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Identifying The Land-Use And Land-Cover Change Caused By Migration Patterns In Gated Housing Communities: A Case Study Of Bahria Town Lahore

Sahar Zia[1], Khadija Waheed[2], Aqsa Shabbir[3]*, Aysha Hanif[1], Naveed Iqbal[4], Huma Tauseef[5], Sajjad Rabbani[6], Amina Mauzzum[7]

Abstract

Global mobility is a growing ongoing phenomenon driven by economic, social, political, and environmental factors. Migration of city dwellers to suburbs is a commonly observed phenomenon consequently changing LULC patterns. This study evaluates the changes in LULC of Bahria Town Lahore from 2000 to 2016 due to migration. Characteristics of migrants are investigated to predict the prospects of Bahria Town Lahore. Image Analysis was performed on Landsat Images to detect LULC change. Descriptive statistics was used to perform an analysis of collected data. The results revealed multifaceted migration flows in Bahria Town Lahore. To search for better amenities of life and a safe environment is mainly responsible for migration. The research showed that Bahria Town Lahore mainly encompasses the upper-middle and higher classes. The results found that 37% area was converted into a built-up area from 2000 to 2016. This research helps in evaluating the prospects of Bahria Town Lahore.

Keywords: *Migration, Suburbanization, Land use, Land cover, Gated housing community*.

1. Introduction:

Human mobility is on an increase enabling people to migrate to the desired areas either inside or outside the country. Migration takes place when an individual chose to move rather than to stay and where the difficulties of moving seem to be more than the expected rewards (Parnwell, 1974). Migration is a permanent or semi-permanent change which is influenced by various factors associated with the area of origin, area of destination, intervening obstacles between place of origin and destination and personal factors (Lee, 1966).

Migration is as old as human history. Human migration has taken place at all times and in a great variety of circumstances. Rural-urban migration flow is increasing in volume and complexity (Selier, 1988). In urban areas educational and employment facilities attract a large number of male populations to migrate from rural to urban localities (Khan, 1966).

Pakistan is one of the Asian countries, experienced large scale rural-urban migration but now a days migration from less developed areas to mega cities is more prevalent in Pakistan. The

[1] Assistant Professor, Department of Geography, Lahore College for Women University Lahore.
[2] Lecturer, Department of Geography, Government Islamia Graduate College Allama Iqbal Town Lahore.
[3]* Associate Professor, Department of Electrical Engineering, Lahore College for Women University, Lahore.
[4] Assistant Professor, Department of Mass Communication, Lahore College for Women University, Lahore.
[5] Associate Professor, Department of Computer Science, Lahore College for Women University, Lahore.
[6] Assistant Professor, Department of Electrical Engineering, Lahore College for Women University, Lahore.
[7] Professor, Department of Psychology, Lahore College for Women University, Lahore.
Corresponding Author: Aqsa Shabbir ORCID # 0000-0002-3798-1223

ongoing migration from less developed areas to mega cities is affecting the sustainability of cities by making them overpopulated and overcrowded (Rizvi, 2011). It is widely recognized that cities nowadays are confronted with challenges like congestion and suburbanization. The migration of city dweller to suburbs is a commonly observed phenomenon which in turn changing the LULC pattern in an area. Suburban migration is motivated by an increase in incomes and the desire to live further away from congested cities (Agnieszka & Adam, 2012). The expansion of cities has resulted in the segmentation of different social groups and the worst aspect of this segmentation is apparent in the development of walled or gated housing communities, appearing on the outskirts of the city. The global spread of the gated housing communities has been triggered by the experience of the United States of America (Environmental Planning A, 2002). The first modern development of guarded housing community was found in Los Angeles in 1915 (The Guardian, 2003).

The concept of gated communities continues to sweep across the globe. In the previous few decades a drastic expansion has been observed in Lahore which is the second largest city of Pakistan. This expansion has resulted in the development of gated housing communities on the outskirts of the cities. Due to land unavailability in other directions, Lahore city has expanded towards the south and south-west where we find most of the private gated housing societies or communities (Latif, 2016). Lahore has become a part of gated housing societies mainly for the people who are returning back to Pakistan from abroad and the people who are living in congested areas of the city in search of better physical environment, privacy and security (Rahmaan & Anis, 2009).

1.1. Consequences of Migration

People are migrating away from the problems like congestion, overcrowding, over population which they are facing in their origin places. In one hand, people are migrating in order to prosper themselves in economic, social and educational perspective but on the other hand they are changing or affecting the environment in the place of destination. Landscape changes are dynamic over time due to natural processes and societal development (Wood & Handley, 2001; Burgi et al., 2005). These changes in landscape patterns are influenced by a number of driving forces. The land use and land cover changes (LULC) are one of the most important and easily detectable indicators of change in the environment (Gilani et al., 2015). Rapid and uncontrolled population growth, increasing migration rate and economic development has continuously changes LULC patterns (Dutta et al., 2019).

2. Literature Review

Migration is such type of phenomenon that is far from being new and various studies have been conducted on different aspects of human migration at the global and national levels.

Some studies are conducted to examine the socio-economic and demographic characteristics of migrants. The pull and push factors are also investigated which compel them to migrate (Liang, 1989; Siddiqi, 2004; Thet, 2014; Jamil & Mohyuddin, 2015; Singh, 2010). Dora & Kuschminder et al. (2009) have explored the migration patterns and prospects of migration in Afghanistan. They concluded that migration in and from Afghanistan has been motivated by insecurity, underdevelopment, severe poverty and lack of opportunities. The future prospective of the migration is evaluated by the fact that unfortunately all of these conditions presently persist in Afghanistan which suggests that migration will continue in the next years.

Some researchers are focused on the suburban migration patterns and the composition of suburban migrants (Ouredníček, 2007; Kasarda, Appold & Sweeney, 2010; Szczepanska & Senetra, 2012).

2.1. Migration towards Gated and Guarded Housing Communities

A study was conducted on the comparative analysis of choosing either to live in gated communities in urban areas or gated communities in suburban areas (Hapsariniaty et al., 2013). Another study was emphasized to evaluate the effectiveness of gated communities in providing safe environments for children's outdoor use (Shamsuddin et al., 2014). Another study was carried out to assess the satisfaction level of residents in gated community on 4 main characteristics: security and safety; social and the environment; status; and exclusivity; and recommending ways of improving them (Mohd, 2016).

2.2. Relation between migration rate and LULC change

Various studies have been conducted to identify the LULC changes. A study was emphasized to detect LULC about migration between 1988 and 2013 in Nepal by performing image analysis on satellite images (Bhawana, 2015). Another study was conducted to evaluate LULC changes and urban expansion in Greater Dhaka, Bangladesh between 1975 and 2003 through a supervised classification algorithm on Landsat images using GIS (Dewan & Yamaguchi, 2009).

Some studies have been carried out to observe LULC change by performing supervised classification methodology on Landsat images using maximum likelihood algorithm in ERDAS software (Kumar & Rawat, 2015; Islam et al., 2018; Mosammam, Tavakoli & Khan, 2017).

Aniya & Mundia (2007) have found that the integration of Remote Sensing and Geographical Information System (GIS) is very effective in monitoring LULC changes and providing valuable information necessary for planning and research.

Previous studies have accounted the major influencing factors responsible for migration along with finding the characteristics of migrants. Some studies have monitored the changing LULC patterns. As migration towards suburban gated housing societies is a continuous and rapidly occurring phenomenon in Lahore which is affecting the LULC patterns. This study is first to assess the rate and extent of migration and to examine the temporal changes in LULC patterns caused by migration from 2000-2016 in one of the largest gated housing societies Bahria Town Lahore. This research also examines the key contributors behind migration along with the socio-economic and socio-behavioral characteristics of migrants.

