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# ANALYSIS OF THE DETERMINANTS OF AGRICULTURAL LAND CONVERSION (ALC) INTO HOUSING COLONIES IN BAHAWALPUR CITY, PAKISTAN

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Agricultural land conversion (ALC) is a trend of converting arable land into non-arable uses worldwide particularly in housing colonies, industries, road network and others. The main objectives of the current study were to explore the possible determinants of ALC into housing colonies and examine the socio-economic characteristics of the people to search out a connection with ALC in Bahawalpur City. Total 24 housing colonies were randomly selected and 72 respondents were chosen for interview through cluster sampling technique. Primary data about socio-economic characteristics of respondents gathered through a semi-structured interview. SPSS 16.0 was used to perform statistical operations for data analysis. Descriptive statistics and Multiple Linear Regression (MLR) techniques were applied for recognizing the statistical significance of possible determinants of ALC into housing colonies. Findings of the study suggest that socio-economic characteristics of respondents greatly affect ALC in Bahawalpur City viz. income per month, major profession, availability of conveyance, provision of housing facilities. Empirical results of regression analysis were further supported the survey results as about 81% ALC into housing colonies was modeled and forecasted by the independent variables viz. people income, profession, availability of conveyance, provision of housing facilities that were also statistically significant by coefficients. Hence, variety of socio-economic determinants was responsible for the conversion of pure arable land into housing colonies.

**Keywords:** Agricultural land conversion, housing colonies, socio-economic characteristics, urban expansion, urban sprawl

## INTRODUCTION

Human population growth and sequent development in industrial, commercial and residential sectors put a huge strain on limited natural resources crucial for sustenance of life like agricultural land, pivotal for the supply of food commodities and food security to rapidly growing human word population. Agricultural land conversion (ALC) is a phenomenon associated with the loss of arable land into non-arable uses worldwide particularly in housing colonies, industries, road networks etc. ALC is one of the burning issues of global concern that has been neglected for a long period of time especially in many African and Asian developing countries like Pakistan, India, Bangladesh, Indonesia, Philippines, China, Egypt, Niger, South Africa (Mohsin, 2014). Moreover, ALC is more intensified in developing countries (Azadi *et al.,* 2011). Perhaps, sprawling housing colonies due to urban expansion of cities are the most dangerous threat for fringing arable land. Thompson Jr. (2001) concluded that arable land nearest to cities and suburbs possibly endangered by urban sprawl. On the same lines Irham (2010) also found that one of the impacts of urban sprawl is conversion of arable land to other uses such as housing, industry, roads, public and private offices and offices. Among countries having a prominent share of cultivated land, Pakistan has ranked on 40 among more than 200 countries holding 24.44% out of its total land area under cultivation (Nation Master, 2005). In 2014-15, about 20.9% of the country's GDP and livelihood of 43.5% population living in rural areas directly or indirectly dependent on agriculture sector (Govt. of Pakistan, 2014). The determinants of arable land conversion may vary area to area but some more common determinants have been prevailed almost throughout of the world like urbanization, industrialization, commercial expansion, residential developments and others. Mohsin *et al.* (2015) found that residents socio-economic characteristics and physical conditions of housing colonies highly accelerate the ALC. Massive increase in population and development are also the most powerful factors in Pakistan that engulfing prime arable land (Din and Samiullah, 2005). Migration from rural to urban areas for seeking job, education and health facilities is one of the major reasons of arable land conversion in the form of housing colonies (Ghaffar, 2006). Another study conducted in selected villages of Peshawar and Nowshera also concluded that unplanned urbanization in the form of housing colonies (30.95%) highly reduced agricultural land and productivity (Javed *et al.,* 2010). Zaman and Baloch

