

Research Article



Spatial and Temporal Analysis of Landholdings and Farm Fragmentation in Peshawar City District, Pakistan

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Abstract | This paper spatio-temporally analyses the nexus of landholdings and farm fragmentation (FF) in Peshawar City District, Pakistan. In order to achieve objectives of the study, data were collected from revenue department and field survey. For micro level analysis, five villages were randomly selected for detailed and intensive study. In addition to questionnaire survey, detailed focused group discussion was also arranged with the key stakeholders. The analysis reveals that rapid urban expansion has resulted in reduction of farmland and sub-division of landholdings into smaller land fragments. Beside urbanization, a major contributor to fragmentation is the law of inheritance, which divides the land among successors. In the absence of specific policies on land consolidation or development control, it is hard to see any expected change in landholding and farm fragmentation and continued invasion of farmland by urban uses.

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Keywords | Landholdings, Fragmentations, Law of inheritance, Land tenure

Introductions

This paper attempts to analyze the nexus of landholdings and farm fragmentation in capital city district Peshawar (CCDP), Pakistan (Figure 1). Fragmentation of land is a condition of splitting up of farm holdings into two or more parcels (Idowu et al., 1999; Rahman, 2009) and spread over an extensive area generally cultivated as a single unit (Samiullah, 2013). This process takes place; through vertical division, which reduces the size of holdings, and horizontal dispersion, by which the number of land parcels not only increases but also get fragmented (Niroula and Thapa, 2004) and dispersed. Though, the supply of land is fixed, yet its utilization varies in a dynamic process with substantial variation in productivity (Khan, 2005). The subsistence of fragmented landholdings has been considered as an important component of developing farm struc-

ture (Rahman et al., 2012; Samiullah, 2013). Farm fragmentation in subsistence agriculture is often considered an impediment in agricultural advancement. It also hampers farm mechanization, often reduces production and needs huge investment to alleviate its impacts (Rahman and Khan, 2008). Recently, numerous countries have undertaken land reforms to promote farms integration (Khan et al., 2012).

In East Asian countries such as Japan and Korea, the average size of farms are getting bigger as a consequence the number of farms is declining (Samiullah, 2013). It has been often advocated that this makes room for efficient utilization of land resources (Rahman et al., 2013). It facilitates farmers in improving their farm production and livelihood (Van-Dijk, 2003; Rahman and Khan, 2012). The situation is reverse in south Asia including Pakistan, where population growth is high and rate of urbanization is com-

paratively low (Khan, 2005; UNHABITAT, 2010). As a result, size of landholding and land ownership is steadily declining in South Asia (FAO, 1994), and there is a growing trend of fragmentation of farms into smaller parcels amongst heirs (Liu et al., 1996). According to Government of Pakistan, the number of landholdings was 4.07 million in 1980, which increased to 5.07 million in 1990 and 8.26 million in 2010 (GoP, 2012).

ronment (Samiullah, 2013). In such situation, it is the demand-side that determines the use of plots. It considers fragmentation largely as a better option adopted by farmers and assumes that the profit of fragmentation goes beyond costs to a farmer (Ilbery, 1984).

The impacts of land fragmentation on productivity have been presented in literature from different perspectives. Binswanger et al. (1995) was of the opinion that land fragmentation and productivity have an inverse relationship. Similarly, Jabarin and Epplin (1994) found that there is negative impact of fragmentation on yield and farm production. Rahman and Rahman (2009) found that considerable variation in land productivity occurs and mainly depend on factor of disparities in farm size, land holding, environmental conditions and agriculture inputs.

Jabarin and Epplin (1994) explored the effect of farm fragmentation (FF) on the production cost in Jordan. Nguyen et al. (1996), Wan and Cheng (2001) and Tan et al. (2010) studied the consequences of FF on efficiency of main farm outputs of rural households in China. Kawasaki (2010) assessed costs and benefits of farm fragmentation for yield of rice in Japan, likewise Rahman and Rahman (2009) did it in Bangladesh. Parikh and Shah (1994) examined the impact of FF on the technical productivity of farms in the Khyber Pakhtunkhwa Province of Pakistan, whereas Manjunatha et al. (2013) conducted an analogous study in India. In Europe, Di Falco et al. (2010) investigated that in what way FF affects agricultural profitability in Bulgaria and Corral et al. (2011) evaluated its impacts on the revenues of Spanish dairy farms (what were the findings of these studies – it is important to write these).

Study area

The Peshawar City District is located in the Khyber Pakhtunkhwa province of Pakistan. It stretches from 33°44' to 34°15' north latitudes and 71°22' to 71°45' east longitudes, covering an area of about 1267 km². (Figure 1). Physically, the City District is a part of Peshawar vale, which constitutes the extreme north-western tip of the Indo-Gangetic synclinorium, a depression filled with alluvial material. Peshawar city district has semi-arid climate. The area has a warm summer followed by a cool winter. The rainfall occurs due to monsoon in summers as well as western depressions in winter. The rainfall is more from western depressions than monsoon but the annual rain-

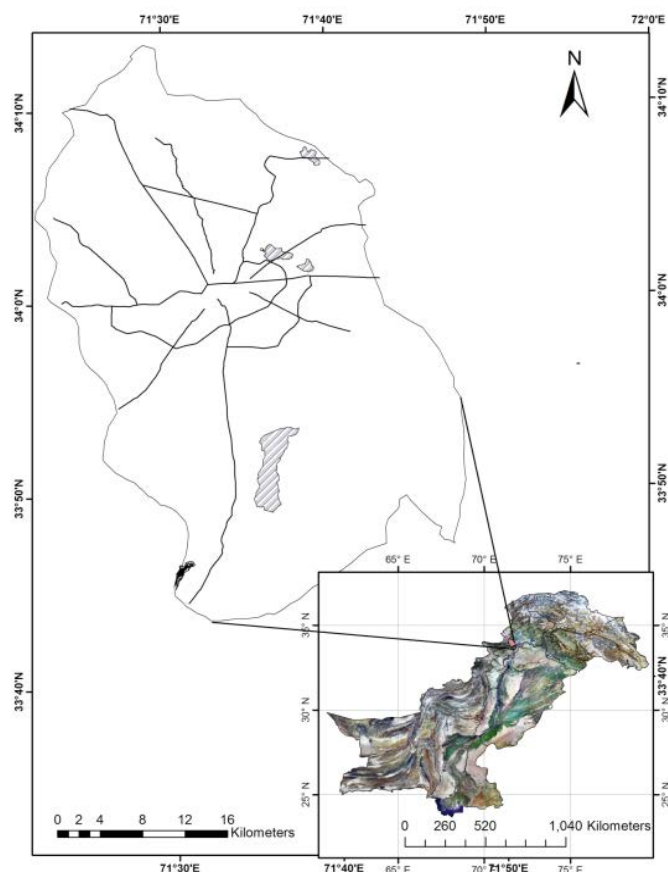


Figure 1: Location of capital city district Peshawar.

