The Costs and Benefits of Alternative Development Patterns: A Paradigm of Two Universities

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By

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Abstract

Cities are places where innovation, invention, technological and knowledge spillovers occur. However, they are also places where unemployment, crime, pollution, and exploitation of human resources occur. One major problem of cities of today is the low density leapfrog/scattered development pattern that leads to high service provision costs and reduces the welfare of society. This study aims at comparing the cost of smart versus scattered development patterns for Pakistan. Due to data limitations two universities are selected for analysis purpose. On the basis of observational analysis QAU is labeled as leapfrog/scattered whereas COMSATS is categorized as Compact Development. We hypothesize that low density scattered development leads to higher service provision and social costs and compact development can lead to cost savings. The empirical exercise consisted of a randomized survey indicate that COMSATS students have better access to different facilities due to compact development pattern. The ordinal probit model was employed on survey results. Connectivity was found to be significantly associated with walkability though association is not the same as causation. The comparative analysis for service provision cost showed striking cost differential, as QAU spends a lot more than COMSATS to provide basic facilities. The results prove the baseline hypothesis. It is suggested that. QAU should use elements of smart growth like infill development and should make better use of large land endowment rather than it has become a curse. Both universities should work to raise social interaction among students. The real benefits of smart growth lie with the cities, and each city should apply smart growth to achieve cost savings and higher social capital.

Key Words: Sprawl, Density, Social Costs, inefficient Land Endowment

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1. Introduction

Cities around the globe serve as the hub of innovation, creativity, knowledge and skill. They provide employment opportunities and overall raise living standards. Today, half of the world population lives in cities and contribute to 80 percent of Gross Domestic Product. We live in an urbanized world, and Pakistan has faced the most rapid urbanization among South Asian countries. The big metropolitan areas contribute almost 78 percent to GDP and 1.5$ to GDP per capita (GOP, 2011).Though urbanism has revolutionized cities and has created agglomeration benefits, it is not free from the consequences. One of the most cited effect of Urbanism is its impact on land use. Overtime the land use around the world has turned into a pattern that is referred as "urban sprawl". It is a phenomenon which is identified by low density and scattered pattern of development. The expansion usually occurs from the core to the suburbs of a metropolitan area. Sprawled developments synonymously known as conventional or leapfrog development share the common features of low density; monologues land use, automobile dependency, and gated neighborhoods. Common causes for sprawl are rapid population increase, poor regulation, mismanagement of resources and city planning. Further sprawl also occurs when central and provincial government own large parcels of land in city centers, thus discouraging housing development at the core, and ultimately pushing it to the periphery.

The low density and scattered development pattern is favored on the ground that to live in the central city or the suburbs is a matter of individual preference. In most cities, suburbs are cleaner, safer, and have less congestion (Slack, 2002).Urban Development at the fringes is also favored on the taxation argument. The central city has high property taxes and housing affordability is expensive. Moving to the suburbs, the upper middle and elite class has the chance of availing low taxation and saving on rents (Carruthers and Ulfarsson, 2003).Another reason given is that the current urban patterns are just due to the increase in population, and have no or little effect on the environment and the society (Gordon and Richardson, 1997).Yet the arguments and evidence against leapfrog development pattern are very strong. It is discouraged by different stakeholders of the society due to a number of reasons. More importantly, most economists agree that sprawl is an externality and a market failure situation-primarily due to three main reasons Firstly the current land development patterns fail to account for the value of social space. Secondly it makes longer commutes look artificially cheap and thirdly it fails to capture the infrastructure costs. Additionally, sprawl is caused because federal and provincial governments own large parcels of land which discourage housing development in city center.

The alternative proposed to current low density scattered development pattern is known as "smart growth". It is a multidimensional concept, all about intelligent use of technology, making people live and work easily in an atmosphere that is environment friendly and has an equitable distribution of resources. Smart growth strategies propagate protecting environment, conserving natural land, promoting mixed land use, reducing automobiles dependency, upgrading public spaces, and saving the infrastructure and operating costs.

The developed and the developing world including Pakistan is in a state of constant debate on the two development patterns (leapfrog VS the smart growth). Over years, the situation in Pakistan has turned cumbersome. The population has almost doubled in 60 years and the major chunk of this resides in cities. All major cities have stretched enormously in a horizontal manner, and have acquired the areas that were once used for agriculture or

recreational purposes. Due to this enormous city size municipality service delivery has become a challenge for the government and an issue of survival for residents. This has also led to the formation of slums. According to latest Urban Unit report, 47% of the population is residing in slums, thus only 53% have access to basic amenities and municipal services Moreover, many of the government policies are encouraging low residential density development. Monologues land use and single family homes are encouraged and a number of housing schemes have emerged in the suburbs. All these suburban development has to be provided with basic amenities, thus making both the public and private sector encourage huge costs. Floor to area (FAR) ratio is very low in cities like Karachi than that of other cities of the world. Further, as the major state institutions are themselves involved in business, it becomes very difficult to make the prime land available for mixed use. The rent seeking behavior by the bureaucracy and the "Not in my back yard" NIMBY mindset of the people coupled with weak city administration has made cities in Pakistan hub of problems. It is high time that research, city planning and policy making address the issue of sprawl and save the costs associated with it, as well as protect the environment and land.

1.1 Research Question and Objective of Study

Based on the above discussion, it is imperative for Pakistan to undergo a process of rethinking about cities. Thus the general question of this research is to assess the service provision costs and the social costs of current leapfrog development pattern, versus alternative development pattern.

The study has three basic hypotheses

1. The area under study has scattered/leapfrog development pattern over time.
2. Due to this low density and leapfrog pattern of development, the costs for service and infrastructure provision are high besides having social exclusion.
3. The compact pattern of development can lead to saving benefits.

The objectives are

- To calculate the service provision and social costs of current land use patterns and compact development pattern.
- To highlight the costs that can be saved by moving from leapfrog development pattern to compact development patterns
- To put forward suitable policy recommendations for alternative development patterns and promote efficient utilization of land and other natural resources.

