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Socio Economic Effects of Developed and Under Developing Mega Housing Projects on Rural Area: A Case Study of Rawalpindi and Islamabad

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ABSTRACT

Housing is a major concern in all over the world and show the quality of life and living standards. Housing in presence of proper infrastructure can provide a wide range of positive impacts like improved health, safety from hazard, security, privacy and social well-being. Aims of the study is to determine the impacts of developed and under developing mega housing projects on rural areas. The geographic location of the mega housing projects is influencing nearby rural areas directly and indirectly. Indicator based approach is used to understand these impacts of both developed and under developing housing schemes on surrounding rural areas. Eight indicators were shortlisted and recorded on a 5-point Likert scale. The acquired data of 251 respondents, 135 from developed housing schemes and 116 from under developing housing schemes were analyzed statistically using Pearson Chi-Square and weighted mean method. Result shows that out of eight indicators 5 indicators (Education, Health, Market, Social and Economy) have a significant difference between developed and under developing housing schemes impacts on rural areas. Three out of eight indicators (Roads and connectivity, Environment and Gender) have same impact of developed and under developing on rural areas. The study indicates that Education, Health, Market, Social and Economy are affecting the rural areas in a different way than Roads and connectivity, Environment and Gender indicator.

| **Keywords:** | Environment, Gender Indicator, Housing, Roads, Rural Areas, Socioeconomic |

Introduction

Housing is a major concern not only in Pakistan but all over the world because it is the basic need of human being. Housing is not the basic need, it shows the quality of life and living standard. If housing considered in an investment way it promotes economic activities and employment opportunities(Agnew & Lyons, 2018). The relation between housing and poverty is very strong. Hosing in presence of proper infrastructure can provide a wide range of positive impacts like improved health, safety from hazard, security, privacy and social well-being(Cassatt et al., 1975).Preferring individual housing on low-cost land is encouraging these Mega housing projects on peri urban land. The main purpose is to study the impacts of mega housing projects on rural areas. Mega housing projects are carried out with the aim of providing adequate housing facilities. Most of these projects are located on the city countryside or at urban fringe in the presence of main road or highway(Katsoulakos et al., 2016). The geographic location of the mega housing projects is influencing nearby

rural areas directly and indirectly. The direct cost of such projects is paid by the concerned cities; however, the rural areas are also bearing the indirect cost in the form of agricultural land sacrifice. This type of isolated development needs higher public and private capital and operating cost than compact development(Poon & Brownlow, 2016).

Policy intervention require to turn its negative impacts into positive. On the other hand, due to improvement of economy, people prefer to make their living better in order to move to new sites i.e. isolated housing. As these projects are geographically separated, therefore, more requirements arose like, schools, colleges, shopping centers, medical facilities, new roads, sewers and water supply, telecommunication, transportation, Utilities etc. and having a huge impact on surrounding areas. (Bover & Jimeno, 2007)

Literature Review

The development of mega housing projects on the outskirts of cities provides housing but the developers don't know how the rural areas are being affected(Meyers et al., 2013). These projects have directly impacted on cropping pattern, livestock farming, land use pattern, food and commodity prices, land prices, transportation facilities, and impacts on employment, production. and yield of crops, medical and educational facilities, rural urban migration, impact on arable land, water resources, health quality, living standards and impact on income(Ali et al., 2019)People of rural areas shifting their occupation from practicing agriculture to non-agricultural activities which results in decreasing in agricultural activities(Dudzińska et al., 2018).

It becomes a main reason of decreasing in some high value or specialty crops. This development leads to problems like feeding the population and environmental protection and also results in loss of deforesting and disappearance of These projects also may cause pollution from waste generated by households. Social disparities can be increased due to these projects(G. Li & Li, 2019). Labor and other people who comes daily in these areas for work are started to living nearby these areas which is a big factor of slums creation. As these projects mostly in Peri-urban areas it affects local climate. Land use Land cover changes are direct and unavoidable consequences of these projects(G. Li & Li, 2019).For sustainable planning and development monitoring of Land use, Land cover changes is necessary. Commercial activities around rural areas helps to get working opportunities (Wilson & Chakraborty, 2013).Infrastructure construction, social connection, leisure habits getting benefit from public infrastructure increase their positive impacts (J. Li et al., 2018).