(2011) also verified that in Lahore City about 283,257 acres of arable land had been converted to urban built-up land in last 40 years where significant proportion were converted to 252 housing colonies. Since Bahawalpur is not a famous commercial or industrial centre therefore the major proportion of urban land is devoted to local residential uses as Ahmed (1995) agreed that housing is the major consuming sector of urban land in Bahawalpur City. In Bahawalpur, approximately 40% land area is under cultivation while 60% land area is still uncultivated (Ali, 1994). Conversion of arable land into other non-arable uses is also growing in Bahawalpur City since last few years as Khan (2000) concluded that total cultivated land area of Bahawalpur City was 1,147.06 acres in 1987 that shrank fastly in 10 years and had been reduced to just 50.15 acres in 1997. Malik (2009) also agreed that due to the rapid urban growth in Bahawalpur about 7% prime arable land has been lost during the period of 1976 to 1996. Yasmeen (2009) also pointed out that the transformation of agricultural land into colonies is an emerging a major threat to local food grain production. According to an estimate about 257 acres of arable land has been lost to these housing colonies in Bahawalpur City during the last ten years. Latest studies conducted by Mohsin *et al.* (2014) and Mohsin *et al.* (2016) also verified that housing colonies are proved chief sign of threat to local agricultural land sustainability. Results cleared that selected 7 colonies converted 256 acres of precious agricultural land during 1988-2008 while 102 colonies converted 1,142 acres of agricultural land during 1950-2011, respectively. Now these housing colonies rapidly taking place into peripheral arable land of the City in all directions. Therefore, the main objectives of the study are, to examine the socio-economic characteristics of the people to search out a connection with ALC and to explore the possible determinants of ALC in the account of housing colonies in Bahawalpur City.

## MATERIALS AND METHODS

***Study area*:** Bahawalpur City is the divisional headquarter and twelfth largest City of Pakistan (Govt. of Pakistan, 2014). It has possessed a very unique place in district regarding to its historic, geographic, physiographic, climatic, demographic and cultural features. It is located between 71°-41´ East longitudes and 29°-20´ North latitudes with a mean sea level of about 384 ft. it is situated on the southern bank of river Sutlej and also part of its plain while on its western margin the famous Cholistan desert located. According to recent figures Bahawalpur had the population of 560,588 and covering an area of 2,372 $km^2$ (Govt. of Punjab, 2012;

**Table 1. Location of sample colonies.**

| Sr. | Name of the colony | Relative location in City | Absolute location |
|---|---|---|---|
| 1 | Marri Allaichi | NE | 29°– 24´, 32´´ N & 71°– 41´, 39´´ E |
| 2 | Muhajir Colony | SE | 29°– 22´, 44´´ N & 71°– 43´, 27´´ E |
| 3 | Goth Noora | NE | 29°– 24´, 32´´ N & 71°– 41´, 40´´ E |
| 4 | Javed Colony | NE | 29° – 24´, 50´´ N & 71°– 40´,32´´ E |
| 5 | Shadab Colony | SE | 29°– 23´, 4´´ N & 71°– 42´, 23´´ E |
| 6 | Cheema Town P. I | NW | 29°– 23´, 37´´ N & 71°– 39´, 8´´ E |
| 7 | Sabzazar Colony | SE | 29°– 23´, 7´´ N & 71°– 42´, 23´´ E |
| 8 | Al-Janat Town | NE | 29°– 24´,24´´ N & 71°– 42´, 14´´ E |
| 9 | Cheema Town P. II | NW | 29°– 23´, 33´´ N & 71°– 39´, 3´´ E |
| 10 | New Shadab Colony | SE | 29°– 23´, 3´´ N & 71°– 42´, 23´´ E |
| 11 | Bahawal Town | SE | 29°– 22´, 8´´ N & 71°– 43´, 49´´ E |
| 12 | Al-Mehboob Gardens | SE | 29°– 22´, 24´´ N & 71°– 44´, 30´´ E |
| 13 | Allama Iqbal Town | NE | 29°– 24´, 19´´ N & 71°– 42´, 6´´ E |
| 14 | Al-Khair Town | NE | 29°– 24´, 19´´ N & 71°– 42´, 10´´ E |
| 15 | Baharia City | SE | 29°– 21´, 44´´ N & 71°– 45´, 9´´ E |
| 16 | Shadman City | NE | 29°– 24´, 24´´ N & 71°– 43´, 35´´ E |
| 17 | Hamza Town | NE | 29°– 24´, 11´´ N & 71°– 42´, 42´´ E |
| 18 | Royal City | NE | 29°– 23´, 18´´ N & 71°– 43´, 17´´ E |
| 19 | Fine City | NE | 29°– 24´, 7´´ N & 71°– 41´, 55´´ E |
| 20 | Shaheer Garden | SE | 29°– 22´, 17´´ N & 71°– 44´, 35´´ E |
| 21 | Qurashi Garden | SE | 29°– 22´, 16´´ N & 71°– 39´, 0´´ E |
| 22 | Doctors Town | NW | 29°– 23´, 31´´ N & 71°– 41´, 40´´ E |
| 23 | Zakariya Town | NE | 29°– 24´, 6´´ N & 71°– 42´, 59´´ E |
| 24 | Diamond City | NE | 29°– 24´,58´´ N & 71°– 43´, 19´´ E |

Source: Field Survey (2011) Note: NE= North East, SE= South East, NW= North West

TMA Bahawalpur City, 2011). In recent years Bahawalpur experienced subtle growth in population, transitioning economy from agro-based to commercial-based, high change in land use with the establishment of housing colonies as found most of the big cities of the country.

