Pakistan Journal of Commerce and Social Sciences
2019, Vol. 13 (3), 796-805
Pak J Commer Soc Sci

Impacts of Accessibility on Vertical Commercial Land Use Pattern in the Central Business District of Peshawar, Pakistan

Sher Muhammad Malik (Corresponding author)
Department of Geography, The Islamia University of Bahawalpur, Pakistan
Email: sher.malik@iub.edu.pk

Amjad Ali
Centre for Disaster Preparedness and Management, University of Peshawar, Pakistan
Email: aliswabi@uop.edu.pk

Abstract

Now a days, commercial growth and development in cities are more vertical than horizontal. This vertical growth and development are controlled by the type of occupancy or land use. Higher the order of commercial activity in bid-rent system is supporting more vertical development. Consequently, the central business (CB) uses and particularly the retailing supports and control the vertical growth. Retailing and all sort of CB uses are directly associated with the mode & nature of accessibility. This study focuses on impacts of accessibility on the vertical commercial land use pattern in central business district (CBD) of Peshawar, Pakistan and thoroughly studies this association in detail. The subtypes of accessibility and retailing/commercial activity are grouped into singular expression by measures of central tendencies and then correlated with the number of visitors and level of vertical occupancy. The results show a common pattern in vertical land uses which is in liaison with the accessibility. This study not only explores the relationship of accessibility with vertical land use pattern but also provides basic information for investment and economic endeavor.

Keywords: accessibility, vertical commercial land uses, central business district (CBD), commercial retailing.

1. Introduction

Likewise, the other cities of Pakistan, the city of Peshawar is populated in three major patterns i.e. pre, during and post-colonial period. The major difference in development is the colonial grid pattern of the cantonments and their Saddar Bazaar areas. In Peshawar, the Saddar bazaar is the retail heart of the city with ongoing horizontal and vertical developmental activities. The Saddar bazaar is declared central business district (CBD) of Peshawar (Ali et al., 2018; Ali et al., 2019). These developmental activities modify the existing land use pattern by regional agglomeration of activities as well as economic centripetal and centrifugal forces (De Beule et al., 2015; Debrezion et al., 2007). The commercial land use pattern is very dynamic and complex phenomena in the CBD of Peshawar. The mode and nature of accessibility directly control the land use pattern in

the CBD of Peshawar. The CBD of Peshawar has grid pattern of roads and streets with wide widths. The parking facilities and variety in retailing activities not only attract customers from all around but also intensified vertical development in this area of the city (Baraklianos et al., 2018; Iseki & Eom, 2019; Hansen, 2009). The vertical development is controlled and modified by certain factors in which the accessibility plays a principal role (De Beule et al., 2015; Minner & Shi, 2017). The accessibility not only affect the location quotient of the activities on horizontal level but also control the vertical commercial land use pattern (Lin et al., 2018; Merino & Ramirez-Nafarrate, 2016; Mou et al., 2018). The present study in detail elaborated the components of accessibility along with their combined impacts on number of visitors and type of commercial activity.

The large portion of the economy relies on the commercial retailing activities. The modern techniques of shopping e.g. internet, debit cards, shipping from aboard etc. indirectly support the growth of mall-halls, big shopping centres etc. This situation provides new opportunity for development and modification in existing land uses (Ali et al., 2018; Hansen, 2009; Terayama et al., 2015; Turhan et al., 2013). Most of the studies focuses on the location quotient for a retail activity. This study has unique aspect of combining accessibility, land uses, types & hierarchy of retailing and customers' number on the same location. In other words, the horizontal factors and/or location quotient is a binary constant in this study. The major focus of this study is on the vertical arrangement of commercial land uses in the CBD of Peshawar. The accessibility, type of retailing/commercial activity, number of visitors and level of vertical occupancy work together to shaped the existing vertical commercial land uses in the CBD of Peshawar. Previously available research data shows that the upper portions of the most of buildings are used for non-central business (CB) uses (Ali et al., 2018; Ali et al., 2019). The agglomeration of commercial retailing and high-class offices & service in the ground and highly accessible first and basement floors shows the strong association of accessibility, type of retailing/commercial activity, number of visitors and level of vertical occupancy (Hoppenbrouwer & Louw, 2005; Manaugh & Kreider, 2013; Murakami & Chang, 2018). The relationship among these factors are explored in this study to quantify their impacts on the vertical land use arrangement in a building then the whole CBD of Peshawar. The tested association among four major variables shows strong interrelationship. Most of the variables like hierarchy of commercial activities, number of customers, floor occupancy for CB uses are strongly associated the accessibility. All other variables are moving around the accessibility. Higher the score of accessibility directly attract the higher values of the other variables. The vertical commercial land use pattern follows the pattern of accessibility. The first floor and basement show similar pattern of land uses based on the score of the accessibility. Higher portions/floors are least attracted to customers due to low score of accessibility and thus mostly occupy the low hierarchy of commercial land uses. These results are very important for future investment in kind of economic as well as physical development in any CBD or commercial areas of Pakistan. Similarly, these results can be interpreted for any economic and physical opportunity and endurance in the commercial areas of Pakistan (Acheampong, 2019; Ali et al., 2018; Mou et al., 2018; Turhan et al., 2013).

