac{\sum Xs}{n}$$

n is the number of observations
S is the Standard Deviation

$$S = \sqrt{\frac{Xs - \overline{Xs}}{n-1}}$$

This model has been applied in this paper to measure inequalities of housing and environment.
Firstly, the data has been converted into percentages and units i.e. variables. Secondly, all selected variables have been arranged in descending order (X).
Thirdly, highest value of each variable has been selected as specific standard for each variable in the study area (Xs).
Fourthly, the specific standard for each variable has been subtracted from the value of variables formulated (Xi).
Fifthly, the mean and standard deviation of the set of specific standards for the set of variables has been calculated.
Finally, Standard Score (Zj) has been calculated for each variable.
To remove negativity of (Zj) the values have been squared.
The Standard Score Additive Model has been used to develop a Composite Housing and Environment indicator. The twelve selected variables require the addition of the Z-Score for the individual variables taken to measure them. The model is thus:

$$I_j = \sum_{i=1}^{K} Zij$$

Where
I_j is the magnitude of the indicator for the district 'j'
Z_{ij} is the standard score on variables (i) in the district 'j'
K is the number of variables measuring the criterion in question, being a subset of the

total 'm' variable

Results and Discussion

The spatial pattern of inequality pertaining to the set of indicators relating to housing and environment has been portrayed in Fig. 2**.** Karachi Central, East, South, West, and Malir have better housing facilities as compared to other districts of the province, so lowest level of inequality exists in this region. All these five districts are part of Karachi city which is the Mega city of Pakistan, but the situation is not supportive to equivalency of all related indicators revealed in housing and environment. Karachi Central, East, South, West and Malir are facing 42.42, 49.74, 55.47, 63.05, and 63.54 percent magnitude of problem respectively compared to the provincial standard.

Hyderabad has emerged as a low inequality district as compared to other parts of the province and 115.67 percent away from the standard. Moderate inequality has been observed in districts of Sukkur, Larkana, Dadu, and Nawabshah. Their backwardness levels are 162.88, 173.21, 176.82 and 180.39 percent respectively. High disparity has been observed in Khairpur, Shikarpur, NaushahroFeroze, Mirpurkhas, Ghotki, Sanghar and Jacobabad. Large numbers of districts appear in this category; however their variance of backwardness is low among themselves but compared to the standard they record nearly twice the amount. Their values are 184.80, 185.66, 188.09, 189.11, 189.81, 195.96 and 197.84 percent respectively. Thatta, Badin, Umerkot and Tharparkar have recorded highest inequality in the province. Three districts (Thatta, Badin and Umerkot) from the following category have nearly same performance while the remaining districts are 33 percent more backward. Their poorest performance in terms of selected indicators made them 232.25, 233.68, 243.96 and 276.12 percent backward compared to Ideal Condition i.e. 0 % Inequality.

Fig. 3 explains inequality in comparison with the Ideal Condition i.e. inequality 0 %. The graph shows the proportion of inequality ranging from lowest to highest with reference to the Ideal Condition. It also shows the varying proportions of inequality range between the different categories. Lowest inequality districts are 54.84 percent backward with reference to the Ideal Condition. Moderate, high and highest disparity categories have not shown much backwardness among them, but they comparatively seem to be nearly 1.7, 1.9 and 2.4 times backward respectively to the Ideal Condition.

Figs. 4 to 15 give details of the selected variables for sets of indicators of housing and environment. Fig. 4 shows existing houses for selected population in the province. Major problem can be seen in Karachi Central, East and South, while least problematic districts emerging are Tharparkar, Thatta, Umerkot, Ghotki and Badin. Here housing structures are very poor because most of the houses are constructed of twigs, branches, bushes and other pitiable materials especially seen in Tharparkar and Umerkot, while highest problematic districts have high rate of land value and no excess land for housing construction has been observed especially in Karachi Central, South and East. The present variable has created an issue for discussion and debate because these districts clearly indicate shortage of houses, while we compare houses to total households there is no difference found in the District Census Reports (DCR) 1998. In the DCR the number of households and housing units are recorded as having the same values. According to 1998 Census “”A household means a group of persons living together who have collective arrangement for eating. A person living alone was also considered to constitute a household; the distinguishing characteristic of a household is its common cooking arrangement, (PCR 1998 p. VII, paragraph, 2). In terms of Housing Unit according to 1998 Census “A Housing Unit means a separate and independent place of abode, inhabited by one household and, if vacant, meant for habitation by one household. It does not necessarily mean a separate building. A building may have one or

more housing units. Furthermore, any place not intended for habitation but occupied by a household at the time of census was also treated as a housing unit" (PCR 1998, p. VII, paragraph, 3). The above mentioned definitions clearly explain different things in terms of data collection but data for both observations are same in the Census publication (PCR 1998, Table 41 & 42). We also observed high rate of selected age group in the highly problematic areas as compared to other districts of the province. In Karachi East age 15 and above population is 63.27 % to total population, while the West, South, Central and Malir districts have 58.95, 64.83, 64.25, 58.60 percent respectively. The question arises here as to why a wider range of variation has been observed in highly problematic districts? Probably this is because of a high rate of migration in these districts. People migrate to urban areas in search of fresh pastures, all over the world as also in Pakistan. Majority of the migrant population come from North West Frontier Province, Punjab, Federally Administered Tribal Area, Northern Area and Azad Kashmir. These migrants mostly belong to the age group 15 and above. In the least problematic districts the proportion in the selected age group ranges between 53 to 56 percent, excluding Tharparkar where selected age group is 49 percent to total population. On this perspective the study strongly supports the selected variable (Houses to Population Age 15 and above) for assessment of shortage of houses.

Fig. 5 shows the position of houseless ness (rented and rent free houses have been considered houseless in the present study). The problem of houseless ness is acute not only in Karachi South, Central, Mirpurkhas, Karachi, East, West and Malir, but also high in Umerkot. Except for Mirpurkhas and Umerkot the result of houseless ness is a reflection of shortage of houses but in Mirpurkhas and Umerkot the problem observed is that of poverty because 34.57 and 31.11 % houses respectively are rent free accommodations. Districts of Tharparkar show outstanding position, while Thatta and Dadu show a better position in terms of this indicator.

Tharparkar, Karachi East, Karachi Central and South show high standards of living in terms of average room congestion, while poor standards are shown in Shikarpur, Nawabshah, Ghotki, NaushahroFeroze, Badin, Mirpurkhas and Sukkur (Fig. 6). When we compare Shikarpur which has highest value of room congestion (DCR, 1998, Shikarpur, Table-3.1) to other districts of the province, a very interesting scenario has emerged. It has been found that Shikarpur has 64.65 % houses with one room, while Khairpur 66.86, Ghotki 77.73, NaushahroFeroze 75.19, Nawabshah, 71.25, Jacobabad 70.28, Larkana 68.46, Dadu 73.29, Hyderabad 65.95, Badin 81.82, Thatta, 78.14, Mirpurkhas, 65.11, Sanghar, 68.76 percent. In Shikarpur the value is lowest among all mentioned districts but room congestion is very high. A perusal of the data pertaining to number of rooms in Shikarpur reveals that there are 96810 houses with one room, 36601 two, 9573 three, 4534 four, 1186 five, 1055 six and above rooms (DCR, 1998, Shikarpur, Table-4.3) houses, so total number of rooms are 229122 (1055 multiplied by six) and total rooms divided by total population of the districts i.e. the value of room congestion thus obtained is 3.84 persons per room. Further checkup of DCR values of room congestion of the districts, reveals that the values of household size and room congestion are same. Thus it has emerged that Shikarpur does not have highest value of room congestion in the province.

Fig. 7 shows housing structure in the districts of Sindh. High percentage of 'Pucca' houses to total houses can be seen in Karachi Central, South, West, and East and Malir districts. Hyderabad shows a better position compared to other districts of the province. Most of the districts of the province exhibit poor quality of houses and houses of Tharparkar are typical examples. The problem of poor quality of houses largely has been found in the rural areas of the province because of lack of economic opportunities, poor education and backward agricultural practices. The rural population does not have sufficient earnings. Most of the farmers build their houses on the land owner's plots as rent free dwellings or on vacant

barren land, the reason why they do not take much interest in housing investment.

Electricity nowadays has become an essential part of human basic needs. Fig.8 shows percentage of electrified houses in the province. In this respect Tharparkar shows lowest value while Thatta, Badin and Umerkot have below 40 % electrified houses. The reason is that the province does not produce much electricity to fulfill consumer demands. It has also been observed that the problem is most acute in the rural areas especially the remote areas where the number of villages is highest i as compared to other districts. But in the case of Tharparkar reverse is the situation. Tharparkar has only 166 villages as compared to other high problematic districts in terms of electricity connections.

Fig. 9 shows houses with Tap water connections in the province. Much disparity has been observed among Karachi, Central, South, East, Malir and other districts of the province. Lowest value has been found in Tharparkar which is an arid region with acute scarcity of water. A very interesting situation exists in the province because the Indus is a permanent river which flows through the central area of the province. Most of the districts avail irrigation water from this source but the situation of Tap water connection is very poor. All districts of Karachi division although far from the Indus River have leading number of Tap water connections in the province but the problems of contaminated water in the city is acute (Haq, 2006). Most of the population of rural areas of the province drink irrigation water from open canals, under ground water through tube wells, pond water (stored during the rain) while others suffer from a lack of water. There are no facilities of water treatment plants in rural areas and no drinking water monitoring either in urban areas.

Fig.10 is another example of great disparities in terms of the variable on gas consumption as a domestic fuel in the province. Karachi Central, South and East have shown highest gas connections preceded by West and Malir. Some significant values have been shown in Hyderabad and Sukkur.

Fig.11 shows the position of post office facilities in the province. Larkana leads in terms of the variable, while Khairpur, NaushahroFeroze, Dadu and Hyderabad also have a comparatively better position. Karachi Central, East and Tharparkar have great pressure on their postal services facility.

Fig. 12 shows condition of High Type Road (National and Super Highway standard) in the province. The figure shows that Karachi Central, South and East have better proportion primarily because of its small geographical area, preceded by Hyderabad. Tharparkar is quite backward in terms of road network due not only to the large geographical area and also short length of road network. In terms of length measurement Hyderabad leads in the province.

Fig. 13 shows that Karachi East, Central, West and South have exceedingly high population pressure resulting in high rate of noise and air pollution and traffic congestion comparatively with other districts of the province. Malir in Karachi division is in a comparatively better position, while in Tharparkar high pressure has been observed compared to other low density and low pressure recording districts (except Karachi Division) due to short length of High Type Road network.

Fig.14 shows percentage of infrastructure in terms of road network in the province. Karachi Division reveals much better conditions in terms of this infrastructure. Khairpur and Ghotki exhibit top ranks (Except Karachi Division) in respect of this infrastructural facility.

Fig, 15 indicates districts of Karachi Central, East and South in terms of housing structure, while Karachi West and Sukkur show high percentage of constructed houses in the province, moderate level of construction has been seen in Malir, Hyderabad, NaushahroFeroze, Khairpur, Shikarpur and Tharparkar. This variable portrays the economic status of the districts. Tharparkar has shown notable value because it is widely known as the poorest district of the province. The study explains the reason for Tharparkar being one of the largest

districts of the province in terms of geographical area and arable area but the scanty rain and abject condition of water resources is the cause of negligible agricultural productivity in the area. There is no charm for landowners to take over this land while, other problematic districts have large areas of arable land hence the high population of workers engaged in primary activities (especially as agricultural workers) with most of the farmers living in close proximity to fields to look after and protect the crops. They change their residential areas due to poor agricultural productivity or similar reasons, this being the main reason why they do not prefer permanent dwellings. Poverty is also one of the significant factors for absence of permanent abodes.

Overall the study shows that no district of the province stands out as an ideal district. Although Karachi Central, East, South, West and Malir have been observed to have lowest disparity but they are also facing serious problems such as shortage of houses, high population pressure, traffic congestion, malfunctioning of post offices, high decibel noise levels, outdoor and indoor air pollution, houseless ness etc. in terms of selected indicators. The study reveals a better situation in the extremely backward district of Tharparkar in terms of indicators of houseless ness, average room congestion and built houses in the last ten years. This is possible because land values here are low by virtue of it being located in a desert area where there are mainly 'kuccha'houses, therefore construction of these make shift houses does not incur much financial outlay or energy input. The number of houses being high along with a low density of population is responsible for low housing congestion and low proportion of houseless people.

Conclusion

The study clearly reveals that no well conceived plans have been designed for the area. The comparatively better districts are becoming better due to historical inertia, i.e. the attention it received during the bygone days of British rule i.e. prior to 1947 or because of their somewhat more powerful political clout, though only on a regional scale. The province has sadly been grossly neglected on the national scale and no efforts of regional planning in order to improve the condition of the lagging districts have been made. Even the conditions of the better districts are not very appreciative. Nevertheless gross disparities have been observed in the realm of housing and environment, the poor being conspicuously in the grip of abject poverty while the landowners and to some extent the urban dwellers enjoying a markedly secure lifestyle. Minimizing of this gap is essential as housing is one of the basic needs of human beings and crucial for fostering self respect, one of the essentials of life.

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Fig. 1 Location of Study Area

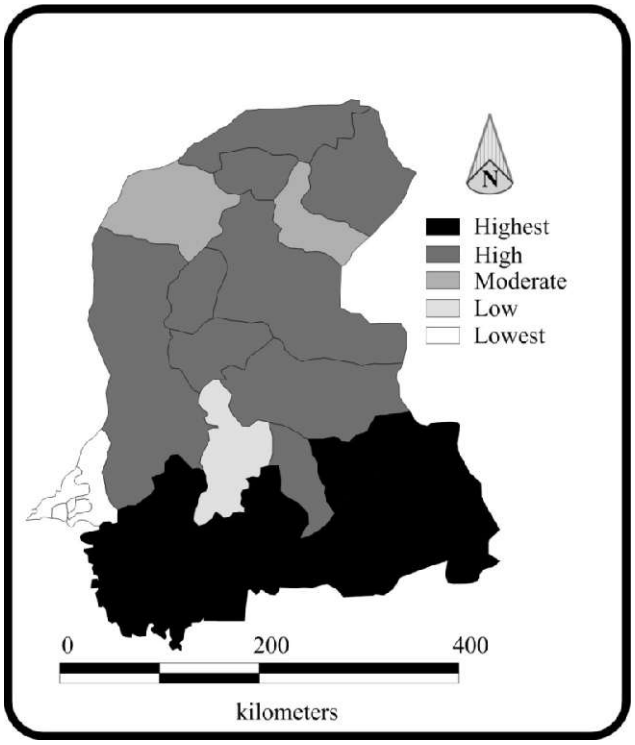

Fig.2 Inequality in Housing and Environment - Sindh 1998

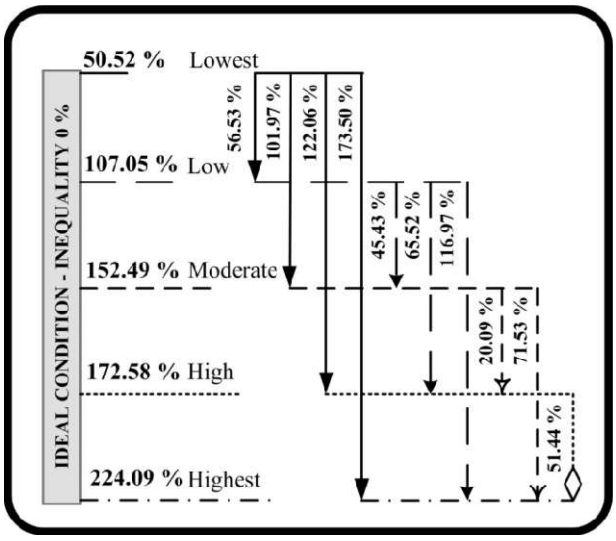

Fig.3 Percentage Variation of Inequality of Standard Scores Above Ideal Inequality in Housing and Environment - Sindh 1998