***Sample and sampling technique*:** Total 24 housing colonies were randomly selected as sample sites in the result of a detailed field survey in 2011 and 72 respondents (3 respondents from each housing colony) were chosen for interview through cluster sampling technique. Because all of these colonies are nearby to each other, located in different directions of the City mostly on peri-urban areas and indicate the trend and direction of sprawling settlements too. The absolute location of these colonies is also recorded with the help of handheld Global Positioning System (GPS) (Table 1).

***Data collection*:** Primary data about socio-economic characteristics of respondents gathered through a semi-structured interview as a research instrument with face to face meeting to the residents of sampled housing colonies. These respondents were male by sex and having different age groups. Simultaneously, deep field observation of the housing colonies was also made. The semi-structured interview utilized for getting information was consisted total 30 questions including both open ended and close ended.

***Data analysis*:** The collected information has been properly arranged and dealt for analysis. Statistical package for social sciences (SPSS) 16.0 was used to perform statistical operations for data analysis and interpretation. Descriptive statistics (frequencies and percentages) were used to examine the socio-economic characteristics of respondents. While Multiple Linear Regression (MLR) analysis was applied for finding the statistical significance of possible determinants (variables) of ALC into housing colonies in Bahawalpur City.

## RESULTS AND DISCUSSION

***Income per month*:** Income of people is also a key factor to gear up the trend of arable land conversion worldwide. Increase in per capita income is one of the main reasons of encroachment on arable land (Irham and Sudirman, 2009). The findings of the study conducted by Mohsin *et al.* (2015) also proved the income per month as a powerful driver of ALC. Table 2 depicts the average income of respondents in study sites and also shows considerable variations as 8.3% respondents have earned <10,000 PKR per month mostly were the residents of less developed colonies (e.g Goth Noora and Javed colony) while 22.2% respondents of different colonies have monthly income ranges from 20,000-30,000 PKR. These were the middle class people by income level. The leading 40.3% respondents have monthly income varies from 40,000-50,000 PKR mostly the residents of well-developed colonies of Royal City, Fine City, Doctors town and others. Whereas 29.2% respondents of Sabzazar colony, Cheema town phase I and Allama Iqbal town have highest income of >50,000 PKR per month. These results have been demonstrated that about 70% prosperous respondents having handsome monthly income have been purchased costly plots in new modern housing colonies on greater price. Thus it can be inferred that level of income or earning is a key factor in the process of ALC.

***Major profession*:** Majority of the respondents in target colonies were belonged to high income class by financial status except some less developed areas like Goth Noora, Javed colony and Hamza town where the inhabitants were mainly engaged in minor works. Table 2 portrays the respondents' employee groups as 26.3% respondents were Govt. employees engaged mostly in high scale jobs as doctors and engineers. While 23.7% were private employees doing jobs in different NGOs, banks and other big

**Table 2. Socio-economic characteristics of respondents.**

| **Socio-economic characteristics (N=72)** | | | | | |
|---|---|---|---|---|---|
| **Income (per month) PKR** | | **Major profession** | | **Availability of conveyance** | |
| **Income** | **%** | **Profession** | **%** | **Conveyance type** | **%** |
| <10,000 | 8.3 | Govt. emp. | 26.3 | Car | 33.3 |
| 20,000-30,000 | 22.2 | Private emp. | 23.7 | Motor cycle | 57 |
| 40,000-50,000 | 40.3 | Per. business | 43 | Bicycle | 6.9 |
| >50,000 | 29.2 | Labourer | 7 | No conveyance | 2.7 |
| | 100 | | 100 | | 100 |
| **Provision of housing facilities** | | | | **Houses outlook conditions** | |
| **Facility type** | | | **%** | **Conditions** | **%** |
| Basic facilities (electricity, gas, sewerage, road) | | | 45.9 | Luxurious | 23.7 |
| Basic+modern facilities (park, commercial area, outer wall, security, plantations, light poles etc.) | | | 54.1 | High class | 47.2 |
| | | | | Middle class | 19.4 |
| | | | | Low class | 9.7 |
| | | | 100 | | 100 |

