

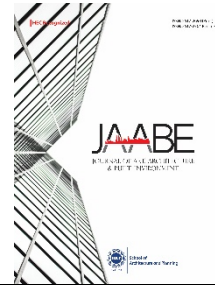
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Assessing the Potential of Sustainable Urban Regeneration in Lahore: The Case Study of Orange Line Metro Train Route

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Abstract

Urban regeneration is viewed as a far-reaching field in urban planning. Urban regeneration contributes not just to set up new urban structures in urban communities, yet in moulding the urban communities as well. The long-term vision of urban regeneration projects along with transit corridors is to promote sustainable patterns of urban growth by ensuring all urban design features and creating higher densities along transit and non-motorized transit use. This research aims to assess the potential of urban regeneration along the route of Orange Line Metro Train. The primary data was gathered using in-depth interviews and structured questionnaires. All the 26 stations of Orange Line Metro train were divided into three equal stratum. Furthermore, the middle order station had been selected from all the three stratum and for each selected station a buffer was drawn of half of a kilometer radius and selected as a sample of the study area. Respondents were asked about their opinion regarding the significance level of the different urban design features of a sustainable urban regeneration project. The Cronbach's alpha of the data collection instrument was calculated as 0.71, which is higher than the acceptable reliability coefficient. The validity test was completed by Principal component analysis. Varimax rotation was used for the rotation of components. KMO adequacy test was 0.707, which must be more than 0.5 to retain the variables, and the variables with Kaiser-Meyer-Olkin Measure less than 0.5 must be excluded from the study. Bartlett's Test was significant at $p < .05$. The significance index of urban design features for sustainable urban regeneration projects had been calculated. Overall, the necessary attributes of sustainable urban regeneration project were found. The research provides the priority areas of urban regeneration as per the key stakeholders along the Orange Line Metro Train Route.

Keywords: Urban regeneration, Light Rail Transit (LRT), urban design features, mixed development, security against crimes, price premium

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Introduction

Urban territories are mind-boggling and dynamic frameworks. These reflect many procedures that drive physical, social, natural and monetary progress. Therefore, to manage urban areas and arising issues that travel from history need to be managed by sustainable urban regeneration (Alpopi & Manole, 2013). Despite, the city managers know the importance of sustainable development but yet regeneration of urban areas led by market or property development (Chan & Lee, 2008b). The issue of market led regeneration is not only in developing countries but a country like the UK also faced the issue of regeneration practices based on economic regeneration and sustainability somehow couldn't be achieved. Sustainable Development recommended four steps to achieve sustainable development i.e. integration of socially responsible policies, investment in new and cost effective data gathering procedure, resource allocation for monitoring at the planning stage of a project and linking social projects with city wide plans (Colantonio et al., 2009) are prime generators of numerous such changes. No town or city is safe from either the outside powers that manage the need to embrace or inside weights that are available inside urban ranges and which can hasten development or decline (Power, 2008).

Lahore is the capital of Punjab, province of Pakistan and on the second number in country with respect to the population. Lahore is a hub of educational and economic activities with an urbanization rate of three percent per year which is the fastest leap in South Asia. To relieve the undesirable symptoms of population growth, the development or augmentation of a fast rail travel framework is regularly endorsed.

The Orange Line Metro Train track interfacing Raiwind Road, Multan Road, Mcleod Road and the Grand Trunk Road, is passing through the thickly populated urban areas of the provincial capital and an economic hub of Punjab. It won't just be the first line of the Metro Train in Lahore yet in addition to the nation. The work on this task began on 25th October 2015 on Package-1 from DeraGujran to Chauburji (13.6 Km). The metro will give a simple method of transportation and will carriage around 250,000 people on everyday schedule which will reach up to 500,000 travelers in ten years. This 27.1 km long Metro Train venture will help the subjects of Lahore by decreasing a blockage caused by transports and autos and furnish with a fast method of transportation having stations at each kilometer of its route. As indicated by LDA's Land Use Rules, 2014, the authority will