While the economic literature consists of a number of studies addressing alternative costs of development patterns, both qualitatively and quantitatively, these studies are confined to the developed and very few for developing countries. To date the topic remains unaddressed with respect to Pakistan. As Pakistan is the most rapidly urbanizing country among the South Asian countries, the need of the hour is to address the issue of costs of current development pattern with special reference to Pakistan. Unfortunately, Pakistan severely lacks data on urban indicators at town and municipality level; hence a sort of analogy analysis is conducted. This is done as a preliminary step towards an area of research and policy making which is very important, yet remains unaddressed in Pakistan. Thus the study hopes to somehow narrow down this literature gap, and set founding stones for future research in the respective domain

2. Literature Review

2.1 Leapfrog Development VS Smart Growth: The Case of Service Provision Costs

Numerous studies have calculated the costs for the two development patterns and have made valuable contributions. The pioneering empirical work is of Real Estate Corporation, 1974. The study measures costs for different land use and development patterns. It was concluded that low density development uses almost four times greater land for residential purposes in comparison with other development patterns. Moreover, a high density development has 21% lower costs than a combination development, and 44% lower costs than sprawled development. Similar results were found by Keyes, 1979 who concluded that high residential development in the form of towns and downtowns instead of single family detached homes will lead to modest energy savings. A well planned urban spatial structure would reduce travel demand, and save commuting costs and congestion.

Fodor, 1997 examines the cost of growth patterns for Oregon and identifies physical infrastructure costs as the basic focus of urban development. He concludes that service provision to single detached homes is expensive, impact fees and tolls only cover a part of these costs, thus new strategies to deal with urban sprawl should be devised. Similarly Synder and Bird, 1998 carries a detailed analysis of sprawl and agrees with the notion of applying impact fees on new development. The new development should pay its fare share and Impact fees are generally acceptable by the general public because it makes new development pay for itself without a decrease in service provision to downturns. However, with impact fees imposed the new development becomes expensive, hence discouraging economic and business activity. Thus the solution to use impact fee depends on careful analysis of the local market.

Bruegel et al, 2000 asses the alternative development costs for New Jersey. Almost 2.3 billion dollars can be saved, and huge amounts can be preserved from road construction, water supply, and sewerage facilities. Similarly Carruthers and Ufarson, 2003 examined the sprawl costs in America. The empirical evidence strengthens the finding that per capita expense on service provision declines with the increase in density. A recent Survey conducted by Smart growth America, 2013 highlights that smart growth can lead to an average savings of 38% in infrastructure and 10% in municipal services. It tends to increase revenue by 10% per acre against the conventional development pattern. Litman, 2014 points out that compact development leads to reduction in operating and capital costs, improvement in accessibility, decrease transportation costs, fatalities, and pollution. It is due to the benefits of smart growth that people cluster in central business districts. For municipal service costs it is mostly the capital costs that are compared between a dispersed and compact development and critics argue this difference is not very large, however, Litman through calculations from previous work makes the point that if operating costs are added, the difference goes wide and compact development leads to cost savings. The final form of relationship between density and costs of service provision is complex, since it differs from area to area, the elements that constitute costs and the level of service provided. However, sufficient evidence shows that clustering and increasing densities from low to medium decrease service costs. Single land use development is inefficient, costly, and wasteful for resources.

2.2 Leapfrog development VS smart growth; The Case of Social Costs

Besides high service provision costs, the current built design is blamed for limiting accessibility and mobility, reducing connectivity and increasing social isolation. These costs are collectively referred as social costs. We first define them and then cite some literature regarding the social impact of the current development pattern.

Accessibility and Mobility is defined as the ability of people to reach offices, homes, shopping centers and other recreational places. This to and fro mobility of people is highly dependent on transportation mode, time, and money and is affected by the land use proximity and density of different areas. Mobility is about including all modes of transport (walking, bicycling, and motorbike) whichever people prefer to reach their desired area or service (Litman, 2014). Mobility should not only be limited to people who can drive a car but should also include women, children, old people, handicapped and those wishing not to drive for any reason should be equally mobile to reach places and facilities.[1]

Connectivity is a measure of the strength of the built design as well as of the transportation system. The public transit is important to make everyone connected (Zhao, 2011) However, in current land use patterns central cities and suburbs appears to be disconnected. Further the interconnections between communities and societies appear to be weak and often absent. Glaeser and Kahn, 2003 labels the current suburban form of cities as the byproduct of automobile dependency and the only back drop of the current development pattern is that it divides the society i.e. those cannot afford a car are left behind. Farbar and li, 2013has examined social interaction potential for the metropolitan areas of America. The results reveal that decentralization, fragmentation, and longer commuting time reduce the value of social interaction metric. Automobiles were also blamed for increasing sprawl and social segregation. Contrary to these negative effects, infill development and intensification of residential and employment density will have a positive effect on the social interaction of a society.

Social Interaction is all about interaction, communication, and relations among people of a society. At the individual level, social interaction is important for physical, mental development, and happiness of an individual. At a society level, good social interactions and strong social ties promote cohesion and strengthen social capital. One of the most famous works regarding social capital was of Putman. It was Putman, 2000 who argued that the social capital of America has declined over the years, and one of the factors responsible is the current housing pattern. Later the work was carried further in many aspects. Freeman, 2001 examined the relationship between neighborhood ties and land use pattern. Current leapfrog patterns limit the chances of face to face interaction among people of a neighborhood. Contrary to it, a compact neighborhood design enhances social ties and reduces driving. Camagni et al, examined the relationship for Milan, Italy. The study highlights the notion that development at the fringes consumes land, limits mobility, socially segregate the society, and lead to high economic and social costs. With respect to mobility, the efficiency and competitiveness of the public transport appear to be dependent on the urban form. Thus compact development and polycentric pattern of development should be focused as they save costs.

[1] For a detailed discussion of Accessibility and mobility Please see 'Evaluating Accessibility For Transportation Planning: Measuring People's Ability to Reach Desired goods and activities by Litman, 2014.

Similarly studies have explored the benefits of other components of smart growth. Handy and Ewing, 2009 Emphasizes the importance of walkability as not only a means of exercise, or of reaching destinations, but also as a leisure time activity. The physical features of an urban area influence the behavior of walkability, thus a good urban form should promote the activity of walkability. Societies that encourage walking are conducive to the environment, and strengthen the transport system. Litman, 2007 points out those Good walking conditions saves transportation costs as a recent study points out that automobile dependent households spend 50% more for transport than those households that are located in walkable and accessible neighbor hoods Good walkability also saves the land needed for transportation activities.