The causes of land fragmentation have been studied from supply as well as demand perspectives (Bentley, 1987). Supply-side takes fragmentation as an external obligation on farmers that emanates from population pressure, inheritance, and land shortage. Proponents of this perspective maintain that inheritance in an increasing population leads not only to breakup of farms but also dispersal of parcels, as farmers desire to deliver similar quality of land to all the successors (Khan, 2005). Supply-side perspective focuses mainly on the breakup of common property systems due to population pressure as in Nigeria and Kenya (King, 1977). However, supply-side perspective falls short in explaining land fragmentation in a situation, where plots vary in terms of soil type, water withholding potential, gradient, elevation and agro-climatic envi-

fall ranges only from 300 mm to 450 mm. It is also erratic and insufficient for crop growth, which is dependent on canal irrigation. Kabul River, which enters the district from Afghanistan, is the main source of irrigation system for agriculture in the district. It is snow-fed and its flow increases in spring because of snowmelt. The City District has diverse economic activities including agriculture, industries and service functions. The city of Peshawar within the district houses major administrative functions as the capital of the Province. Historically it has been an important market town located on silk route from Central Asia to India. Currently, it is a very important dry port for Afghanistan. The city district has a good network of farm to market roads and is also well connected with other parts of Pakistan by road, railroad as well as air. The population of the city district has seen enormous growth in recent years. Historically it was a walled city, to which Britishers added a cantonment. After independence, with the improvement of law and order situation, the city experienced relatively faster growth and was given the status of a city district in 2001 to provide an opportunity for better integration of city and its surrounding rural environment. The current population of the district is over 3 million.

There are about 200 revenue villages (Mauza) in the city district. They are located in different agro-ecological zones. Major part of the city district consists of irrigated land therefore most of the villages belong to this category (Table 1). Nearly two third population of the city district lives in this part. The data indicates that irrigated land is the most fragmented. As against this, range land supports least population and is least fragmented.

For the current study five sample villages were taken as case study selecting three from the irrigated, and one each from rain fed and rangeland areas. The data as obtained from the revenue department indicate that average land holding in rain fed and rangeland areas was higher than the irrigated part (Table 2).

It is clear from the table that with increasing population, the competition for land has increased, and built up area has increased in all villages. It is also augmenting fragmentation; the average holding size has reduced in all sample villages. For instance, in Maryamzai the average land holding reduced from 5.1 in 1991 to 4.35 in 2012. Holding size was reduced more in irrigated villages particularly those located near the

city centre. Thus, land holdings in Pakha Ghulam and Hargoni have greatly reduced from 2.5 to 1.8 and 1.8 to 0.4 ha respectively. Both of them are located in the irrigated zone near the city centre. This indicates the impacts of market forces on farm fragmentation. A number of private housing estates were established in both Hargoni and Pakha Ghulam where small land holders sold their land to real estate dealers due to poverty as their holdings were below subsistence level.

In Peshawar city district, farm fragmentation, conversion of urban and peri-urban farmland into non-agricultural uses has been posing serious challenge to the agricultural system. The overwhelming increase in population has enhanced competition for potentially scarce land (Rahman et al., 2012). The prime agricultural land is facing serious competition from residential, commercial, industrial or infrastructural developments. Non-agricultural uses are regularly expanding their market boundaries in asymmetrical manner over many land parcels. With growing population, the landholding and farm fragmentation is multiplying day-by-day. The rapid pace of land fragmentation and its control in the district is a challenging task and demands studies to be carried out on its causes and impacts. Therefore, a case study like this on spatial and temporal analysis of landholding and farm fragmentation may assist policy makers for choosing suitable strategy.

Materials and Methods

In order to achieve the study objectives, data were collected from both primary and secondary sources. The primary data was collected through a series of household questionnaire survey, Focused Group Discussions (FGDs) with the key stakeholders and interviews with the officials of the government line agencies and farmers. Secondary data were obtained from District Revenue office, Crop Record Section (office of the Qanungoo) and revenue officials (Patwari) of the sample villages (Mauza: smallest revenue estates). For detailed study, five sample villages were selected from different environmental set-up by random sampling techniques including varying distance from the city centre and type of farmland such as irrigated, non-irrigated and rangeland. There are 200 villages in Peshawar City District (Figure 1). The Three villages namely, Kochian, Pakha Ghulam and Hargoni were selected from irrigated farmland, whereas village Maryamzai from predominantly non-irrigated tract and village Garhi Janu from the rangeland (Figure 2).

Table 1: Peshawar City District: Profile of villages.

Farm Fragment Classes	Number of Villages	Area (ha)	Population ^a (est 2012)	Land use (Area in ha)			Agro-ecological zone
				*Cultiv	**Noncu	Built up	
less than 100	22	16400	23450	5610	9650	1140	Mainly rangeland
100-150	27	30140	35612	15930	12050	2160	Mainly Rain fed
150-200	75	12300	56480	7560	1240	3500	Mainly Irrigated
Above 200	76	38120	78720	21520	2150	14450	Mainly Irrigated

Built up area refers to area under buildings and roads or civic uses etc. (*Cultivated land ** Non-Cultivated).

Source: Revenue Record, 2012 and ^a projected population for the year 2012 since no census was conducted in Pakistan after 1998.

Table 2: Peshawar City District: Land holdings in sample villages.

Sample Mauza	Population		Land owner-ship		Average land holding (ha)		Land use (Area in ha)					
	1991	2012	1991	2012	1991	2012	1991			2012		
							*Cultiv	**noncu	Built up	Cultiv	noncu	Built up
Maryamzai	7,854	14,532	3210	5213	5.1	4.35	1121	192	78	1039	230	124
Pakha Ghulam	7,243	18,756	5123	6214	2.5	1.8	283	41	20	248	36	62
Hargoni	453	5,431	360	4536	1.8	0.4	107	4	4	75	16	24
Kochian	2,456	5,891	1987	3245	3.1	2.3	169	17	16	162	16	24
Garhi Janu	1,924	2,942	1521	2103	4.6	3.9	89	57	5	111	34	6

Source: Land Revenue Record, 2012; District Census Reports, 1981, 1998 (*Cultivated land ** Non-Cultivated).