choose a task range by distinguishing and organizing the urban region if there would be a pattern and the market demand of changes in the existing land uses. The Orange Line Metro Train will go about as an impetus for the progressions in existing area employment. There would be a need for resemblance with the bordering land utilizes and the upgradation of running streets. This research aimed to assess the potential of urban regeneration in the case study area seeks the property owners and experts concerns and views on necessary features of the urban regeneration project. Imran (2016) suggested that the composed bus rapid system called metro transport in Lahore required new arranging and outline strategies as refreshed zoning directions and land utilize criteria for improvements along with the travel passages. This will not only lead to integrate land utilization along these courses but also build the business, the urban thickness and inevitably the housing density.

Literature Review

According to Sykes and Roberts (2000) urban regeneration is a “thorough and combined vision and movement which prompts the fortitude of urban problems, and which looks to achieve a stable change in the monetary, environmental, social, and physical characteristics of a territory that has been responsible to alteration.” Urban regeneration is hard to characterize because it manages the need to change physical, social, financial, and ecological procedures working inside a region (Bianchini & Parkinson, 1993).

In the present era, urban transit rail has been found as a solution to traffic congestion, environmental pollution, and a catalyst to urban regeneration. Newman et al. (2018) suggested urban transit planning as a foremost essential to the development and redevelopment of land rather than a transport system.

In 2008, the Government of Malta carried out studies to lay down Light Rail Transit (LRT) and found it not only provides commuting services but also reassures the regeneration in the area. Toensurean overall sustainable urban area, it was necessary to integrate its LRT with the other land uses and transport systems. Attard and Attard (2019) found many key factors in urban areas as opportunities and success points for a sustainable LRT and urban regeneration.

Certain urban design characteristics have been suggested by Furlan et al. (2019) for sustainable urban regeneration in an area after inducing Light Rail Transit including diversity, connectivity, density and public space.

Doha has faced tremendous urban regeneration after the construction of urban rail transit. The need was found to integrate the existing land uses with the LRT and priorities shifted toward urban design and sustainable urbanism (Furlan et al., 2019). The research on TOD showed the transformation of Design, Density and Diversity called 3Ds around the route of LRT for TOD to work (Bernick et al., 1997; Calthorpe, 1993; Cervero & Kockelman, 1997, Howe et al., 2016). Scholars believe livability, creating and expanding opportunities and promoting equality are the important ingredients for sustainable urban regeneration (Brown & Dixon, 2014).

Urban areas like Copenhagen, Denmark and Singapore have benefited from relevant local dreams that high-limit travel ventures wanted urban-frame results. Encounters from these and different urban areas propose that station zone arranging should be completed specifically and prudently. Travel and land-utilize mix can yield the results expected to speed up and bolster the procedure (Liguang et al., 2008).

Factors Impacting Sustainability of Urban Regeneration Projects

Sustainability alludes to support and change of prosperity of present and who and what is to come (Chiu, 2003). The venture is said to be supportable when it makes a congruous living condition, decreases social disparity as well as stratifications, and enhances personal satisfaction all in all. Following are the main elements that can influence the sustainability of urban regeneration ventures.

Provision of Social Infrastructure

Arrangements of different pleasantries are imperative to the public. Public places, for example, schools and medicinal facilities are essential needs of the natives while others like offices and playgrounds offer settings for holding distinctive recreation exercises. To take care of exposed gatherings, for example, handicapped, elderly and kids inside a group, extraordinary arrangements ought to be promptly accessible for their employments. Likewise, open spaces and green ranges give cradle zones in swarmed territories to encourage get-together and open associations (Chiu, 2003, Corbett & Corbett, 2000, Cuthbert & Dimitriou, 1992).