Most of the research activity does support the notion that current resource use pattern is unsustainable and needs to be changed. One of the limitations of this research is that for empirical purposes, we would conduct the analysis for two universities. However, this isn't a bizarre activity for two reasons. Firstly the two universities do have an analogy with the two developments patterns-discussed in detail in section 3. The second and more important reason is the importance of universities in itself. Universities are places where idea sharing, knowledge generation, and social collision occur. Universities around the world maintain an active student environment which is only possible through compact built designs. A good university is meant to enhance student life activity. Just like a city, a university should encourage social interaction, and provide equal access to students to all facilities, and ensure mobility even of the handicapped. Ultimately, it is conducive environment through smart and socially inclusive built-in patterns that facilitate ideas sharing, debates to take place on innovative ideas and opportunity for other positive activities.

3. Data and Methodology

3.1 The Study Area

It is important to investigate the costs of current land development patterns for Pakistan and to conduct the task empirically certain assumptions are made. As the data for urban indicators at town level is not available, we assume two universities as the unit of analysis. We assume that these two universities have almost the same elements as of municipality of a city, and thus drawing an analogy of universities with municipality area, we would analyze them to strengthen the case that the current development pattern is inefficient and is leading to high costs.

The two universities selected are Quaid i Azam University and COMSATS Institute of Information Technology. Both universities are located in suburbs of Rawalpindi/Islamabad. Universities just like cities incur transportation costs; provide basic infrastructure, drinking water and sanitation services, trash collection security and many more services. Thus, with regard to service provision, a university administration is quite similar to the local government of a town/municipality area. While both universities are located in suburbs both have different physical characteristics and land use patterns.

The Quaid i Azam University is a government institute established in 1960s.The University stretches over an area of 1700 acres. It has 19 academic and 1 administration building, 1 library, 8 hostels, and suites for faculty and staff. Other services like gym, daycare, guests, mosque, gardens, and cafes are also provided, though the quality of these services is questionable. The university almost enrolls 5000-6000 students. The other university selected is COMSATS University. It is a semi government institution. The institute has eight campuses in

different cities. We would be analyzing the Islamabad campus that was established in 1998. The campus enrolls more than 5000 students. The building stretches over a land area of 3 acres and is equipped with latest technology and modern infrastructure. Anyone familiar with Quaid i Azam University campus can relate its land development as a low density and scattered development pattern. The main campus and other building consist of scattered departments and to reach from one place to another the walking distance is between 10-30 minutes. Resultantly many people use private cars and bikes, or use the university shuttle service. There are few sidewalks and footpaths and thus the university appears less pedestrian friendly. Due to these distances involved, reaching the library, mosque, bus stand, café, and play ground require a good amount of time. Thus the element of accessibility and social interaction gets limited. The university has a lot of uncovered area and to maintain the security and cleanliness of these areas requires a chunk of the labor force, and yet it has not been able to manage all issues efficiently. Thus the university bears the high cost due to its development pattern. The social exclusion and lack of interactivity between students remains there.

How is COMSATS designed? Stretching over an area of 3 acres the university appears a more planned and well designed structure. Different Academic departments are grouped in two to three main buildings, thus reaching from one department to another doesn't require much transportation or walking. Cafes, mosques, and green areas appear not only accessible but also these places nice look generate positive externalities to their users. The university has a tighter control on security, and maintenance around the campus is pretty good. The faculty block, administration department, hostels and residential area for staff are closely related thus promoting proximity, closeness and a better social interaction. A major part of the university is provided with good heating and cooling system and is illuminated even at night.




3.2 The Methodological Approach

The methodological approach followed in this study is a qualitative and comparative approach and compromise of three parts.

3.2.1 Density

Density is a simple, yet highly important concept. Generally density is a ratio between the total number of people and the total area they occupy. In this study, we would calculate the student density for both universities i.e. the total number of university students divided by the university areas. Comparing density is important because scattered form of development is lined with low density and compact development promotes higher density score. Thus we would check the student density score for both universities. A low score would highlight dispersion, and a higher score would indicate compactness in the design. The calculation of density requires data for two variables (total land area, total student population). Thus information would be collected from official fact books and yearly reports of both universities.

3.2.2 Social Costs

For this research as we are examining land use patterns. We will analyze the impact of the existing development pattern on the social ties and linkages among students. Thus students would serve as the focus group for this study. The social impact would be gauged through four common indicators that are commonly used in the studies addressing segregation or integration in any society. For this research, we would be examining the mode of transport which majority of students uses to reach university. This would give a clear picture of mobility of the universities from the perspective of students. Similarly accessibility would be measured through the frequency of visit and time spent on reaching different facilities and services within the university. For example, if the café is situated at a distance of thirty minutes, then the facility is almost inaccessible to students, and thus immobility from the department would be preferred.

We are also concerned with the connectivity between different departments of the university. Strong interconnections are important to facilitate students and foster social capital. As the basic unit of analysis are the students. Thus we have tried to gauge the social interactions among students at the university level and have tried to answer the question Does *the built environment of these universities promote social interaction among students, or limit the ability*. Thus social interaction serves as our fourth indicator. The findings will reveal the social interaction level of our universities.

The major issue this study faced was of data availability. We didn't have data or survey reports regarding the within campus accessibility, centeredness, social interaction, energy efficiency, walkability and mobility. To gauge the social costs of current land patterns a survey has been designed. The above mentioned indicators would be captured through a short survey. This survey consists of 11 closed ended and 2 open ended questions. The survey would be conducted through random sampling, selecting 140 students from each university. This randomization will ensure that the students surveyed are from all departments of the university. The results would be then analyzed and would sketch the social integration or segregation of the university students. The results of the survey exercise will give us a rich data set which can be

used for further statistical analysis. We would apply two statistical procedures, the details of which are discussed in the following section.