Large scale cadastral maps of each sample village were geo-referenced, digitalized and spatial data of landholdings, land utilization, cropping pattern and fragmentation record of each land parcels for the year 1991-1992 and 2011-2012 were entered in GIS environment. As a result, spatio-temporal maps for each parameter were developed to depict the nexus of landholding and farm fragmentation. Similarly, the data collected through questionnaire survey and FGD were analyzed and presented in the form of tables and diagrams. The tabular data obtained from Patwari (revenue officials) were then joined with digitized cadastral maps for spatio-temporal calculation of farm size, size of holdings, number and size of fragments in each sample village for two-time periods: 1991-92 and 2011-2012. Finally, the results were interpreted in the light of rapidly expanding Peshawar City District and its impacts on landholdings and farm fragmentation, and policy recommendations were made for concerned government line agencies.

Results and Discussion

In this section both macro and micro level analysis have been carried out with key focus on farm size, land holdings and tenure, as well as land fragmentation. The discussion is supported by statistical data obtained from primary and secondary sources. Fur-

thermore, the factors that triggered the size of landholdings and farm fragmentation and the resultant implications have been elaborated.

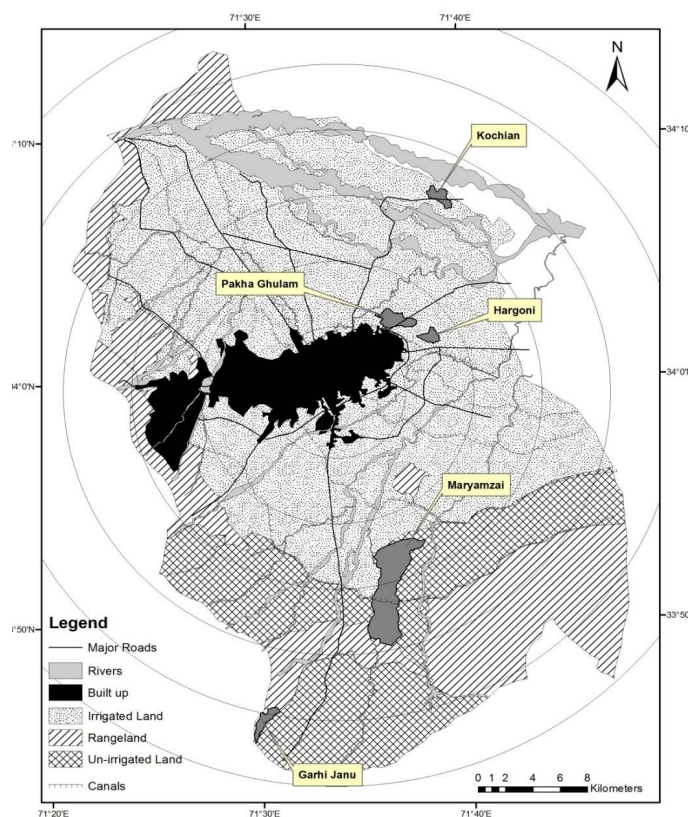


Figure 2: Location of sample villages in capital city district Peshawar.

Spatio-statistical analysis of land use, farm size, landholdings

The analysis reveals that in Peshawar City District, agricultural land is highly skewed towards urban development. It was found from the analysis that as much as 69 percent of the landholdings were less than 2 hectares (ha) and a predominant majority (85%) of landholdings was less than 3 ha (Figure 3). The farmers with less than 1 ha of land are “marginal” and those with 1-2 ha are “small” farmers. Household questionnaire survey showed that about 5 percent of the households were landless and 69 percent had marginal or sub marginal landholdings.

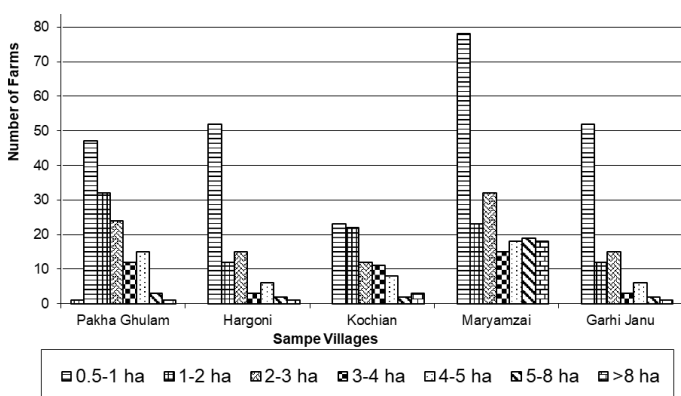


Figure 3: CCDP, Farm Ownership by size in Sample Villages.

According to revenue record, in 2010-2011, the average farm size in all the sample villages was 2.3 ha. However, the average farm size varies from village to village ranging from 0.4 ha in sample village Hargoni (irrigated area) to 4.35 ha in Maryamzai (non-irrigated land). The farm sizes were small in Pakha Ghulam and Hargoni, where over 95 percent farms were less than one hectare as these villages are located in the periphery of city centre (Figure 3). The sample villages Pakha Ghulam and Hargoni are located in immediate suburb of the city and, main transport corridors pass through them (Figure 4). These are the main factors that have influenced urban expansion the land values thereby promoting fragmentation of farms and preponderance of small farms. Similar pattern was found in sample village Kochian. The farm size are relatively large in rain-fed areas as compared to irrigated villages (Figure 5). In Garhi Janu many parcels were over 3 hectares, but these are rarely cultivated due to deficiency of rain.

The analysis revealed that the quality of agricultural land based on environmental factors such as water availability was a major factor affecting the farm size. Hence, generally farm size was found bigger in the

unirrigated areas as compared to irrigated zones. This is mainly because irrigated land has more socio-economic potentials, expensive and intensively cultivated. Therefore, irrigated farmlands have been more frequently divided and sub-divided amongst the successors. The field survey also confirmed that the frequency of farm fragmentation was higher in northern part of the study area, where farmlands are irrigated. On the contrary, in the unirrigated and rangeland environment in southern section of city district less farm fragmentation existed, where scarce and erratic rain provides limited opportunity to grow crops.