Availability of Job Opportunities

Business and jobs are one among the most important concentrations of social maintainability (Omann & Spangenberg, 2002). Business gives earnings to the people and the working region provides a location for social interaction, which are fundamental to enhance the sentiment social prosperity of the people. It has been found that separation rates, suicide rates and the occurrence of liquor abuse would be significantly higher if joblessness rate was high in the groups as indicated by Omann and Spangenberg (2002).

Accessibility

Accessibility is by all accounts a fundamental topic in enhancing urban regeneration sustainability. The subjects try to live, work and take an interest in recreation and social exercises without voyaging too far (Bertolini et al., 2005). The general population might want to be housed in ranges with business areas and offices for easement and low-cost day to day travelling.

Townscape Design

Awful townscape configuration hones destruct the distinctiveness of spots and impede the creation of a sense of belonging among the residents. As indicated by Porta and Renne (2005), visual representations of road furniture, as well as the interconnection of road designs have effects on the community maintainability of spots. Furthermore, the subjects are more fulfilled when there is a pleasing aesthetic appearance and building setups as far as thickness, tallness, mass and format is legitimately planned (Chan & Lee, 2008a).

Conservation of Local Characteristics

Heritage to be protected legitimately for the contentment of future population (Fung, 2004). It is left by earlier eras recognizing our identity, what we do, and how we live previously, and it proves the realism of changes in time.

Ability to Satisfy Psychological Needs

Security is a fundamental component in each area. As said by Corbett and Corbett (2000), Individuals like to stay in a safe and secure environment free of criminals, thieves, and vandals. The general population might want

to know what is happening in the regions around their residences. At the point when the inhabitants are engaged with the urban regeneration projects of their areas, the settled plan proposition is probably going to address their issues and wants.

This research is expected to benefit the community in several ways. Firstly, at the highest level, it has explored the potential of urban regeneration of large-scale urban projects as the literature suggests that light rail transit plays seed to urban regeneration in the surrounding areas (Attard, 2019). As the drive for regeneration and densification increases across developed cities, these insights will apprise the planning and redevelopment of sites along the case study area and is critical for the institutions and specialists taking an interest in urban (re)development ventures.

The objectives of the research work were to review the literature on various approaches and strategies being applied in selected developed, and developing countries for achieving sustainable urban regeneration along transit corridors, to assess the potential of urban regeneration in the case study area, to seek the property owners and experts' concerns and views on necessary features of urban regeneration projects and to determine the urban design features which are necessary for sustainable urban regeneration along Orange Line Metro Train Route.

Materials and Methods

Study Area and Data

Orange line train corridor of 27.1 kilometers with 26 stations and from the total nine zones of Lahore the Orange Line route passes through the seven zones namely, 1) Iqbal Town Zone2) Samanabad Zone3) Data GunjBuksh Zone4) Gulberg Zone5) Shalimar Zone6) Wagah Zone7) Aziz Bhatti Zone.

Stratified sampling has been used in which the population is subdivided into subgroups that share the same characteristic(Owen et al., 2006). All the 26 stations of the Orange Line Metro train were divided into three equal stratum. By using the systematic sampling, a middle order station has been selected from all the three stratum and for each selected station a buffer is drawn of half of a kilometer radius and selected as a sample of the study area. The radius of half of a kilometer has been selected because the average distance between the two consecutive stations of the Orange Line Metro

train is one kilometer and the radius of more than half a kilometer will enter in the catchment area of the next station.

Figure 1

Land uses along the Orange Line Metro Train Route, Lahore, Source: Google Maps, (2017)



A questionnaire was used to collect data for this research. Five-point Likert scale was used from strongly disagree to strongly agree. Scholars have identified many design elements that satisfy economic, environmental, and social objectives and should be considered simultaneously while drafting urban renewal ideas to support a sustainable urban regeneration concept (Chan & Lee, 2008a).