Socio economic impacts of Mega Housing Projects on Rural areas

Segregation and metropolitan fragmentation has been increased by these projects with the provision of housing stock and public infrastructure at local level. (Abdullah, 2012) It is important to consider social exclusion among these urban pathologies. Housing projects caused residential segregation and low social interaction(Shi & Cao, 2020b).Housing schemes considered to be in the right place to urban space production cycle by public policies and private strategies not as a source of increasing segregation in the developmental process (Stamm et al., 1976). The new housing development causes tension on existing infrastructure and services reduce environmental amenity and become a reason to decreasing the land prices around it . New housing projects on peri urban areas not only decrease property values but also reduce individual welfare, amenity and increase pressure on local infrastructure services, create pollution, congestion and reduce road safety. If these projects are ill planned and ill designed it may fail to foster community. These include economic, social and environmental cost which give push to the cause of reducing the property value around it (G. Li et al., 2020).

Environmental impacts of the mushroom growth of Mega housing projects on rural areas

Development of mega housing projects required big chunks of land and mostly this land is available at urban fringe and having many trees Greenland, open space and agricultural land which have to be removed for the construction (Abdullah, 2012) .For the development of these projects so much material required and the best-known material for construction of roads and buildings is river gravel because the frail fragments and frail of that gravel and sand removed by the flow of water and remaining are the stable ones (Shi & Cao, 2020a).Over extraction of gravel from river beds or ridges has many harms like annihilating the river fishes and their breeding, movement and growth of the river path, changing in the river's depth (increased or decreased), increasing in the width of the channel, increasing banks erosion and canal bed disturbance, effecting the number of aquatics and destroying the meanders(Wilson & Chakraborty, 2013)

. Carbon dioxide is the most anthropogenic greenhouse gas due to its high radiative effects and relative atmospheric. Carbon dioxide emission due to increasing land use change and Fossil fuels consumption are major reasons. Water is the basic need. And available water resources in the rural areas or at urban fridge directed towards these developments which is stressing the rural areas. Increasing the consumption of water by these areas' farmers are relying on waste water for irrigation mostly, which poses high range of health risks(Wilson & Chakraborty, 2013).

Mega housing project's development causing the fragmentation of large areas of natural habitats by constructing roads, houses and many structures which is causing the losses of native species including insects, birds, animals and plants. Many local and sensitive species are becoming locally extinct because many sensitive species need large and contiguous habitat to maintain the stable populations. (Ali et al., 2019).Development of mega housing project causing the loss of best agricultural land, farmland, forest, open spaces, trees and the habitat is the most important issue of these mega housing projects from a land use perspective. Many fertile areas were occupied by these housing projects so farmers have to use the less productive land to. The cultivation in less productive area increases the use of water and fertilizer. Increase in water usage it can cause water crisis and use of fertilizer effects the crops and environment too.

Material and Methods

Study Area

The strategy was used in this study is based upon classification strategy. Four largest housing schemes DHA Islamabad, Bahira town Islamabad, Capital Smart City and Mumtaz city were selected for this study and three villages around each housing society was selected. The location of selected villages is shown in Fig.1.

Figure 1 Villages around study area

Socio-Economic Impact indicator index

After literature review and interviews of experts few indicators education, health, market roads and connectivity, social impacts, impact on economy, environmental impacts and impacts on gender were selected. Mean values of these indicators was calculated by using arithmetic mean formula. Pearson chi square and paired sample t-test were used to explain the dissimilarities in perception based on developed and under developing housing schemes.

$$mean(\bar{x}) = \frac{1}{n}\sum_{i=1}^{n} F_i$$

Data collection and data analysis

Sample size was calculated as 399 by using solvin's formula. Data was collected during the first wave of COVID-19, March-May 2020 by survey questionnaire form. The questionnaire was divided into three parts, Socio-economic, selected housing scheme and villages detail and impacts indicators. Likert scale was used on impact indicators from "very high" to "very low". Out of 350 questionnaire 251 were correct and completed and these 251 was selected for analysis. Cronbach's alpha was 0.875 which shows high consistency of data.

Results and Discussion

To know the impacts of mega housing projects on rural areas an indicator-based approach has been used. Few indicators were selected after interviewing the experts and from literature review (Long et al., 2020). impacts data was collected from the selected area by using Likert scale which is unidimensional scale used to collect respondent's opinion. When respondents were responding about the impacts on Likert scale, they were showing their level of using facilities of housing schemes from very high to very low. In this study the Likert scale is indicating

Very high as 1, High as 2, Neutral as 3, Low as 4 and very low will be considering as 5.