3. Methodology

3.1. Investigation Site

Bahria Town Lahore is the largest privately owned gated housing community in Lahore, established in 2000s in the south-western Lahore along the canal road in the Maraka UC 122 of Iqbal Town Lahore. The latitudinal and longitudinal extent of Bahria Town Lahore is from 31.337° N to 31.392° N and 74.162° E to 74.203° E respectively. Bahria Town Lahore is bounded by Sui Gas Phase II to the south-west, NFC-2 to the south-east, Sukh Chayn Gardens Housing Society to the north-west, Canal Gardens Housing Society to the extreme north, Bhatti Waal and Juliana (less developed areas) to the north-east. Foundation Housing Project to the west and agricultural farms to east. The total area of Bahria Town Lahore is 14.033 sq.km which is mainly divided into 6 Sectors A, B, C, D, E and F and these sectors are further divided into blocks having different residential classes.

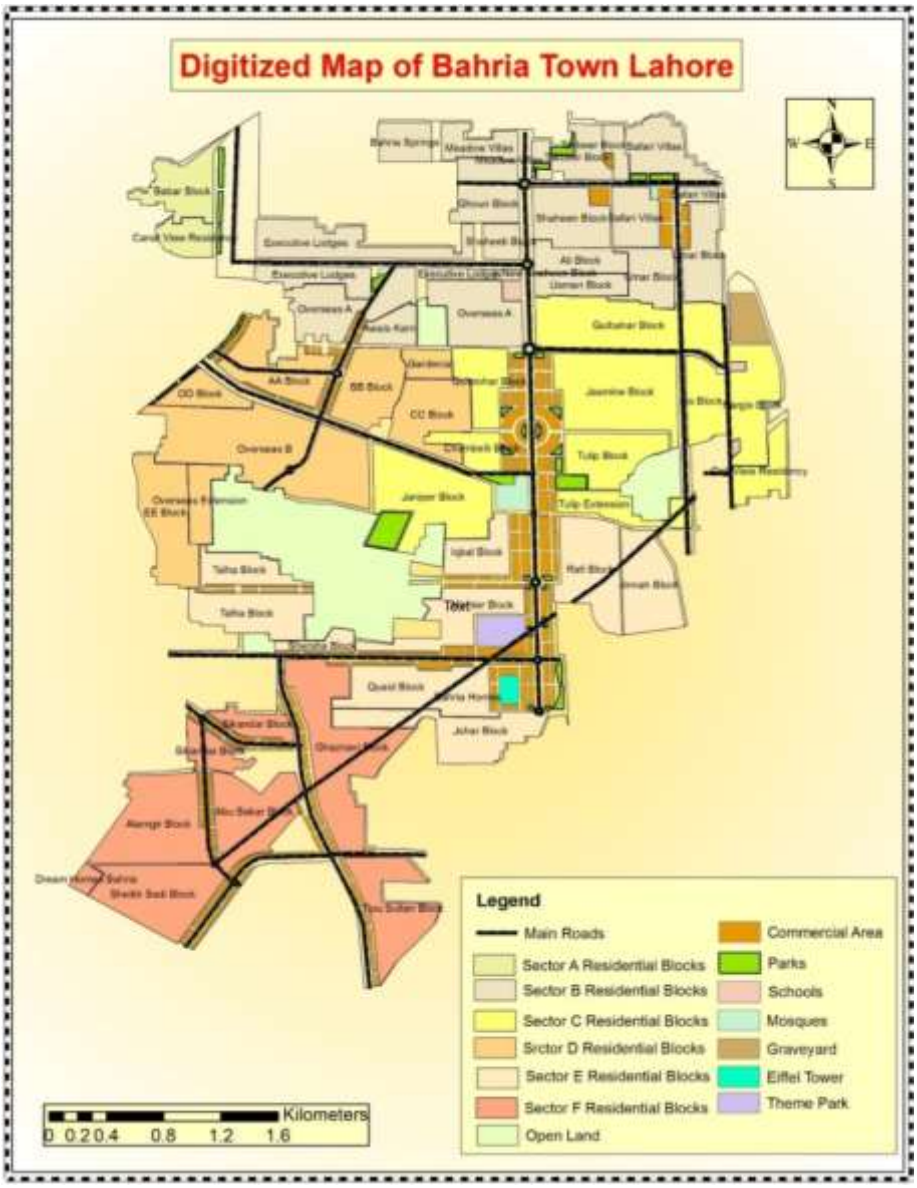

Figure (1) Study area map

3.2. Materials and Methods

3.2.1. Data Collection and Instrument

The present study collected both primary and secondary data. Questionnaire based survey was conducted to collect primary data and descriptive statistics was used to perform analysis in order to determine the socio-economic and socio-behavioral characteristics of migrants. Secondary data was collected from ESSA Real Estate in Bahria Town Lahore to acquire the master layout plan of Bahria Town Lahore. In order to detect the LULC change in Bahria Town Lahore from 2000-2016 two Landsat imageries, Landsat 7 ETM+ and Landsat 8 OLI/TIRS for the year 2000 and 2016 respectively were collected from USGS website as a secondary data collection source.

3.2.2 Sample size and Sampling Technique

For this study 10 Marla Residential Class was selected in Bahria Town Lahore. The total number of plots and constructed houses were counted manually from the Bahria Town Lahore master plan

layout (2015). The sampling frame was constructed individually for each sector and block. (The sampling frame is attached in annexures). Sample size (n) is determined by the following formula:

n = Total 10 Marla Constructed Houses * 10% of Constructed 10 Marla Houses
A two-step selection procedure was used to determine sample size. In the first step, 241 households were selected from the above formula. In the second step, the stage cluster sampling technique was used by dividing the whole of Bahria Town into 6 sectors A, B, C, D, E, and F out of which 5 sectors A, B, C, D, and E were selected from which sample households are collected randomly. Data was not collected from sector F due to under construction and no residence in sector F.

3.2.3. Data Analysis
In this study data analysis was performed mainly on SPSS Software version 19 and Arc GIS 10.3.

3.2.3.1. Descriptive Analysis
Descriptive statistical analysis including single variable frequency analysis and cross-tabulation analysis was performed on SPSS software to examine demographic, socio-economic and socio-behavioral characteristics of migrants. The main contributing factors for migration were also identified through descriptive statistical analysis. Spatio-temporal patterns of migration flow were analyzed with the help of cross-tabulation analysis.

3.2.3.2. Analysis performed on Arc GIS
Arc GIS software was used to assess the source regions of migrants towards Bahria Town by making flow-line maps. Flow line maps may be used to show both qualitative data (e.g., connections) and quantitative data (e.g., magnitudes). Quantitative flow mapping was used by selecting of line symbol and altering its width based on the data values.
Image analysis was performed on Arc GIS to detect the LULC change in Bahria Town Lahore from 2000-to 2016. The maximum likelihood classification algorithm was used to derive supervised LULC classification on two satellite images namely Landsat 7 ETM+ and Landsat 8 OLI/TIRS for the years 2000 and 2016 respectively. In this study, LULC was classified into three classes including vegetation cover, built-up area, and open land. The area of each class was calculated and tables were made to detect LULC change patterns from 2000 to 2016 in Bahria Town Lahore.

4. Results and Discussion

4.1. Socio-economic Characteristics of Migrants

4.1.1. Educational Qualification of Migrants
The results indicate that in Bahria Town Lahore better educated migrants outnumbered those with no or less educational status. The most dominant educational status among migrants is Graduation and Post-Graduation, accounting for 36% and 22% respectively. The un-educated migrants also exist in Bahria Town Lahore but in the least proportion accounting for only 1%. The result shows that only 4% of total migrant respondents have attained higher educational status.