After the questionnaire was adapted from literature (Chan & Lee, 2008a), a pilot study was conducted using 30 Professional Town Planners and 30 property owners as sample. The respondents for the pilot research were representative of the population in the study region. The pilot research was carried out to examine the reliability and understandability of the questionnaire's items. It was necessary for the section of the questionnaire adopted from literature to check its reliability and validity in the local circumstance before using it as an instrument for this study. Although some modifications have been made and some more questions have been added afterwards. Cronbach's alpha was calculated. A reliability estimate of 0.70 or above is regarded adequate (Santos, 1999). Cronbach's alpha of the data

collection instrument is 0.71, which is higher than the acceptable reliability coefficient. Participants in the pilot research were asked if any of the items were unclear, ambiguous, imprecise, or needed to be rephrased. Except for two items, all of the questionnaire's items were well received; therefore, the questionnaires were circulated to additional respondents chosen as samples for this research project.

Practitioners taking an interest in urban regeneration ventures i.e. Town Planners, Architects and property developers were the objective respondents for the fundamental overview. With the assistance of the experts Lahore Development Authority, planning practitioners and Local Government, surveys were conducted from 200 individuals. Snowball sampling procedure was used to survey field experts. Not with standing purposive sampling was additionally utilized by which all the Town Planners serving in the Local Government yet just in the regarded Zones of Lahore finding Orange Line Metro Train course were talking with.

Notwithstanding the in-depth interviews with the experts, Town Planners serving in the Local Government and Lahore Development Authority, have likewise been directed to get profound knowledge. To direct in-depth interviews, the purposive sampling technique has been utilized (Mehdipناه et al., 2013).

Another survey with mostly the same but a bit different questionnaire was carried out with the commercial and residential property owners in the selected three sections which have either been doing business or living in target area for over 10 years. To conduct this survey, purposive sampling / voluntary sampling technique has been used. A total of 180 local individuals were asked to participate in the questionnaire survey, which was held in business and residential areas in chosen portions. However, only those residents who expressed an interest in participating in this poll were questioned.

Table 1

Response Rate of this Study

Target Respondents	Sample Size	No of Responses	Response Rate (%)
Architect	34	9	26.5
Planner	166	50	30

Target Respondents		Sample Size	No of Responses	Response Rate (%)
Practitioners	Property Development Managers	7	5	71
	Sub-total	207	64	31
Property Owners	1.Wahadat Road Section	30+30	19+21=40	66.7
	2.Lake Road Section	30+30	20+23=43	71.7
	3.Mahmood Booti Section	30+30	30+26=56	93.3
	Sub-total	180	139	77.22
Total		387	203	52.5

65.5% of the respondents were shopkeepers as the commercial area along the Orange Line Metro train was surveyed by taking 30 as the sample size for commercial use and 30 for residential use separately from all the three sampled sections of the said route. 49.6% of surveyed property was in commercial use and 50.4% was in residential use as there was the same sample size for both uses. Most buildings were having an age between 21-25 years that is (25.9%), 21.6% with the age between 11-15 years whereas 18% were 26-30. Only 3.6% of buildings were having an age of less than 5 years. Most of the respondents were property owners (79.1%). Whereas 18% were on rent and only 2.9% have mortgaged. Commercial plots were having a size of 0.5 marla to 2 marla. Whereas the residential plots were of size from 2.5 marla to 7 marla. Most of the buildings (50.4%) were double-storied, 28.8% were triple storied and only 2.2% were having 4 or more stories.

Results and Discussion

The validity test of urban design elements was carried out by Principal component analysis. Varimax rotation was used for the rotation of components. KMO adequacy test was 0.707 which must be more than 0.5 to retain the variables and the variables with Kaiser-Meyer-Olkin Measure

less than 0.5 were excluded from the study. Bartlett' Test was significant at $p < .05$ (Buijs et al., 2009).