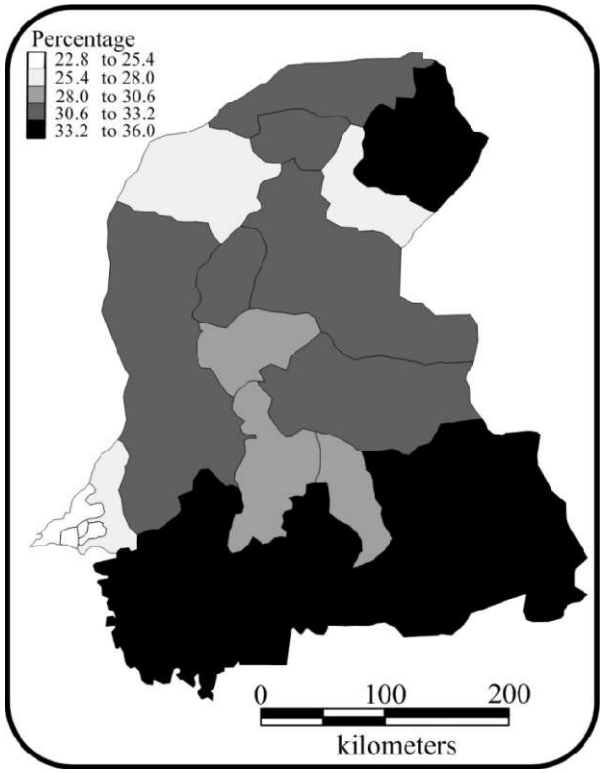

Fig.4 Percentage of Houses to Population Age 16 and Above - Sindh 1998

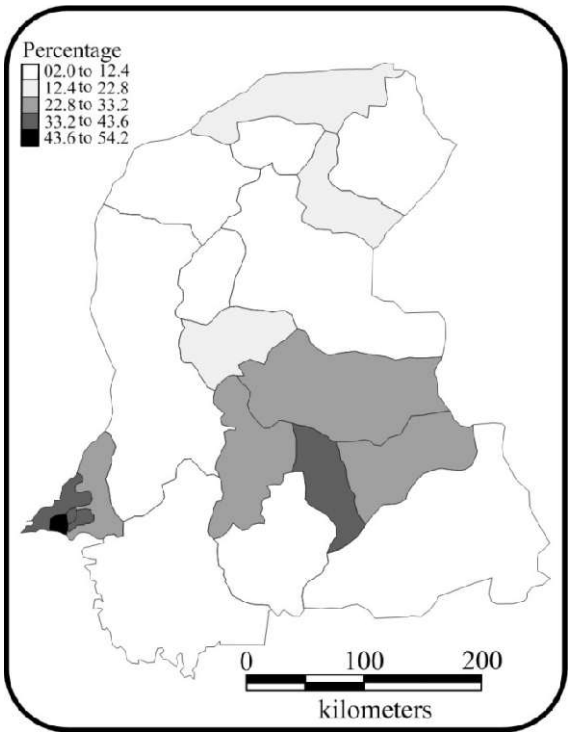

Fig. 5 Percentage of Houseless to Total Households Sindh 1998

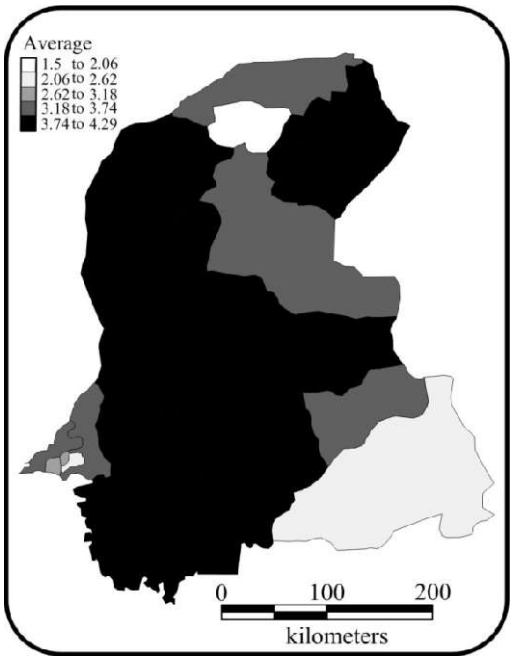

Fig. 6 Average Room Congestion Sindh 1998

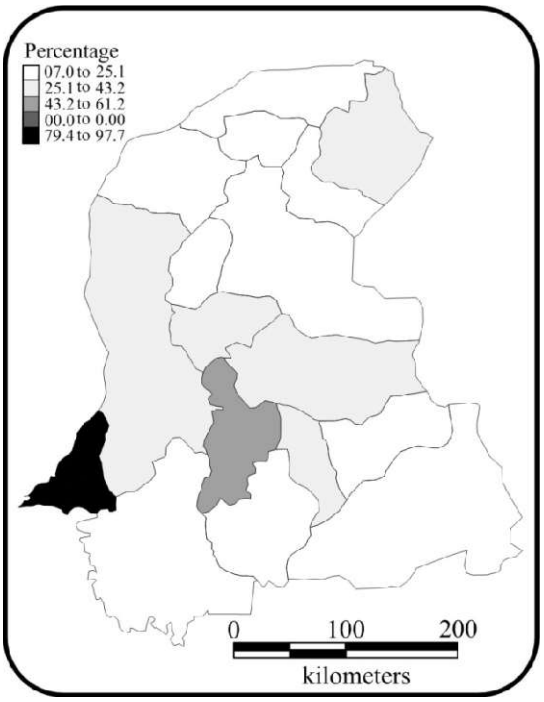

Fig. 7 Percentage of 'Pucca' Houses to Total Houses
Sindh 1998

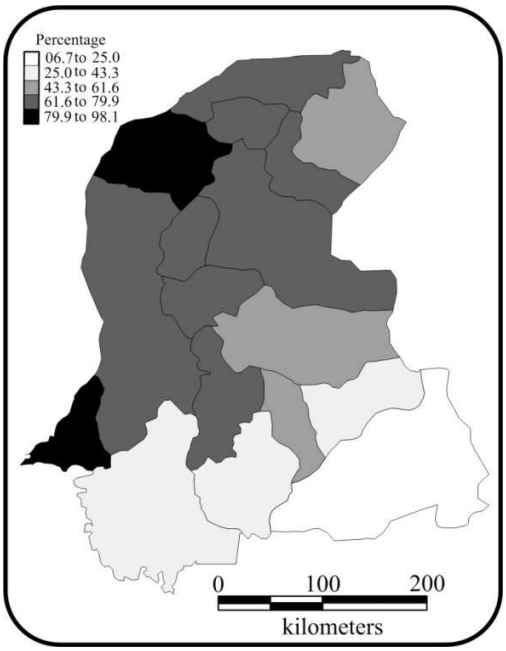

Fig.8 Percentage of Electrified Houses to Total Houses
Sindh 1998

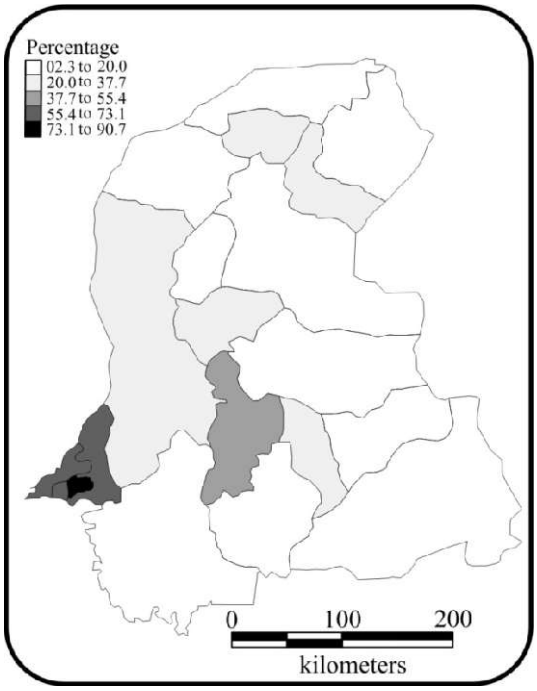

Fig. 9 Percentage of Houses with Tap Water to Total Houses
Sindh 1998

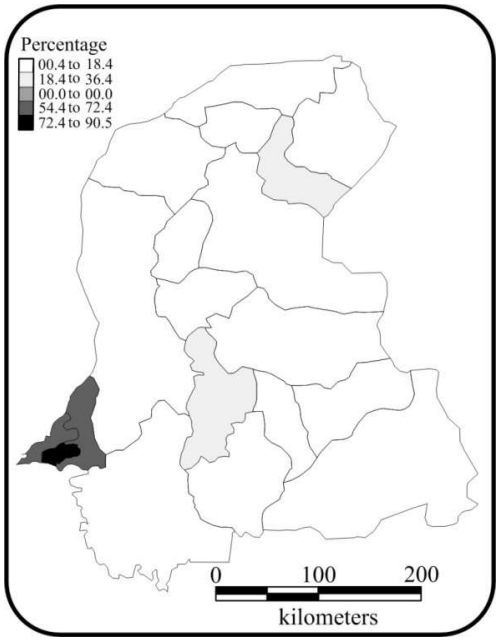

Fig.10 Percentage of Houses with Gas Connections to Total Houses
Sindh 1998

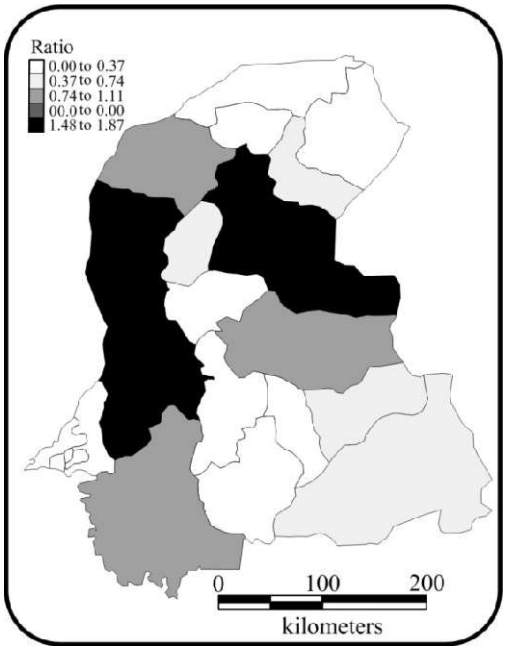

Fig.11 Ratio of Post Offices to Density of Population
Sindh 1998

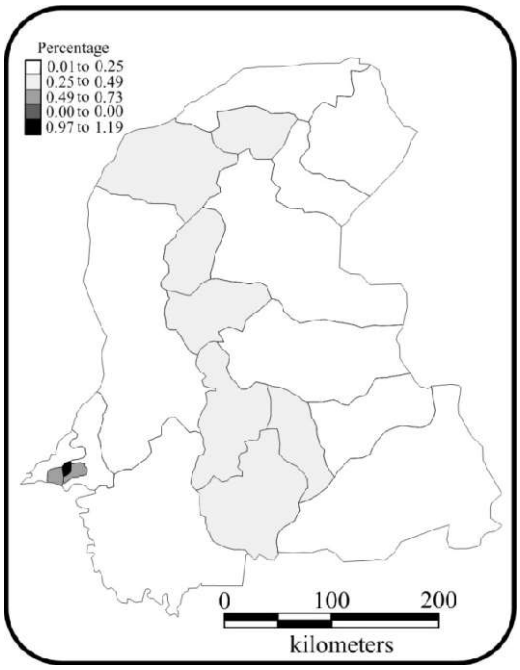

Fig.12 Percentage of High Type Roads to Total Area of Districts
Sindh 1998

Fig. 13 Ratio of High Type Roads to Total Population in Thousand
Sindh 1998

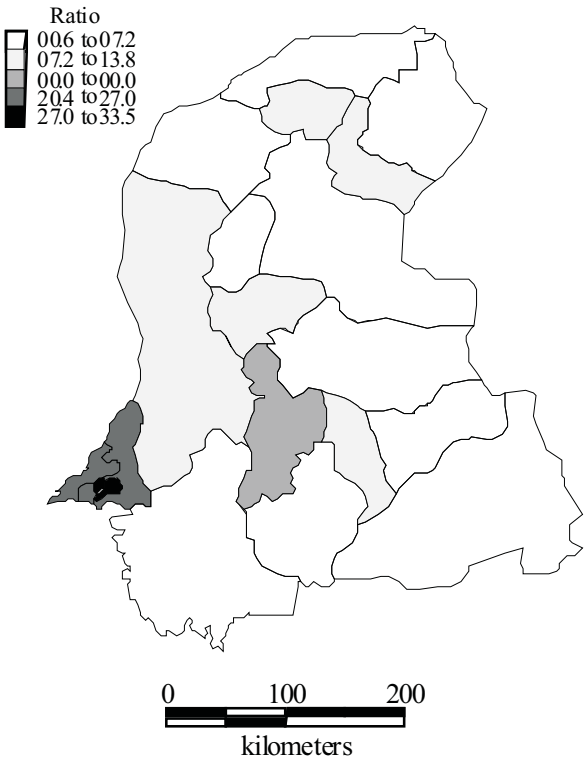

Table 1
Selected Variables

1. Percentage of Houses to Population Age 16 and above
2. Percentage of Houseless to Total Household
3. Average Room Congestion
4. Percentage of 'Pucca' Houses to Total Houses
5. Percentage of Housing Units by Period of Construction More Than 10 Years
6. Percentage of Electrified Houses to Total Houses
7. Percentage of Houses with Tap Water to Total Houses
8. Percentage of Houses with Gas Connections to Total Houses
9. Ratio of Post Offices to Density of Population
10. Percentage of High Type Roads to Total Area of Districts
11. Ratio of High Type Roads to Total Population in Thousand
12. Percentage of High Type Roads to Total Road Network

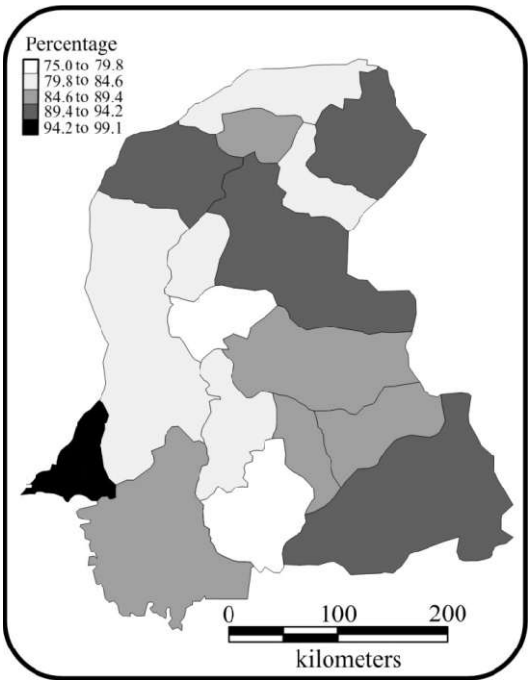

Fig. 14 Percentage of High Type Road to Total Road Network
Sindh 1998

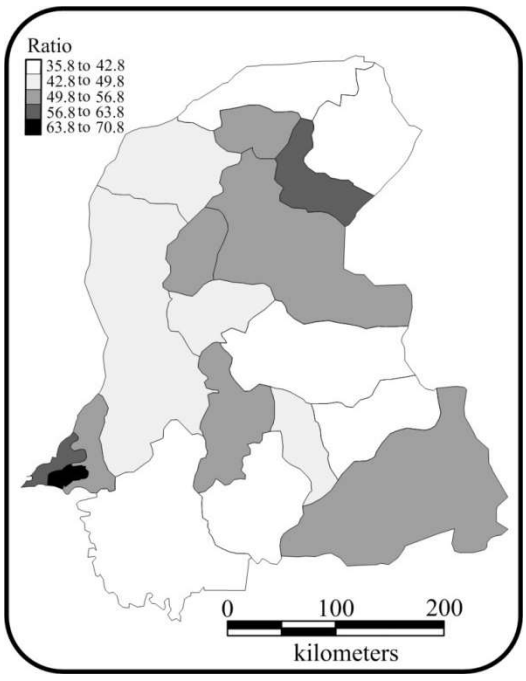

Fig. 15 Percentage of Housing Units by Period of Construction More Than 10 Years
Sindh 1998

Pakistan Geographical Review, Vol. 61, No. 1, June 2006 PP 21-36

Mapping the Spatio-temporal Relationship of Regional Disparities in NWFP

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Abstract:

NWFP is comparatively a less developed province of Pakistan having extreme regional disparities. Peshawar, the provincial capital and its adjoining areas dominate the entire province. These districts are the hub of industrial activates and economic development. While the northern and southern districts of the province are considered as underdeveloped areas. Lack of basic infrastructure and poor exploitation of natural resources are the major cause of this uneven development pattern. It is, therefore, necessary to map the wide regional disparity covering 1981 2001 period.