Source: Field Survey (2011) Note: Ave. = Average, Emp. = Employee, Per. = Personal

companies and majority of 43% respondents were businessmen engaged in commercial activities, selling and buying goods, shops, hotel industry and farming whereas, remaining 7% respondents were daily wages labourers involved in building construction, peasantry works and daily wages works. These results expressed that majority of the respondents in study sites were involved in high income professions and therefore able to afford and purchased land on high price.

***Availability of conveyance*:** Availability of personal conveyance is a main factor of converting the arable land on far-away places from City core because people have a source to access these sites in comfortable way and less time. Ellis (2013) stated that wide adoption of automobile in developed and developing countries is a major danger which has converted large areas of arable land into relatively low density residential lots around cities and roads. Table 2 demonstrates that 33.3% respondents have possessed car as a main source of conveyance. These were high class rich inhabitants of newly established colonies, while 57% respondents of middle and low income class were used motor cycle as a main conveyance source. Indeed, nowadays, motor cycle is the chief and cheap source of conveyance used frequently throughout the country with less use of fuel. Whereas 6.9% respondents were used bicycle as a conveyance and 2.7% respondents haven't any kind of conveyance source. These respondents were mainly labourers of less developed colonies. These results suggest that availability of conveyance is also become a powerful factor of arable land conversion in Bahawalpur and its vicinities.

***Provision of housing facilities*:** The number of facilities found in colonies also considered an important reason of converting arable land and proliferation of new colonies and towns. These facilities have been divided into basic and basic plus modern facilities to compare their existence in old and newly established colonies. Generally, TMA City is responsible for the provision of basic facilities like electricity, gas, sanitation, sewerage and others but these services could be provided by TMA City only when these colonies and towns should get registered by paying a fix fee of registration on the basis of per Marla land. While modern facilities like road network, plantations, mosque, park/open space, light poles and others have provided by colony planners. Table 2 depicts that, 45.9% respondents of some old colonies have availed just limited basic facilities like electricity, gas, sewerage and fewer link roads. whereas, 54.1% respondents of newly established colonies have provided and enjoyed all basic plus modern facilities like park, commercial area, outer wall, security, plantations, light poles and others. These results elucidate that most of the new colonies established after the year 2000 have furnished all important basic and modern facilities to facilitate and attract people to enjoy life in more comfortable manner whereas the old colonies established before the year 2000 and back mostly were deprived from these facilities. Hence, provision of basic plus modern facilities is also a major factor attracts rich people to purchase plots and build large houses on a high price and accelerate ALC.

***Houses outlook conditions*:** Table 2 also portrays the houses outlook conditions in colonies as 23.7% respondents' houses were big luxurious bungalows that comprised a vast area. These were mainly the residents of Shadman City, Cheema town phase I, Sabzazar colony and Allama Iqbal town. Majority of the respondents (47.2%) have modern type houses elegant in appearance and were found in Allama Iqbal town, Cheema towns phase I and II, Shadab colony, Royal City, New Shadab colony, and Al-Khair town. While 19.4% respondents have middle class houses founded in Al-Janat town, Hamza town and Marri Allaichi whereas, remaining 9.7% respondents of Goth Noora, Javed colony and Muhajir colony have low class type and small houses. Thus, houses outlook condition is an important factor does matter in the occupancy of house area on arable land and inhabitants' financial position.

***Multiple linear regression (MLR) Analysis*:** Multiple Linear Regression (MLR) is most frequently used statistical method to finding the relative significance of factors affecting some thing or predict dependent variable because it has the ability to analyze data in more objective and systematic way (Armstrong, 2012). Regression analysis is only relevant to data sets which correlate too (Lenon and Cleves, 1983). It has been used in various concerned studies of social and life sciences disciplines (Adetayo, 2014; Nzabakenga *et al.*, 2013; Ishtiaque and Ullah, 2013; Ahmed, 2012; Irham and Sudirman, 2009; Ramsey and Corty, 1982). Therefore, to meet the second objective of the study, Multiple Linear Regression (MLR) analysis employed for knowing the statistical significance of possible determinants (variables) of ALC in the form of housing colonies using following equation;

$$Y=\beta_0+\beta_1 d_1+\beta_2 d_2+\beta_3 d_3+\beta_4 d_4+\beta_5 d_5+\beta_6 d_6+\beta_7 d_7+\beta_8 d_8+Ui$$