Table 2

Communalities

Factors	Initial	Extraction
Welfare requirements	1.000	.690
Conservation of resources & the surroundings	1.000	.388
Creation of harmonious living environment	1.000	.937
Provision facilitating daily life operations	1.000	.530
Form of development	1.000	.730
Availability of open spaces	1.000	.437

Note: Extraction Method: Principal Component Analysis

Table 3

Total Variance Explained

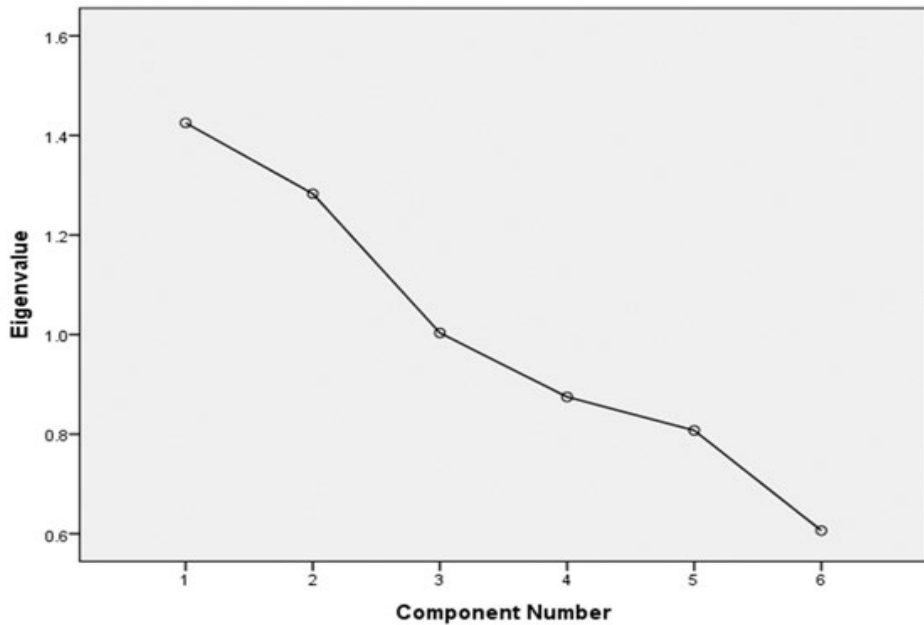
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.4	23.752	23.75	1.4	23.752	23.752	1.3	22.715	22.715
2	1.2	21.381	45.13	1.2	21.381	45.133	1.3	22.281	44.996
3	1.0	16.723	61.856	1.0	16.723	61.856	1.0	16.859	61.856
4	.875	14.580	76.435						

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
5	.807	13.458	89.893					
6	.606	10.107	100.000					

Note: Extraction Method: Principal Component Analysis

Figure 2

Screen Plot



Three factors had Eigen value greater than one as shown by Scree plot explained as under:

1. Welfare requirements measured as
 - Provisions for the fundamental requirements of the disabled, the aged, or children, with appropriate access

- Keeping and supporting social networks
 - Community sense of belonging
 - Provision of public services for example, an education, health care services, or sports facilities.
 - Access to public amenities
 - Comfort, efficiency, and safety for pedestrians and users of public transportation
 - Accommodation for people of various economic levels
 - Protection from criminals
 - Participation of the public in decision-making
2. Preservation of resources & the environment measured as
- Installation of energy efficient/water saving equipment, usage of recyclable/durable building materials are examples of green characteristics (construction related).
 - Green aspects (design-related), such as natural sunlight and ventilation optimization, sunshade availability, and balcony
 - Measures for pollution control, such as air and noise
 - Buildings, facilities, and spaces management
3. Development of a livable environment is measured as
- Compatibility with the surrounding area
 - Building and street layout
 - Recognition of local uniqueness
 - Building structures that can be repaired are rehabilitated
 - Historic structures and elements should be preserved
 - Structure design in terms of look, density, mass, and height

The above-mentioned factors have Eigen value greater than 1 and have been found important design elements for the urban regeneration project of the study area.