The mapping of this spatio-temporal relationship of regional disparity will be highly beneficial for decision-makers for the future development projects. It will also help planners and authorities to support those areas which lag behind in the over all development process of the province.

Introduction:

Regional disparity in such phenomena as levels of living, opportunity of employment, wide ranges in regional or local economic development and the variation in the functional quality of administrative units, produce an interesting and important geography of inequality. Spatial variation in such levels of socio-economic development is a multi-dimensional phenomenon (Thurstone 1949, Berry 1960, Thompson et al. 1962, Ahmad 1965) and can be studied by multivariate statistical techniques. In this research NWFP has been selected for the study where wide variation in the level of development has been observed. This province is comparatively less developed province of Pakistan having peculiar physical landscape. Principal Component Analysis has been employed to explain the development pattern of districts of NWFP (Berry 1960, Thompson 1962 and Mahmood 2003).

The concepts and methods used in this study are capable of revealing a realistic development pattern of the districts of Pakistan. However, in Pakistan, the paucity of studies on regional development and disparity cannot be overstated. The noteworthy contributions in this regard are those of Philbrick (1957), Zaidi (1966), Thompson et al (1962) Whitney (1970), Ross (1975), Pasha and Hassan (1982), Jamal and Malik (1988) and Pasha et al (1990), Mahmood (2003 and 2004). Such studies are useful because these help in measuring the over all development level of various administrative units. Districts which show extreme poverty can be identified for support and development programs. Such studies can be usefully employed in other provinces in the Asian and under developed world for the identification of poor areas.

As it is revealed by its name NWFP covers the northwestern corner of Pakistan. It stretches between 31° 15' N to 36° 55'N and 70° 05' E to 74° 08' E, comprising an area of approximately 74,521 sq. km. Previously it was a part of Punjab but in 1901 it became a province. The central and southern districts of NWFP are separated by FATA strip from Afghanistan in the west. According to 1998 census it has average population density of about 235.6 person per sq km, 16.9 % urban population and 35.4 % literacy rate. It constitutes 13.4

% of the total population of Pakistan (Census, 1998).

NWFP has a very diverse physical structure, mostly dominated by rugged hilly terrain. The northern part consists of high-rise mountains and inaccessible deeply dissected valleys. The altitude of these mountains exceeds up to 20,000 feet. It is an area where three great mountains, Himalayas, Karakorum and Hindukush meet. Due to this great height a number of glaciers are found in this region. Panjkora and Swat valleys are the most fertile regions of this area. Alpine, coniferous and sub-tropical dry forest covers large tracts. The eastern part has dense forest cover while towards the northwest trees become stunted and sparse.

Waziristan hills and Safed Koh occupy the southern half of the province. These have comparatively lower height than the northern mountains. The east-west running Safed Koh segregates watershed of Kabul (north) and Kurrum (south) rivers. Waziristan hills are mostly barren and treeless region. Due to low height (5,000 to 10,000 feet) it has no snow cover peaks. Though it is spread over only few districts of NWFP but it has significant role in the economy of the province.

Vale of Peshawar lies between Northern Mountains and Safed Koh. It is very fertile, well irrigated and highly cultivated land, drained by river Kabul. It has a good mixture of sand and clay soil and hence the most productive part of the province. Warsak dam some 30 km from Peshawar ensures the supply of water all the year round. The Kurrum basin lies in south of Peshawar valley, comprising the Bannu district and its adjoining areas. Peshawar valley is also encircled by low mountain ranges from three sides, opening towards the Indus plain in the east. Kurrumgari dam on river Kurrum provide irrigational facilities to the whole valley of Bannu and make it the secondary well-cultivated region of the province. The tableland of Kohat lies between vale of Peshawar and Bannu. Dera Ismail Khan stretches south of Bannu. It is a vast expense of barren plain enclosed between the Suleiman ranges in the west and Indus river on the east.

Since the NWFP has all types of rocks like igneous, sedimentary and metamorphic, therefore, it contains tremendous mineral wealth. More than 50 minerals have been explored in various areas of the province in which china clay, coal, gypsum, feldspar, limestone, marble, rock salt, soap stone, silica and laterite are common.

NWFP possesses 29% cultivated land and 23% forested area of the total land of the province. Maize, bajra, sugarcane, pulses, groundnut, rap mustard and vegetables like potato, onion, garlic, turmeric etc. are the chief agricultural commodities. The northern districts are dominated by fruit production and are known as fruit basket of Pakistan. These districts produce good quality of apple, plum, apricot, peaches, fig, walnut, almond, loquat, mulberry and pistachio, which not only fulfill the local needs but a good quantity is also exported (Census, 1998).

Due to a large area of rangeland, animal rearing is widely practiced throughout the province. Range land and irrigated areas of the province support 13.8 % large and 14.8 % small ruminants, 8 % camels and 16.5 % equines of the national animal population (Census 1998).

Peshawar, Mardan, Charsadda, Nowshera, Risalpur, Gadoon Amazai and Haripur are the main industrial centers. Since the province consists of rugged topography that is why still many areas are not connected by the rest of the country. The world's magnificent Karakorum Highway stretches through Abbottabad, Manshera, Batgram, Shangla and Kohistan districts the province.

NWFP has tremendous resources of tourism. Swat, Dir, Chitral, Manshera and Galliyat of Abbottabad district provide excellent resorts for recreation and leisure activities. These also provide hiking, tracking, angling as well as skiing facilities. The natural outstanding beauty of this province not only attracts tourists from Pakistan but from abroad as well.

Methodology and Procedure:

The statement of objective reveals that this study aims to determine the regional disparity of districts in NWFP between 1981 and 2001. The entire analysis of the regional disparity of districts was done by principal component analysis using the computer software SPSS. The statistical procedure to determine the ranking of districts in terms of overall effectiveness is done by obtaining a composite score. It is simply the weighted component score for each of the district. The weights correspond to the eigenvalue of each score produced by the principal component analysis. Weighted component score is used as an index for ranking districts on the basis of the general characteristics of variable set. It is a data transformation technique, which can convert a large number of correlated variables into a smaller number of components (Adelman and Dalton 1971, Doultrey 1976). Many geographers have used this method in their analyses, Thompson et al, 1962, Ahmad, 1965 and Mehmood, 2003.

The mathematical model employed to determine the underlying dimensions of variation is known as the principal component analysis. The choice of component analysis is based on several considerations. The study of the covariance of economic, social and demographic characteristics of district is essentially a problem, which is multivariate in nature. The multiplicity of variables requires simplification, which can be achieved if we utilize the principal component technique (Ahmad 1965, Doultery 1976).

Principal component analysis produces components in descending order of their importance. First component explains the maximum amount of variation in the data and the last component the minimum. It is often found that the first component accounts for a sizable part of the variation and subsequent components contribute very little. Using factor loadings of these principal components, factor score for each district is computed as follows:

$$(CS)_{jk} = a_{ij} * Z_i$$

where,

CSjk represents factor scores of kth district and jth factor,

Z i is the standardised value of ith variable,

aij is the factor loading of jth factor and ith variable.

To compute Weighted Component Scores (WCS), these individual factor scores are added using the following equation:

$$(WCS)\,k = ej\ (CS)\,kj$$

where,

e_j is the eigenvalue of the factor j and depicts the proportion of variation in the data set explained by the factor j.

Table 1

List of Variables

Variables	
Population	Urban population % share
	Population potential (000)
Agriculture	Cultivated area %
	Own farm %
Employment	Non -agricultural labour force %
	Industrial labour force %
Income	Value of crop per rural capita
	Manufacturing value added per capita urban population
	Bank branches
Health	Doctors per 10,000 population
Education	Literacy rate % (10 years and above)
	Primary enrolment % (5-9 age group)
	Secondary enrolment % (10-14 age group)
Transport	Metalled road per 100 sq. km. geographical area
	Immigrants %
Voting	Voters turn-out
Geographical shape	Shape index

This WCS is used as an index for ranking districts on the basis of the general characteristics of the variable set.

Data Source:

Diverse sources have been used for obtaining data on the variables selected. In view of the objective of this study which attempts to investigate changes in the spatial pattern of functional effectiveness in the districts, data sources have been used covering both early 1980s and 2001. However, research on regional levels of development and inequality has been severely constrained by the lack of data at the district level.

The diverse sources of data used for quantifying the variables are the decennial censuses of Pakistan for the years 1981 and 2001, agriculture census 1990 and 2000 and of manufacturing census 1980 and 1995-96 etc. Provincial Development statistics 1980-81 and 2001-99, for NWFP; Agricultural Statistics 2001-99 of Pakistan provided data for each district and on wholesale prices of major and minor crops; while Banking Statistics 1980 provided information on the number of bank branches. Information on number of doctors was not available (obtained from Pasha, Malik & Jamal 1990). Report of Election Commission of Pakistan 1993-1997 was used for voter turnout.

In this study, variables from various sectors like population, health, agriculture, literacy, employment, transport, immigration, voting behavior and population potential have been

Table 2

Districts with Extreme Component Scores on Component 1

Highest score		Lowest score	
Peshawar	0.82	Chitral	-1.26
Abbottabad	-0.11	Dir	-0.67
Dera Ismail Khan	-0.15	Swat	-0.56

Table 3

Districts with Extreme Component Scores on Component 2

Highest score		Lowest score	
Chitral	1.56	Kohistan	-1.82
Kohat	1.05	Dir	-0.53
Abbottabad	1.00	Bannu	-0.36

selected. The following list of seventeen variables is provided here (Table 1).

The Component Analysis Results

Using SPSS software a correlation was run among the 17 variables for 12 districts of 1981, 24 districts of 2001 on all Pakistan basis (Figure 1 and 2). PCA based on the correlation matrix identified four principal components which have eigenvalues greater than 1. Eigenvalues are measures of the relative importance of each component. Thus, the closer the principal component is to the entire original variable, the larger the first eigenvalue, i.e., the more representative the principal component is of the whole matrix of data (Rogerson 2001).

The result begins with initial statistics. The choice of 1 as the cutoff point is quite reasonable because only seventeen variables were used in PCA. The communality, which is the sum of the square of the component loadings of each variable, indicates the proportion of the variance for each variable accounted for by the four components. Thus in this study more the 90% of the variance of the variables is explained by the first four components. With the exception of two variables showing income, value of crop (63%) and manufacturing value added (52%) all other variables are socio-economic variables. In other words the first four components reflected very strongly the socio-economic characteristics but only moderately the role of wealth or prosperity (SPDC, 2001).

The eigenvalue (or the sum of squared component loadings for a component) divided by the total number of variables (seventeen) employed in this study indicated the percentage of variance accounted for by a component. The component matrix shows how each variable loads on four components. It is important to realize that the output of a principal component analysis is a strong function of the input (Manly, 1993 and Rogerson, 2001). The components that emerge from a principal component analysis are the ones that capture the nature of the data set.

Table 4

Districts with Extreme Component Scores on Component 3

Highest score		Lowest score	
Dera Ismail Khan	0.45	Abbottabad	-1.71
Mardan	0.03	Kohistan	-1.68
Bannu	-0.02	Mansehra	-1.22

Table 5

Districts with Extreme Component Scores on Component 4

Highest score		Lowest score	
Mardan	1.34	Chitral	-0.89
Abbottabad	1.33	Swat	-0.48
Bannu	1.30	Manshera	-0.33

Analysis of Component Scores 1981

The first component has been defined as a component of urbanization, industrialization and modernization. No district of the NWFP has been able to obtain the highest level of score, on component score 1. Moderate development is found only in Peshawar districts. Low level of development is found in the majority of the districts of NWFP, except Peshawar such as Chitral, Mansehra, Dir, Swat, Kohistan, Malakand, Mardan, Kohat, Bannu and Dera Ismail Khan in NWFP (Table 2). The low quality of component 1 of a large number of districts can be attributed to poor levels of development.

Component 2 emerged as the component of education and development, it is the continuation of the first component. The distribution of scores of component 2 in table 3 reveals that that only three districts of the province like Chitral, Kohat and Abbottabad account for high scores. Swat Malakand, Mardan and Peshawar fall in intermediate level. The remaining districts show low scores on component 2 indicating relatively poor development and relatively low enrolment in primary and secondary levels. The more developed districts show positive scores on this component while high negative scores have been obtained by the districts with a low primary and secondary enrolment, which constitute the less developed parts of the NWFP

Component 3 embraces three variables, which are the variables of own farm, cultivated area and value of crops per rural capita. Component 3 has been identified with the component of agricultural development. Districts with crop value per capita rural population have secured high positive scores. Most of these districts are those where major ocupation of people is agriculture. This can be termed as the component of agricultural development. The component score 3 shows that there is only two districts Dera Ismail Khan and Mardan in the NWFP that have positive scores in this component (Table 4).

Component 4 also includes two variables of manufacturing value added and 'geographical shape'. This component has emerged as the least important component in the analysis (Table 5). It shows that geographical shape is very weakly associated with the development

Table 6

Districts with Extreme Component Scores on Component 1

Highest score		Lowest score	
Peshawar	1.60	Karak	-1.52
Kohat	0.55	Buner	-1.35
Dera Ismail Khan	0.36	Kohistan	-1.09

Table 7

Districts with Extreme Component Scores on Component 2

Highest score		Lowest score	
Abbottabad	2.64	Shangla	-1.21
Karak	2.27	Kohistan	-1.10
Haripur	1.92	Batgram	-0.93

level of districts. Some districts having a compact shape have scored high positive on this component while those with roughly regular shapes or extreme elongation have negative scores. Elongation represents longer boundaries and fewer neighbours. It also represents sometimes, inconvenience of movement, transportation or administration. Abbottabad, Peshawar, Mardan and Bannu are at top.

Weighted Component Score 1981

An interesting picture emerges from the map showing the weighted component scores for districts for 1981 analysis (Figure 3). No district has been able to obtain higher then 1.00 on WCS. Only Peshawar falls into moderate category with WCS ranging between 1.00 and 0.50. NWFP does have a pocket of development represented by Peshawar which is much ahead of a large number of districts of the province. Districts with WCS ranging between 0.50 to zero demonstrate poor level of development. Abbottabad in NWFP is the only district which falls in this category. The position of Abbottabad can be attributed to improved economic development.

Except Peshawar and Abbottabad, all other districts have below zero WCS. These districts lag behind in economic development, hence relatively less developed. A very wide inequality in WSC can be observed in NWFP.

Analysis of component scores 2001

Results of 2001 analysis show entirely different pattern than 1981. Component score 1 has been identified with development process and modernization resulting from urbanisation. The higher the score (above 1) the greater the impact of urbanization. Accordingly, districts that rank high positive on this component are identified with urban economy as reflected in Peshawar district, which is the only district in the province to obtain such high score. Moderate development is reflected by districts like Kohat and Dera Ismail Khan (Table 6). The poorly developed districts have high negative score such as Karak, Buner and Kohistan.