2. Methodology

The impacts of accessibility on vertical commercial land use pattern in the CBD of Peshawar, Pakistan are studied in three major phases i.e. profile land use survey & selection of samples sites; detail survey of accessibility, retailing type and number of visitors at selected sites; and studied the association among accessibility, type of retailing/commercial activity, number of visitors and level of vertical occupancy. The profile land use survey in the CBD of Peshawar is spread over 2,785,500 Sq. feet with the 6,855 commercial units of the 9,375 total units. All the data of these units regarding central and non-central business uses along with number of floors are recorded in 710 blocks. It is obvious from the data that ground floor is extensively used for retailing and very few buildings with better accessibility are used offices and retailing (Ali et al., 2018; Ali et al., 2019).

Based on this data source, 100 sample sites of buildings are selected from 20 main road/streets by stratified sampling technique for detail survey of accessibility, retailing type and number of visitors. All major building/commercial plazas e.g. Dean Trade Centre, Bilour Plaza, Peshawar Trade Centre, Arsheen Arcade, State Life Building etc. in the bazaar are selected (Figure 01). The type of the nature of accessibility is divided into size of front road/street, parking facility, frontal space of a building, entrance & exits, stairs and lift system. The data regarding different type of the nature of the accessibility is collected from maps, Google Earth images and video recordings. The different type of data is normalized (Equation 01). Similarly, the data about the number of visitors are collected from security cameras and personal observations at rush hours of the businesses. Each site data is converted to 01-hour average and then normalized (Equation 01).With equal weightage, all type of accessibility is combined into singular expression. Similarly, the type of retailing/commercial activity is grouped and number of visitors of all units are combined at each floor level.

$$X_{New} = \frac{x - \mu}{\sigma} \qquad (1)$$

Or $$X_{New} = \frac{x - x_{Min.}}{x_{Max.} - x_{Min.}}$$

Whereas μ represents the mean value of the variable, σ is the standard deviation between different values of the variable, $x_{Min.}$ is the minimum value of the variable and $x_{Max.}$ is the maximum recorded value of the variable.

$$r_{ij} = a + \frac{\max\{X_{ij}\} - X_{ij}}{Max\{X_{ij}\} - Min\{X_{ij}\}}(b - a) \qquad (1a)$$

$$r_{ij} = a + \frac{X_{ij} - \min\{X_{ij}\}}{Max\{X_{ij}\} - Min\{X_{ij}\}}(b - a) \qquad (1b)$$

For direct functional relationship among the variables (positive domain), equation “3a” is used, while for variables having indirect functional relationship (negative domain), equation “3b” is used.

All the basic variables of accessibility, type of retailing/commercial activity, number of visitors and level of vertical occupancy are normalized to study the association among

these variables. The combined weightage of the accessibility is converted to the range of excellent, good, satisfactory, poor and limited. Based on their hierarchy and location quotient, type of commercial activities is grouped into retailing: fashion & jewellery; retailing: company & cloths'; retailing: food & electronics; retailing: miscellaneous activity; and services & offices (Ali et al., 2018; Ali et al., 2019). The number of visitors is arranged in orders of > 40; 30 – 39; 20 – 29; 10 – 19; and 0 – 9. For practical purposes, the upper floors used for non-CB uses are excluded from level of vertical occupancy i.e. ground floor; basement; 1st floor; 2nd floor; and 3rd floor. The association and inter-relationship of the nominal nature data is studied through Cramér's V (φc) method while nominal vs ordinal is studied through Partial Eta Squared method (Equation 02&03). To conclude the overall impacts of the accessibility on the vertical commercial land uses, all the averages of four major variables are normalized from range 1 to 5 and plotted on graph with trend line for vertical occupancy (Equation 01).

$$\varphi c = \sqrt{\frac{\varphi^2}{\min\,(k-1,r-1)}} \qquad (2)$$

Whereas: φ is the phi coefficient; $x^2$is derived from Pearson's chi-squared test; n is the grand total of observations; k being the number of columns; rand being the number of rows. The values of ranges between 0.00 to 1.00 (no relationship to perfect relationship)

Partial $eta^2 = SS_{effect} / SS_{effect} + SS_{error}$. (3)

Partial eta squared is the ratio of variance associated with an effect, plus that effect and its associated error variance.