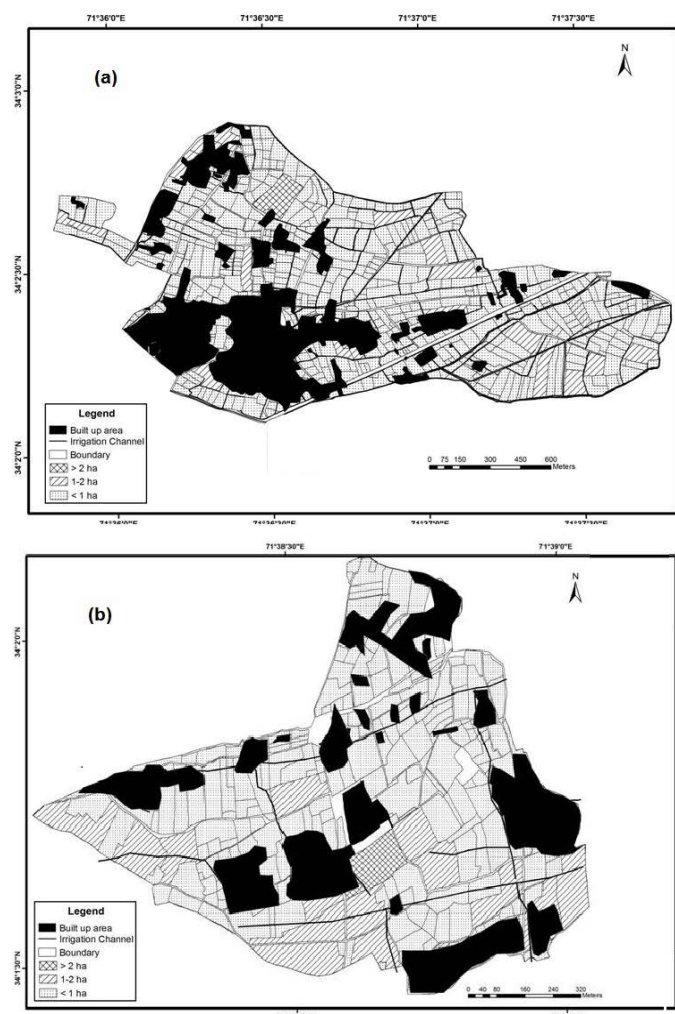


Figure 4: Farm Size in Villages (a) Pakha Ghulam and (b) Hargoni, 2011.

Spatial nexus of land tenure and farm size

Bureau of Statistics in Pakistan defines land tenure as an arrangement under which the land is operated (GoP, 2012). Conceptually, land tenure is the relationship between land and its cultivator. The analysis reveals that in the study area, three different types of tenure system are reported namely, owner cultivator, tenant cultivator and owner cum tenant cultivator. In case of owner cultivator, the owner cultivates

their farmland, whereas the tenant cultivator takes the farmland from the owner (mostly on lease) on a predetermined rent in cash or kind or in return for a share of the output. The input charges for ploughing, threshing, water access (*Abyana*), seed and fertilizer in such cases are shared between the parties. Within owner cum tenant system, the cultivator owns part of land while the remaining he gives to other farmer (s) against a rent or share in the produce (same as tenant system).

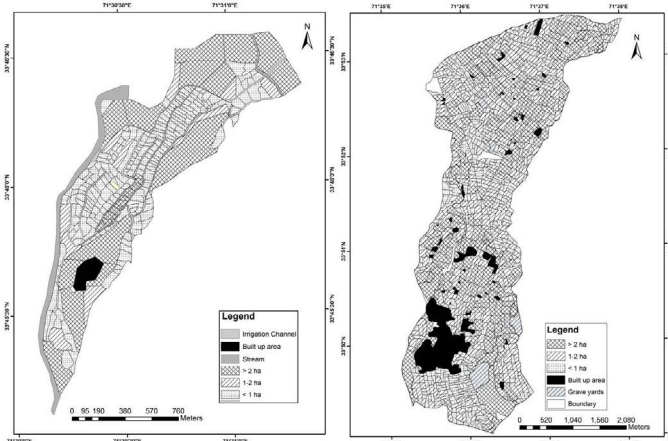


Figure 5: Farm Size in Garhi Janu and Maryamzai, 2012.

The analysis shows that in all the sample villages, owner cultivators dominate (Table 3 and Figure 6) followed by tenant cultivators. The owner cultivators dominate mainly due to small size of farm and small landholdings, whereby owners prefer to cultivate their land themselves. During focused group discussions it was revealed that in village Maryamzai and Garhi Janu the land was much less fragmented than the other villages where tenant cultivation was more common.

Table 3: Farm tenure by number and size of farms, 2011-2012.

Sample Villages	Number of Farms				Farm Area (ha)			
	Total	Owner	Owner cum tenant	Tenant	Total	Owner	Owner cum tenant	Tenant
Pakha Ghulam	170	112	32	26	290	185	45	60
Hargoni	136	92	18	26	65	29	15	21
Kochian	93	65	12	16	172	112	24	36
Maryamzai	268	176	38	54	1168	726	214	228
Garhi Janu	136	102	12	22	139	86	32	21

Source: Revenue Records of sample villages, 2011-2012.

Leasing of land and employment as agricultural laborer was common feature of tenure system. The study revealed that several landless farmers were leasing more than 2 ha land and paying to the landowners in kind or cash at fixed annual rates. The lease rate varied from place to place and largely depended on location and quality of land based on water availability. Lease rate per hectare for irrigated land in sample villages Pakha Ghulam and Hargoni on average was about 15,000 rupees (1 US dollar is equivalent to 105 Pak rupees). The rate for the same category of irrigated land in Maryamzai was Rs 11,000 per hectare per annum. However, lease rate for rain-fed agricultural land was comparatively low at less than Rs 6,000 per ha per annum.

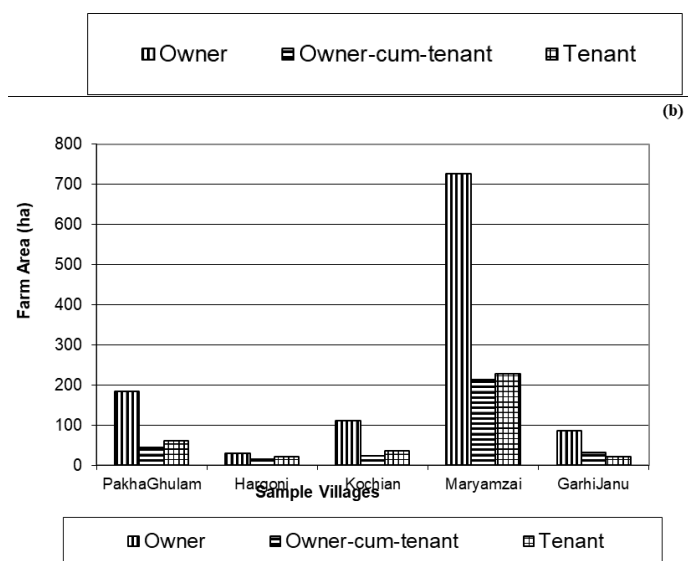
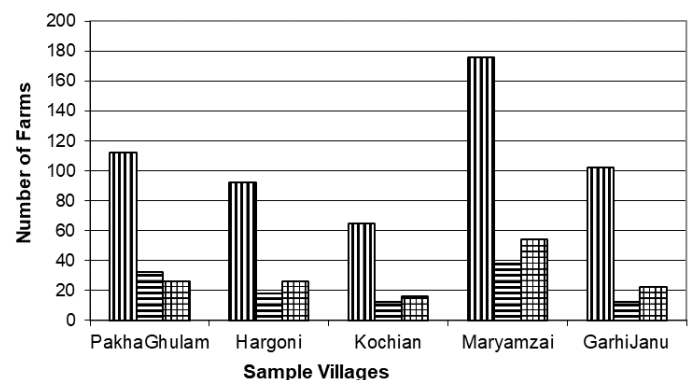


Figure 6: Tenure by (a) Number of farms (b) Area, 2012;

Source: Field Survey, 2012.