Table 4

Overall Trend of Resident's Perception about the Significance of Urban Design Features for Sustainable Urban Regeneration Project

S. No	Urban Design Features	Least Significant		Less Significant		Indifferent		Most Significant		Weighted Total	Significance Index
		Score	Score	Score	Score	Score	Score	Score	Score		
1	Mixed development	0	0	0	13	0	0	380	393	1.94	
2	Measures for pollution control, such as air and noise	0	0	0	16	0	0	374	390	1.92	
3	Community involvement in public decision making	0	0	0	19	0	0	368	387	1.91	
4	Provision of public facilities	0	0	0	21	0	0	364	385	1.90	
5	Layout of building and streets	0	0	0	22	0	0	362	384	1.89	
6	Proximity to business activities	0	0	0	22	0	0	362	384	1.89	
7	Availability of local employment	0	0	0	25	0	0	356	381	1.88	
8	Security against crimes	0	0	0	26	0	0	354	380	1.87	

S. No	Urban Design Features	Least Significant		Less Significant		Indifferent		Significant		Most Significant		Weighted Total		Significance Index
		Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	
9	Access to work	0	0	0	0	0	0	29	348	377	1.86			
10	Provision of open spaces	0	0	0	0	0	0	28	350	378	1.86			
11	Access to public facilities	0	0	0	0	0	0	31	344	375	1.85			
12	Structure design in terms of look, density, mass, and height	0	0	0	0	0	0	31	344	375	1.85			
13	Development's capacity to adapt to changing demands	0	0	0	0	0	0	36	320	356	1.82			
14	Convenience, efficiency & safety for drivers	0	0	0	0	0	0	39	328	367	1.81			
15	Development of various commercial operations, such as retail stores and banks	0	0	0	0	0	0	37	314	351	1.81			
16	Accommodation for people of various economic levels	0	0	0	0	0	0	40	326	366	1.80			
17	Access to open spaces	0	0	0	0	0	0	42	322	364	1.79			

S. No	Urban Design Features	Least Significant		Less Significant		Indifferent		Significant		Most Significant		Weighted Total		Significance Index
		Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	
18	Green features (design related)	0	0	0	0	0	0	43	43	320	320	363	363	1.79
19	Ease, efficiency, and safety for pedestrians and users of public transportation	0	0	0	0	0	0	43	43	320	320	363	363	1.79
20	Effectual use of land & space	0	0	0	0	0	0	46	46	314	314	360	360	1.77
21	Conservation of historical structures & features	0	0	0	0	0	0	46	46	314	314	360	360	1.77
22	Compatibility with neighborhood	0	0	0	0	0	0	53	53	300	300	353	353	1.74
23	Disabled, elderly, or children's essential requirements are met with sufficient access.	0	0	0	0	0	0	60	60	286	286	346	346	1.70
24	Preserving & facilitating social network	0	0	0	0	0	0	62	62	282	282	344	344	1.69

S. No	Urban Design Features	Least Significant		Less Significant		Indifferent		Most Significant		Weighted Total		Significance Index
		Score	Score	Score	Score	Score	Score	Score	Score	Score	Score	
25	Management of buildings, facilities & spaces	0	-6	0	0	45	304	343	1.69			
26	Community sense of belonging	0	0	72	262	334	1.65					
27	Design of open spaces	0	-10	45	296	331	1.63					
28	Rehabilitation of repairable building	0	-12	49	284	321	1.58					
29	Promotion of local distinctiveness	0	-18	39	292	313	1.54					
30	Green features (construction related)	0	-20	42	282	304	1.50					

The overall trend of resident's perception about the significance of urban design features for sustainable urban regeneration projects was calculated by assigning an index score to each significance level of the design feature as per the respondents. Then, the actual frequency of each response was multiplied with the assigned score to get the weighted score which the divided by the total number of responses (203) to get the significance index. Mixed development had a maximum significance index of 1.94. Provisions for pollution control, such as air and noise pollution had 1.92 whereas community involvement in public decision making had 1.91 significance index.