Figure 1: The Central Business District of Peshawar
Source: Modified after (Ali et al., 2018)

3. Results and Discussions

The accessibility, type of retailing/commercial activity, number of visitors and level of vertical occupancy are in complex and compound interrelationship. Accessibility has fundamental role in their interdependence. Development and/or modification in any variable directly affect the other variables and ultimately their vertical land use pattern. This compound and complex relationship is studied in three major steps. In the first step, the association of accessibility with the type of retailing/commercial activity, number of visitors and level of vertical occupancy are studied. Similarly, the relationship of the type of retailing/commercial activity with the number of visitors and level of vertical

occupancy is also studied. In the last step, the overall performance of the four variables in the selected sample size is summarized with normalized values.

The CBD of Peshawar has almost twenty small and large bazaars i.e. Mall Road, Arbab Road, Stadium Chawk, Saddar Road, Liqat Bazaar, Shafi Market, Landa Bazaar, Tipu Sultan Bazaar, Fawara Chawk, Jinnah Streets, Holy Street, Library Street, Hali Street, Kabari Bazaar, Jami Street, Faizullah Khan Street, GPO Lane, Fakher-e-Alam Road, Sunehri Mosque Road and FC Chawk area. The Saddar roads has the average width of 22 metres while in the centre of the bazaar has 36 metres and thus provide huge parking area. The Mall road has 22 metres width. Both are unique due to vehicular parking facilities. Most of the roads in the CBD are with the width of 15 metres while centrally located areas has small streets with the width of 6 metres (Figure 01). Certainly, the new development of Rapid Bus Transport (RBT) has visible impacts on the present bus stops and pedestrian flow. All sub types of accessibility for a building is converted to normalized values and then their averages into nominal values of excellent, good, satisfactory, poor, and limited (ranges from 1to 5). Similarly, the CB uses are grouped into five nominal categories of fashion & jewellery, company & cloths', food & electronics, retailing (miscellaneous), and services & offices (ranges from 1to5).The values of the association of accessibility with the type of retailing/commercial activity, number of visitors and level of vertical occupancy are: Cramer's V = 0.629; Partial Eta^2 = 0.789; and 0.82, respectively. These values indicate strong positive relationship of accessibility with other three variables (Table 1). On the same passion, the study of the relationship of the type of retailing/commercial activity with the number of visitors and level of vertical occupancy shows very strong positive relationship with Partial Eta^2values of 0.786 and 0.809 (Table 02).

The combined study of all four variables shows that the ground floor has highest retailing activities with maximum accessibility and visitors' number. The basement and first floor are in mixed response situation where the accessibility defines the number of visitors and commercial activity. The higher combine score reflects higher number of visitors and thus higher commercial land use and vice versa. The non-availability of basement with buildings is the only difference in the first floor and basement values. Either it is big shopping centers like Dean Trade Centre, Bilour Plaza, Peshawar Trade Centre, Arsheen Arcade, State Life Building etc. or small plazas/building, the combined values sharply declined which impacts are visible on the vertical land use pattern. It is common trend in the results that the upper portion of building is used for non-CB uses and low-profile CB uses (Figure 2).

Table 1: Association of Accessibility with the Type of Retailing/Commercial Activity, Number of Visitors and Level of Vertical Occupancy

	Level of Accessibility	Excellent	Good	Satisfactory	Poor	Limited	Total
Type of Commercial Activity	Fashion & Jewellery	19	0	0	0	0	19
	Company & Cloths'	5	14	0	0	0	19
	Food & Electronics	3	14	0	0	0	17
	Retailing: Miscellaneous	2	0	8	8	0	18
	Services & Offices	0	0	16	6	5	27
	Total	29	28	24	14	5	100
	Cramer's V = 0.629						
Level of Vertical Occupancy	Ground Floor	25	9	0	8	0	42
	Basement	1	11	0	0	0	12
	1st Floor	2	8	9	0	0	19
	2nd Floor	1	0	8	6	0	15
	3rd Floor	0	0	7	0	5	12
	Total	29	28	24	14	5	100
	Partial Eta^2 = 0.789						
Number of Visitors (per 01 Hour)	> 40	20	0	0	0	0	20
	30 - 39	7	18	0	6	0	31
	20 - 29	2	8	8	2	0	20
	10 - 19	0	2	12	2	0	16
	0 - 9	0	0	4	4	5	13
	Total	29	28	24	14	5	100
	Partial Eta^2 = 0.82						