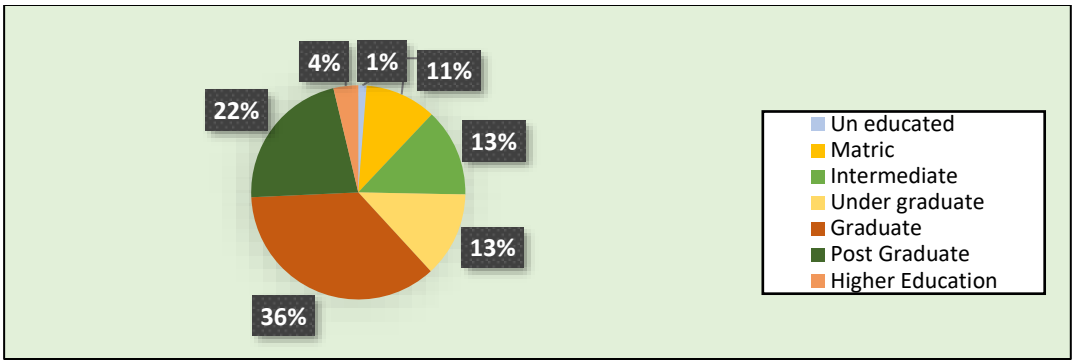

Figure (2) Educational Qualification of migrant respondents

4.1.2. Occupational Composition of Migrants

The results show that the proportion of workers employed in the private sector is most numerous among migrants. The remaining occupations with 34.4% of the total are business owners, government officers (11%), and retired pensioners (5.4%). The proportion of people working outside the country is least among all occupations.

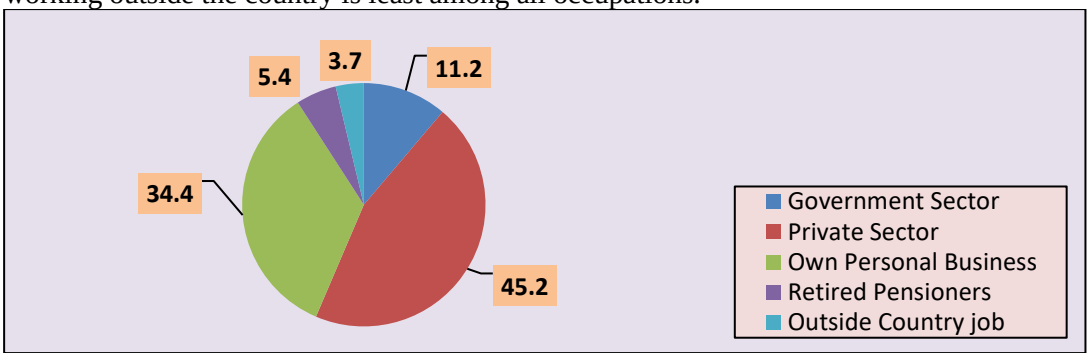

Figure (3) Occupational Composition of Household head

4.1.3. Economic Status of Migrant Families

The results indicate that Bahria Town Lahore encompasses household with high income accounting 45% of the migrants' household income falls under the 61,000-81,000 rupees while 7% of household income falls under the income of 200,000-400,000 rupees. Only 2% household income fall under 20,000-40,000 rupees.

4.1.4. Social Class of Migrant Families

The results show that 50% of migrant families are from upper-middle class whose income is ranging between 61,000-80,000 rupees. Only 2% of migrant families are belonging from middle class having income range between 20,000-40,000 rupees.

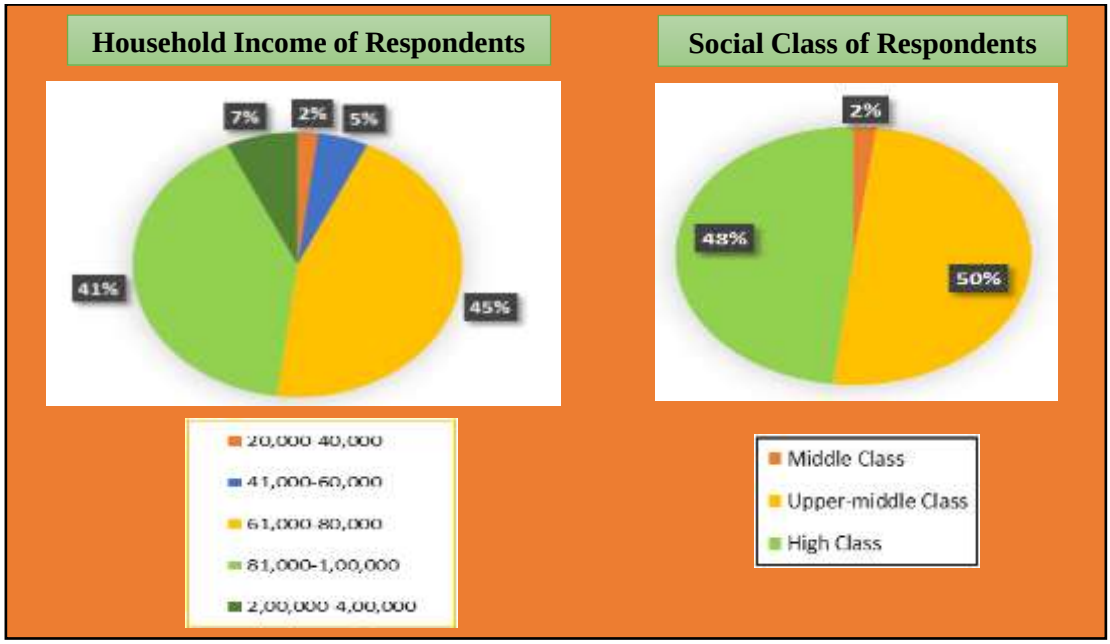

Figure (4) Household Incomes and Social Class of Migrants

4.1.5. Residential Status and Household Type of migrants

4.1.5.1. Residential Status of Migrants

The results indicate that own house residential status is more prevalent as compared to rental residential status. 85% of total migrants have their own houses in Bahria Town Lahore while the rest of the 15% of total migrants are living on rent.

4.1.5.2. Household Type of Migrants

In Bahria Town Lahore, the result shows the dominance of nuclear/single-family households. 70% of migrants came with their families including their fathers, mother, and children. 30% of migrants constitute the joint family household type in which the father, mother, children, and grandparents are living in a single household.

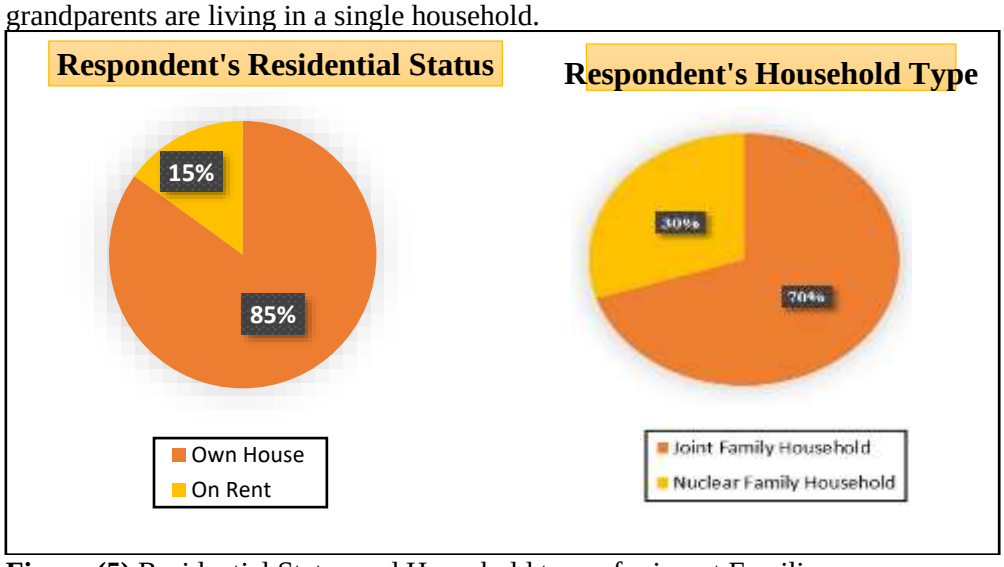

Figure (5) Residential Status and Household type of migrant Families

4.2. Spatial Patterns of Migration

4.2.1. Places of Origin of Migrant Families

The result reveals that Bahria Town Lahore encompasses both short-distance and long-distance migrant families but short-distance movers are more dominant among the total migrant families. Bahria Town Lahore constitutes the largest proportion of migrant families from Lahore accounting for 132 families. Only 25 migrant families came from outside Pakistan.