Table 8

Districts with Extreme Component Scores on Component 3

Highest score		Lowest score	
Charsadda	1.19	Kohistan	-1.18
Swabi	1.02	Chitral	-0.99
Mardan	0.96	Upper Dir	-0.90

Table 9

Districts with Extreme Component Scores on Component 4

Highest score		Lowest score	
Haripur	3.23	Buner	-0.16
Abbottabad	1.62	Kohistan	0.14
Kohat	1.23	Mardan	0.21

Component 2 appears to be the continuation of the previous component of urbanisation but own farm has also shown high loading on this component showing the relationship with such economic system, which is rural in nature. The high component loadings associated with the second component are those related to provision of education facilities by public sector gross primary enrolment and secondary enrolment which are associated with the provision of such services by public sector, a responsibility of governments in developing province like NWFP. Table 7 shows districts which are rural and have high scores of component 2 (above 1). These districts are mostly located in the two pockets located in middle and north of the province. Abbottabad, Karak, Haripur, Kohat, Chitral, Nowshera, Malakand and Peshawar fall in this category. Moderate scores (zero to one) have been obtained by districts, which are contiguous to those having high scores. These are Bannu, Tank, Hangu, Mansehra, Swabi, Charsadda, Swat, Mardan. Rest of the districts has low scores of component 2.

Component 3 representing rural sector development, which includes percentage of cultivated land, metalled roads, voter turnout, population potential and geographical shape. This is an interesting aspect of this component that rural variable of cultivated land tends to load highly on this component reflecting the overall rural development where metalled roads connect rural areas together. Also apparent is the fact that districts with a large share of rural economy tend to have a compact shape. High scores have been only obtained by Charsadda and Swabi (Table 8). Nowshera, Mardan, Malakand, Buner, Karak, Bannu and Lakki Marwat fall in intermediate level. Including Peshawar, Dera Ismail Khan and Abbottabad, rest of the province shows low scores of component 3.

Component score 4 has been identified with the dimension of rural and urban income, includes value of crops and manufacturing value added per capita. The variables represent agricultural and manufacturing income of districts. This shows that the districts with high crop value per capita are characterized by low manufacturing value added per capita. Analysis of

the variation explained by these components reveals clearly the increasing importance of modernization resulting from urbanization and industrialization in relation to agricultural development. The results also highlight the importance of investments in physical and social infrastructure. Moreover it emphasizes the role that government can play in influencing the spatial pattern of development in these districts.

Table 9 depicts the concentration of high scores of component 4 (above 1) in districts of Haripur, Abbottabad, Kohat, Karak and Bannu. Excluding Buner, rest of the districts stand with moderate component scores (zero to one). Buner falls in lowest score in this component.

Weighted Component Scores 2001

According to the weighted component scores ranking, the top category of very high level of development (scores above 1.00), consists of only Peshawar district, the largest urban centre of the province. This confirms the close link between the extent of urbanization and development. The higher the level of development, the greater the urbanization and thus the greater will be the level of development.Weighted component scores ranging from 0.50 to 1.00 demonstrate moderate development level and include two districts of the province, Kohat and Abbottabad. Kohat is the new entrant. Though not a very large urban population but it has a large share of manufacturing value added per capita. Third category of WCS (ranging 0.00 to 0.50) includes six districts of the province. Haripur, Nowshera, Malakand, Dera Ismail Khan, Mardan and Chitral.Fourth category of WCS (below zero) includes fifteen districts of the entire province, specially the northern districts. These include Upper and Lower Dir, Kohistan, Mansehra, Buner, Batgram, Swat, Shangla, Charsadda and Swabi. In southern part of the province Hangu, Bannu, Lakki Marwat, Karak and Tank have the same score. These are very poorly developed areas of the NWFP (Figure 4).

The results indicate that in the province of NWFP most of the northern and southern districts show poorer level of development mostly due to their rural background and underdeveloped infrastructure. Districts located in close proximity of Peshawar and having a developed economic base have high level of weighted component scores and thus are functionally effective.

Conclusion and suggestions:

As a result of this study, recognizable spatial pattern of regional disparities have been found in districts of NWFP. The period between 1981 and 2001 has witnessed a number of political demographic, social and economic changes in the country, which are likely to have major spatial consequences. There are several districts showing low level of development. However some districts in NWFP show sharp improvement in development process. Chitral could be termed as a dynamic district, which has improved its rank from 11th in 1981 to 9th in 2001. Administrative changes and bifurcation in districts have adeversaly affected the level of development in 2001, such as Bannu, which has slipped from 7th rank to 15th rank in 200 after the separation of Lakki Marwat. Other districts which show considerable drop in ranking order are Mardan (4th to 8th), Swat (8th to 11th) and Manshera (9th to 13th).The findings show that the districts can be classified into four categories with good, moderate, poor and very poor development level. This study reveals the fact that a clear-cut urban-rural divide is

visible in the entire province. One category of districts, identified with urbanization and industrial development are located in agriculturally productive irrigated fertile valleys of NWFP. Pockets of development are Peshawar and Kohat. The rugged mountainous areas of NWFP are among those showing low development. A comparison of the two maps (Figure 3 and 4) help to substantiate the hypothesis stated above and clearly show the temporal change occurred between 1981 to 2001. The period of twenty years, though very brief, seems to be adequate enough to highlight the fact that the expansion of the area occupied by districts with higher development level reflects the significance of urban-industrial component as a factor contributing to development of districts. No less important is the growth of tertiary activity including trade and transportation. The districts of central NWFP have during this relatively short period strengthened their position as regions comprising districts that stand out in terms of very high level of development and modernization process.The province of NWFP has long suffered mainly due to one major factor, that of remoteness resulting from poor communications. Now, that greater attention is being given to road construction it is expected that the remoteness will be much reduced if not eliminated. This will go a long-way towards boosting industries and economic development.

Such sharp variations in the intensity of development and in the regional disparity call for a proper administrative geography of small provinces of a developing country like Pakistan. Keeping in view of an overall development of the province, it is imperative that such spatial inequalities are minimized.

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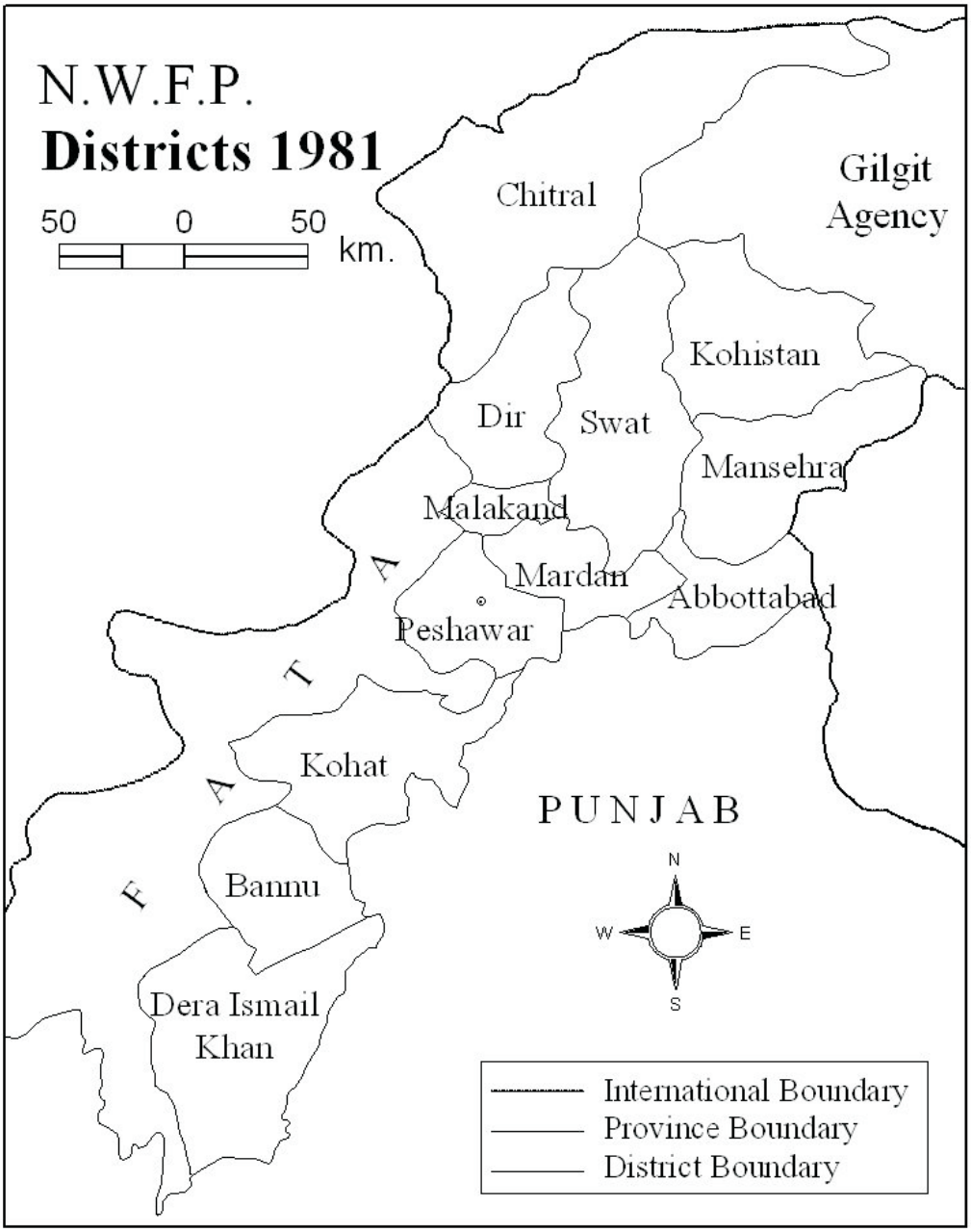
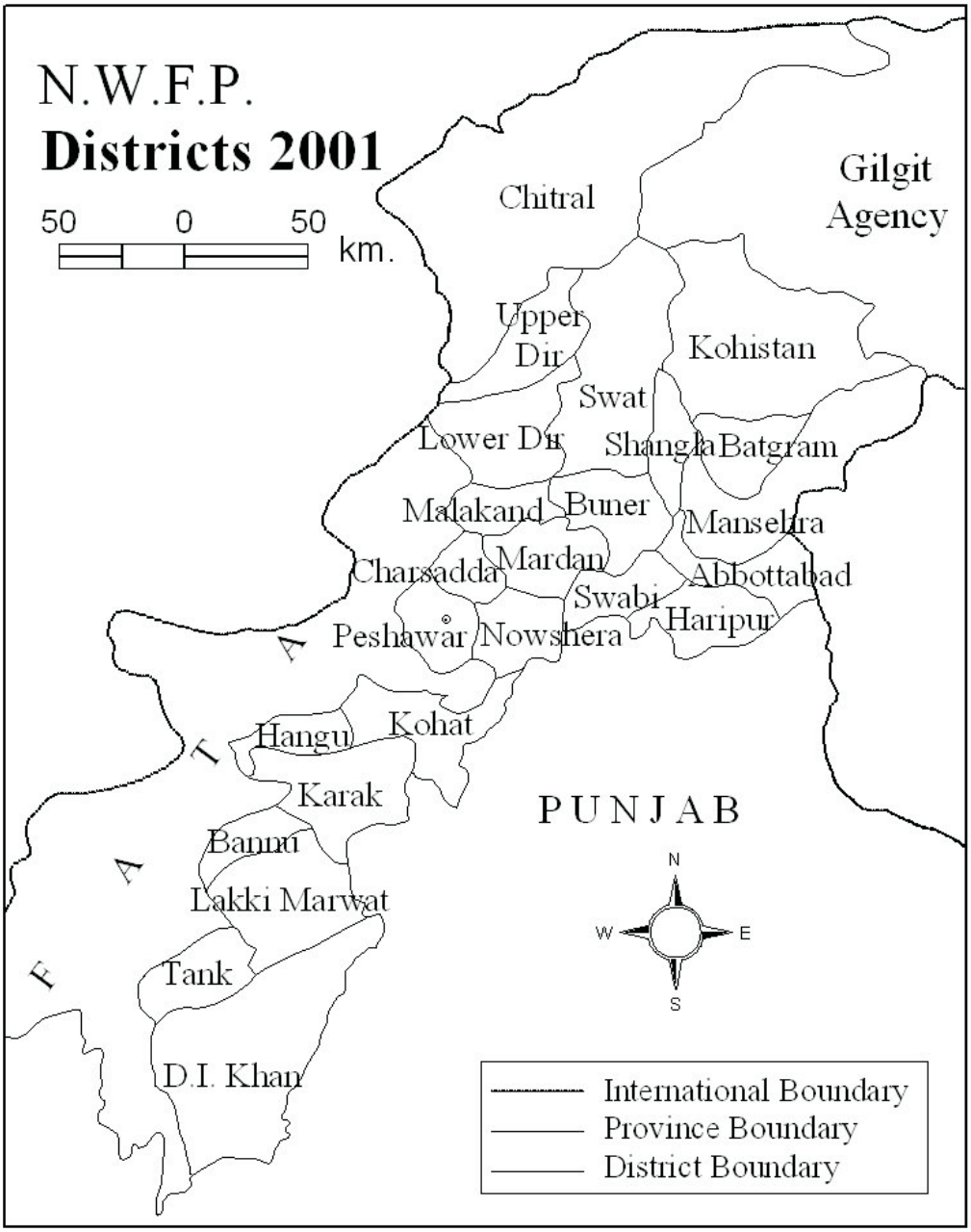

N.W.F.P.
Districts 1981
50 0 50 km.
Chitral
Gilgit Agency
Kohistan
Dir
Swat
Mansehra
Malakand
Mardan
Abbottabad
Peshawar
F A T A
Kohat
PUNJAB
N
W
E
S
Bannu
Dera Ismail Khan
International Boundary
Province Boundary
District Boundary