3.2.2-A Hypothesis Test for Proportions

For this analysis, we have four main indicators and thus we represent each indicator through one main set of hypothesis. Thus, for our four indicators we would have four sets of hypothesis to be tested. These hypotheses are as follows:

For the indicator social interaction we select the variable "prayer place". The question asked was that *Where do you offer prayer besides Jumma?* The question was restricted to male students only. The null hypothesis stated means that there is no difference between the place of praying for both universities and the alternative hypothesis state otherwise.

For the indicator accessibility, we select the variable "access to library". The question asked was that *how much time does it takes you to reach the following facility*. The question was asked for a number of services however, we will only test for one of these facilities i.e. library. The null hypothesis states that there is no difference in accessing library in both universities and vice versa.

For the indicator walk ability, we select the variable "walkability in university". The question asked was that *do you agree that the distance between all departments and services of your university are walkable on foot?* The null hypothesis states that there is no difference among the walkability conditions of both universities and the alternative hypothesis state otherwise.

For the indicator connectivity, we select the variable "interconnectivity in the built design". Students were given a statement and options ranging from agree to disagree. *The Different departments of your university have interconnections and are constructed in a compact form was* the statement asked.

Thirdly an ordinal probit model would be estimated. Model formulation and results are discussed in section 4.

3.2.3 Service Provision Costs

The service provision costs are the costs that the universities are incurring to provide basic services and facilities to students, faculty, and other activities related to the university. Generally a university incurs many service delivery costs. It is supposed to provide services for drinking water, sanitation, trash collection, security, in campus roads maintenance, and many more. All these service provisions are a liability for any university, and thus it incurs a cost to provide them. For this analysis we would only focus on the variable and operating costs. Further, there are a number of service provision costs, however, for analytical simplicity; we would consider the costs that are incurred in the service provision of following four facilities.

I. Drinking water
II. Electricity
III. Gas
IV. Repairing Costs

The exercise here would compare costs of the two different land use patterns and would highlight the costs that could be saved by designing these universities smartly. It would be an

interesting exercise to analyze the costs that these universities are incurring over time due to their land use patterns. The results of this investigation would either prove or reject our basic hypothesis whether higher density/compact development uses land efficiently and leads to lower costs of service provision or not. Despite the fact that cities are more complex units than universities still most of our results implied for our case study are valid for cities of Pakistan as these two universities are used as an analogy to cities. Further, none of the universities have all of the features of leapfrog development or smart growth, but based on observational analysis, we have labeled one of them as having a scattered structure, and other as a relatively compact form. The results of this comparative analysis would answer the question that which land use pattern is saving costs and is thus efficient.

4. Results & Discussion

4.1: Density the Identifier

In our preceding discussion, QAU has been categorized as a low density and COMSATS as an example of compact built design. To add more strength to the argument, we calculated densities for both universities. The calculations are presented in the following table.

	QAU	**COMSATS**
Total Population	7024	6,147
Total area	1704 acres 689.58 hectare	43 acres[2] 17.40 hectare
Density Score	10.18 people per hectare	353.27 people per hectare

TABLE 1: Comparative Density Analysis

From Table 1 we observe that while QAU holds almost 11 people per square km, COMSATS hold 354 students on average. Individually, these scores may look fine; however on comparative basis the difference is large. The density scores for both universities support our observational analysis that QAU has a low density development pattern, whereas COMSATS had a compact built design. This simple exercise further serves as basis for testing our hypothesis that low density development leads to high service provision costs and social segregation.

4.2 Social Costs-Survey Descriptive Analysis

The social costs that the society suffers due to the built in design have been covered in section two. A survey was designed and conducted among students of the two universities to capture the social costs that are borne by the students. The selected indicators were represented through a set of questions. Some of these results are as discussed in the following sections.

- **Walkability**

The set of questions intended to capture the situation of walkability within the campus. Walkability is important for reaching amenities provided by the university administration. Figure

[2] 1 acre=0.404686 hectare

1 reports the response to the statement that *the distance among all departments (including admin and other basic services) of your university is walk able and accessible on foot.*

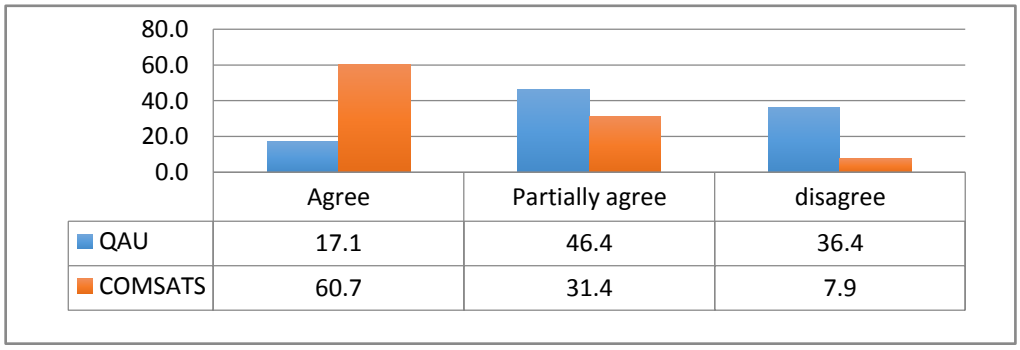

FIGURE 1: Walkability within Campus

The walkability among departments and basic services is a major concern for students. The basic amenities provided by university management should be equally accessible and located at a walk able distance from all departments While 17% of QAU students agree that the distance is walk able. The frequency is much higher in COMSATS and is almost 60%. Thus the results show that QAU university design doesn't promote walk ability mainly because of its built design. The results of the other questions that were designed to capture walkability are reported in appendix-Table 3. Overall the results confirm that COMSATS report improved walkability within campus and this is attributed to the built design. While we do acknowledge that QAU has a hilly landscape, thus making walkability difficult, this difficulty gets further aggravated as more roads and paths are required to connect the scattered prototype. This in turns leads to higher construction costs, repairing and maintenance costs, as well as a reduction in overall walkability.