Land tenure has an impact on farm fragmentation. Owner cultivation encourages farm fragmentation while leasing the land to tenants discourages it. When the land is divided among the heirs, it is in fragmented form as every owner cultivates his own land. When the land is leased to tenants then it is cultivated in consolidated farm. The share of the owners may be

more but the land is cultivated as a single unit. Owner-cum-tenants also encourage fragmentation as the owner does not have sufficient land to cultivate and part of the land is leased from other farmers.

Farm fragmentation

Farm fragmentation is quite common in the Peshawar City District as depicted by the situation in five sample study villages between 1991 and 2012 (Table 4). Altogether there were 663 farms in the sample villages in 1991, which increased to 803 in 2012, an increase of 21 percent in about 30 years. The intensity of fragmentation was very high in Hargoni, where the number of farms increased by 48% as a result of fragmentation. It was followed by Kochian and Pakha Ghulam; all these were primarily irrigated villages (Figure 7 and Figure 8).

Table 4: Increase in number of farms in sample villages (1991 and 2012).

Sample villages	Number of farm fragments		Change in fragments	
	1991	2012		
Hargoni	92	136	44	48%
Kochian	72	93	21	26%
Pakha Ghulam	136	170	34	25%
Maryamzai	238	268	30	13%
Garhi Janu	125	136	11	9%

Source: Revenue record of sample villages.

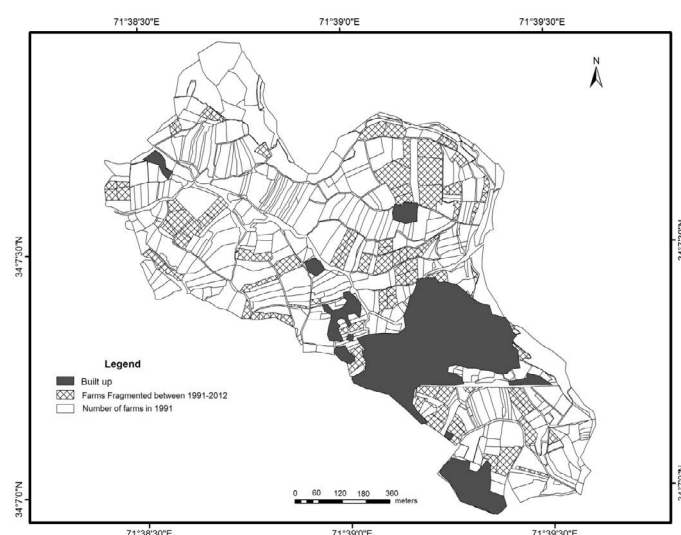


Figure 7: Farm fragmentation in Kochian between 1991 and 2012.

Driving forces behind farm fragmentation

Causes of farm fragmentation are numerous and they vary in different countries (Van Hung, et al., 2007; Tan, 2006; Niroula, 2005; Bentley, 1987; King, 1982).

However, most scholars agree that there are four main factors responsible for farm fragmentation. Law of inheritance is considered to be the most prominent of them. As per law of inheritance, the land is to be distributed among the potential heirs in certain proportions as fixed by law.

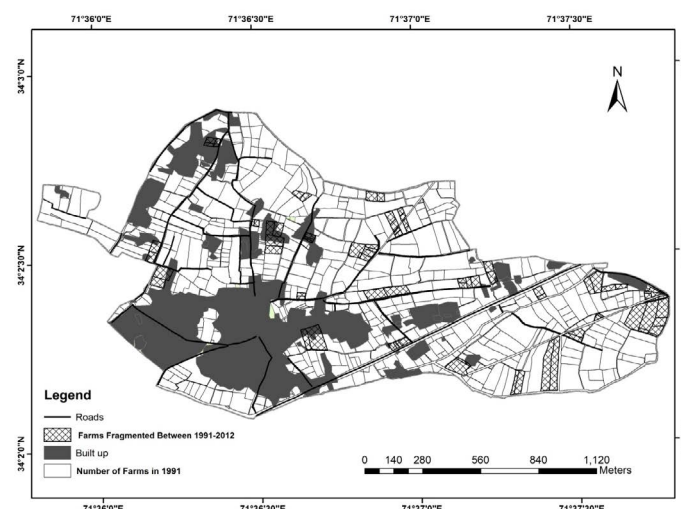


Figure 8: Farm fragmentation in Pakha Ghulam between 1991 and 2012.

As land varies in potential therefore every type of land is fragmented and distributed among heirs. In case where fertility is uniform for the whole farm, fragmentation is less. The land potential is not uniform in Peshawar, where some land is irrigated and other un-irrigated. Hence the fragmentation here is more severe as can be seen by the example of village Pakha Ghulam, where a person x owned land in both irrigated and rain fed tract and both lands were split into a total of 16 fragments for distribution among his heirs (Figure 9). He had left five heirs in total with three sons and two daughters. The land was to be divided into eight equal fragments so that each son will get two times land as the daughter will get (Qur'an in Surah Al-Nisaa) However, because land was located in both irrigated and rain fed tracts, therefore land located in both categories was divided separately. It resulted in further fragmentation of land.

Similarly, in village Maryamzai a person y died and his farmland (whole land was rain fed) was equally subdivided among his three sons. His land was fragmented into five parts at different locations (Figure 10). Here each of the fragment had to be divided among the heirs. Therefore, his land was divided into further fifteen fragments. As all the land belonged to same category i.e. rain fed, therefore, each heir was given the plots attached to each other. It indicates

that if land belongs to one category then land is less fragmented whereas when land belongs to different categories then each type of land has to be divided separately.



Figure 9: Fragmentation of a sample farm in Pakha Ghulam (rain fed and irrigated).

Population growth is another factor, which increases competition for getting hold of land. Grigg (1980) is of the view that land acquisition is most important endeavor for people all over the world, which increases with growing population, promoting fragmentation. However, some scholars differ with this view (Tiffen et al., 1994). They believe that increasing population mean better management of land resources, reversing the fragmentation. Land market is yet another factor that is considered to increase farm fragmentation. Urban sprawl and rising land prices are, for example, encouraging even joint families to split farmlands for sale. It is for the same reason that in the Peshawar city district, the villages located adjacent to the city are much more fragmented than those located away from it. As urban areas expand nearby villages are being engulfed in the expanding-built environment. Property dealers play a very critical role in this regard as they entice poor farmers/landowners into selling their lands. Hence villages Hargoni, Kochian and Pakha Ghulam experienced more fragmentation as compared to Maryamzai and Garhi Janu (Table 2). Although argument is advanced that if one farmer sells land another should purchase it and this way fragmentation would reduce but in reality, the farmers are so poor and the land is so expensive due to speculation created by estate agents that the next-door farmers have no capacity to purchase it.