Fig 1


N.W.F.P.
Districts 2001
50 0 50 km.
Chitral
Gilgit Agency
Upper Dir
Kohistan
Swat
Lower Dir
Shangla
Batgram
Malakand
Buner
Mansehra
Mardan
Charsadda
Abbottabad
Swabi
Haripur
Peshawar
Nowshera
Hangu
Kohat
Karak
PUNJAB
Bannu
Lakki Marwat
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D.I. Khan
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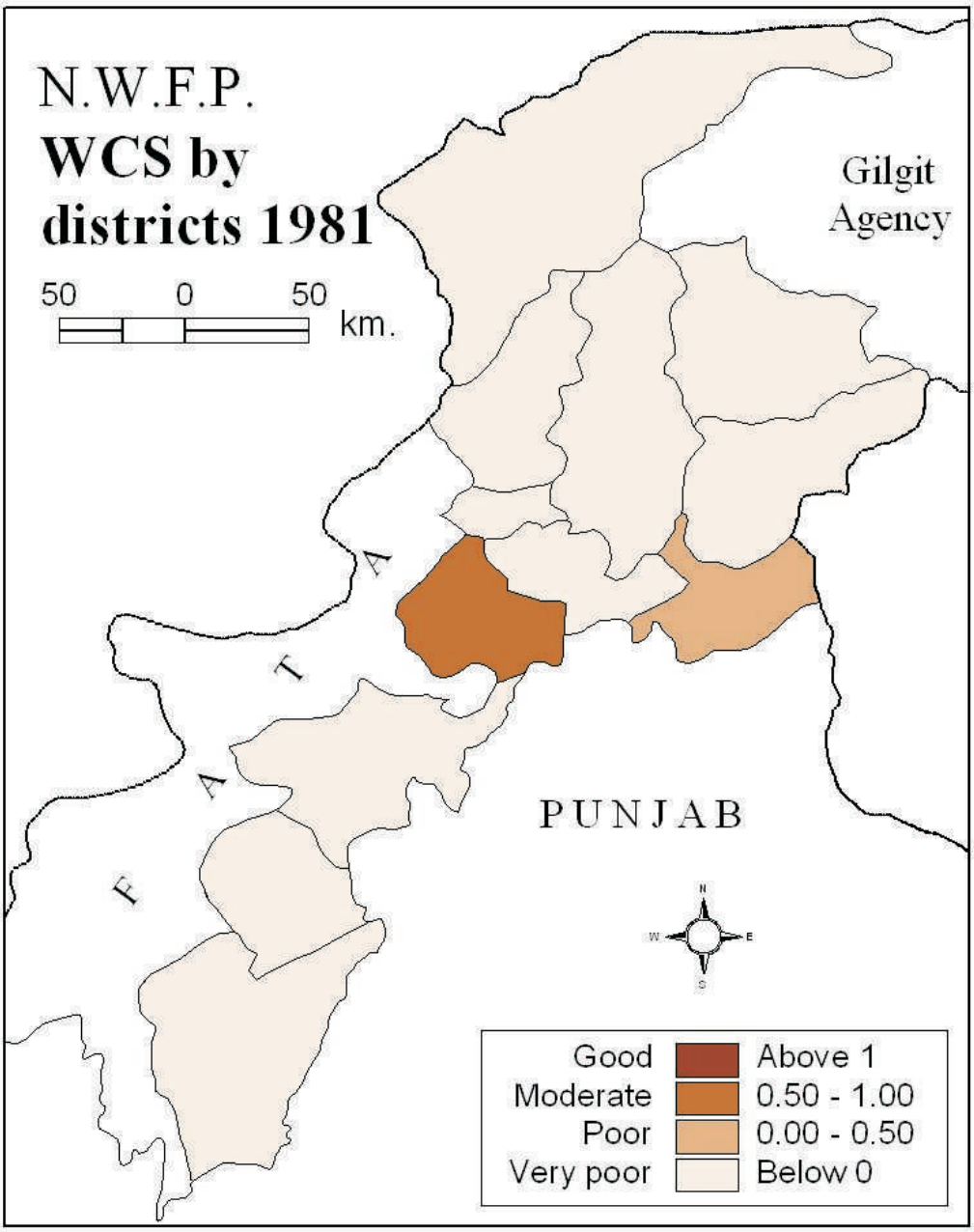
International Boundary
Province Boundary
District Boundary

Fig 2


N.W.F.P.
WCS by districts 1981
50 0 50
km.
Gilgit Agency
F A T A
PUNJAB
N
W
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Good
Moderate
Poor
Very poor
Above 1
0.50 - 1.00
0.00 - 0.50
Below 0

Fig 3

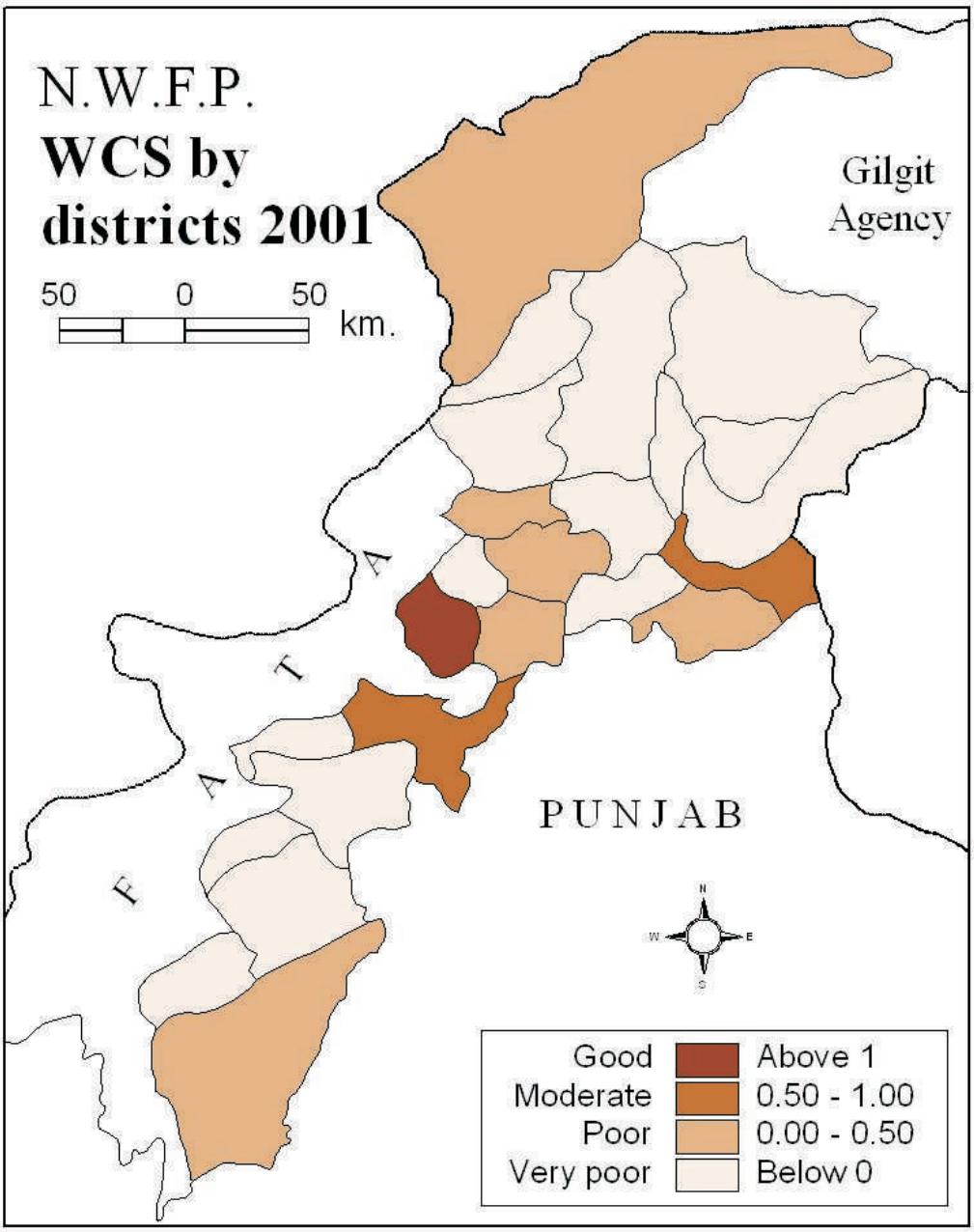
N.W.F.P.
WCS by districts 2001
50 0 50
km.
Gilgit Agency
F A T A
PUNJAB
N
W
E
S
Good
Moderate
Poor
Very poor
Above 1
0.50 - 1.00
0.00 - 0.50
Below 0

Fig 4

Pakistan Geographical Review, Vol. 61, No. 1, June 2006 PP 37-47

Farmers's attitude towards the use of agrochemicals for cotton crop A case study of Lodhran district

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Abstract

Agrochemicals, in present age, are considered to be the integral part of agriculture. Our farmers apply these chemicals in order to protect the pre and post harvest losses and to enhance crop produce. Although, diversity of crops is the prominent feature of the study area but cotton is the dominating crop. Apart from climatic factor, agricultural produce also depends upon production methods, inputs in terms of agrochemicals and farmers technical expertise. In the present survey, 230 farmers from three sample agricultural villages were interviewed and we tried to figure out the ways in which farmers use agrochemicals and their effects on crop yields. Apart from fertilizers, another class of agrochemicals is pesticides, which plays an important role in getting the enhanced yield by controlling pest losses. Knowledge of pesticide use is very essential for all the farmers not only to get highest crop potential but also to control effectively the pest for which a particular pesticide is used. District Lodhran falls in the cotton growing belt and about 472 thousand acres of area come into cotton agriculture, producing about 11807 thousand tones of cotton per annum. The development of pesticide resistance in pest populations in the district has also influenced farmer's choice, both in terms of the pesticides available and in the implementation of IPM. The research in hand depicts that at all the study sites farmers with adequate knowledge are of very low percentage that is why per acre crop yields are low in comparison to the world levels.

Introduction

Agriculture is the backbone to economic development and growth in Pakistan. Being dominant sector of the economy, it contributes about one-fourth of GDP, employees 44% of country's work force and contribute major share in exports of the country. It also provides raw material for the industrial growth. Any fluctuation (good or bad) to the agriculture ultimately effects the growth of overall GDP (Pakistan Statistical Year Book, 2003).

During the last decade, agriculture grew at an average annual rate of 4.5% and exhibited fluctuating trend mainly because of adverse weather conditions, pest attacks on crops, adulterated pesticides and little attention given to its sub-sectors other than crop farming. Within agriculture, production of major and minor crops grew at an average annual rate of 3.5% and 3.0%, respectively (Economic Survey of Pakistan, 2000-01)

Our farmers usually apply agrochemicals in order to protect the pre and post harvest losses and to enhance crop produce. The pre and post harvest crop losses are very high in the country, approaching to about 50% (losses due to insects 20%, weeds 15%, diseases 10% and rodents 5%) as compared to many other developing countries (Baloch and Haseeb, 1995). Fig 1 gives the general classification of agrochemicals. It says that agrochemicals can be classified into two broader categories i.e. fertilizers and pesticides. The term fertilizer is employed here to all kinds of natural and artificial inputs meant to enhance the fertility of soil while the term pesticide embraced chemicals like herbicides, insecticides, rodenticides and fungicides (Miller, 1988).

The area selected for current study forms an important agricultural region of the Punjab Province. It is located between 29.48° & 29.92° north latitudes and 71.38° & 72.18° east longitudes at an average altitude of 380 feet above mean see level. It comprises an area of 1790 square kilometers (715,889 acres) and is almost rectangular in shape, with one arm 34.58 kilometers and other 51.8 kilometers long, encapsulating 438 mauzas. The district

was created on 01-07-1991. It is bounded on its north by the Multan, Khanewal and Vehari districts, on the south by river Sutlaj and Bahawalpur district. On its east lies the Districts of Vehari and Bahawalpur while on its west lies the district of Multan (DCR of Lodhran, 1998).

The soils of Lohdran are alluvial mainly deposited by Indus, Bias and Ravi rivers. The generalized classification of soil can be based on texture, ratio of sand, slit and clay and may be divided into two main parts. Transported sandy soil and loamy soil in the most western areas, that are adjacent to the rivers Indus, Bias and Ravi, the loamy soil in the southeastern areas of Lohdran mostly with sand and silt imparting red color (DCR of Lodhran, 1998).

The climate of the district is hot and dry in summer and cold in winter. The summer season starts in April and continues till October. May, June and July are the hottest months. The minimum and maximum temperature of these months ranges between 28°C and 42°C respectively. December, January and February are the coldest months. The minimum and maximum temperature of these months ranges between 5°C and 21°C. Excessive heat and dust are the common features of study area (DCR of Lodhran, 1998). Detailed climatic data is given in fig 2.

As regards cropping pattern of the region, according to seasons of cultivation, crops of the study area are divided into Rabi and Kharif groups. Although diversity of crops is the important feature of the study area but cotton is the dominating crop. Other main crops of the region are wheat, oil seeds, sugar cane, maize, *jawar, bajra* (millet), rice and *till* (an oil seed)

Two main canals serve the district Lodhran. Qutabpur canal is perennial and Malsi canal is non perennial. Total area under perennial irrigation in the district is 17,101 acres whereas 520,105 acres of land is served by non perennial irrigation. Tub-wells irrigate an area of about 398,060 acres. *Nal Nahri* area is about 16,250 acres and *Jhalr* area consists of about 479 acres. Region is also served by two perennial and two non perennial distributaries. The total area of Lodhran district is about 715,889 acres, out of which 472.0 thousand acres are under the cotton cultivation. The total production of this area is about 11807 thousand tones giving an average of 393.94 Kg per acre (DCR of Lodhran, 1998).

The study was initiated with the objectives to know the attitude, knowledge and difficulties of Lodhran's farmers for the use of agrochemicals and their effect on the agricultural produce. We also asked the respondents about the health hazards they face when they expose themselves to the poisonous chemicals.

Methodology

The data presented here was collected during the October 2006 when the cotton season was ending and the crop was almost ready for picking. Questioners were filled by direct interview technique. Three villages of Lodhran district viz: A) Raja Pur East with the population of 5,910, B) Sandhiwala with the population of 3,112 and C) Kot Lal Shah with the population of 2893 individuals, were selected for the survey (fig 3), hitherto called as Site-A., Site-B and Site-C respectively. Almost all the house holds at all the survey sites were directly involved in farming. With the help of *numberdars* (heads of the villages)and other knowledgeable persons between 70 to 80 farmers were selected from each site to fill the questioner. In total 230 farmers were interviewed. The secondary data (pertaining to population, location of study sites, area under crop, etc.) was gathered from literature, maps, and official records of Lodhran Municipal Carporation and Nazim office.

It may be envisaged that researchers faced much difficulty in gathering information as most of the farmers were illiterate and hesitate to give answers taking them as government officials for agriculture tax assessments. In order to draw the correct information the researchers have to repeat their questions in very simple manner and often cross-questioning technique was used to confirm the given information. The information gathered were analyzed to form various tables and figures which are presented here.

Analysis

Apart from climatic and other environmental factors, agricultural produce also depends upon production methods, inputs in terms of agrochemicals and farmers technical expertise. In the present survey, we tried to figure out the ways in which farmers use pesticides and fertilizers, and their effects on the yield of crop. It was noted that cotton and wheat are the two most important crops of study area. Cotton is an important cash crop of Kharif while wheat is Rabi crop. In this paper, the survey results only related to the cotton crop are presented because currently, this is the more-earning crop as compared to wheat. However, data collected in relation to wheat will be published later on.

Table 1 presents the farmers's attitude towards the use of fertilizers. It is obvious from the table that farmers mostly use two types of fertilizers in all the studied settlements. DAP (Di-ammonium phosphate) is used one bag per acre at the seedling stage to enhance the rate of root proliferation and to reduce the rate of mortality so that maximum yield may be achieved. Farmers who used DAP acquired more yield than those who did not used DAP as a starter fertilizer.

The case with the urea fertilizer is somewhat different. Urea is an excellent fertilizer and used for the rapid vegetative growth of crop, to reduce the temperature shocks and to produce disease resistance. While comparing farmers at all the three study sites who used three bags of Urea (about 150Kg) per acre were able to get maximum out put comparing to those who used four bags (about 200Kg) or two bags (about 100Kg).

Figs 4 to 7 represent various aspects to use pesticides that collectively enhance the total produce of farmer. Fig 4 says that optimum use of pesticides doze is an important factor than the number of sprays indicated in fig 5 and methods of spray indicated in fig 6.But the most important of all is the knowledge, how to use pesticides (fig 7).

The ratio of farmers who used optimum dosage of pesticides was found high at all the study sites than the ratio of farmers who used under or over dozes. Fig 4 indicates that 50% farmers at site-A, 46.67% at site-B and 44.44% at site-C used optimum dosage of the pesticides per acre. These farmers thus got maximal yields. Methods of spray were also found to be playing an important role in gaining the highest possible potential of crop. While comparing the study sites, minimum farmers i.e. from 18 to 19 percent used power spray method. Highest percentage of farmers (variable from 44.44% at site-C, 53.33% at site B and 65.00% at site-A respectively) used boam spray method which seems to be best spray method than all the other spray methods because these farmers picked up maximum yield per acre i.e. from 1400 to 1450 Kg per acre (fig 6).

Knowledge of pesticide use is very essential for all the farmers not only to get highest crop potential but also to effectively control the pests for which a particular pesticide is used. Fig-7 depicts that most of the farmers were not familiar with the appropriate use of pesticides. Even some farmers were found to be using these toxic chemicals without any precautionary measures. Resultantly they face the hazardous effects of these cheliferous. Insignificant percentage of farmers (18.75% at A, 20.00% at B and 22.22% at C) were able to describe the correct use of pesticides. Except few, most of such farmers were with education even some possessing M. Sc. Agriculture degree.