❖ Connectivity

Three questions were planned to capture the connectivity scenario of the two universities. Figure 2 reports the response to the question the *roads and path network is well connected, maintained, and free from natural or physical barriers.*

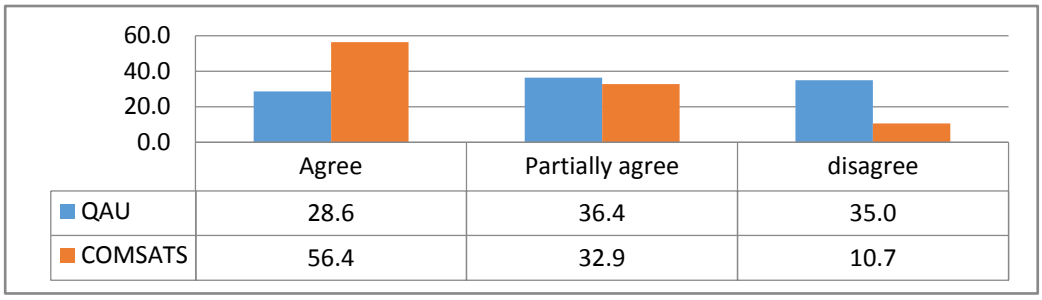

FIGURE 2: Connectivity within Campus

A good built design should have interconnections and promote connectivity. The results reveal the difference in connectivity due to roads and networks. For QAU 29% of students agree with the question statement, the frequency is much higher for COMSATS and is almost 55%. It

is evident from our preceding discussion that compact building design encourages compactness. Further, due to a compact design, the maintenance and construction costs decrease. Thus the highlight remains that though the majority of QAU campus is connected by roads and pavements, the conditions of these roads is poor thus discouraging connectivity and consuming more student time.

Overall for all four indicators difference in results are reported. Thus, accessing facilities, walkability, connectivity and social interaction differs between the two universities. COMSATS provide better access to services and improved walkability and connectivity. The situation of social interaction is same and needs to be focused. The difference in social costs proves the basic point of discussion that smart built design reduces the social costs. Thus our base line hypothesis holds that QAU students gets less opportunity for liaison with students from other disciplines. This also proves that smart built design like COMSATS promotes social inclusion. [3]

4.2.1 Hypothesis Test for Proportions

In section 3 we formulated four sets of hypotheses for our four indicators of social costs. These hypotheses were tested for significance using STATA. Overall four indicators are statistically significant at the 5% level and indicate difference in both universities with respect to the four main indicators representing social costs. The exercise of hypothesis of test for proportions strength the case that individually all four variables are significant and statistically different between both universities. It is important to remember that all these four indicators have many aspects. We have tried to capture them holistically. The importance of these variables has been discussed in the literature review. A built design that promotes any of these social costs is thus making the society suffer. By testing these variables for our both universities we can safely say that the variables are significant, important, and thus cannot be neglected. Designing universities that foster social capital and bring equity among students should remain the main focus of planning and designing.

4.2.2 Ordinal Probit Model

For this research, we would employ ordinal probit model. In general the ordinal regression models are presented as a latent variable model. Mathematically they are written as

$$y_i^* = x_i \beta + \mathcal{E}_i$$

In our case the model assumes the following form

$$\boldsymbol{y_i^* = \beta_0 + \beta_1 Cinterconect + \beta_2 Gender + \beta_3 Uni + \beta_4\ Cinterconectuni + \varepsilon} \ldots\ldots\ldots\ldots (\mathbf{1})$$

Where

y_i^* = unobserved walkability within campus

y_i = An ordinal variable for walkability between departments within campus.

[3] Percentage results for the survey questions of mobility, accessibility, walkability connectivity, and social interaction are shown in Table 1-5, Appendix.

$y_i = 1$ indicating the student marked the statement as 1 thus agreeing with the question statement that walkability between departments is difficult within the campus.

$y_i = 2$ indicating the student marked the statement as 2 thus partially agreeing with the question statement that walkability is difficult within the campus.

$y_i = 3$ indicating the student marked the statement as 3 thus disagreeing with the question statement that walkability is difficult within the campus.

The other explanatory variables are explained as follows

Cinterconect : The ordinal variable assesses the response regarding interconnections between departments and basic facilities thus representing the indicator connectivity. It records the student's response on a likert scale of three options (agree, partially agree, disagree).

Gender: A dummy variable representing 1 for males and 0 for females.

Uni: A dummy variable coded as 0 for Quaid I Azam University and 1 for COMSATS

Cinterconectuni: It is an interaction term between the connectivity and the university. Thus signifying the impact that the connectivity pattern of a specific university has on the walkability within campus.

Ɛ: It is simply the error term and is assumed to be normally distributed. The results of the estimation are presented in the following table for analysis purpose.

Variable	Estimated Coefficient	Standard Error	Z statistics	P value
Cinterconect	.			
2	.4805493	.2137529	2.25	0.025
3	1.042835	.2811636	3.71	0.000
Gender	-.2505775	.1417403	-1.77	0.077
Uni	-.8497617	.4298483	-1.98	0.048
Cinterconectuni	-1578489	.1926821	-0.82	0.413

TABLE 2: Estimate of Ordered Probit Model

Log likelihood=-254.21274 LR chi (5) =96.39

Prob Chi2=0.0000 Pseudo R2=0.1594

Cut 1=-.6042598 Cut 2= .6989936

The table 2 shows the results of the ordinal Probit model of equation 1 that was estimated using STATA 11. Walkability was the dependent and connectivity was the main independent variable Overall the variable is statistically significant and shows that an increase in connectivity leads to an increase in walkability around campus.

The variable gender represents gender of the survey respondents and result show it to be statistically significant. This implies that the probability of a male student, other factors held constant to have better walkability around campus is low. . Thus females enjoy better

walkability. The other variable *uni* represents the University of Respondents. The z value of (1.98) is statistically significant at 0.048. This implies that the probability of a COMSATS student, other factors held constant to have better walkability around campus is low. The last term *cinterconectuni* is an interaction term between two independent variables (connectivity*uni). This was used to gauge the impact of connectivity pattern of a university with respect to the university. The impact is negative and appears to be statistically insignificant.

The results report a log likelihood of 254.21274. This is the value at which log likelihood converges. Overall the results report a chi square of 96.39 with degree of freedom equal to 5 and a p value of 0.000.This suggests that overall the model is statistically significant and connectivity does affect the walkability condition. Pseudo R^2 also known as the McFadden R^2 has a value of 0.1594.As the dependent variable had three possible values, we have 2 cut points or threshold parameters.