135 out of total 251 total respondents were considered from developed housing scheme and 116 were from the surrounding areas of under developing housing scheme. Pearson's Chi- square test was used for the development status-based analysis on each indicator showing in the following table.

Table 1
Chi-Square test

CODE	INDICATORS	DEVELOPED $\bar{x}$	UNDER-DEVELOPING $\bar{x}$	X^2	p-value
		EDUCATION			
ED-01	Utilization of the educational facilities	3.59	2.93	51.65	.000
ED-02	Time to travel to avail the educational facility	3.45	2.96	54.68	.000
ED-03	Educational facilities helpful for village	3.60	3.09	45.08	.000
ED-04	Increase in educational facilities	3.67	3.11	60.10	.000
ED-05	uplift the education level	3.65	3.00	64.33	.000
ED-06	Availability of technical institute	3.98	3.03	121.66	.000
ED-07	Affordability of housing scheme's schools	4.11	3.10	107.19	.000
ED-08	Transportation provision	4.00	3.09	100.52	.000
ED-09	Village's teacher provides home tuitions in nearby housing schemes	3.94	3.09	105.94	.000
ED-10	Home tutors from housing schemes to village	3.97	3.07	103.73	.000
ED-11	Increase in confidence level of child	3.87	3.17	78.89	.000
		HEALTH			
H-01	Utilization of health facilities	3.92	3.12	76.04	.000
H-02	Level of benefits by these housing facilities	3.54	2.94	47.15	.000
H-03	Time to travel to avail facilities	3.48	3.08	24.95	.000
H-04	Affordability of health facilities	3.94	3.17	100.52	.000
H-05	Satisfaction level	2.98	3.00	5.01	.167
H-06	Growth of health facilities in village	3.94	3.17	117.87	.000

H-07	Preference of housing scheme health facility over village health facility	3.37	3.06	18.05	.000
H-08	Private clinic in village	3.96	3.03	140.48	.000
H-09	In emergency use of housing scheme's health facilities	3.29	3.00	37.28	.000
H-10	Avail the ambulance service	4.06	3.01	224.44	.000
H-11	Level of help from ambulance service	4.04	3.00	152.58	.000
MARKET					
M-01	Utilization of market facilities	2.94	3.01	9.88	0.020
M-02	Time to travel to avail the market facility	3.18	2.99	25.43	.000
M-03	Level of benefits by these housing facilities	2.82	3.08	63.22	.000
M-04	Affordability of markets	3.53	3.07	47.66	.000
M-05	Increase in food supply from village	3.23	3.12	6.53	0.088
M-06	Demand of Raw material	2.94	3.06	5.23	0.073
M-07	Purchase raw material from housing scheme	2.89	2.61	13.46	0.001
M-08	Increase in business	3.52	2.91	25.14	.000
M-09	Price difference	1.01	3.00	251.00	.000
ROADS AND CONNECTIVITY					
R&C -01	Main roads improve the connectivity	2.30	2.95	92.83	.000
R&C -02	Reduction in commuting cost	3.24	3.19	2.58	0.460
R&C -03	Time to access the main road	3.02	3.07	3.66	0.160
R&C -04	condition of village's road	3.00	3.07	10.16	0.006
R&C -05	Trips per day in HS	4.05	4.11	4.12	0.127
R&C -06	Business trips per day in HS	3.37	3.20	15.56	.000
R&C -07	Social trips per day in HS	4.19	3.21	133.00	.000
R&C -08	Leading roads from village to HS	2.17	3.00	140.12	.000
R&C -09	Any Bus or transport from village to HS	4.22	3.92	19.47	.000
R&C -10	Improvement in village's road infrastructure	3.27	3.17	5.16	0.160
SOCIAL					
S-01	Social interaction	4.09	3.00	235.44	.000
S-02	Segregation of residential area	2.91	3.01	63.36	.000
S-03	Level of satisfaction being near to HS	2.85	3.00	20.72	.000
S-04	Level of satisfaction of living environment	3.20	2.94	12.41	0.006
S-05	Disturbance in village's privacy	3.21	3.01	14.26	0.003