Another major cause of farm fragmentation in the



Figure 10: Fragmentation of a sample farm in Maryamzai (rain fed area).

study area is poverty. When land is not sufficient to fulfill the household demand then some of individual members of the marginal farmer's family who are joint owners of land sell their share of land to fulfill their immediate needs – spending on marriages, house construction, health care, debt payment or to finance the education of their children. During focus group discussions, in the sample villages, respondents informed that they sold part or all of their lots for marriages of their children. Several farmers sold their entire landholdings and started other small businesses, as agricultural output was not sufficient to meet their growing needs. With the above factors still in operation, land fragmentation is likely to continue in Peshawar city district in the near future.

Farm fragmentations, land use and production

Technical efficiency is greatly hampered by increased fragmentation (Kalirajan, 1983). Due to continued fragmentation of land, more than 20 per cent of total farms or about 25 per cent of the cultivated area in five villages now has small, subsistence and below subsistence level farms, where modern advanced technology cannot be effectively applied. A survey conducted to find the efficiency of various farm sizes indicated that the farm efficiency declines with decrease in farm size (Table 5).

Table 5: Farm performance by size.

Farm Performance indicators	Average Value		Farm Size in acres			
	Per farm	Per Acre	< 1	1	2	3+
Fertilizer cost	800	1700	800	1,700	3,000	4,000
Seed cost	250	550	250	550	1,000	1,500
Pesticide cost	250	500	250	500	800	1,200
Labour cost	1,000	2,200	1,000	2,200	4,000	6,000
Fuel cost/hiring machinery	800	1,500	800	1,500	2,600	4,000
Total Operation cost	3,100	6,450	3,100	6,450	11,400	16,700
Gross production Value	5,600	12,500	5,600	12,500	26,000	40,000
*Farm Efficiency			95%	101%	107%	120%

Source: Field Survey, 2012 (*Farm efficiency is taken as Crop yield index for the year 2012).

Apart from land fragmentation, land use and farming dynamics in peri-urban environment in this research indicate that they are also responsible for major changes in agriculture production in the sample villages.

The land use changes have been more drastic in those villages located near the core city than those located away from it. Hargoni and Pakha Ghulam located near the core, for example, have significantly changed during the last two decades from pure agricultural to pre-dominantly non-agricultural as a result of conversion of farm land to build up area. Both villages have excellent irrigation facilities and very fertile soil but continuing farming has become a losing proposition in these villages, due to low yields in the absence of Government support and spending, increasing farm fragmentation, subsistence agriculture, poverty and rising cost of agricultural inputs. This is particularly the case with the small farmers, who dominate the farming community. On the other hand, the successes of housing schemes on agricultural land have inspired individuals and groups of all types of speculators to join the race and they have been buying land across Peshawar.

The consequence is sprawling of built environment in all directions; the land that provided residents with fresh supplies of vegetables are vanishing and fields that produced wheat, sugar cane and maize are also shrinking. In some cases, lands, even with crops still cultivated in them, have been purchased at low rates by speculators. A few amongst them spotted the potential of the trade some time back and, possessing resources to spare, purchased agriculture fields from farmers who could not make ends meet because of low crop yield and meager financial returns. Members of the farming community possessing lands encircling core city due to woes of land speculators feel that they have a bargain at hand that can help them start life anew in another field. In the absence of research, one does not know if the hopes of similar farmers materialized in the past but nevertheless the outcome has been loss of cultivable land.

As far as fragmentation is concerned, the Government of Pakistan made efforts in past for production improvement through land reforms of 1959, 1973 and 1977. First land reform programme was initiated in Pakistan in 1959, which included both consolidation and size restriction measures. The regulations under this programme fixed subsistence holdings of 5 ha (12.5) acres and economic holding of 20 ha (50 acres), below which sub-division was prohibited. However, the reforms failed to achieve the desired results and the progress was extremely sluggish and only 1.8 million ha of farmland were consolidated between 1977

and 1983. Like other developing countries, the government could not enforce the mandated job owing to two reasons - lack of adequately skilled, trained and motivated workers; and lack of adequate participation of rural community especially poor farmers groups. The complicated system of the management also made the process slow, prolonged and costly. Some efforts were also made in Punjab and Sindh provinces to integrate fragments by mutual substitution of land parcels among owners and around 12 million ha of land parcels were merged (Shaukat, 1999). Nevertheless, the process was hindered by differences in land assessment, lack of a satisfactory compensatory method and farmers' sentimental attachments to land. This is unfortunate because the neighboring India managed to control land fragmentation better through land reforms as a result of which the yield of crops in India on similar lands as Pakistan is higher.

Conclusions and Recommendations

The case study of farm fragmentation in the Peshawar city district reveals a preponderance of small size farms. The fragmentation has been a continuing process in the past and under the current operating milieu, the fragmentation is likely to continue unless checked with the use of suitable measures. The fragmentation of landholdings combined with poverty, increasing cost of inputs and low yields is hampering efficient management of land. The financial cost of land division has not been realized by most of the farmers, as they practice subsistence cultivation rather than commercial dairy, poultry or truck farming. The analysis indicate that most of the farms are very small i-e over 69 percent of them are less than 2 ha, indicating that most of the farmers are subsistence and marginal.

The study revealed that several factors are responsible for land fragmentation in Peshawar. Most important cause is inheritance and rapidly growing population. With growing population, the number of owners increase and as per law of inheritance, the farm area is to be distributed among the heirs. Each one receives only very small parcel of land and that are also dispersed because every type of land has to be divided among the heirs. Besides this, land market, poverty and rapid urban expansion were some other factors for rapid farm fragmentation. Land tenure system also has an impact on fragmentation of farms. Owner cultivators were most dominant because of very small farm size.

Leasing of land to tenants usually discourages fragmentation and owner cultivation encourages it.

Analysis further revealed that impacts of fragmentation on productivity appears to be negative in subsistence agriculture as the study revealed that farm efficiency was found higher for larger farms and lower for small farms. Perhaps the situation could have been different if the pattern of agricultural production were towards higher value-added activities such as animal husbandry and dairy farming. There is a provision in law regarding land consolidation in Pakistan, whereby an owner selling a plot must offer it first to the closest family members. If family members are not willing then it is offered to contiguous owner of land at fair market rate. If they are unable to buy it then only it can be sold to other persons (GOP, 2012). In case this law is violated then contiguous owner can sue against the owner and seek remedy in a court of law. The poverty of adjacent farmers, however, is not enabling them to purchase any extra land at the prevailing high cost.