An important exercise on ordinal probit model is to calculate the marginal effects at each possible level of outcome. It is indeed the marginal effects that are of importance in ordinal probit models. For our ordered Probit regression the outcome (walkability) had three possible outcomes, thus for each level of outcome, marginal effects are calculated.[4]Two interesting findings were that firstly males have more probability of enjoying better walkability around campus in comparison with the girls. And secondly overall COMSATS students have more probability of having better walkability around campus. The last term is the interaction term and appears to be positively related yet it is insignificant in effect.

4.3: Service Provision Costs

To explore the cost of service provision data were obtained from the two universities. The services that we included are gas, water, and electricity. We are also interested in comparing the repairing and maintenance costs that both universities incur. It is worthwhile to look at these costs comparatively through a table.

	QAU	**COMMSATS**	**Cost Differential**
Service Provision Cost	75,497,000	18,762,086	56,734,914
Repairs and Maintenance Costs	32,061,000	28,235,794	3,825,206
Total Service Costs (i+ii)	108,107,000	46,997,880	60,560,120

TABLE 4: Comparative Analysis of Costs for QAU and COMSATS[5]

The table.4 shows the service provision and repairs and maintenance costs for the two universities. On average QAU spends Rs.75 million, while COMSATS spend Rs.18 million to provide its students and faculty with the service of water, gas, and electricity. The difference between the two amounts spent is almost of 57 million Rupees. For repairs and maintenance, the difference is of 4 million, which is smaller as compared to the service provision costs; still it is the QAU which is spending more. It is important to notice that despite this very high cost

[4] The results of marginal effects calculations are reported in table 3-Appendix.

[5] Note: The amounts are from 2012-2013 record

incurred by QAU, COMSATS provides a cleaner and illuminated view, better heating and cooling services to its students and faculty members, thus presenting a managed and compact built design.

Though both universities enroll almost the same number of students, it is the QAU that spends more on providing basic services .We have hypothesized that a leapfrog development pattern leads to high service provision costs, and compact development saves costs. The density analysis labeled QAU as low and COMSATS as a high density development. The comparison of service costs validate our basic hypothesis and we can safely conclude that QAU incurs high service provision costs due to its scattered development pattern, whereas COMSATS which is constructed in compact manner incur lesser service provision costs.

This hypothetical finding is also supported by academic literature and empirical evidence. Most of them agree with the fact that low density development costs more, and smart growth is the proposed solution.

For these two universities the finding is again validated. Initially we were interested in comparing some other costs as well. For example the security costs that both universities incur. The observational analysis does suggest that QAU incur high security costs because the campus has a scattered form, and has no boundary wall-which in itself is costly to construct around 1700 acres. However the comparison could not be made since we didn't have the relevant data. The above exercise is sufficient to establish the point that low density developments such as QAU ultimately lead to higher service costs. Compact development is the savior of the situation as it saves costs. Additionally due to a very large parcel of land for QAU, slums development is on rise and it is becoming difficult to stop this slums phenomenon at QAU.

What would happen if the current development pattern persists? Assuming the number of students constant for a while, it is clearly evident that QAU will keep on incurring higher costs, and these higher costs would be due to its differential patterns. COMSATS will still enjoy the benefits of smart growth. The table..shows the situation when the total service costs are assumed to increase by 10%, 20%, and 30%. In this situation QAU will bear the high costs, and though COMSATS costs will also increase, it will remain at low level then QAU. Clearly, in this situation QAU would start having smart growth benefits, and the cost differential between the two universities will decrease.

University	-30%	-20%	-10%	Service Cost	+10%	+20%	+30%
QAU	75290600	86046400	96802200	107558000	118313800	129069600	139825400
COMSATS	32898516	37598304	42298092	46997880	51697668	56397456	61097244

TABLE 5: Projecting the Costs and Benefits of Service Provision Costs[6]

Overall, this small table is a simple exercise that projects current costs into the future, the basic gist remains that the current development patterns would lead QAU incur higher and higher costs in future. If QAU overcomes its scattered development patterns, the cost will decrease. By achieving smart growth savings both universities can incorporate higher number of students in low service delivery costs. Thus gaining efficiency of resource.

[6] Note: The amounts are computed from 2012-2013 records

5. Conclusion

In today's world the ultimate aim of planning and policy making is to strive for cities that are sustainable, resilient, and smarter..Cities as engines of growth have established there importance, and so has urban infrastructure. We cannot imagine a city without proper communication system, efficient transport networks, well functioning sewers, water supply, garbage collection, fire protection etc. Indeed, it is the quality of the urban infrastructure that helps us assess the quality of life the citizens of a city have. Urbanization of cities has its pros and cons, and Pakistan is no exemption. While it has raised the GDP, and improved the standard of living; it has also led to sprawled land development and inadequate service delivery. This research aims to highlight the issue of low density development and poor service delivery with focus on Pakistan.

The Current land use pattern of leapfrog development has resulted in limited accessibility and connectivity, social segregation, developed neighborhoods that can only be reached by car. The pattern is blamed to create number of inefficiencies and ultimately the society suffers. In contrast with this pattern smart growth propagates of communities that reduces social and service provision costs and ultimately raises the happiness of people. Various researches have shown that smart growth leads to cost savings and have been explored in Section 2.

Against this background, this study explored the social and service provision costs of the current development patterns and to propagate the benefits of smart growth. The original analysis for such studies is done on city/town level; since for Pakistani cities data are not available. Thus to bring the issue into lime light an analogy analysis was conducted i.e. we selected two universities, namely QAU and COMSATS. On observational analysis QAU was labeled as a prototype of leapfrog development and COMSATS depicted Smart growth. It was hypothesized that low density development like that of QAU leads to higher service provision and social costs and smart development like that of COMSATS has the potential of saving costs.