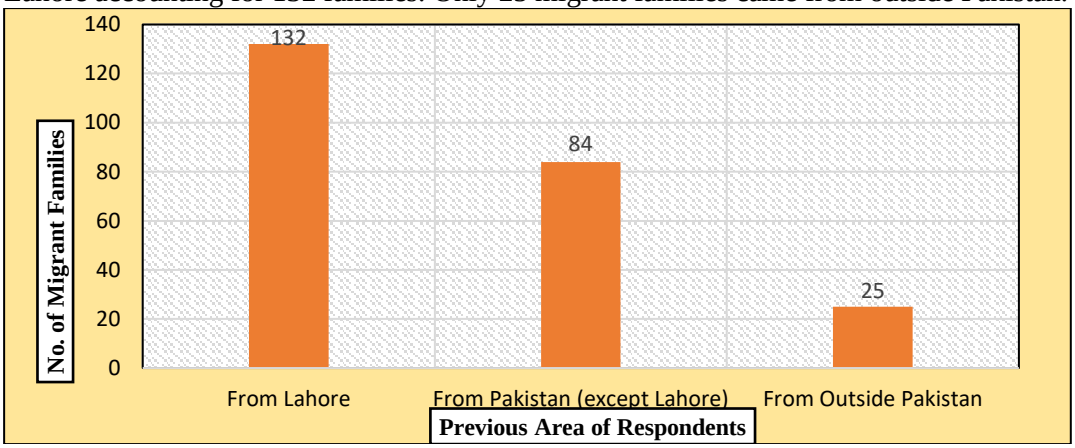

Figure (6) Origin of migrant families

4.2.1.1. Origin of Migrant Families from Lahore to Bahria Town

The results indicate that the majority of the migrant families came from Iqbal Town and Samanabad Town accounting for 34-56 and 22-33 migrant families respectively. Whereas from Nishtar Town there is a least proportion of migrant accounting for only 1 migrant family. There is no migrant flow from Wagha and Aziz Bhatti Town towards Bahria Town Lahore. It is revealed that short-distance migrants are more numerous as compared to the long-distance migrants in Bahria Town Lahore from Lahore.

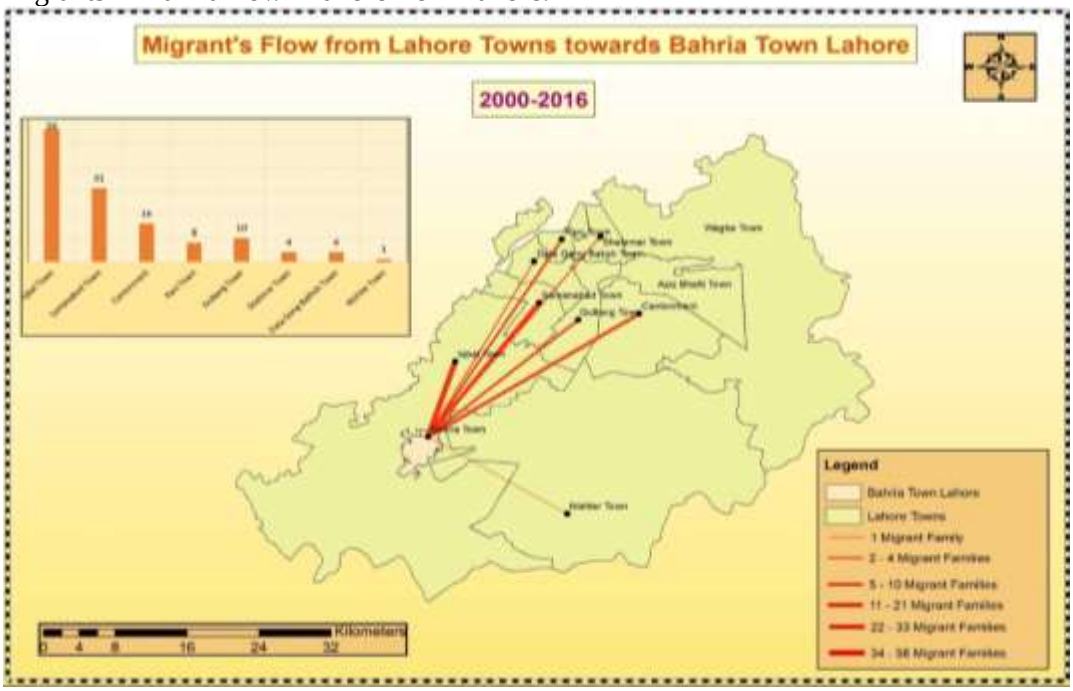

Figure (7) Migrant flows from Lahore towards Bahria Town

4.2.1.2 Origins of Migrant Families from Pakistan to Bahria Town

The result shows that the highest proportion of migrant families came from Punjab province. The least proportion of migrants came from KPK and Balochistan accounting for only 1-2 migrant families.