S-06	Labors start to living in village	3.08	3.10	7.72	0.102
S-07	Slum settlements after the development of HS	3.29	3.20	5.76	0.124
S-08	Safety issue to village	3.82	3.72	6.14	0.046
S-09	Crime rate	3.80	3.87	12.96	0.005
S-10	Improvement in life style	3.20	3.29	2.46	0.117
ECONOMY					
EC-01	HS provides employment opportunities	2.91	2.90	5.98	0.050
EC-02	Increase in household expenditure	3.11	2.93	13.81	0.003
EC-03	Provision of labor from village to HS	3.02	3.12	14.40	0.001
EC-04	Increase in land price	2.13	2.91	93.72	.000
EC-05	Increase in investment opportunities	3.02	2.88	5.40	0.067
EC-06	Increase in local employment	2.87	3.09	9.67	0.008
EC-07	Increase in village's productivity	2.91	2.89	0.37	0.828
EC-08	Increase in business opportunities	2.92	3.03	7.68	0.021
ENVIRONMENTAL					
EN-01	Consumes villages land	3.24	3.21	1.15	0.764
EN-02	Cutting of fruit trees	3.89	3.71	12.86	0.005
EN-03	Loss of any species or natural habitat	3.67	3.68	1.04	0.592
EN-04	Consumption of agricultural land	2.95	3.23	13.87	0.003
EN-05	Increase in air pollution	3.25	3.40	9.30	0.026
EN-06	Enough water resources	2.77	2.96	16.52	0.001
GENDER					
G-01	Women headed household	4.45	4.38	8.90	0.031
G-02	Found employment in HS	3.68	3.49	17.51	0.001
G-03	Runs small business	4.11	3.94	8.89	0.012
G-05	Girls started to go school and college of HS	3.34	3.37	0.89	0.827
G-06	Provision of domestic service to HS	3.08	3.21	14.85	0.002
G-07	Women started to get technical education	4.15	4.21	2.67	0.263
G-08	Women leaves agricultural activities	4.54	4.18	2.41	0.491
G-09	Cultural change	4.34	3.08	1.25	0.534
G-10	Availability of gynecological facilities in village	3.74	5.4	6.08	0.048
G-11	Avail gynecological facilities of HS	1.40	2.00	251.0	.000

Education

People of rural areas have different perception regarding the educational facility of nearby housing scheme. The only factor in education category having significant difference in development-based perception of rural resident for availability of technical institute (X^2 = 121.66, p-value 0.000). with higher difference between develop and under developed. Remaining results of Utilization of the educational facilities, Time to travel to avail the educational facility, educational facilities helpful for village, increase in educational facilities, uplift the education level, Affordability of housing scheme's schools, Transportation provision, Village's teacher provides home tuitions in nearby housing schemes, home tutors from housing schemes to village and increase in confidence level of child shows that all indicators have significant difference between developed and under developed areas.

Health

Health indicator is very important variable to direct measure the community's health and also the reflection of the health facilities (Tansel & Gungor, 2013).These indicators are used to measure health of community, to compare the health between different communities, to identify the healthiness requirements and allocating rank to them, assessment of health amenities, planning and apportionment of well-being possessions and measure of health success (Choi et al., 2019). The significant factor highlighted in the results are avail of ambulance service and satisfaction level of health facilities. There is a significant difference between developed and under developing regarding the availing of ambulance service of the nearby housing scheme (X^2 = 222.44, p-value 0.000), whereas the satisfaction level between developed and under developing is same (X^2 = 5.01, p-value 0.167) it shows that there is no significant difference.

Market

Market indicators are quantitative in nature and also used to attempt forecast market moves, Demand and Supply. These indicators are subset of technical indicators and aid to investor's investment and business decision. Significant factor in market indicator with a huge significant difference between developed and under developing is level of benefits by these market facilities (X^2 = 63.22, p-value 0.000). However, the factors increase in food supply from village and demand of raw material have no significant difference among developed and under developing. Increase in food supply from village (X^2 = 6.53, p-value 0.088) and demand of raw material (X^2 = 5.23, p-value 0.073). Remaining factors Utilization of market facility, time to travel to avail market facilities, Market affordability, purchase of raw material from nearby housing scheme, increase in business and price difference have also significant difference among both categories.