The density calculations confirmed the observed relationship. The academic and empirical literature does state that low density development leads to social exclusion. So what are the social costs that are being faced by the students due to the development patterns of their universities? To answer all these questions a randomized survey was conducted on students of both universities with respect to the key indicators of social aspects of the current patterns. This survey exercise provided a rich data set which was analyzed in three major ways. The hypothesis tests of proportions for selected variables representing the indicators for social costs were conducted. The results reveal that the variables significantly differ between the two universities. Secondly a descriptive analysis of the key variables was done. For all four indicators difference in results are reported. COMSATS provide better access to services and improved walkability and connectivity. The situation of social interaction is same and needs to be focused. Thirdly an ordinal probit model was estimated. The empirical results confirm the notion that walkability of an area depends on connectivity. Thus an increase in the connectivity tends to improve the walkability of a region.

Similarly the service provision costs were compared for both the universities. And it was found that quite a substantial gap exists. Thus the comparison of social costs and service provision costs for the two universities do prove the hypothesis that low density development pattern leads to higher service provision and social costs. Compact development can lead to cost

savings. Overall the results implied differences with respect to social and service provision costs. Designing universities that foster social capital and bring equity among students should remain the main focus of planning and designing Based on the above analysis we recommend following recommendations for the two universities

- Smart land use in itself is the policy recommendation for QAU. The university should focus on infill development and mixed land use. New departments should be constructed in connection with the previous departments and the old buildings should be merged with the new one. Increasing storey level is also an option that is available to the university.
- COMSATS should strengthen its compact development by expanding the same built design i.e. new blocks should be synchronized with the old ones. Currently the building is 3 floored. Vertical built up can enable COMSATS to incorporate more students in future.
- Both universities should work to increase extracurricular activities, as students reported low participation in extracurricular activities.

While we analyzed universities, the real implications lie with the cities. Currently cities in Pakistan face numerous challenges. It is high time that at individual level we raise voice for areas that are walkable and connected, and neighborhoods that can be reached without car. Much has to be done by the government and the planning authorities. The elements of smart growth like infill development, mixed land use, walkable neighborhoods, and pedestrian friendly street designs can solve many issues that our cities face. It would bring down the escalating land price, solve the housing shortage, and promote the development of social capital. Large land endowments like that of QAU are inefficient utilization of resources, leads to high service costs, and result in slum development. This large land endowment should be discouraged. Urban development at the fringes and conversion of agricultural land to housing societies needs to be stopped. Investing in central business districts and opening of suburbs to the poor and middle income class are also suggested to curb sprawl. Government policies like congestion pricing, discouraging housing consumption at the periphery, and taxing income of those who wish to live in big houses are effective measures that are taken around the world, and can be used in Pakistan as well. In a nutshell, urban sprawl and the spread of low density development is a major threat to sustainable territorial development; public services are more costly and difficult to provide, natural resources are overexploited, public transport networks are insufficient and car reliance and congestion in and around cities are heavy .Most of the ideas proposed by smart growth cannot be refused as they are sensible and appears to be legitimate. Thus smart growth is the policy and planning solution to scattered development.

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APPENDICS

Questionnaire:

Social Costs Of Current Land Use Patterns:

We would like to find out more information about the way that you perceive or think about your university. Please answer the following questions about your university as realistically as possible. There is no right or wrong answer. Your cooperation is highly appreciated. All information provided will remain confidential.

i. Student gender-----
ii. Department---------
iii. Age----------

A. ACCESSIBILITY AND MOBILITY

Please circle the answer that best applies to you and your university.

1. Which of the following transportation mode do you use to reach your University?

1	2	3	4
Motorbike	University bus	Car	Others (please specify)

2. How often do you visit following places in your university?

Note; for each facility, please tick only one relevant box

	More than once a day	At least once a day	2-3 times a Week	3-5 times a week	Don't Know
Café	1------	2------	3------	4------	5------
Green Area	1------	2------	3------	4------	5------
Mosque	1------	2------	3------	4------	5------
Sports Area	1------	2------	3------	4------	5------
Library	1------	2------	3------	4------	5------

3. How much time does it take you to reach the following facilities in your university?

Note; for each facility, please tick only one relevant box

	1-5 Min	5-10 Min	10-15 min	15-20 Min	20-30 min	More than 30 Min
Café	1-----	2-----	3-----	4-----	5-----	6-----
Green Area	1-----	2-----	3-----	4-----	5-----	6-----
Mosque	1-----	2-----	3-----	4-----	5-----	6-----
Sports Area	1-----	2-----	3-----	4-----	5-----	6-----
Library	1-----	2-----	3-----	4-----	5-----	6-----
University administration	1-----	2-----	3-----	4-----	5-----	6-----

Department Management	1-----	2-----	3-----	4-----	5-----	6-----
Photocopying Services	1-----	2-----	3-----	4-----	5-----	6-----
Printing Services	1-----	2-----	3-----	4-----	5-----	6-----

B. WALKABILITY

1. All basic amenities and services are at an easy walk able distance in my university.

1	2	3
Agree	Partially Agree	Disagree

2. The roads and pavements of my university are hilly thus making walkability difficult.

1	2	3
Agree	Partially Agree	Disagree

3. The distance among all departments (including admin and other basic services) of your university is walkable and accessible on foot.

1	2	3
Agree	Partially Agree	Disagree

C. CONNECTIVITY

1. The Different departments of your university have interconnections and are constructed in a compact form.

1	2	3
Agree	Partially Agree	Disagree

2. The roads and path network is well connected, maintained, and free from natural or physical barriers.

1	2	3
Agree	Partially Agree	Disagree

3. There are alternative route available for getting from one place to another (Library, department, cafeteria etc).

1	2	3
Agree	Partially Agree	Disagree

D. SOCIAL INTERACTION

1. How many fellow students name do you know from the department next to you?

1	2	3	4	5 or more	None
-----	-----	-----	-----	-----	-----

2. How many inter university extracurricular groups have you joined?

1	2	3	4	5 or more	None
-----	-----	-----	-----	-----	-----

3. How often do you help other fellow students in any aspect?

1	2	3	4
One Person Daily	Once a week	Once a month	Never help

4. Does your department have a common sitting area?

1	2
Yes	No

5. Where you/your class fellows say your prayer other than *JUMA (only for male students)*

1	2
Central Mosque	Department (A temporary prayer hall)