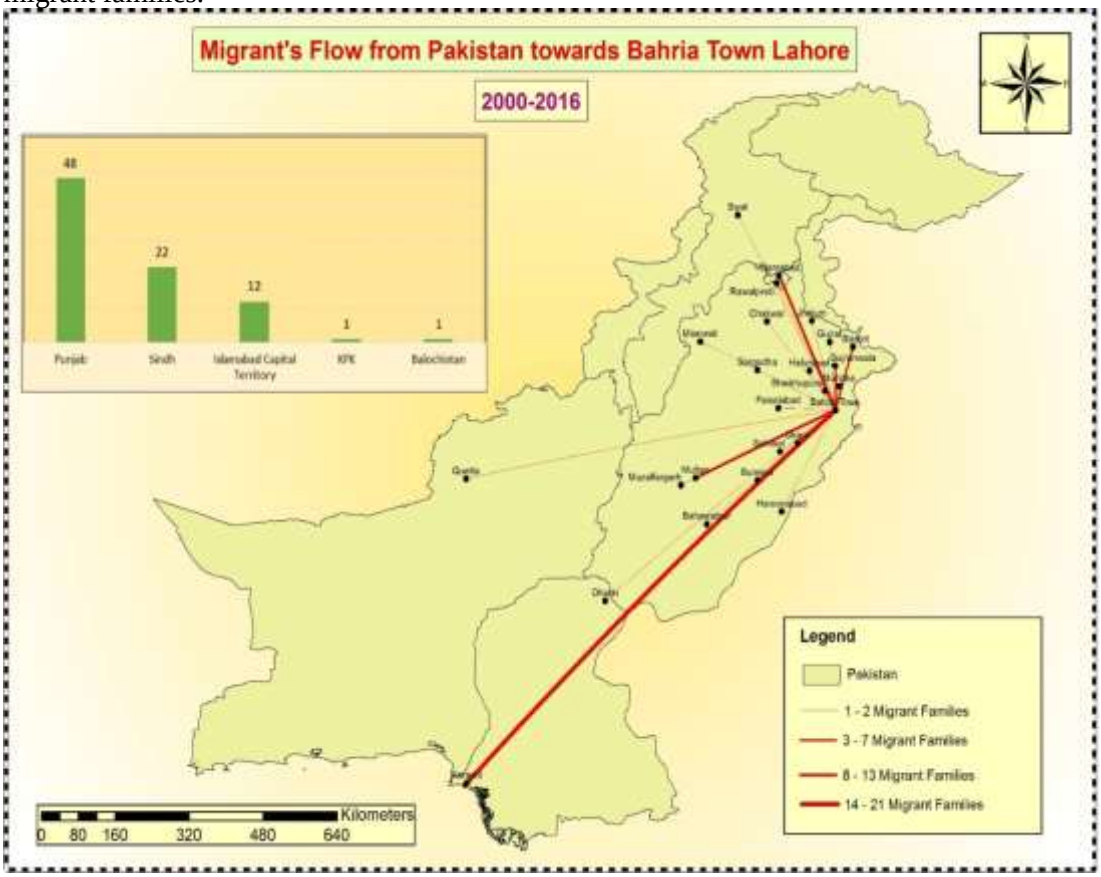

Figure (8) Migrant flows from Pakistan towards Bahria Town

4.2.1.3. Origin of migrants from Outside Pakistan to Bahria Town

The result indicates that the proportion of migrant families having origins from outside Pakistan is least as compared to those with origins located within Pakistan. A large proportion of migrant families came from Dubai. The lowest proportion of migrants came from Holland accounting for only 1 migrant family.

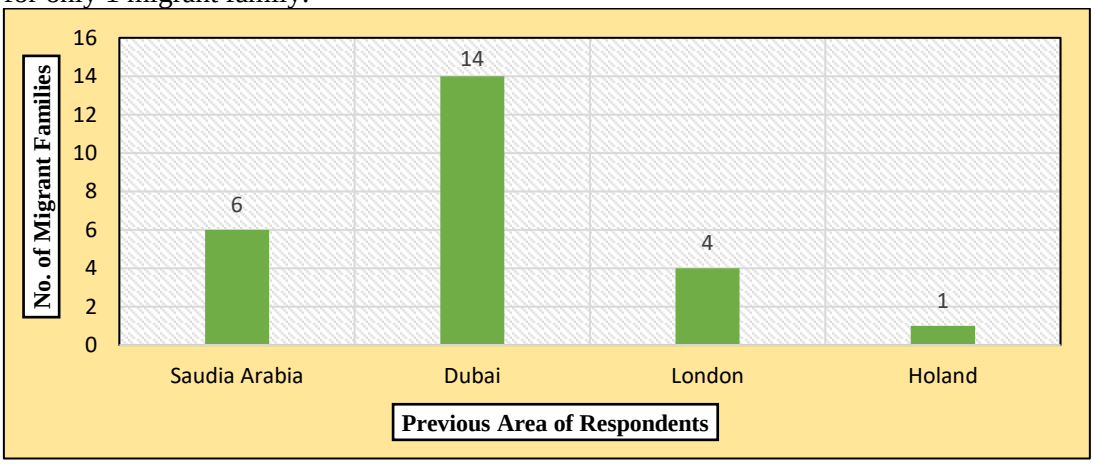

Figure (9) Origin of migrants from outside Pakistan

4.3. Spatio-temporal patterns of migration flow

Saptio-temporal patterns of migration flow reveal that migrant families with Lahore origin drain in Bahria mainly during 2006-2011 and 2012-2017 and no migration flow is seen during 2000-2005.The least migration flow is seen from Balochistan and KPK province accounting for 1 migrant family during 2006-2011 and 2012-2017 respectively. Migration flow from outside Pakistan is more dominant during 2012-2017. It is revealed that the migration flow is increasing temporally towards Bahria Town.

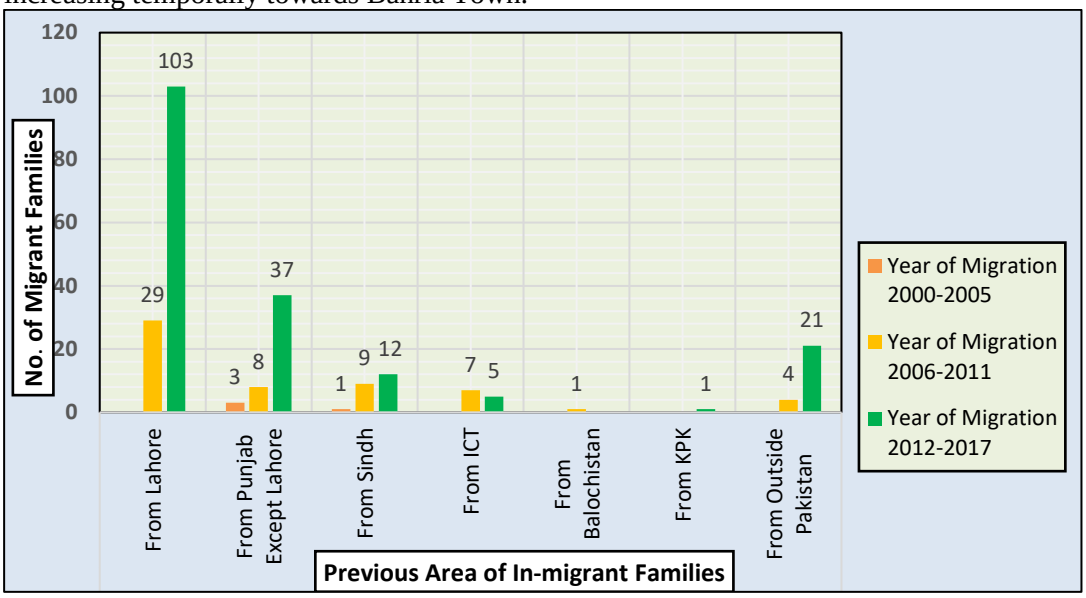

Figure (10) Spatio-temporal patterns of migrant families

4.4. Causes of Migration

4.4.1. Causes of Migration from Lahore, Punjab and ICT to Bahria Town

The result reveals the same cause of migration among the migrants of Lahore, Punjab and ICT. To find better amemities of life is consider the most influencial factor for migration. The second important factor which influence migrants to move towards Bahria is to find a safe environment for their childern.. The less important factor which influence migrants to move is to upgrade their living standards.

4.4.2. Causes of Migration from Sindh to Bahria Town

The result indicates that causes of migration from Sindh are different than that of Lahore, Punjab and ICT. To find safe environment is the most influencing factor for migration from Sindh despite of the distance factor between Karachi and Bahria Town Lahore. The second important factor which influence the migrant families to move towards Bahria is to find better amenities of life.

Causes of Migration from Balochistan and KPK to Bahria Town

The results indicate the least amount of migrants came from Balochistan and KPK. The main factor which influence 1 familiy to migrate from Balochistan is to find a safe environmentt because in Balochistan, target killing of punjabis was prevailing. 1 family from KPK also migrated towards Bahria in order to provide their children with best environment.

4.4.3. Causes of Migration from outside Pakistan to Bahria Town

The most influential factor among the migrants from outside Pakistan is to find better amenities of life because they believe Bahria Town Lahore is eminent with all the basic facilities under one roof. In order to provide their children better knowledge about their home country's religion, culture and traditions in a safe environment is also considered important pull factor.