Author's Contribution

Samiullah: Main author of the paper who contributed in all aspects particularly in the analysis of data.

Mohammad Aslam Khan: Supervised the study.

Atta ur Rahman: Contributed in the conversion of data to the maps and diagrams and helped in writing the manuscript also.

Shehla Gul and Attaullah: Helped in the data collection and field work.

References

- Banerjee, A.V., P.J. Gertler and M. Ghatak. 2002. Empowerment and efficiency: tenancy reform in West Bengal. *J. Polit. Econ.* 110(2): 239-280. <https://doi.org/10.1086/338744>
- Bentley, J.W. 1987. Economic and ecological approaches to land fragmentation: In defense of a much-maligned phenomenon. *Annu. Rev. Anthropol.* 31-67. <https://doi.org/10.1146/annurev.an.16.100187.000335>
- Binswanger, H.P., K. Deininger and G. Feder. 1995. Power, distortions, revolt and reform in agricultural land relations. *Handbook Develop. Econ.* 3: 2659-2772.
- Burton, S.P. 1988. Land consolidation in Cyprus. *Land Use Policy.* 5(1): 131-149. [https://doi.org/10.1016/0264-8377\(88\)90015-4](https://doi.org/10.1016/0264-8377(88)90015-4)

- Carlyle, W.J. 1983. Fragmentation and consolidation in Manitoba. *Can. Geogr.* 27: 17-34. <https://doi.org/10.1111/j.1541-0064.1983.tb00678.x>
- Charlesworth, N. 1983. The Origins of Fragmentation of Landholdings in British India: A comparative examination. *Rural India*. Carson Press Ltd., London. Cooperation (GTZ), Boon.
- Dawson, P.J. and J. Lingard. 1989. Measuring farm efficiency over time on Philippine rice farms. *J. Agric. Econ.* 40(2): 168-177. <https://doi.org/10.1111/j.1477-9552.1989.tb01096.x>
- del Corral, J., J.A.Perez and D. Roibás. 2011. The impact of land fragmentation on milk production. *J. Dairy Sci.*, 94(1): 517-525.
- Demetriou, D., J. Stillwell and L. See. 2012. Land consolidation in Cyprus: Why is an integrated planning and decision support system required? *Land Use Policy*. 29(1). 131-142. <https://doi.org/10.1016/j.landusepol.2011.05.012>
- Di Falco, S., I. Penov, A. Aleksiev and T.M. Van Rensburg. 2010. Agrobiodiversity, farm profits and land fragmentation: Evidence from Bulgaria. *Land Use Policy*. 27(3): 763-771.
- Ellis, F. 1992. *Agricultural policies in developing countries*. Camb. Univ. Press.
- FAO. 2001. Urban and peri-urban agriculture. A briefing guide for the successful implementation of urban and peri-urban agriculture in developing countries and countries of transition – Rome.
- Feder, G., and R. Noronha. 1987. Land rights systems and agricultural development in sub-Saharan Africa. *The World Bank Res. Obs.* 2(2): 143-169. <https://doi.org/10.1093/wbro/2.2.143>
- Famoriyo, S., Y.L. Fabiyi and A. Gandonu, 1977. Problems posed by land tenure in Nigeria Agriculture. Federal Ministry of Agriculture Lagos.
- FAO. 1994. Land degradation in South Asia: Its severity causes and effects upon people. World soil resources report. Food and Agriculture Organization, Rome.
- GoP (Government of Pakistan). 2011. Pakistan: Framework for economic growth. Planning Commission, Islamabad.
- GoP (Government of Pakistan). 2012. Census of Agriculture. Pakistan Bureau of Statistics, Islamabad.
- Grigg, D.B. 1980. Population growth and agrarian change: An historical perspective. CUP Archive.
- Gulati, A. 2001. The future of agriculture in South Asia: Whither the small farms? Proceedings of the international conference on sustainable food security for all by 2020, German Technical.
- Heston, A. and D. Kumar. 1983. The persistence of land fragmentation in peasant agriculture: An analysis of South Asian cases. *Explor. Econ. Hist.* 20(2): 199-220. [https://doi.org/10.1016/0014-4983\(83\)90022-0](https://doi.org/10.1016/0014-4983(83)90022-0)
- Huang, C.J. and F.S. Bagi. 1984. Technical efficiency on individual farms in northwest India. *South. Econ. J.* 108-115. <https://doi.org/10.2307/1058325>
- Idowu, F.O. and J.O. Oladebo. 1999. The effects of scattered farm plots on agricultural production in the Guinea Savannah zone of Oyo state. *J. Rural Econ. Dev.* Vol. 13.
- Ilbery, B.W. 1984. Farm fragmentation in the Vale of Evesham. *Area*. 159-165.
- Jabarin, A.S. and F.M. Epplin. 1994. Impacts of land fragmentation on the cost of producing wheat in the rain-fed region of northern Jordan. *Agric. Econ.* 11(2): 191-196. [https://doi.org/10.1016/0169-5150\(94\)00027-1](https://doi.org/10.1016/0169-5150(94)00027-1)
- Jha, R. and M.J. Rhodes. 1999. Some imperatives of the green revolution: Technical efficiency and ownership of inputs in Indian agriculture. *Agric. Res. Econ. Rev.* 28: 57-64. <https://doi.org/10.1017/S1068280500000976>
- Kalirajan, K.P. and J.C. Flinn. 1983. The Measurement of Farm Specific Technical Efficiency. *Pak. J. Appl. Econ.* 2(1): 167-80.
- Kawasaki, K. 2010. The costs and benefits of land fragmentation of rice farms in Japan. *Aust. J. Agric. Res. Econ.* 54(4): 509-526.
- Khan, M.H. 1999. Agricultural development and the changes in land revenue and land tenure systems in Pakistan. In: (ed. S.R. Khan) *Fifty Years of Pakistan's Economy: Traditional Topics and Contemporary Concerns*. Oxford University Press.
- Khan, F.K. 2005. *A geography of Pakistan: Environment, people and economy*. Oxford University Press, Karachi.
- King, R. and S. Burton. 1982. Land fragmentation: Notes on a fundamental rural spatial problem. *Prog. Human Geogr.* 6(4): 475-494. <https://doi.org/10.1177/03091325820060040>
- King, R. 1977. *Land Reform: A World Survey*. West View Press, Boulder.
- Kumbhakar, S.C. and A. Bhattacharyya, 1992. Price