Major Findings

Cotton is the main cash crop and contributes significantly to the national economy. It accounts for 11.5 percent of value added in agriculture and about 2.8 percent of GDP. In addition to providing raw material to the local textile industry, the lint cotton is a major export item.

Agrochemicals are essential for the optimum agriculture production (Alam and Naqvi, 2003). During the present survey it has come to light that most of the farmers use agrochemicals

with little basic knowledge about their proper use. For instance, take the example of fertilizer application. Those farmers who used proper amount of DAP fertilizer at the seedling stage were able to earn maximum out put as compared to the farmers who did not use it. In fact, ammonium phosphates have the advantage of a high plant-food content which minimizes the stress shocks of climate to plants. However, care must be taken to place it properly with respect to seeds. This is especially true when used on alkaline soils as under such conditions, released free ammonia may cause seedling injury (Tisdale and Nelson, 1966). It may be noted that as we move from study site A to C there is alleviation of percentage of the farmers who used DAP. One reason may be the distance of the study site from the main city (i.e. Lodhran) and the other reason may be the economic and educational conditions of the farmers as most of the respondents at site-C were well off and were relatively batter educated as compared to the other study sites.

The other fertilizer used in the study area was the urea. Though, it is an excellent fertilizer but it possesses several properties which should be understood so that the greatest benefit may be derived from its use. The first is related to its rapid hydrolysis. If urea is applied to a bare soil surface or to soil in a sod cover, significant quantities of ammonia may be lost by volatilization because of its rapid hydrolysis to ammonium carbonate. So the application of Urea at the right time is very essential to get maximum use of it before volatilization. Second important thing is that rapid hydrolysis of Urea in soils is responsible for ammonia injury to seedlings if large quantities of this material are placed with or near to the seed (Tisdale, et al., 1993). This is why farmers who used four bags per acre of Urea were not able to get good yield. Proper placement and quantity per acre of the fertilizer with respect to the seed can eliminate the difficulty. Another fact is that fertilizer grade urea may contain variable amounts of a compound known as biuret. This material is formed by the combination of two molecules of urea with the release of one molecule of ammonia when the temperature in the manufacturing process goes above the certain level. Biuret is toxic, and if content of this compound in the urea is too high injury to the plants may result (Tisdale and Nelson, 1966).

The foregoing discussion is not intended to discourage the use of urea as a fertilizer. Urea is indeed, an excellent source of nitrogen and most of the drawbacks mentioned can be overcome by its proper placement and by making sure that the biuret content is less than 1.5 to 2.0 percent. Urea manufacturers are very well aware of the toxicity of biuret, and high concentrations of this material found are seldom in commercial urea (Hall, 1978).

Besides fertilizers, another class of agrochemicals is pesticides, which played an important role in getting the enhanced yield by controlling the pests. District Lodhran falls in the cotton growing belt and about 472 thousand acres of area come into cotton agriculture producing 11807 thousand tones of cotton per annum (DCR of Lodhran, 1998). Cotton is such type of crop that is susceptible to variety of pests including Thrips, Jassids, White fly, Aphids and many types of chewing worms. To control these minas is a difficult task but latest generation of pesticides made it possible to minimize their harm full effects (Khan, 2001). In our country pesticides are still assumed as the only tool for the pest control. Therefore, most of the growers mainly depend only on chemical control (Maythews, 1986). However, the choice of suitable pesticides is an important job that usually depends upon the knowledge of farmer (fig 7). There are number of factors, which influence the farmer's choice of pesticides. Primarily, the efficacy of pest control and price but likely residues, toxicity to operators and neighbours, environmental and other off target impacts such as trade or market implications and effect of IPM strategies have increasingly been recognized in pesticide choice. In recent years, there has been a noticeable shift from the more toxic, broad-spectrum chemicals, for example, organophosphate insecticides, to those, which are more target-pest specific, efficacious and less toxic to humans (Japan Plant Protection Association, 2000).

The development of resistance against pesticides in pest populations has also influenced

farmers's choice, both in terms of the pesticides available and in the implementation of IPM and pesticide resistance programs. During the present survey, it was felt that development of pest resistance to certain groups of pesticides was the burning issue among the progressive farmers. A representative of Agriculture Extension Department wandering in the study area told us that the areas where pesticides are under intensive use are facing this problem. To slow down the pest resistance development, IPM technologies are introduced that usually rely on the rotation of different pesticides during a season. With pest resistance pressure, farmers try to use different methods to lower the damage caused by the pest (EU Official Bureau Report, 2001). Appropriate use of quantity, methods of spray and number of sprays all collectively help the farmer to achieve this goal. The choice of spray method plays an important role in controlling a particular insect. For instance, control is almost impossible with the simple hand spray method because of long incubation period and protective waxy covering on the nymphs and pupae, and location of nymphs and pupae only on under surface of leaves at the lower part of the plant. Therefore, to control such type of pest Boam method of spray is more suitable which sprays the pesticide up to the lower parts of plant with two-way spray nozzles. This is why farmers who used Boam method got maximum yield (fig 6).

Farmers's knowledge about the use of chemicals which they want to use and characteristics of soil on which the crop is cultivated are the basics to address the situation. They should know the exact time and amount of chemical to apply in order to get maximum returns from minimum inputs (Khan, 2001).

In our country, enhanced use of agrochemicals either due to effective marketing strategies of the mass number pesticide and fertilizer distribution networks or due to the lack of knowledge by majority of farmers increase the input cost. The excessive use of agrochemicals also pollutes our environment and intensifies the health hazards to users. Deficit of knowledge also leads to mishandling of agrochemicals, careless washing of containers and equipments, improper disposal of empty bottles, poor conditions of storage and application under adverse weather conditions, all showing the way to contaminate near by or some distantly located ponds, wells, streams and other non agricultural sites (Khan, 2001). Our survey depicts that at all the study sites farmers with adequate knowledge are of very low percentage (fig 7). Apart from illiteracy, hesitation and laziness to acquire knowledge about concerned subject are constraints. For the common farmer most important source of information about pesticide is the label. Manufacturers are required to provide information regarding what the pesticide is to be used for, how it can be used, how toxic it is, how to mix it, rate of application, precautions to take, re-entry times, kind of clothing and personal protective equipment needed, what the antidote is (if there is one), and the symptoms of poisoning if exposed to the pesticide. Other information about the use, storage, handling, or disposal of the pesticide may also be found on the label (Australian Academy of Technological Sciences and Engineering, 2002).

Other sources for the use of agrochemicals are the old wise men who have used them for long time and acquired the knowledge by hit and trial methods but the reliable source would be an educated farmer who can read, reproduce orally, and disseminate the pertinent literature.

Conclusion

From the study, it is concluded that application of agrochemicals play a pivotal role in the agriculture of study area. Farmers are very much convinced that for the maximum yields, fertilizers play a vital role while the use of pesticides is essential to keep the pest damage at the economical level. Despite this per acre crop yields are low in comparison to world standards. This may also be attributed to the lack of proper farmer's training to exercise

correct agricultural techniques. To come at par with other agricultural countries in terms of per acre yield, farmers are keen to adopt latest crop technologies such as Integrated Pest Management (IPM) approach but due to certain constraints they are forced to stick with the existing techniques. Mishandling of agrochemicals is another threat for the study area, which causes various environmental hazards. Using appropriate methods with proper knowledge can minimize these hazards. In this connection, our agricultural research institutes should play an active role. By arranging special training programs for the farmers according to their need, and improving the quality and application of agro-chemicals yields can be enhanced considerably.

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Table 1: Farmers's attitude towards the use of fertilizers

Settlements	Site-A					Site-B					Site-C				
Fertilizers	DAP		Urea			DAP		Urea			DAP		Urea		
	Using	Not using	Using 2 bags/acre	Using 3 bags/acre	Using 4 bags/acre	Using	Not using	Using 2 bags/acre	Using 3 bags/acre	Using 4 bags/acre	Using	Not using	Using 2 bags/acre	Using 3 bags/acre	Using 4 bags/acre
Percentage of farmers	62.5	37.5	25	46.25	28.75	73..33	44.44	33.33	46.67	20.00	77.78	22.22	22.22	26	44.44
Yield/ acre (in Kg)	1150	850	1100	1300	950	1050	900	850	1350	900	1100	850	650	1300	850

Source: Field Survey October 2006

Fig 1: General classification of agro-chemicals used in study area

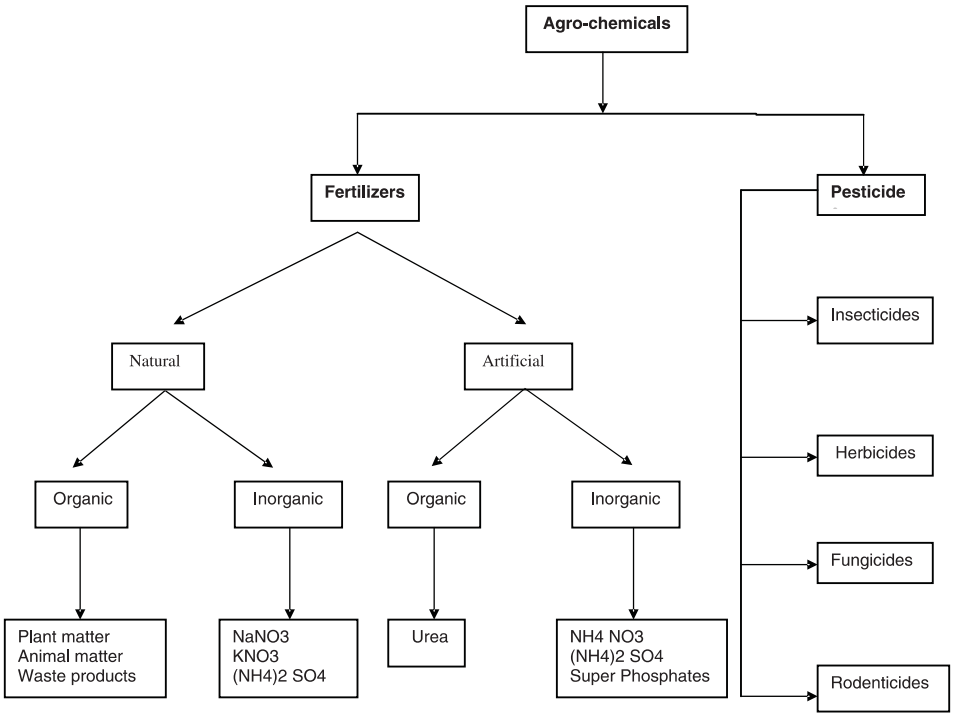


Fig 2: Climate of Lodhran

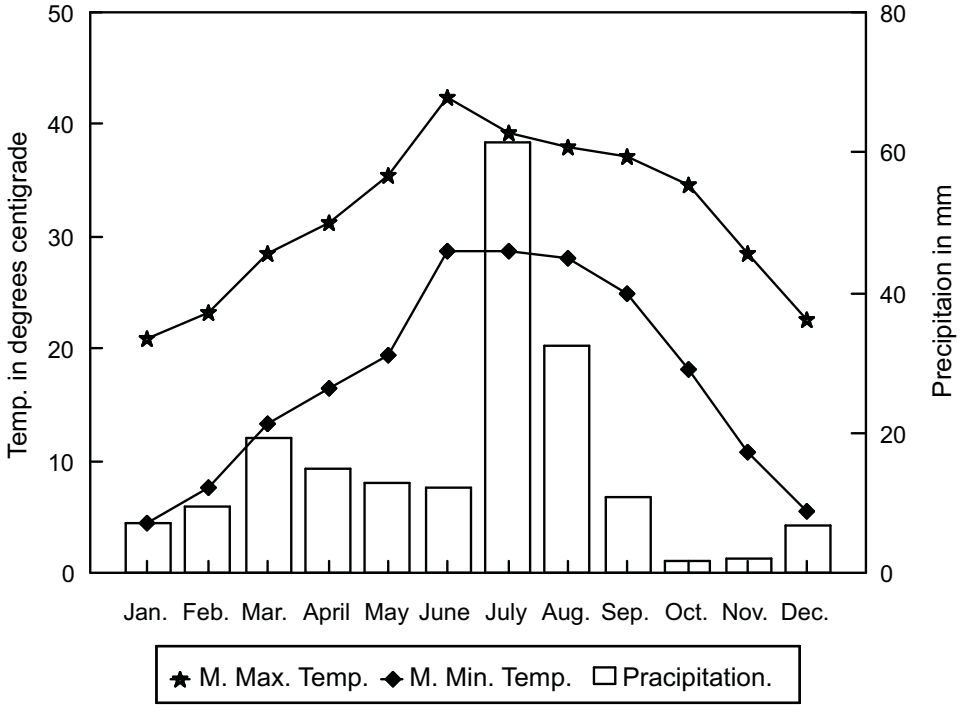


Fig. 3: Location of surveyed settlements in tehsil Lodhran

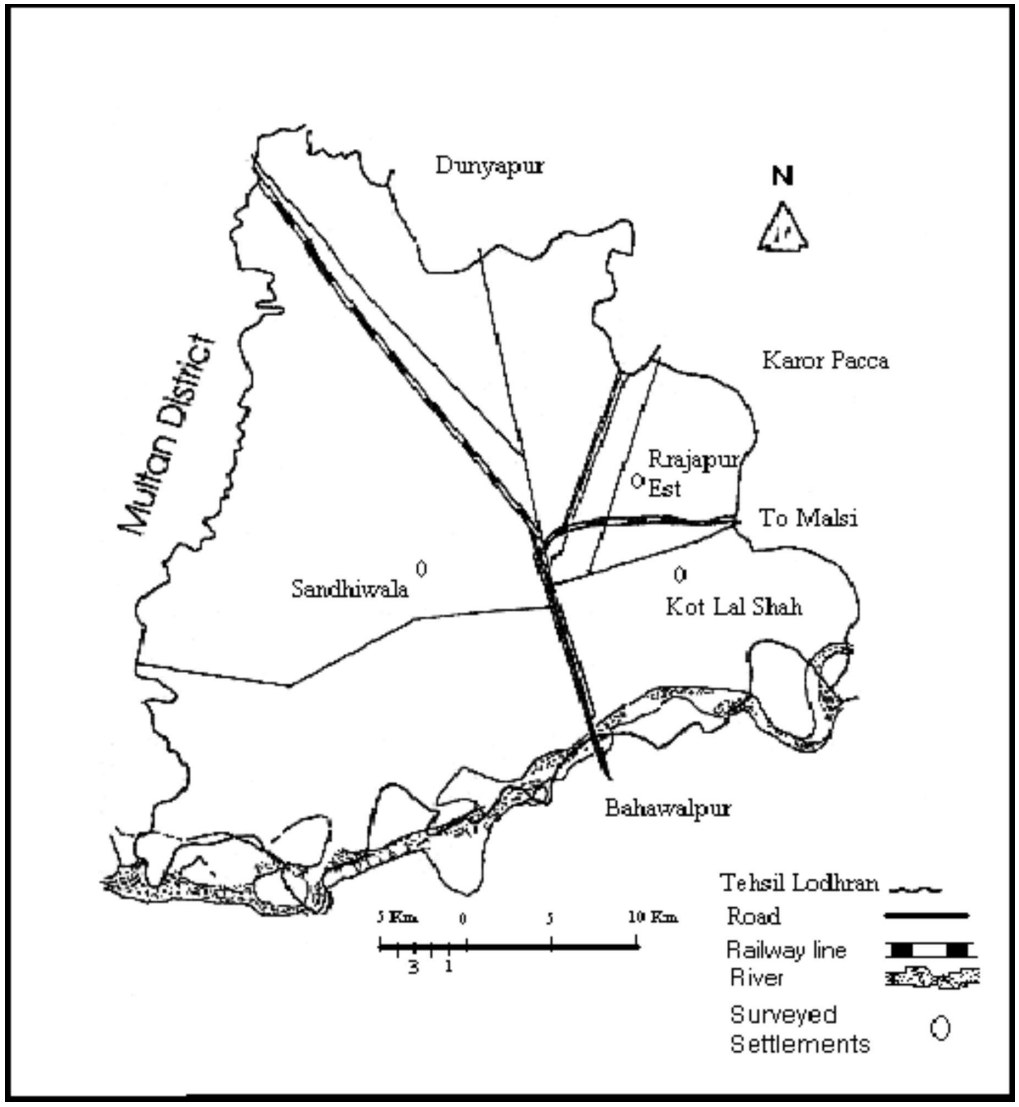


Fig 4: Farmers's attitude towards the use of pesticides and their effect on yield/acre