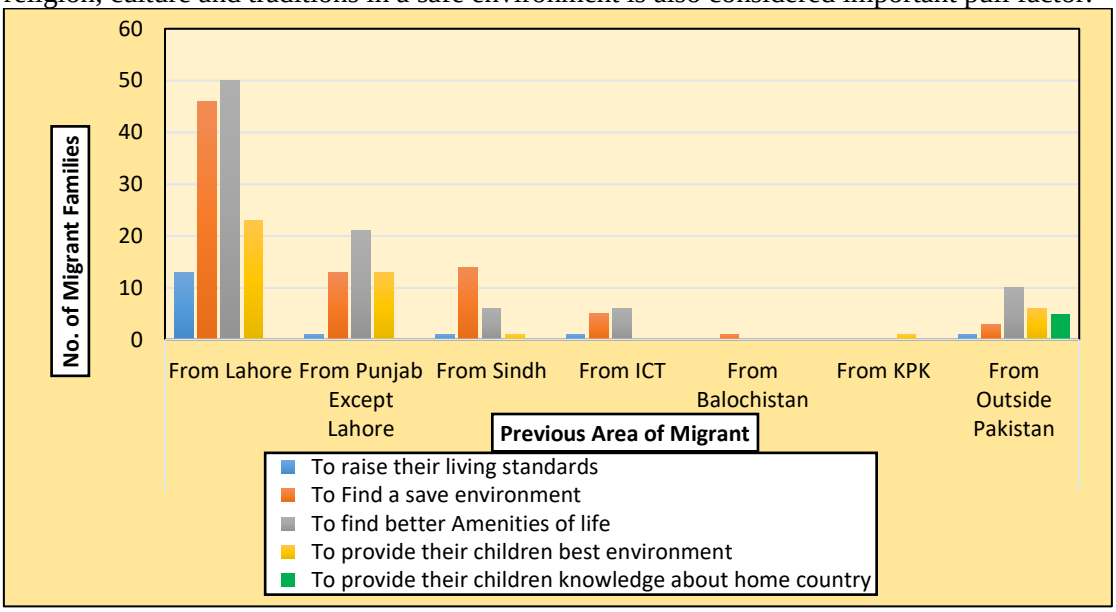

Figure (11) Causes of migration among migrant families

4.5. Temporal Patterns of Migration Motivation

It is revealed that the dominant migration motivation is to find better amenties of life and to find save environment temporally from 2000-2017 in Bahria Town Lahore. The second high migration motivation was to provide their children with best environment during 2012-2017. Temporal patterns of migration indicates the less dominant migration motivation was to upgrade the living standards.

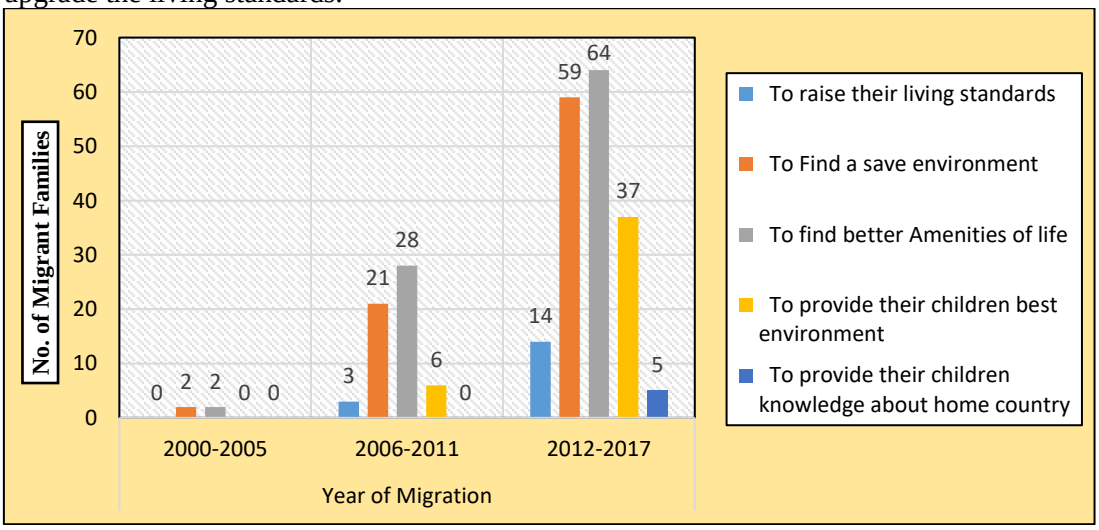

Figure (12) Temporal Patterns of Migration Motivation

4.6. Land use and Land Cover Classification

From land use and land cover classification it was revealed that there was a tremendous decrease in vegetation cover from 10.7487 sq.km (76% from total) in 2000 to 3.078 sq.km (22% from total) in 2016. The built-up area was increased from 0 sq.km (0% from total) in

2000 to 5.1408 sq.km (37%) in 2016. It was revealed from results that due to the rapid migration flow in Bahria Town the land use and land cover is changing tremendously. It is concluded that due to the internal migration in Bahria Town Lahore 54% vegetation cover has been converted into open land which has been further converted into built-up area in 2000-2016. The built-up area has been increased by 37% from 2000-2016 due to the internal migration of families.

Table (1) LULC change data from 2000-2016

Type	**Area in sq. km**		**Difference (between 2000 and 2016)**	**Growth rate**	
	In 2000	**In 2016**		**Per annum**	**After 6 years**
1.Vegetation Cover	10.7487 sq.km	3.078 sq.km	7.6706 sq.km	-0.45	-1.28
2.Built up Area	0 sq.km	5.1408 sq.km	5.1408 sq.km	0.30	0.86
3.Open Land	3.258 sq. km	5.8149 sq.km	2.5299 sq.km	0.14	0.42
Total	14.0337 sq.km	14.0337 sq.km			