- Distortions and Resource-use Inefficiency in Indian Agriculture: A restricted profit function approach, *Rev. Econ. Stat.* 74: 231–9. <https://doi.org/10.2307/2109654>
- Liu, S., M. Carter and Y. Yao. 1996. Dimensions and diversity of property rights in rural China: Dilemmas on the road to further reform. *Agric. App. Econ.* (Staff Paper Series No. 395, revised). Madison, Wisconsin: University of Wisconsin, Madison.
- Manjunatha, A.V., A.R. Anik, S. Speelman and Nuppenau, E.A. 2013. Impact of land fragmentation, farm size, land ownership and crop diversity on profit and efficiency of irrigated farms in India. *Land Use Policy*. 31:397–405.
- Myrdal, G. 1968. *Asian drama: An enquiry into the poverty of nations*. Pantheon, New York.
- M. Ali and M.A. Chaudhry, 1989. Inter-regional farm efficiency in Pakistan's Punjab: *Front. Prod. Funct. Study*.
- McPherson, M.F. 1982. Land fragmentation: A selected literature review. *Development Discussion Papers*, Harvard Institute for International Development, Harvard University. pp. 4–8.
- Nabi, I., N. Hamid and S. Zahid, 1986. *The agrarian economy of Pakistan: Issues and Policies* Karachi. Oxford University Press.
- Niroula, G.S. and G.B. Thapa. 2005. Impacts and causes of land fragmentation and lessons learned from land consolidation in South Asia. *Land Use Policy*. 22(4): 358–372. <https://doi.org/10.1016/j.landusepol.2004.10.001>
- Nguyen, T., E. Cheng and C. Findlay. 1996. Land fragmentation and farm productivity in China in the 1990s. *China Econ. Rev.* 7(2): 169–180.
- Ortiz, S. 1991. *Peasant Economics: Farm Households and Agrarian Development*. Frank Ellis. *Am. Anthropol.* 93(1): 213–214. <https://doi.org/10.1525/aa.1991.93.1.02a00570>
- Parikh, A. and K. Shah. 1994. Measurement of technical efficiency in the north-west frontier Province of Pakistan. *J. Agric. Econ.* 45(1): 132–138. <https://doi.org/10.1111/j.1477-9552.1994.tb00384.x>
- Qur'an in Surah Al-Nisaa (the fourth chapter) verses 11 and 12 and then in verse 176.
- Rahman, S. and M. Rahman. 2009. Impact of land fragmentation and resource ownership on productivity and efficiency: The case of rice producers in Bangladesh. *Land Use Policy*. 26(1): 95–103. <https://doi.org/10.1016/j.landusepol.2008.01.003>
- Samiullah, 2012. Expansion of built up area and its impact on urban agriculture: A case Study of Peshawar-Pakistan. Unpublished Ph.D. thesis submitted to department of Geography, Univ. Peshawar, Pakistan.
- Shaukat, M. 1999. Agricultural land tenure system in Asia and the Pacific. *Proceedings of the international seminar*. Asian Productivity Organ. Tokyo. 262–268.
- Simpson, S. 1987. Land fragmentation in developing countries: The optional choice and policy implications. *Explor. Econ. Hist.* 25: 703–716.
- Tan, S., N. Heerink and F. Qu. 2006. Land fragmentation and its driving forces in China. *Land Use Policy*. 23(3): 272–285. <https://doi.org/10.1016/j.landusepol.2004.12.001>
- Tan, S., N. Heerink, A. Kuyvenhoven and F. Qu. 2010. Impact of land fragmentation on rice producers' technical efficiency in South-East China. *NJAS-Wageningen. J. Life Sci.* 57(2): 117–123.
- Taylor, G.T. and J.S. Shonkwiler, 1986. Alternative stochastic specifications of the Frontier production function in the analysis of agricultural credit programs and technical efficiency. *J. Dev. Econ.* 21: 149–60. [https://doi.org/10.1016/0304-3878\(86\)90044-1](https://doi.org/10.1016/0304-3878(86)90044-1)
- Thiesenhusen, W.C. 1990. Sri Lanka: Strife, Development, and the Environment. *Land Reform: Land Settlements and Cooperatives*, 1 and 2. FAO, Rome. pp. 50–62.
- Tiffen, M., Mortimore, M. and Gichuki, F. 1994. More people, less erosion: Environmental recovery in Kenya. John Wiley and Sons, Chichester.
- Udo, R.K. 1965. Disintegration of new cleared settlement in Eastern Nigeria. *Geogr. Rev.* 55: 53–67. <https://doi.org/10.2307/212855>
- Van-Dijk, T. 2003. Scenarios of Central European land fragmentation. *Land Use Policy*. 20: 149–158. [https://doi.org/10.1016/S0264-8377\(02\)00082-0](https://doi.org/10.1016/S0264-8377(02)00082-0)
- Van Hung, P., T.G. MacAulay and S.P. Marsh. 2007. The economics of land fragmentation in the north of Vietnam. *Aust. J. Agric. Res. Econ.* 51(2): 195–211. <https://doi.org/10.1111/j.1467-8489.2007.00378.x>
- Khan, F.K. 2003. *Geography of Pakistan*. Oxford University Press, Karachi, pp 192.
- Rahman, A., A.N. Khan and Z. Ali. 2012. *Evalu-*

- ation of the Chashma Right Bank Irrigation Project and strategy formulation using the SWOT approach. *J. Irrig. Drain.* 61(4): 464-476. <https://doi.org/10.1002/ird.682>
- Rahman, A., A.N. Khan. 2008. Application of a checklisting technique for the assessment of impacts of the Chashma Right Bank Canal on land use and cropping pattern of D.I.Khan district, Pakistan. *J. Irrig. Drain.* 57(2): 165-173. <https://doi.org/10.1002/ird.349>
- Rahman, A., A.N. Khan. 2012. Ex post impact evaluation of Chashma Right Bank Canal on land use in D. I. Khan District, Pakistan. *J. Arab World Geogr.* 15(2):139-160.
- Rahman, A. 2009. Environmental impacts of Chashma Right Bank Canal on the land use and agricultural resources of D.I.Khan district, Pakistan. *Ind. J. Punjab Geogr.* 5(1): 121-124.
- Samiullah, 2013. Impact of expansion in built-up area on urban agriculture: A case study of Peshawar city district. PhD Thesis submitted to the department of Geography, University of Peshawar, Pakistan.
- Wan, G.H. and E. Cheng. 2001. Effects of land fragmentation and returns to scale in the Chinese farming sector. *Appl. Econ.* 33(2): 183-194.
- World Bank, 1978. *World Development Report 1978*. Oxford University Press, New York.
- UNHABITAT. 2010. *The State of Asian Cities 2010/11*. United Nations Human Settlements Programme (UNHABITAT), Regional Office for Asia and the Pacific ACROS Fukuoka Building, Japan.