Roads and Connectivity

Roads had varying impacts on their surrounding areas. Some of these communities clearly encourage economic growth . But some roads also have mix impacts both negative and positive. In this study it was observed that many major roads from Housing Schemes to villages also have access to the regional markets and also generates development pressure. Results show that the higher significant difference is between leading roads from villages to housing schemes between developed and under developing (X^2 = 140.12, p-value 0.000). Remaining factors reduction in commuting cost (X^2 = 2.58, p-value 0.460), time to access the main road (X^2 = 3.66, p-value 0.160), trips per day in HS (X^2 = 4.12, p-value 0.127) and improvement in village's road infrastructure (X^2 = 5.16, p-value 0.160) have no significant difference between developed ad under developing, these have the same impacts.

Social

Social indicators are used to evaluate the social objectives of some community or organization(Pramono, 2018). The only factor of social category having significant difference is social interaction between housing schemes and rural areas is (X^2 = 235.44, p-value 0.000). but three indicators labor starts to living in the village (X^2 = 7.72, p-value 0.102), slums settlements after the development of housing scheme (X^2 = 5.72, p-value 0.124) and improvement in life style (X^2 = 2.46, p-value 0.117) have no significant difference. These impacts are same on both categories.

Economy

Economic impacts are often used to examine the economic condition before and after some development or to examine the consequences of economic development projects and efforts like business opening and closure, site selection projects and real estate developments (Ismail & Mahyideen, 2015).

New developments have positive impact on economy. High economic growth leads to higher tax revenue. The economic indicator increases in land price have a clear significant difference (X^2 = 93.72, p-value 0.000) it means increase in land price is different between developed and under developing. Increase in investment opportunity (X^2 = 5.40, p-value 0.067), increase in villages productivity (X^2 = 0.37, p-value 0.828) have no significant difference. These indicators have same impacts on both categories. Remaining factors like Housing scheme provides employment opportunities, increase in household expenditure, Provision of labor from village to HS, increase in local employment, increase in business opportunities have a (p-value < 0.05) shows the significant difference between developed and under developing.

Environmental

New development clearly is not a neutral procedure(Isaac & Thiemer, 1975). It has so many impacts but environmental impacts include increase consumption of non-renewable resources, level of pollution, loss of environmental habitat, cutting of fruit trees, consumption of green land and water resources (Isaac & Thiemer, 1975). Data analysis shows water resources (X^2 = 16.52, p-value 0.001) have a significant difference between both selected variables. On the other hand, consumption of village's land (X^2 = 1.15, p-value 0.764), loss of any species and natural habitat (X^2 = 1.04, p-value 0.592) have no difference between the variables of developed and under developing. Remaining Cutting of trees, consumption of agricultural land, increase in air pollution having p value a (p-value < 0.05) shows that factors have significant difference.

Gender

Indicator gender is very important and have a huge importance in any development (Dogan & Stupar, 2017).Gender equality in education, business, employment, have direct impact on the economy Sustainable development relies on the elimination of gender differences (Teo et al., 2019).

in this study results shows that availing of gynecology facility of nearby housing scheme has a huge significant difference with (X^2 = 251.0, p-value 0.000). Other factors like girl started to going to schools of nearby housing schemes (X^2 = 0.89, p-value 0.827), Women started to get technical education (X^2 = 2.67, p-value 0.263), Women leaves agricultural activities (X^2 = 2.41, p-value 0.491) and cultural change (X^2 = 1.25, p-value 0.534) have a huge significant difference. Remaining factors women headed household, found employment in housing scheme, Runs Small business, provision of domestic services to housing scheme, Availability of gynecology having p value a (p-value < 0.05) shows that factors have significant difference between developed and under developing.

Overall Impact Assessment

The relationship in rural and urban is changing not only in Pakistan but all over the world. Two types of urban development trends are now happening, one is expansion of urban areas and second is new development on peri-urban areas. Urban Expansion is not a threat to the rural areas because the expansion has not much impacts on rural areas. But new development has powerful impact on rural areas.