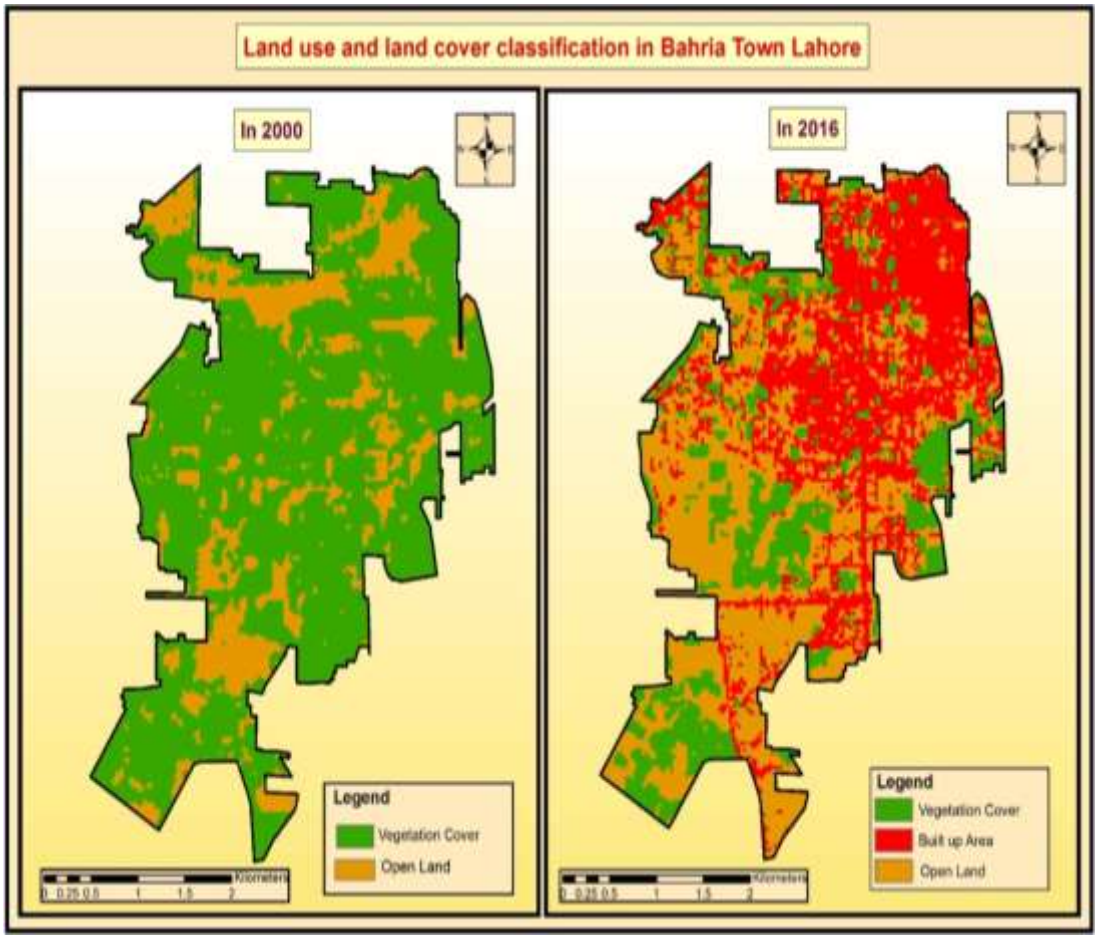

Figure (13) Land use and Land cover Changes in Bahria Town (2000-2016)

4.7. Socio-behavioral Characteristics of migrants

4.7.1. Sector-wise Preferences among Migrants

The result reveals the reason behind sector A preference was that sector A is peaceful and one door sector as compared to other sectors. Fully developed infrastructure along with proximity to all necessary facilities was the most numerous reason behind sector B preference among mirants of Sector B. Among Sector C preferences, the dominant reason was proximity to all basic nessesities. The main causes behind sector D and E preferences was the affordibility factor at the time of purchase due to the location factor.

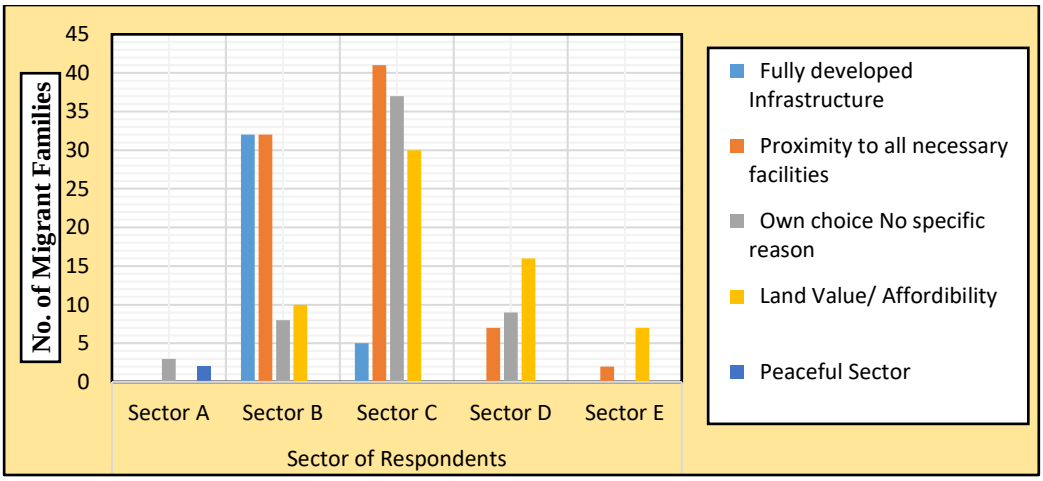

Figure (14) Sector preferences among migrant respondents

4.7.2. Facilites availing patterns among migrant families

The result shows that the highest proportion of migrant families are availing medical facilites from Bahria Town while low proportion of migrant families are availing medical facilites from outside Bahria due to the costly medical facilities in Bahria Town. In case of educational facilites, high proportion of migrant's children are availing educational facilites from Bahria Town while low proportion of migrant's children are availing educational facilites from outside Bahria Town due to the non availability of higher educational institutes. As far as shopping is concerned, the highest proportion of families are shopping from malls located inside and outside Bahria Town. The low proportion of migrant families are shopping from outside Bahria due to the insufficiency of many necessary essentials in Bahria Town.

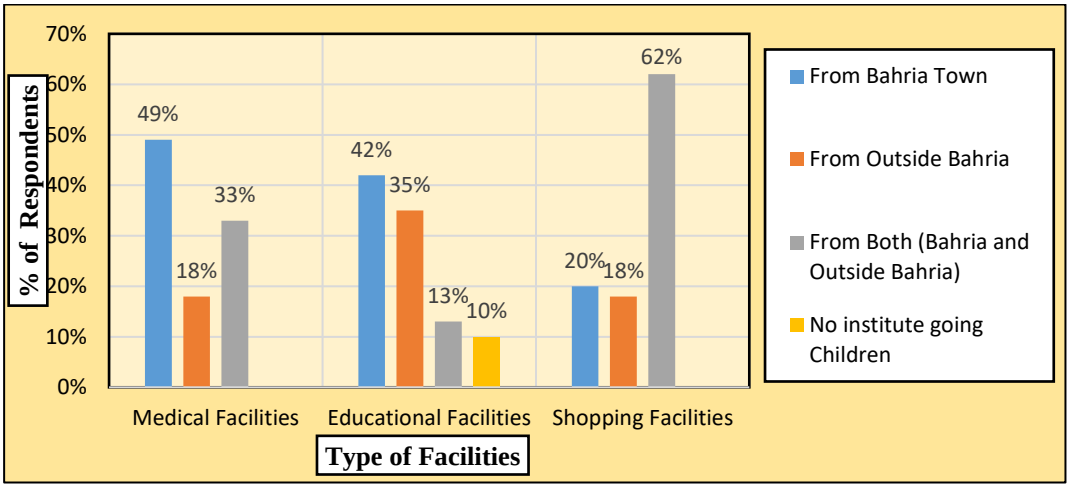

Figure (15) Facilities availing patterns among migrant families

4.7.3. Migrant's Preception about Bahria Town Lahore before Migration

The result indicates that majority of migrant families were tend to strongly agreed that Bahria Town is a worth living locality and equipped with all necessary facilities under one roof before migration.