Source: Field Data, 2018

Table 2: Association of Retailing/Commercial Activity with the Number of Visitors and Level of Vertical Occupancy (Floor Level)

Type of Commercial Activity		Fashion & Jewellery	Company & Cloths'	Food & Electronics	Retailing: Miscellaneous	Services & Offices	Total
Level of Vertical Occupancy	Ground Floor	19	7	7	9	0	42
	Basement	0	12	0	0	0	12
	1st Floor	0	0	10	0	9	19
	2nd Floor	0	0	0	9	6	15
	3rd Floor	0	0	0	0	12	12
	Total	19	19	17	18	27	100
	Partial Eta^2 = 0.786						
Visitors (per 01 Hour)	> 40	16	1	1	2	0	20
	30 - 39	1	11	13	6	0	31
	20 - 29	2	6	2	4	6	20
	10 - 19	0	1	1	6	8	16
	0 - 9	0	0	0	0	13	13
	Total	19	19	17	18	27	100
	Partial Eta^2 = 0.809						

Source: Field Data, 2018

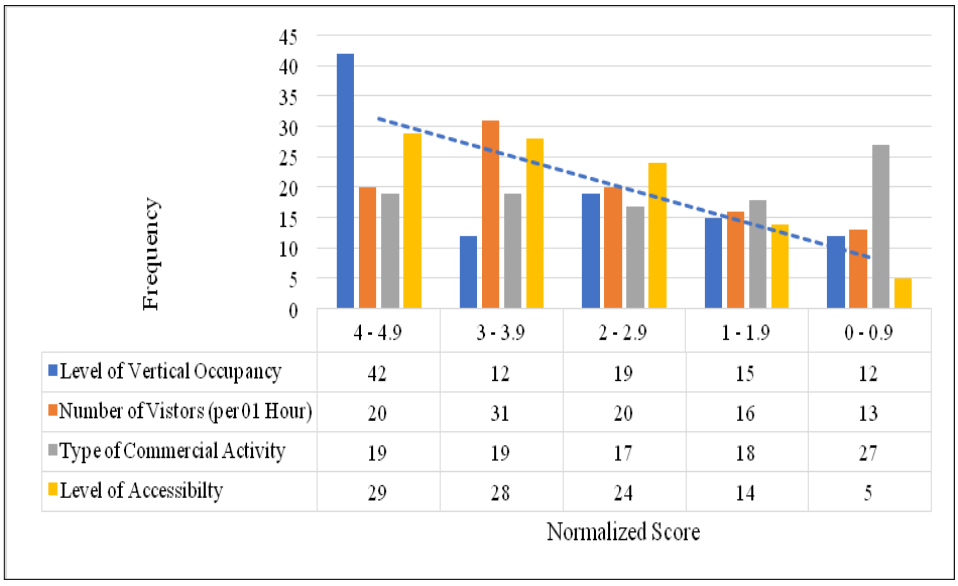

Figure 2: Combined Effects on the Vertical Land Use Pattern in The CBD of Peshawar

Source: Field Data, 2018

4. Conclusion

The vertical commercial land use pattern is affected and modified by accessibility, number of customers, floor number, type and hierarchy of commercial activity. The location quotient is considered as binary constant in which the outside competition for a land use pattern is considered in direct control of accessibility. It is obvious that accessibility, hierarchy of commercial activity, level of floor occupancy and number of customers/visitors has strong interrelationship with more than half values for all association tests. Two components of the four major variables are more compound in nature i.e. accessibility and hierarchy of commercial activities. Similarly, their interrelationship more complex than the rest of two variables. The number of customers at any site is directly dependent on these two variables. Based on previous studies and acceptable criteria these two variables are grouped into five classes of each with nominal nomenclature. It is worth mentioning that each component of accessibility is standing in numerical form and their averages are converted into nominal data for association tests. The 100 selected sample sites are studied with their relationship intensity with accessibility and then with commercial activities based on their hierarchy/rank. Both results show very high association among all variables which support the basic hypothesis that accessibility has direct impacts on the vertical land use arrangement. The individual association analysis and then combined impacts on the land use arrangement verify that the higher accessible areas/floor has higher hierarchy of commercial activity as well as number of customers and vice versa. In other words, the ground floor and those floors whose has better accessibility system can support the movement of higher number of customers and thus occupy higher ranked commercial activities. In contrast, those areas/floors where accessibility has problem and lower combine scores occupy lower grade commercial activities. Least accessible areas/floors are occupied mostly by non-CB uses. In nutshell, the pattern of vertical commercial land uses follows the pattern/score of the accessibility.