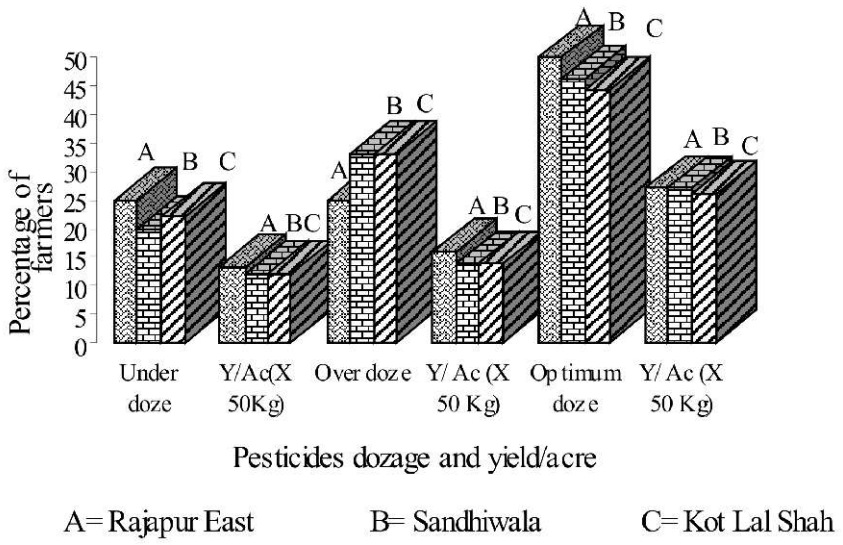


Fig 5: Effect of the number of pesticide sprays of yeild

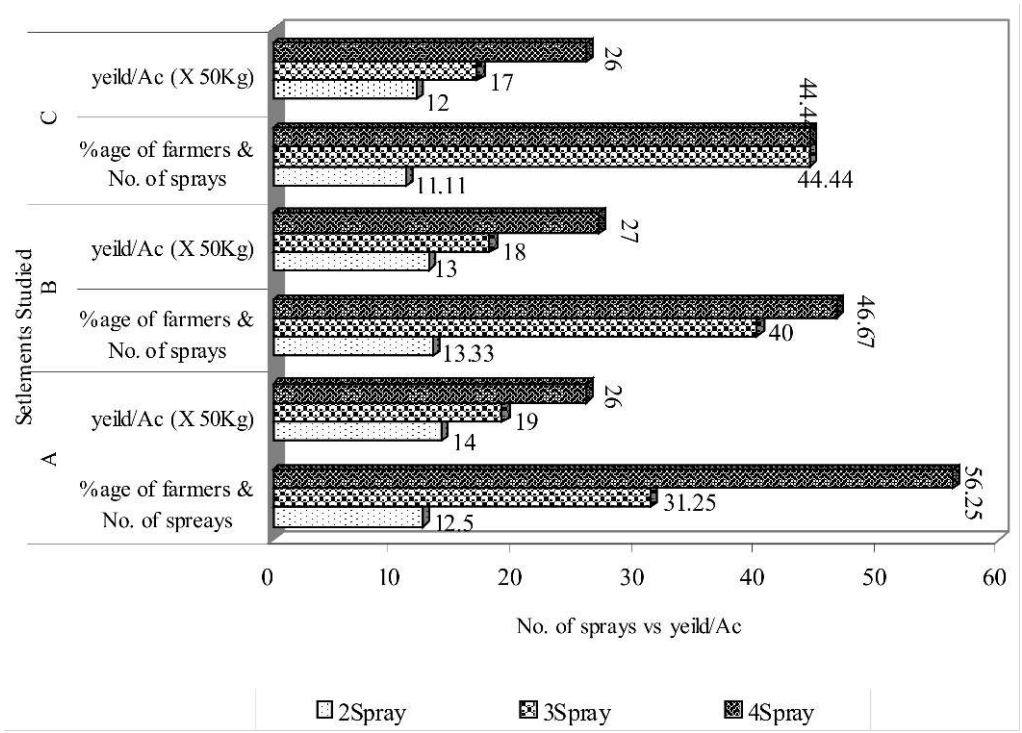


Fig. 6: Methods of spray used by farmers

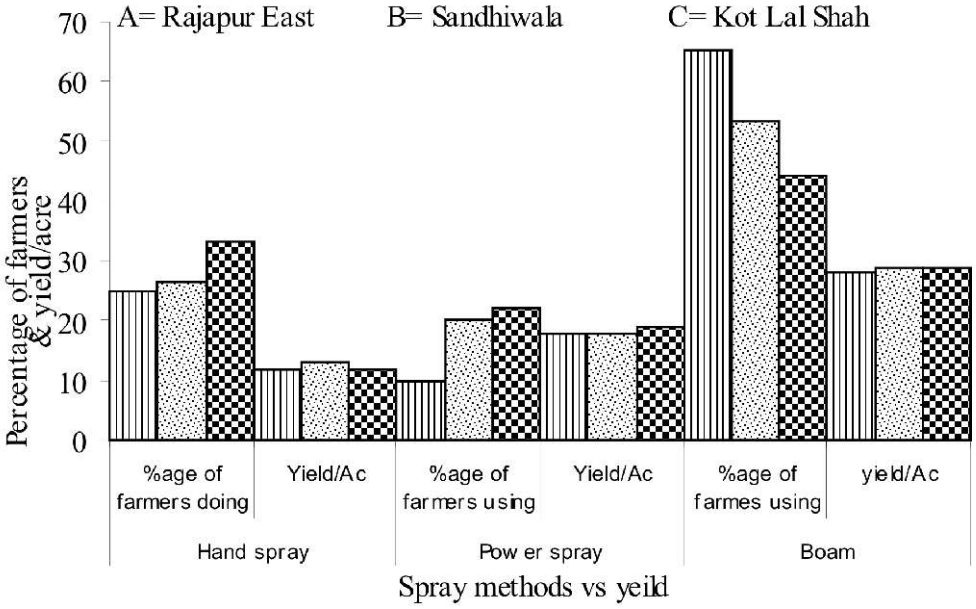
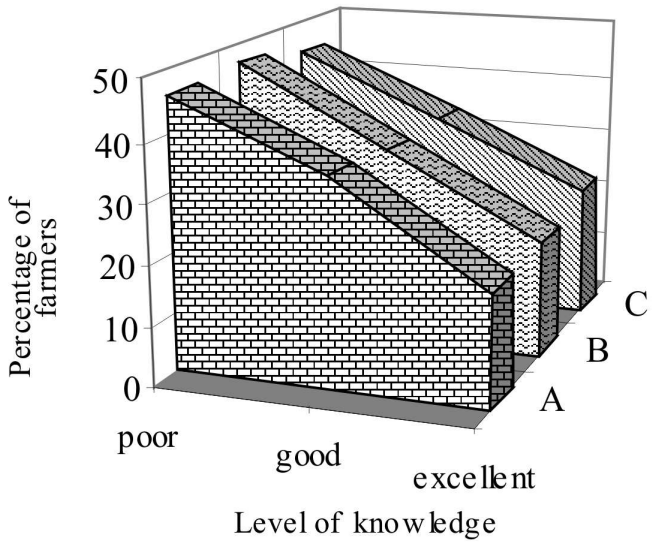


Fig. 7: Percentage of farmers having knowhow about the use of agrochemicals



A= Rajapur East B= Sandhiwala C=Kot Lal Shah

Pakistan Geographical Review, Vol. 61, No. 1, June 2006 PP 48-56

Profile of population of Khairpur District

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Abstract:

In the paper profile of population of Khairpur District is described. In it include growth, cumulative growth since 1951.Also detailed population by talukas is given, with age and sex distribution, and share of Khairpur district population among the other districts of Sindh Province.

Introductions

Khairpur was the Kingdom of Upper Sindh. It was founded in 1783, with the capital developed in 1786. Its status was reduced to that of a Princely State in 1838, when the British took over the foreign affairs. The state was merged into the province of West Pakistan on 14th October 1955, it received a status of district of Sindh Province. It is situated between 26 degree 11 minutes to 27 degree 44 minutes north latitude and 68 degree12 minutes to 70 degree 11 minutes east longitude.

Like other parts of Sindh, Khairpur consists of a great alluvial plain, very rich and fertile in the neighborhood of the River Indus and the irrigation canals, the remaining area being a continuous series of sand-hill ridges covered with a stunted brushwood, where cultivation is altogether impossible. A small ridge of limestone hills passes through the northern part of the state, being a continuation of a ridge known as the Ghar, running southwards from Rohri. It is watered by five canals drawn off from the Indus, besides the Eastern Nara, a canal which follows an old bed of the Indus. In the desert tracts are pits of natron.

Methodology

For the study in hand, data has taken from the population census of Pakistan has been extensively used for the analysis which has almost entirely depended, on the population census as its exclusive and prime source of relevant information. The population census 1998 which is the latest in the sources of the population censuses was used for the analysis of the most recent characteristics or traits deemed as elements of the existing pattern or situation. The data assembled from the pervious censuses from 1951 to 1998 was harnessed to trace past trends and changes in the evolving patterns. In the Censuses, data have three levels of aggregation, national, provincial district. The arrangement of census data under numerous categories and subcategories of the definitive characteristics offers essential details to be useful for wide-ranging studies, yet the Distribution between the morphological divisions i.e. rural and urban population at all three levels does extend the analysis to effective differentiation arising basically under two different environmental settings. To achieve a better appreciation of the differences among the aged groups living under different physical, ecological, and socio-economic conditions, the data subsumed under the rural and urban divisions have been utilized to a considerable advantage to facilitate a very illustrative analysis.

Size of Population of Khairpur

Khairpur district has an area of 15910 sq kms divided into eight talukas. The smallest area out of eight talukas is of Kot Diji 520 sq kms and biggest area is of Nara 11611 sq kms. Based on population Khairpur Taluka stands first with share of total district population 18.66 percent and Nara Taluka with 5.97 percent share of Khairpur District population is on eight's position. Highest population density prevails in khairpur Taluka which is 493 persons per sq km and lowest occurs in Nara Taluka which is only 8 persons per sq km. (Table. 1, Fig. 1)

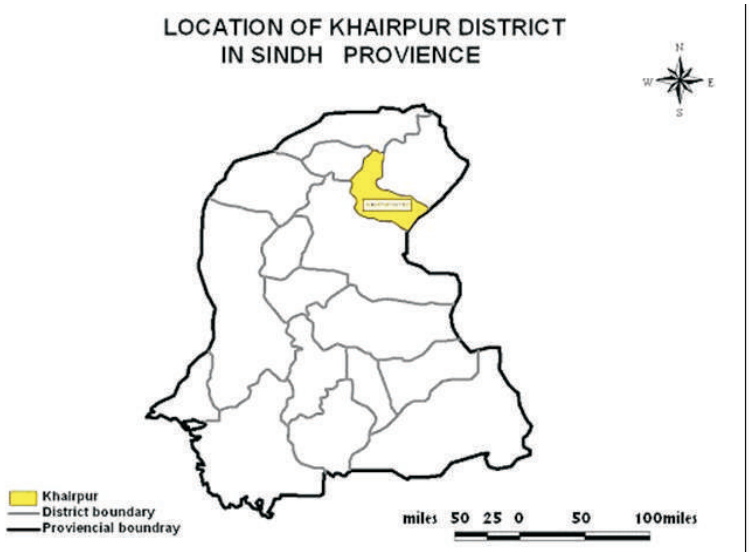
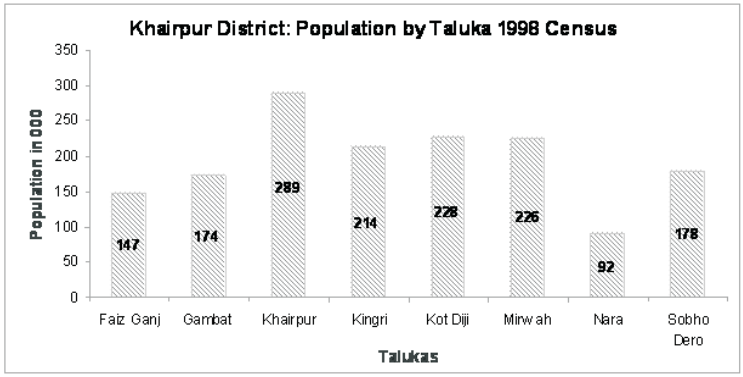
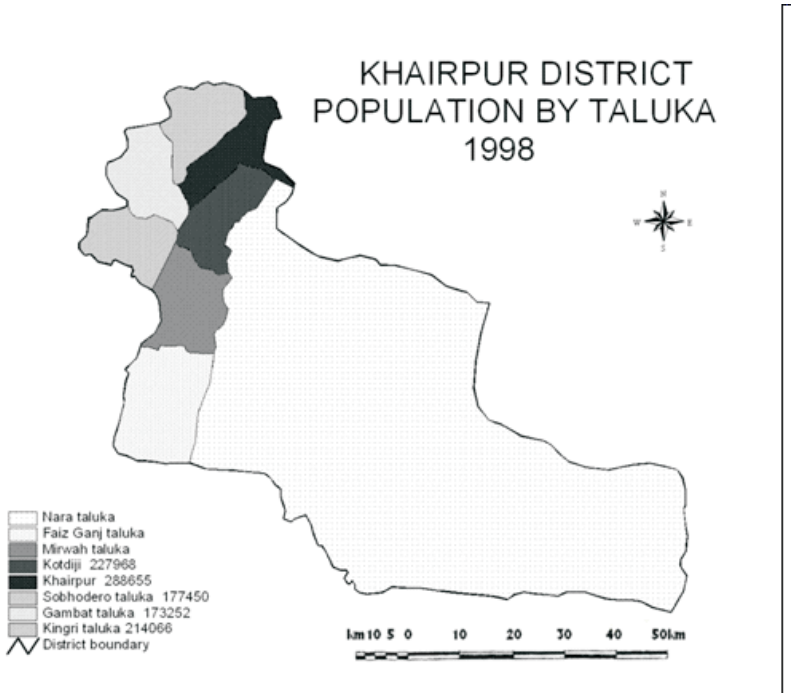


Table. 1: **Khairpur District: Area, Population and Density by Taluka, 1998**

No	Taluka	Area Sq Km	Population	Population Percentage of District Population	Population Per Sq Km
1	Faiz Ganj	946	146436	09.47	155
2	Gambat	582	173252	11.20	298
3	Khairpur	585	288655	18.66	493
4	Kingri	531	214066	13.84	403
5	Kot Diji	520	227968	14.74	438
6	Mirwah	631	226373	14.64	359
7	Nara	11611	92387	05.97	08
8	Sobho Dero	504	177450	11.47	352

Based on Table 1 of Census Report of Pakistan, 1998





Change in Size of the Population of Khairpur Since 1951

As part of the continuously growing population, it had recorded increase since 1951. The size of population as proportion of the total population of Sindh Province has witnessed change. Between 1951and 1961 the size increased gradually from 5.28 percent to 5.58 percent of the total population of Sindh Province. The decline in size proportion occurred in 1972 its percentage was 5.12, it increased in 1981, percentage was 5.16 and showing considerable decrease in the proportion of the populations in 1998 which was 5.08 percent. (Fig. 2)