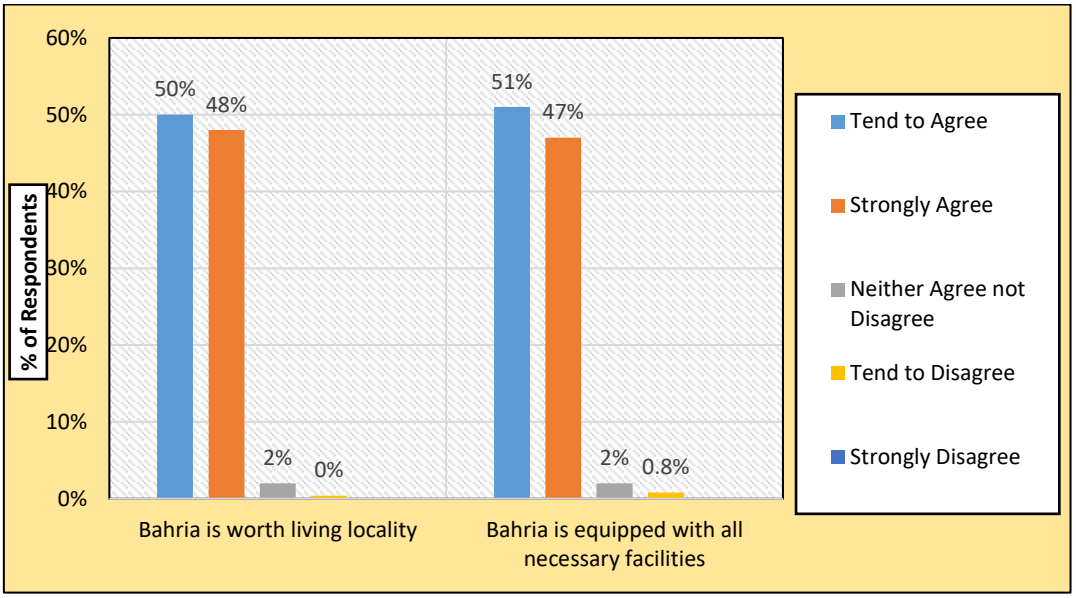

Figure (16) Migrant's percetion about Bahria Town Lahore

4.7.4. Migrant's Preception about Bahria Town Lahore After Migration

The result indicate that migrants strongly agreed that Bahria Town is worth living locality equipped with all necessary facilities under one roof and has become a symbol of luxurious life these day after living in Bahria Town Lahore. Mostly migrants are strongly agreed that Bahria Town is highly secure society and about 10% of migrants are tend to disagree because they thought that security issues (i.e robbery) are generating in Bahria Town with the time. More than half of migrant families strongly agreed that Bahria Town hospital is equipped with all modern health facilities. The result reveals that majority of migrants tend to agree that high income is required in order to reside in Bahria Town Lahore. 39% respondents strongly agreed that Bahria Town Lahore has good connectivity with main road and about 26% tend to disagree with this statement because traffic jams on Bahria town's entrance roads.

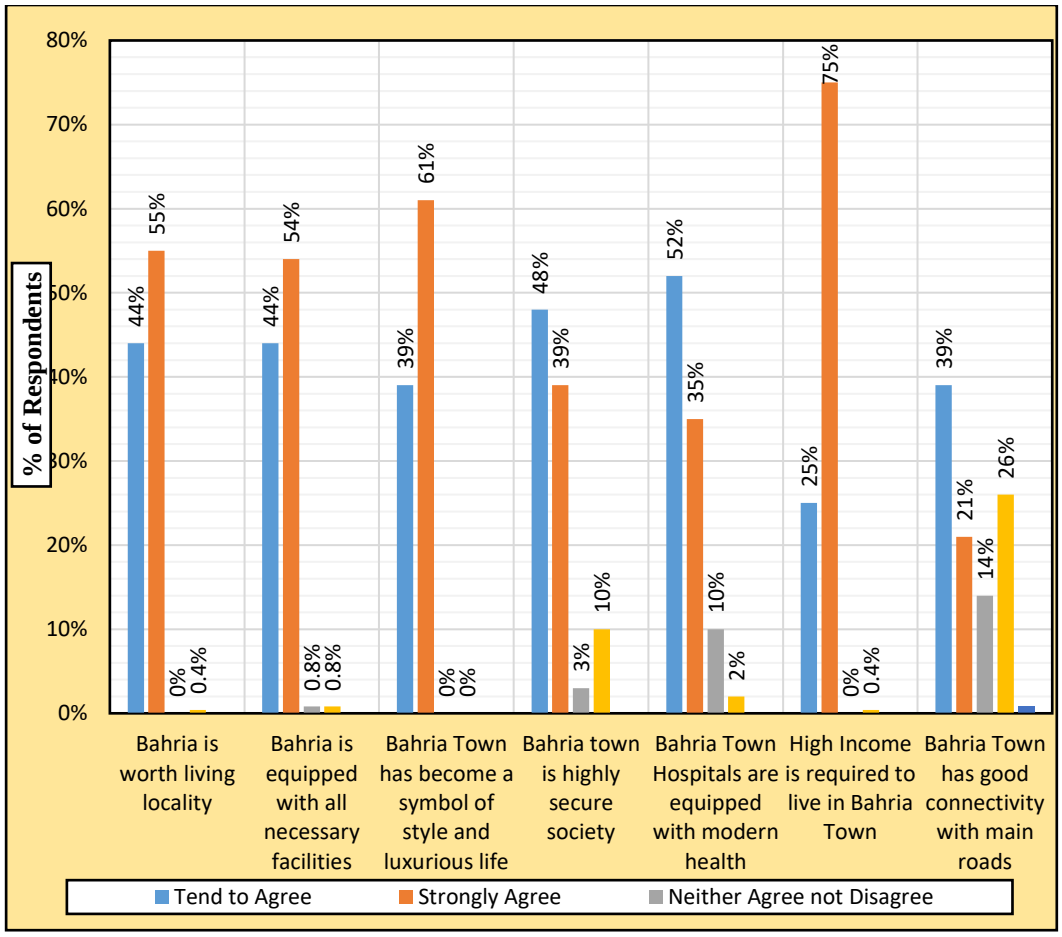

Figure (17) Migrant's percetion about Bahria Town Lahore

5. Conclusion and Discussion

Based on research findings, it is concluded from the socio-economic characteristics that the majority of the migrants have a high level of education and the least proportion of only 1% of migrants are un-educated and if the same proportion continues in the coming years, it will be a positive sign for the future prosperity of Bahria Town Lahore because education is a basic determinant of the quality of life of individuals in a society. Workers employed in the private sector at higher ranks are found more in the proportion which is a positive sign indicating the social well-being of society. Upper-middle income earners of about 61,000-80,000 are more numerous in Bahria Town Lahore and low-income earners of about 20,000-40,000 are found in the least proportion which is positive for the future prosperity of the society because people in the upper-middle class have living standards considerably above the necessities and discretionary income available to spend on higher-quality goods and services available in Bahria Town Lahore.

Own house residential status is more prevailing in Bahria town Lahore as compared to migrants on rent, indicating future prosperity if the trend remains the same because own house residential status indicates that these residents live in Bahria Town Lahore by considering it their home place as compared to renters who have no concern with the prosperity of the region and they can affect the infrastructure which is not positive sign towards Bahria Town's future prosperity. The nuclear family household system is more dominant in Bahria Town Lahore as compared to the joint family household system, accounting for about 70% and 30% respectively and it is

a positive sign for the future well-being of Bahria Town because the nuclear family plays an important role in the development of personality of individuals.

Multifaceted internal migration flows have been prevalent in Bahria Town Lahore for the last 17 years, and the evidence indicates that these flows will continue in the future. Two key reasons for continued migration can be noted. Firstly, migration in Bahria Town Lahore has been motivated in terms of providing better amenities of life under one roof and second in terms of a safe and secure environment. The migration would continue from those areas where many security issues are generated and where amenities are not provided to the residents. However proper management is needed to balance the amenities and security provision among all residents so that the motivation cannot be converted into demotivation.

The land use and land cover is changing due to the in-migration flows. The area of about 76% was covered with vegetation cover and the built-up area was about 0% in 2000. But due to the in-migration during 17 years (2000-2016), 37% is converted into built-up areas. If the in-migration continues at this rate then in the next 20 years, 47% will be converted into the built-up area which is positive for the development of Bahria Town Lahore.

Based on findings about the socio-behavioral characteristics of migrants, it is concluded that development among all the sectors of Bahria Town Lahore is not uniform. The majority of the migrants prefer to live in Sector B and Sector C due to the fully developed infrastructure and there is a need to develop the infrastructure in other sectors also so that the development in all sectors would be uniform which will be a positive sign for future prosperity of Bahria Town Lahore. The majority of the people are satisfied with their decision of migrate which is also a positive sign. 10% of migrants are now not satisfied with the security in Bahria Town because security issues are now generating and there is a need to resolve these security issues.

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