Table 5

Analysis of Responses of Residential Property Owners in all the Three Stratum

S.No.	Categories	Stratum 1		Stratum		Stratum 3	
1	Willing to renovate old building or to erect new building	Yes 15	No 6	Yes 21	No 2	Yes 26	No 2
2	Willingness to accept alternate property	Yes 3	No 18	Yes 5	No 18	Yes 12	No 14
3	Willingness to accept financial compensation	Yes 15	No 6	Yes 14	No 9	Yes 18	No 8

Table 6

Analysis of Responses of Commercial Property Owners in all the Three Stratum

S. No	Categories	Stratum 1		Stratum		Stratum 3	
1	Willing to renovate old building or to erect new building	Yes 18	No 1	Yes 17	No 3	Yes 27	No 3
2	Willingness to accept alternate property	Yes 1	No 18	Yes 2	No 18	Yes 5	No 25
3	Willingness to accept financial compensation	Yes 17	No 2	Yes 17	No 3	Yes 28	No 2

Tables 5 and 6 show the comparison of the responses in terms of willingness to renovate old buildings or to erect new building, willingness to accept alternate property and willingness to accept financial compensation of the residential and commercial property owners respectively in terms of the number of responses under each category.

Respondents in both categories showed a high level of willingness to accept the financial compensation at a market rate of the property.

In-depth interviews were conducted with the field experts and practitioners. (59.4%) of the including, field experts gave their opinion that the stratum 2 & 3 i.e. from Bund Road to DeraGujran have the greatest potential of urban regeneration. (59.4%) had the viewpoint that the Floor Area Ratio along the route of Orange Line Metro train should be “Unlimited for commercial & four storeys for residential”. Most of Professionals (54.7%) picked more than one option for the incentives including “Alternate option of land”; “Exempt commercialization fee” and “Fee concession in building plan” that should be given to property owners to carry out the urban regeneration project along the Orange Line Metro train. 29.7% of respondents thought that offering an alternate option of land would be more satisfactory/attractive for the property owners.

54.7% of Professional Town Planners had the opinion that Lahore Development Authority can play a lead role in carrying out urban regeneration projects along the Orange Line. According to the opinion of the Professionals, the biggest challenge to the implementation of urban regeneration projects along the said route would be Owner/social pressure (37.5%). 32.8% thought “Land Acquisition” would be more challenging. Whereas “Effective coordination between departments” would be more difficult for the implementation of the project according to (15.6%) of respondents.

All the surveyed Professionals suggested that amendments in the current regulations to promote high-rise mixed-use development along the said route were necessary. Most of the field experts (60.9%) suggested that there should be special regulations for the provision of high-rise buildings and parking plazas along the Orange Line Metro train to promote Transit Oriented Development as compared to other parts of the city.

The literature review revealed that allowing high-density development is necessary to facilitate urban regeneration along mass transit corridors. This also provides an opportunity of price premium at the location near the stations. Public participation is considered an important ingredient in designing and implementing urban regeneration projects.

Most of the buildings in the case study stratum were old having an age of more than 20 years and the property owners also showed interest to

rebuild/upgrade if the government offers some incentives. This reflects general acceptability for regeneration. Most of property owners were willing to accept the financial compensation at the prevailing market rate from the government if the up-gradation of the area would be required. The respondents showed their interest to move to some planned community to enjoy better public amenities. Only a few property owners, so far, received an offer by the investors or developers to sell workplaces or residences to them. This trend has also been observed along the route of BRT, Lahore where the investment injected in the corridor by investors and property owners results in the renovation, addition/alteration and redevelopment (Tahir, 2015).

Expert opinion predominantly favors unlimited height for the commercial and mixed-use buildings provided with adequate parking facilities & four storeys for residential buildings. LDA and Metropolitan Corporation (concerned zone) can play a lead role in carrying out urban regeneration projects along the Orange Line. However, effective coordination among all other concerned agencies is mandatory for a successful urban regeneration project along the Orange Line. All possible challenges to the implementation of urban regeneration project along the said route were measured but more weight age was given to the Owner/social pressure following the land acquisition and effective coordination between departments.