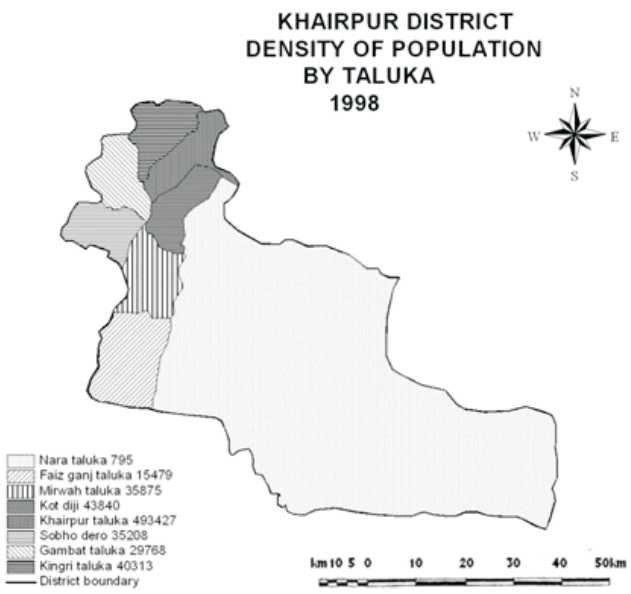
Status of Khairpur District in the Sindh Province 1951 to 1998

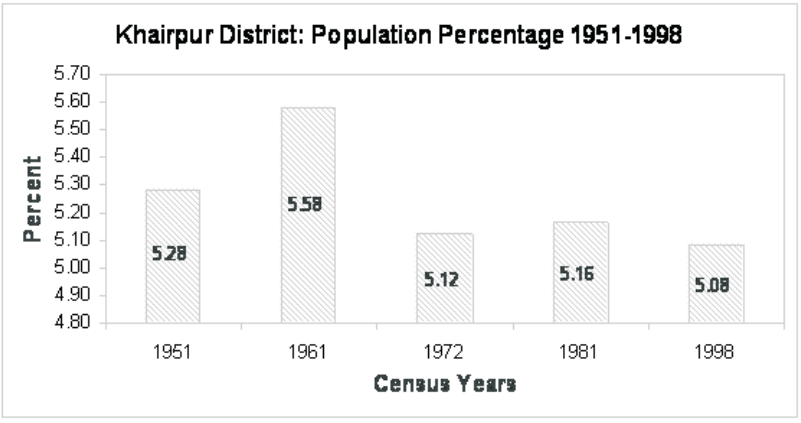
Khairpur is an important district of Sindh Province, because it was the only princely state of Sindh Province, another important feature of this district is that it remain in same condition as it was the state and it is not bifurcated into further small districts as the other districts are divided due to administrative reasons. On the bases of population in the year 1951 rank of Khairpur State was 9th out of 10 administrative divisions of Sindh, with 5.28 percent share of population. In 1961 the rank of Khairpur remains same out of 11 districts with a share 5.58 percent. In census year 1972 it had 8th rank out of 11 districts and share was 5.12 percent. In 1981 again it received 9th rank out of 13 districts and population share was 5.16 percent. In census year1998 it became on 8th rank out of 21 districts of Sindh with a share of 5.08 percent of the population of Sindh. (Table. 2)

Growth of the Khairpur District Population Since 1951

Growth of Population of Khairpur District is higher than growth of Sindh Province which was 40.03 of Sindh and 47.82 of Khairpur district. Cumulative increase was nearly at the same rate of Sindh Province and of Khairpur District.

Population percentage in Sindh Province increased till 1981 and again declined in 1998





which was 59.97. Population of Khairpur was fluctuating; it increased in 1972, was 53.54 percent than declined in 1981 and was 35.35 percent again increased in 1998.with 57.62 percent. Inter censual increase was high of Sindh Province whish was 4.00, 6.11 and 10.47 respectively 1961 to 19981, but declined in 1998 and remained 3.53 percent. In Khairpur District it increased in 1972 which was 4.87 percent and than declined 3.93 percent in 1981

Table. 2

Khairpur District: Population Percentage Share by District of Sindh Province 1951-1998

No	Census 1951	Population	Percent	No	Census 1961	Population	Percent
1	Karachi	1122406	18.56	1	Karachi	2044044	24.14
2	Hyderabad	892296	14.75	2	Hyderabad	1285711	15.18
3	Sukkur	731842	12.10	3	Sukkur	836867	9.88
4	Tharparkar	730121	12.07	4	Tharparkar	728300	8.60
5	Nawabshah	686743	11.36	5	Nawabshah	691539	8.17
6	Larkana	501538	8.29	6	Larkana	604460	7.14
7	Dadu	416673	6.89	7	Jacobabad	528709	6.24
8	Upper Sind Frontier	344858	5.70	8	Dadu	485122	5.73
9	Khairpur State	319408	5.28	9	Khairpur	472137	5.58
10	Thatta	301863	4.99	10	Sanghar	430090	5.08
				11	Thatta	361733	4.27

No	Census 1972	Population	Percent	No	Census 1981	Population	Percent
1	Karachi	3606746	25.48	1	Karachi	5437984	28.58
2	Hyderabad	2243110	15.85	2	Hyderabad	2054159	10.80
3	Sukkur	1385210	9.79	3	Nawabshah	1647143	8.66
4	Nawabshah	1354168	9.57	4	Tharparkar	1501882	7.89
5	Tharparkar	1015924	7.18	5	Larkana	1138580	5.98
6	Larkana	921457	6.51	6	Sukkur	1098240	5.77
7	Dadu	806080	5.69	7	Dadu	1077053	5.66
8	Khairpur	724935	5.12	8	Jacobabad	1012476	5.32
9	Jacobabad	709011	5.01	9	Khairpur	981190	5.16
10	Thatta	695861	4.92	10	Sanghar	922730	4.85
11	Sanghar	693407	4.90	11	Badin	776614	4.08
				12	Thatta	761039	4.00
				13	Shikarpur	619576	3.26

No	Census 1998	Population	Percent	No	Census 1998	Population	Percent
1	Hyderabad	2891488	9.50	12	Thatta	1113194	3.66
2	Karachi East	2746014	9.02	13	Naushero Feroz	1087571	3.57
3	Karachi Central	2277931	7.48	14	Nawabshah	1071533	3.52
4	Karachi West	2105923	6.92	15	Malir	981412	3.22
5	Larkana	1927066	6.33	16	Ghotki	970549	3.19
6	Karachi South	1745038	5.73	17	Tharparkar	914291	3.00
7	Dadu	1688811	5.55	18	Sukkur	908373	2.98
8	Khairpur	1546587	5.08	19	Mirpur Khas	905935	2.98
9	Sanghar	1453028	4.77	20	Shikarpur	880438	2.89
10	Jacobabad	1425572	4.68	21	Umer Kot	663095	2.18
11	Badin	1136044	3.73				

Based on Table 1 of Census Report of Pakistan, 1998

and 3.39 percent in 1998.

Rural Population Growth

Rural population growth in Sindh Province was declined continuously from 59.15 percent in 1972, 27.98 percent in 1981 and increased 44.60 percent in 1998. Cumulative growth increased regularly from 38.59 percent in 1972, 55.99 percent in 1981 and 61.11 percent in 1998. Intercensual percentage declined from 5.38 percent in 1972, 3.11 percent in 1981 and 2.62 percent in 1998. But position was different in Khairpur District. It declined from 42.79 percent of 1972 to 20.74 percent in 1981 and again increased 60.96 percent in 1998. Cumulative increase was very slow rate. It was 41.19 percent in 1972, 58.48 and 59.94 percent respectively in 1981 and 1998. Inter censual growth declined from 3.89 percent in 1972 to 2.30 percent in 1981 and increased to 3.59 percent in 1998.

Urban Population Growth

In Sindh Province urban population percent declined to half of percent of 80.52 in 1972 to 43.91 percent in 1981 and again nearly doubled in 1998 to 80.09 percent. Cumulative increase was 35.65 percent in 1972, 51.92 percent in 1981 and was 53.59 percent in 1998, but intercensual growth declined continuously from 5.38, 3.11 and 2.62 percent respectively from 1972, 1981 and 1998.

In Khairpur District urban percentage declined on a very high rate. It declined from 152.18 percent in 1972, 111.25 percent, 1981 census to 47.72 percent in 1998. Cumulative increase was also on a slow rate like of Sindh Province. Annual growth declined from 13.83 percent in 1972, 12.36 percent in 1981 and 2.81 percent in 1998.

Sex Composition of the Population

The sex composition of the Population (Table. 4) is characterized by prevalent higher proportion of males in the district and taluka population. The same pattern with higher masculinity occurs in both rural and urban areas. These differences, which imply imbalance or gap in sex proportion, are indicated by the sex ratio as given in Table. 5. The highest sex ratios (114.50) is shown in Nara Taluka, which is also much higher than the district ratio (110.09). Similar pattern with masculinity higher than the district average characterizes the Khairpur and Mirwah

Rural masculinity ratio is higher than the district ration in five talukas than district level (110.32), which is 110.73 Faiz Gang, 110.54 Khairpur, 111.80 Kot Diji,110.42 Mirwah and 114.50 in Nara Taluka.

Urban masculinity ratio is higher in three talukas than the district level (109.38) namely in talukas Faiz Gang 113.33, Kingri 109.97, Mirwah 112.49

Age Structure of the Khairpur District

In district Khairpur children percentage is 46.49 and only three talukas percentage exceeds than district level are Kingri 47.04, Mirwah 47.38 and Sobho Dero 47.37, while adult percentage is high than the district level (48.91) two talukas only namely Gambat 49.89 and Khairpur 50.55 percent. Aged 60 and above exceed in two talukas Nara which is very high 5.50 percent and Sobho Dero 4.61 percent. (Table. 6, Fig. 3)

Spatial Distribution Procedures

Spatial pattern display how a population or its characteristics vary over space for which varying densities and concentration levels across the country or district are determined. The pattern have been delineated by applying statistical techniques, rates of change in size of the population over time period that forms the background of the present pattern of spatial

Table. 3: **Population Growth Percentage Increase and Cumulative Increase Over 1951**

	Sindh Province			**Khairpur District**		
Census Year	Percentage Increase	Cumulative Percentage Increase	Intercensul Average Annual Increase	Percentage Increase	Cumulative Percentage Increase	Intercensul Average Annual Increase
Total						
1951						
1961	40.03	41.66	4.00	47.82	40.35	4.78
1972	67.16	50.63	6.11	53.54	52.20	4.87
1981	94.25	60.11	10.47	35.35	60.72	3.93
1998	59.97	61.04	3.53	57.62	61.76	3.39
Rural						
1961						
1972	59.15	38.59	5.38	42.79	41.19	3.89
1981	27.98	55.99	3.11	20.74	58.48	2.30
1998	44.60	61.11	2.62	60.96	59.94	3.59
Urban						
1961						
1972	80.52	35.65	7.32	152.18	28.39	13.83
1981	43.91	51.92	4.88	111.25	44.87	12.36
1998	80.09	53.59	4.71	47.72	59.48	2.81

Based on Table 4 of Census Report of Pakistan, 1998

Table. 4

Khairpur District: Sex Composition by Taluka, 1998

	Total		**Rural**		**Urban**	
	Male	Female	Male	Female	Male	Female
Khairpur District	**52.40**	**47.60**	**52.45**	**47.55**	**52.24**	**47.76**
Faiz Ganj Taluka	52.26	47.74	52.16	47.84	53.12	46.88
Gambat Taluka	52.37	47.63	52.55	47.45	51.80	48.20
Khairpur Taluka	52.45	47.55	52.50	47.50	52.37	47.63
Kingri Taluka	51.89	48.11	51.93	48.07	51.74	48.26
Kot Diji Taluka	52.61	47.39	52.79	47.21	51.92	48.08
Mirwah Taluka	52.57	47.43	52.48	47.52	52.94	47.06
Nara Taluka	53.38	46.62	53.38	46.62	0.00	0.00
Sobho Dero Taluka	52.10	47.90	52.10	47.90	52.11	47.89

Based on Table 4 of Census Report of Pakistan, 1998

Table. 5

Sex Ratio of Population 1998
by Taluka Rural and Urban 1998
(Males per Hundred Females)

	Total	Rural	Urban
Khairpur District	**110.09**	**110.32**	**109.38**
Faiz Ganj Taluka	109.49	109.03	113.33
Gambat Taluka	109.96	110.73	107.48
Khairpur Taluka	110.29	110.54	109.97
Kingri Taluka	107.86	108.03	107.21
Kot Diji Taluka	111.03	111.80	107.99
Mirwah Taluka	110.81	110.42	112.49
Nara Taluka	114.50	114.50	0.00
Sobho Dero Taluka	108.78	108.76	108.82

Based on Table 4 of Census Report of Pakistan, 1998

distribution of population.
In the analysis of spatial distribution, a 'district' has been taken as the basic aerial unit and accordingly all the measures are based on the district data. The measures facilitate classification or grouping of the districts by intensities and concentration levels.

Conclusion

It is derived from various measures that there is a great variation in talukas of Khairpur district by areas, density of population. It is clear that in growth of population there is fluctuation taluka wise and also in male female ratio, masculinity ratio and difference in children, adults and aged population.

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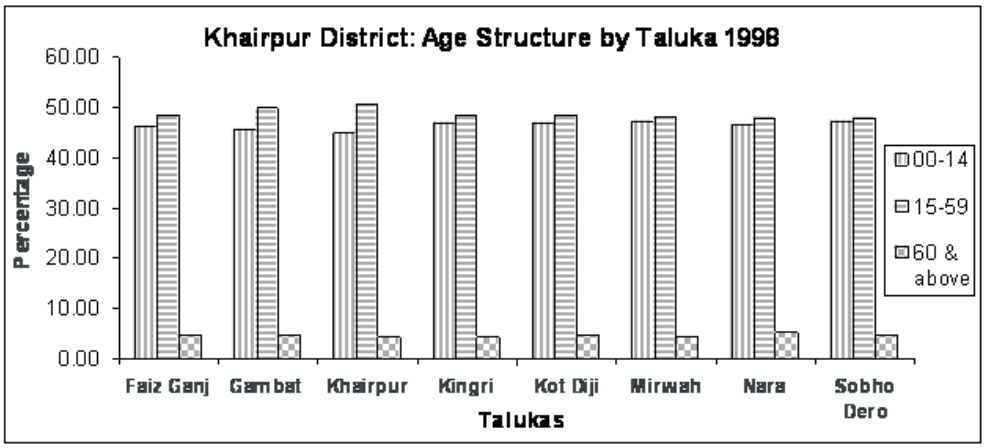
Table. 6: **Khairpur District: Age Structure by Taluka 1998**

	Total	Male	Female	Total	Male	Female	Total	Male	Female
		Children 00-14			**Adults 15-59**			**Aged 60 & Above**	
Khairpur District	**46.49**	**24.70**	**21.80**	**48.91**	**25.23**	**23.69**	**4.60**	**2.48**	**2.12**
Faiz Ganj Taluka	46.34	24.42	21.92	48.65	25.17	23.47	4.56	2.51	2.05
Gambat Taluka	45.55	24.19	21.36	49.89	25.67	24.22	4.56	2.51	2.05
Khairpur Taluka	45.07	23.88	21.19	50.55	26.24	24.31	4.38	2.33	2.05
Kingri Taluka	47.04	24.78	22.26	48.60	24.76	23.83	4.36	2.35	2.02
Kot Diji Taluka	46.99	25.18	21.81	48.44	24.99	23.46	4.57	2.45	2.12
Mirwah Taluka	47.38	25.19	22.19	48.13	47.38	23.22	4.49	2.47	2.02
Nara Taluka	46.57	25.19	21.38	47.93	25.14	22.79	5.50	3.05	2.45
Sobho Dero Taluka	47.37	25.13	22.24	48.02	24.51	23.51	4.61	2.46	2.15

Based on Table 4 of Census Report of Pakistan, 1998



Fig, 3