6. Three best attributes of your university

i. ----------
ii. ----------
iii. ----------

7. Three worst attributes of your university

i. ----------
ii. ----------
iii. ----------

THANK YOU FOR YOUR CONTRIIBUTION

SURVEY RESULTS

W-Dep=1	Dy/dx	Std.Error	Z	P(Z)
Cinterconect				
2	-.1587559	.0712627	-2.23	0.026
3	-.320333	.0834956	-3.84	0.000
Gender	.0748432	.0419991	1.78	0.075
Uni	.2538092	.1233669	2.06	0.040
ccintercone~i	.0471467	.0580694	0.81	0.417
W-Dep=2	**Dy/dx**	**Std.Error**	**Z**	**P(Z)**
Cinterconect				
2	.0571027	.0322369	1.77	0.077
3	.0554804	0286226	1.94	0.053
Gender	-.0118845	.0079606	-1.49	0.135
Uni	-.040303	.0180596	-2.23	0.026
ccintercone~i	-.0074866	.0107071	-0.70	0.484
W-Dep=3	**Dy/dx**	**Std.Error**	**Z**	**P(Z)**
Cinterconect				
2	.1016531	.0415499	2.45	0.014
3	.2648526	.0687602	3.85	0.000
Gender	-.0629587	.0353968	-1.78	0.075
Uni	-.2135062	.1108164	-1.93	0.054
ccintercone~i	-.0396602	.0476537	-0.83	0.405

TABLE 3: Margins for Each Level of Outcome

Note

*First category of independent variable (cinterconect) is used as reference category

*dy/dx for factor levels is the discrete change from the base level.

MOBILITY & ACCESSIBILITY

(Percent)

Mode of Transport	QAU	COMSATS
Motorbike	1.4	14.3
Bus	82.1	35.7
Car	2.1	25.0
Others	14.3	25.0

TABLE 6: Mode of Transport Used for Reaching University

(Percent)

	FREQUENTLY		NOT VERY FREQUENTLY		NEVER	
	QAU	COMSATS	QAU	COMSATS	QAU	COMSATS
Café	67.1	84.3	26.4	15.0	6.4	0.7
G.A	65.0	65.7	18.6	18.6	16.4	15.7
Mosque	35.0	44.3	20.7	27.1	44.3	28.6
S.A	26.4	17.9	30.7	27.1	42.9	55.0
Lib	71.4	68.6	22.1	25.7	6.4	5.7

TABLE 7: Frequency of Accessing Basic Facilities

(Percent)

	SHORT DISTANCE		LONG DISTANCE	
	QAU	COMSATS	QAU	COMSATS
Café	81.4	80.0	18.6	20.0
G.A	74.3	81.4	25.7	18.6
Mosque	60.7	79.3	39.3	20.7
S.A	55.7	70.0	44.3	30.0
Lib	67.9	74.3	32.1	25.7
U.A	45.7	87.1	54.3	12.9
D.M	80.0	84.3	20.0	15.7
Photocopy	82.9	79.3	17.1	20.7
Printing	77.9	80.7	22.1	19.3

TABLE 8: Time Required for Accessing Facilities

WALKABILITY

Statement	**QAU Agree**	**COMSATS Agree**	**QAU Partially Agree**	**COMSATS Partially Agree**	**QAU Disagree**	**COMSATS Disagree**
All basic amenities and services are at an easy walk able distance in my university.	45.7	47.9	39.3	37.9	15	14.3
The roads and pavements of my university are hilly thus making walkability difficult.	42.1	11.4	39.3	31.4	18.6	57.1
The distance among all departments (including admin and other basic services) of your university is walkable and accessible on foot.	17.1	60.7	46.4	31.4	36.4	7.9

TABLE 9: Frequency for Walkability Indicators

CONECTIVITY

Statement	**QAU Agree**	**COMSATS Agree**	**QAU Partially Agree**	**COMSATS Partially Agree**	**QAU Disagree**	**COMSATS Disagree**
The Different departments of your university have interconnections and are constructed in a compact form.	18.6	30	46.4	38.6	35	31.4

The roads and path network is well connected, maintained, and free from natural or physical barriers	28.6	56.4	36.4	32.9	35.0	10.7
There are alternative route available for getting from one place to another (Library, department, cafeteria etc).	60	47.9	28.6	35.0	11.4	17.1

TABLE 10: Frequency for Connectivity Indicator

SOCIAL INTERACTION

Statement	**QAU 1**	**COMS 1**	**QAU 2**	**COMSATS 2**	**QAU 3**	**COMSATS 3**	**QAU 4**	**COMSATS 4**	**QAU 5 or more**	**COMSATS 5 or more**	**QAU 6**	**COMSATS 6**
How Many fellow students name do you know	6.4	7.1	3.6	7.1	8.6	7.9	8.6	7.1	65.7	60.7	7.1	10.0
How many extracurricular groups have you joined?	12.9	14.3	17.1	12.1	4.3	9.3	5.7	4.3	7.9	5.7	52.1	54.3

TABLLE 11: Frequency of Social Interaction Among Students

	1 person daily	**Once a week**	**Once a month**	**You never help anyone**
QAU	38.6	38.6	38.6	38.6
CIMSATS	34.29	34.29	34.29	34.29

TABLE 12: Frequency of Helping Others

	Common Sitting Area Yes	**Common Sitting Area No**
QAU	56.4	26.4
COMSATS	43.6	73.6

TABLE 13: Availability of Common Sitting Area in Department

	Central Mosque	Department Hall
QAU	54.3	80
COMSATS	45.7	20

TABLE 14: Frequency of Place used for Prayer

Log-likelihood	
Model	-254.213
Intercept-only	-302.408
Chi-square	
Deviance (df=273)	508.425
LR (df=5)	96.390
p-value	0.000
R2	
McFadden	0.159
McFadden (adjusted)	0.136
McKelvey & Zavoina	0.347
Cox-Snell/ML	0.291
Cragg-Uhler/Nagelkerke	0.329
Count	0.607
Count (adjusted)	0.353
IC	
AIC	522.425
AIC divided by N	1.866
BIC (df=7)	547.869
Variance of	
E	1.000
y-star	1.531

TABLE 15: Measures of Goodness of Fit