The research highlighted the need to have special regulations for the provision of high-rise buildings and parking plazas along the Orange Line Metro Train Route to promote Transit Oriented Development.

Conclusions and Recommendations

As per the international and national practices in the case of transit corridors, urban regeneration is expected along the Orange Line Metro train route in future. This research will provide a guideline once the Lahore Development Authority intends to prepare “Land-use rules and regulations” for the area around the said route and declare it as a project area for urban regeneration. The present research will provide a deep insight into the matter as the sustainable urban regeneration strategy has been recommended on the basis of the opinion of stakeholders including the owners of residential and commercial property, Professional Town Planners

serving in Lahore Development Authority and Local Government and private consultants

In view of the research outcomes, following are the recommendations including proposals and usage measures that are worth vigilant thought at various levels of vital choices and implementation of urban regeneration projects along the Orange Line Metro train.

Mixed Development

The vision of transit development should not be a short-term solution of relief from traffic congestion but should base on long-term outcomes of sustainable urban communities providing business and employment opportunities, housing to all income groups especially low-income people because low-income groups intend to be more dependent on public transport and a blend of all uses and facilities of life.

Provisions to Control Pollution

The weighted index for the provisions to control air and noise pollution was 1.92. Provisions to control air, water and noise pollution is the crucial part of urban regeneration projects along the said route and can be ensured by conserving and enhancing green areas and by promoting tree plantation and promoting green modes of transport.

Community Involvement in Public Decision-Making

The sustainable urban regeneration project can efficiently be designed and effectively implemented by ensuring community involvement in the project. The opportunity of price premium on the location near to the stations of Orange Line Metro train can be utilized in terms of high-rise residential buildings with the public-private partnership. As the recommended strategy for sustainable urban regeneration has been designed in the light of the community's opinion but it is strongly recommended to consult the community again before implementation to ensure the element of conservation and ownership of the project by users.

Provision and Access to Infrastructure and Public Facilities

The areas along Orange Line Metro Train Route were observed lacking with the infrastructure and public facilities especially stratum 2 & 3 (from Bund Road to DeraGujran). Provision and access to public facilities such as school, health care services, sports facilities, accommodation for different

income groups, public parks, and safety for pedestrian in addition infrastructure facilities must be incorporated in the urban regeneration project.

Proximity to Business Activities and Layout of Building and Streets

The weighted index of the factors “proximity to business activities” and “Layout of building and streets” was 1.89. High quality parking and pedestrian facilities must be given to fulfil the concept of TOD. By high-rise mixed-use development, the distances to workplaces can be minimized and pedestrian friendly street layout discourages motorized traffic.

Building Design in terms of Appearance, Density, Height & Mass

Both sides of the Orange Line Metro train route should be declared as a commercial zone by allowing unlimited height provided with adequate parking facilities as the said would attract the retail activities because of high catchment area and proximity to stations. By allowing the high-rise buildings, the population density can be kept high along the transit route.

Security against Crimes

The proximity to the stations would have an indirect impact in terms of crime and security threats. To mitigate the negative externalities and crime generation at stations to ensure a livable community should be an important part of sustainable urban regeneration strategy along the said route.

Finally, a coordination mechanism for all the concerned agencies should be developed to coordinate the development activities efficiently and effectively, provision of infrastructure and public facilities for the effective implementation of urban regeneration projects.

Recommendations for Future Research

“Findings and proposals” of this research, though mainly related to the case study area, can provide a sound basis for the sustainable urban regeneration of Lahore. For this purpose, further research will be needed to mitigate the indirect impact of negative externalities in the proximity of the areas to transit stations and to fully explore the potential benefits of transit and land-use integration. The research was carried out in a mega city i.e. Lahore as researcher belong to this city and it was not possible to carry out research in other cities of less population.

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