Table 2
Overall Impact Assessment of Rural-Urban expansion

Sr.no	Indicators	Means	Std. Deviation	p-value
1	Education	3.5045	.51868	0.000
2	Health	3.3959	.36642	0.000
3	Market	2.9482	.24760	0.000
4	Roads and connectivity	3.2912	.17344	0.436
5	Social	3.2960	.19592	0.000
6	Economical	2.9163	.18667	0.001
7	Environment	3.3466	.20191	0.255
8	Gender	3.8619	.52060	0.100

Indicators selected to know the impacts of mega housing project on rural areas gave some surprising results. Results of education indicators shows that the education facility of nearby housing scheme is beneficial for some of the rural residents who can afford it. Affordability of education is low. But few factors like some young educated people started to providing home tuition in nearby housing scheme and earning well. Education indicator with mean value of 3.504 and standard deviation 0.518. p-value 0.000 shows that this indicator has significant difference.

Some health facilities Avicenna medical Centre, Foundation university college of dentistry & hospital, Integrative medical center, Hijama medication cupping therapy, Islamabad Diagnostic Centre, Basheeran Umar eye Hospital, Yusra General Hospital, DHA clinic and Dental Care Center, dental art clinic, Islamabad diagnostic center integrated medical center, Soch psychological clinic, Begum Akhtar Rakshana memorial welfare trust and Bahira international hospital are available in developed housing schemes. Results Shows that the affordability of these medical facilities is not much good. People of surrounding areas only avail these facilities in case of emergency and to consult some specialist and the satisfaction level of those who avail these health facilities is good. Growth of health facility in surrounding areas due to the presence of existing health facilities have no significant impact. Provision of the ambulance service to the surrounding areas is less and people usually prefer some other ambulance services like 1122 and Eidhi ambulance service.

Green fresh, DHA avenue mall, Commercial Plaza, Satray studio, River Garden cash and carry, Chenone store DHA II, Al Siraj market, Imtiaz super market, Walayat market, Defence mall, Zamzama general, Zemheighhts shopping mall, 7 eleven cash and carry, Life plus paper store, Ascon business centre, Continental tower, Liberty tower, Skyward tower, The pearl mall & residency are some market facilities available in selected housing schemes. There are many other shops and markets available but mostly people of surrounding areas prefer local market. There are reasons of preferring local market first is affordability, second the transportation and third is high price difference. Business opportunities is somehow increasing in surrounding areas of housing schemes.

Some major roads GT road, Main link road, Morgah dha, Link Road Bahria expy, Express Highway, Japan road, Islamabad expressway, Faisal Avenue, Kahuta road, Express way, Bahria expy, Usman Ghani ave, Umer avenue, Rawalpindi jand Mianwali road, M1, Srinagar Highway, Link Road, Chakri road, Chahan road and Lahore Islamabad motorway providing accessibility and connectivity to the selected housing societies. These main roads

improve connectivity in a positive manner. Business and social trip from surrounding areas to housing schemes are not very frequent. The factor of condition od village's road is normal but provision of public transport from rural areas to housing schemes is very low that's why trips frequency in housing schemes is also low. Improvement of village's road infrastructure due to the presence of housing scheme is neutral.

Significant impact was shown in the results on increase in land price due to the presence of housing schemes. Investment opportunities, local employment, village's productivity and business opportunities are increased and have positive impact on rural areas due to the nearby housing schemes. Environmentally there is a negative impact on water resources and increase of air and noise pollution. Clear impact of housing scheme on gender is provision of domestic service from rural areas to the housing scheme. Many women started to providing domestic services in the nearby housing schemes. Remaining factors are not significantly impacted by the housing schemes. Overall Roads and connectivity, Environment and Gender with P-value 0.436,0.255 and 0.100 respectively have no significant difference between developed and under developing.

Conclusion

Rural areas and new developments play a crucial role in accelerating country's development through flow of services, facilities, people, information, technology from and to new development and rural areas. This interdependency is very important to their respective development of economy and social factors. New developments are unthinkable if the rural areas are socially, physically and environmentally isolated places. Theoretically, this research will provide the baseline for indicator-based approach for future research on real estate and its impacts. Education, Health, Market, Social and environment indicator of developed and under developing housing schemes having (p-value < 0.05) shows that factors have significant difference, it means both have different impact on surrounding rural areas. The impact of roads and connectivity, Environment and gender (p-value > 0.05) shows that factors have no significant difference between developed and under developing housing schemes it means that these three indicators of developed and under developing housing areas have same impacts on rural areas. Furthermore, application of advance statistical analysis techniques can provide a more precise depiction of impacts of these indicators on rural areas.

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