5. Outcomes and Recommendations

The study of compound and complex interrelationship of accessibility and vertical commercial land use pattern with appropriate methodology are the two major outcomes of this study. The city planners, investors, businessmen and economists will pay immediate attention to the first aspects. The searchers and students will pay their attention to the second aspects of methodology which improve the knowledge regarding CBD. The sustainable cities and economic growth are the components of SDGs. The present study is a base for understanding of city economics and their development with multidisciplinary lens.

REFERENCES

Acheampong, R. A. (2019). Integrated Spatial Development and Transportation Planning *Spatial Planning in Ghana* (pp. 231-267): Springer.

Ali, A., Malik, S. M., & Jan, M. A. (2018). Delimitation of the Central Business District Peshawar (Pakistan). *Global Social Sciences Review, 3*(1), 193-213.

Ali, A., Malik, S. M., & Sohail, N. (2019). Geo-spatial analysis: Identification of the Central Business District of Peshawar, Pakistan. *Pakistan Journal of Commerce and Social Sciences, 13*(1), 123-149.

Baraklianos, I., Bouzouina, L., & Bonnel, P. (2018). The impact of accessibility on the location choices of the business services. Evidence from Lyon urban area. *Region et Developpement, 48*, 85-104.

De Beule, M., Van den Poel, D., & Van de Weghe, N. (2015). Assessing the principles of spatial competition between stores within a retail network. *Applied Geography, 62*, 125-135.

Debrezion, G., Pels, E., & Rietveld, P. (2007). The impact of railway stations on residential and commercial property value: a meta-analysis. *The Journal of Real Estate Finance and Economics, 35*(2), 161-180.

Hansen, S.H. (2009). *Analysing the Role of Accessibility in Contemporary Urban Development.* Paper presented at the Computational Science and Its Applications – ICCSA 2009. Lecture Notes in Computer Science, Berlin, Heidelberg.

Hoppenbrouwer, E., & Louw, E. (2005). Mixed-use development: Theory and practice in Amsterdam's Eastern Docklands. *European Planning Studies, 13*(7), 967-983.

Iseki, H., & Eom, H. (2019). Impacts of Rail Transit Accessibility on Firm Spatial Distribution: Case Study in the Metropolitan Area of Washington, DC. *Transportation Research Record*. [ONLINE] Available at: doi:/10.1177/0361198119844464.

Lin, G., Chen, X., & Liang, Y. (2018). The location of retail stores and street centrality in Guangzhou, China. *Applied Geography, 100*, 12-20.

Manaugh, K., & Kreider, T. (2013). What is mixed use? Presenting an interaction method for measuring land use mix. *Journal of Transport and Land Use, 6*(1), 63-72.

Merino, M., & Ramirez-Nafarrate, A. (2016). Estimation of retail sales under competitive location in Mexico. *Journal of Business Research, 69*(2), 445-451.

Minner, J. S., & Shi, X. (2017). Churn and change along commercial strips: Spatial analysis of patterns in remodelling activity and landscapes of local business. *Urban Studies, 54*(16), 3655-3680.

Mou, S., Robb, D. J., & DeHoratius, N. (2018). Retail store operations: Literature review and research directions. *European Journal of Operational Research, 265*(2), 399-422.

Murakami, J., & Chang, Z. (2018). Polycentric development under public leasehold: A spatial analysis of commercial land use rights. *Regional Science and Urban Economics, 71*, 25-36.

Terayama, K., Odani, M., & Iwasaki, K. (2015). Study on Evaluation of Convenience of Access to the Nearest Railway Station by Residents in Housing Development Areas in the Suburbs of Kobe City in Japan-Using Utility-Based Accessibility Measures. *Journal of the Eastern Asia Society for Transportation Studies, 11*, 379-391.

Turhan, G., Akalın, M., & Zehir, C. (2013). Literature review on selection criteria of store location based on performance measures. *Procedia-Social and Behavioral Sciences, 99*, 391-402.