Where, Y= Agricultural land conversion (ALC) into housing colonies, $d_1$= Income per month (PKR), $d_2$= Major profession, $d_3$= Household size, $d_4$= Price of plot (PKR), $d_5$= Availability of conveyance, $d_6$= Distance from road (km), $d_7$= Provision of housing facilities, $d_8$= Desire for a large house, $\beta_1$ _ $\beta_8$= Parameters, Ui= Error term

In order to find out how the independent variables (income per month, major profession, household size, price of plot, availability of conveyance, distance from road, provision of housing facilities and desire for a large house) determine ALC into housing colonies in Bahawalpur City the regression analysis has been performed and fulfilled to justify the second main objective of the study:

**Table 3. Multiple linear regression (MLR) analysis.**

| Determinants | Coefficients | Standard error | t-value | Significance |
|---|---|---|---|---|
| (Constant) | 4.895 | 1.057 | 0.517 | 0.133 |
| Income per month (PKR) ($d_1$) | 0.941*** | 0.286 | 2.665 | 0.011 |
| Major profession ($d_2$) | 0.604*** | 0.478 | 2.593 | 0.031 |
| Household size ($d_3$) | -0.623 | 0.614 | -0.833 | 0.652 |
| Price of plot (PKR) ($d_4$) | -0.129 | 0.421 | -0.317 | 0.767 |
| Availability of conveyance ($d_5$) | 0.546*** | 0.124 | 1.171 | 0.034 |
| Distance from road ($d_6$) | 0.465* | 0.049 | 1.103 | 0.072 |
| Provision of housing facilities ($d_7$) | 0.324* | 0.120 | 1.231 | 0.068 |
| Desire for large a house ($d_8$) | 0.167* | 0.150 | 0.185 | 0.062 |

***, * Coefficients significant at 99% and 95% confidence interval respectively

Source: Analyzed from surveyed data

$$Y= 4.895+0.941d_1+0.604d_2-0.623d_3-0.129d_4+0.546d_5+0.465d_6+0.324d_7+0.167d_8+Ui$$

$R^2$= 0.815, R= 0.903, Adjusted $R^2$=0.398, F=0.271, Durbin-Watson=2.214

The empirical results of regression analysis reflected mostly expected theoretical postulations (Table 3). The coefficient of multiple determination of 0.815 implies that about 81% of the variation in ALC in Bahawalpur City is captured by the model and verified that 81% ALC into housing colonies was caused by the independent variables. This indicates that model is strong, highly reliable and has forecasting ability. The multiple correlation coefficient of 0.903 also shows strong positive relationship between dependent and independent variables. In addition, adjusted $R^2$ value of 0.398 is also significant though it is not too high. The coefficients on independent variables viz. people income, people profession, availability of conveyance, distance from road, provision of housing facilities and desires for a large house have conformed to the expected outcome and are statistically significant. The F statistic 0.271 is significant and Durbin-Watson statistic 2.214 reveals a minimal autocorrelation of random variables. In contrast, two coefficients on independent variables i.e. household size and price of plot (PKR) were inconsistent with the theoretical expectations and have t-value that is not significant. This is possibly due to the un-reliability of the data of these variables. However, the fact that this equation does not fit well for the targeted area needs for caution in the interpretation of the result stated but the model apparently cannot be fully discarded.

***Conclusion*:** The findings of the study suggests that ALC in account of housing colonies is a trend that is still going on and threaten local arable land sustainability. In this regard, socio-economic characteristics of respondents greatly affect ALC in Bahawalpur City. Amongst, per month income, people profession, availability of conveyance, provision of facilities were contributed greatly. Particularly, income level and conveyance (i.e. Motor cycle) were played a significant role in ALC. Empirical results of regression analysis were further supported the survey results as about 81% ALC into housing colonies was modeled and forecasted by the independent variables viz. people income, people profession, availability of conveyance and provision of housing facilities were also statistically significant by coefficients. While, only two independent variables (household size and price of plot) were not proved statistically significant. Hence, variety of socio-economic determinants was responsible for the conversion of pure arable land into housing colonies in Bahawalpur City.

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