

Full Length Research Paper

The fast growing megacity Karachi as a frontier of environmental challenges: Urbanization and contemporary urbanism issues

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The megacity Karachi, as a globalized complex, is the business capital of Pakistan and had been the federal capital until 1958. It is one of the most important cities of the world in terms of population, economic potential and geo-strategic location. A growing body of infrastructural development during this decade has thoroughly changed the landscape of the city. The recent development pattern proclaims it as one of the most fashionable and futuristic global city. On one side, it accommodates more than 539 squatter settlements and at the same time, the sky scrapers in the city serves as business and technological parks for the country as a whole. Several researches, supporting authorities and scientists, are focusing on megacities as unique ecosystems worldwide. Unfortunately, Karachi seems abortive in attracting the focus of the scientific community. This paper aims to present a synoptic view of this city by highlighting the contemporary urbanism issues like urbanization trend, environmental quality (physical and built), socio-cultural imbalance, economic settings and urban planning and it is further substantiated with an overview of geography and administrative skeleton. The rebirth of the city's landscape (after the administrative devolution in 2001) has been discussed discretely. An effort has been made to represent explicit urban indicators which could assist to have a generalized perception about the important elements and characteristics of the city. However, a major approach is to underline the sensitivity of Karachi as a challenge for environmental and urban planning and an acute opportunity of research, where the discussion embarks on the requirement of thorough transdisciplinary approaches to study such urban systems.

Key words: Sindh, Pakistan, megacity, sustainable development, mega urbanization, urban regeneration, urbanism.

INTRODUCTION

Megacities are special ecosystems with complex land-use that sometimes function with predetermined plans. Nevertheless, it expands with paradigmatic phenomenon. This expansion seems to be multifaceted more in developing countries where the urban population is increasing with substantial rate (Qureshi and Breuste, 2009). Demographic trend insinuates that urban areas will increasingly become the primary habitat for humans. Although their consumption of resources reaches into diverse ecosystems near and far (Wu, 2008), unfortunately, their role in global sustainability is not yet recognized profoundly. Cities themselves present both the problems and solutions to sustainability challenges of

an increasingly urbanized world (Grimm et al., 2008). Specifically, the megacities are 'laboratories' in which solutions for environmental challenges can and should be developed (Kraas, 2007).

Karachi is a mushroom city, ever expanding over a tract of sand and its edges submerged for extensive distances to different depths at different states of the tide. Karachi, the business capital of Pakistan, is the capital city of the Sindh province. It has been referred to as the "Glory of the East", "City of Lights", "Liverpool of India and Pakistan" (Pithawalla, 1950) and the "Bride of the cities" (Kazmi et al., 2008). The metropolitan area along with its suburbs spreads over 3530 sqkm, having an

estimated population of 18 million (CDGK, 2007). In future, it could be the second largest city of the world (Butler, 2005), because it is expecting to accommodate 27.5 million people in 2020 (CDGK-MPGO, 2007). It rose to be the first airport and the third seaport of the undivided India within a brief period of 100 years, having been formerly established by Sir Charles Napier in 1843 (Pithawala et al., 1946). As a major revenue generator, Karachi contributes substantially to the national exchequer and the provincial revenues. Karachi, with its enormous potential to serve the country, is now emerging as a globalized complex in competition with other regional centers of similar order. Numerous studies have been conducted by several local researchers, but presented with specified objective approach. It is worth saying that this city needs scientific studies based on strong socio-ecological principles and transdisciplinary approach to fulfil the need of ecosystem balance in the region.

The objective of the paper is to outline the state of ecological and social settings of the city that could help to alleviate the understanding of the environmental challenges faced by this colossal ecosystem. The ultimate objective is to highlight Karachi as an unexploited opportunity of urbanism research which needs a pluralistic socio-ecological framework to handle the challenges of unprecedented urban growth. The paper is structured in a form where it gives a glimpse of its historical development, the physical and geo-strategic location and demographic lineaments. It helped to develop a synopsis of the socio-economic trend and the infrastructural development of the city besides the challenges faced by the physical environment as an offshoot land-use changes. The paper concludes on remarks made on the prognosis of the challenges faced by the city and scientific researchers.

BRIEF HISTORY

A glance at the literature suggests that Karachi was setup in 1728 - 29 by Hindu fishermen and merchants at the northern coast of the Arabian Sea (GOP, 1981). A historical account on Karachi has been reported by Hasan (1999) starting from the year 1728, though (Khan, 1979) factually claims it as a city existing from Neolithic age and pre-historic times. Former names of the city had been 'Kalachi Jo Goth' or 'Kalachi Jo Kuh', which later became 'Kalachi' (sometimes referred to as *Kolachi*) until the beginning of the twentieth century. In 1839, the British Army occupied Karachi and its strategic importance was immediately identified as it became the first airport of the undivided India (subcontinent) in 1843 and an important administrative seat for the British Empire. The British developed the irrigation system in the whole province during these years. Later in 1870, it was connected to Punjab with the railway link for mobilizing agricultural products to the port and within the country. So, these three main factors such as: irrigation system, railway link

along with air and sea ports became the reasons for the development of Karachi as the main attraction for the people around. In 1869, Karachi became the largest exporter of wheat and cotton to Indian territories (Hasan and Mohib, 2003). During the first and second world wars, Karachi played an important role for the landing troops and munitions of the British and also as cantonments.

In 1947, the independence year of Pakistan, Karachi became the first capital of the newly founded Pakistan (West). From independence till 1951, migrants kept coming and started settling into squatter settlements. Within a span of four years, more than 600,000 refugees moved-in from India and as a result, Karachi became an ecumenical of cultures. During 1958, it was decided that the capital should be shifted to Islamabad, but Karachi remained the capital of Sindh province. Islamabad started and completed functioning as capital from 1961, though Karachi never loses its industrial, business and financial capital character. Predominant urban growth was mainly because of the migrants and refugees. In 1971, a huge number of refugees migrated from East Pakistan (current Bangladesh) and similarly in the 80s from Afghanistan. Census in 1981 revealed a total of 1.72 million refugees in Karachi with more than 2.15 million in 1998 (Hasan and Mohib, 2003; GOP, 2000). Most of these migrants are settled in the squatter settlements, which is itself a challenge for the authorities.

Geographical settings

Location and administrative structure

Karachi, as a recently reformed district, lays geographically in between 24° 45' N to 25° 37' N and 66° 42' E to 67° 34' E. It is situated 80 miles due west of Indus river mouth. It is surrounded by the Dadu District in the North and Northeast and the Thatta District in the East, while in the South and Southwest by the Arabian Sea and in the Northwest by the Lasbela District (Balochistan province). Undoubtedly, it is one of the most favourable geo-strategic situations, as a centre of three great continents, Europe, Africa and Asia (Figure 1). Until 2001, Karachi was considered as 'division' and comprises five administrative districts such as: Karachi East, Karachi West, Karachi South, Karachi Central and Malir (Figure 1). From August 2001, it has been subdivided into 18 towns, each having Union Councils (UC) as further subdivision. Karachi has total 178 UCs, having population around 55 to 65 thousand people each. It was promulgated by the federal government under Sindh Local Government Ordinance - 2001 (NRB-GOP, 2001) and has provided unprecedented opportunity to the City District Government Karachi (CDGK) to steer and guide the growth of the country's commercial and business capital more independently. As such, the

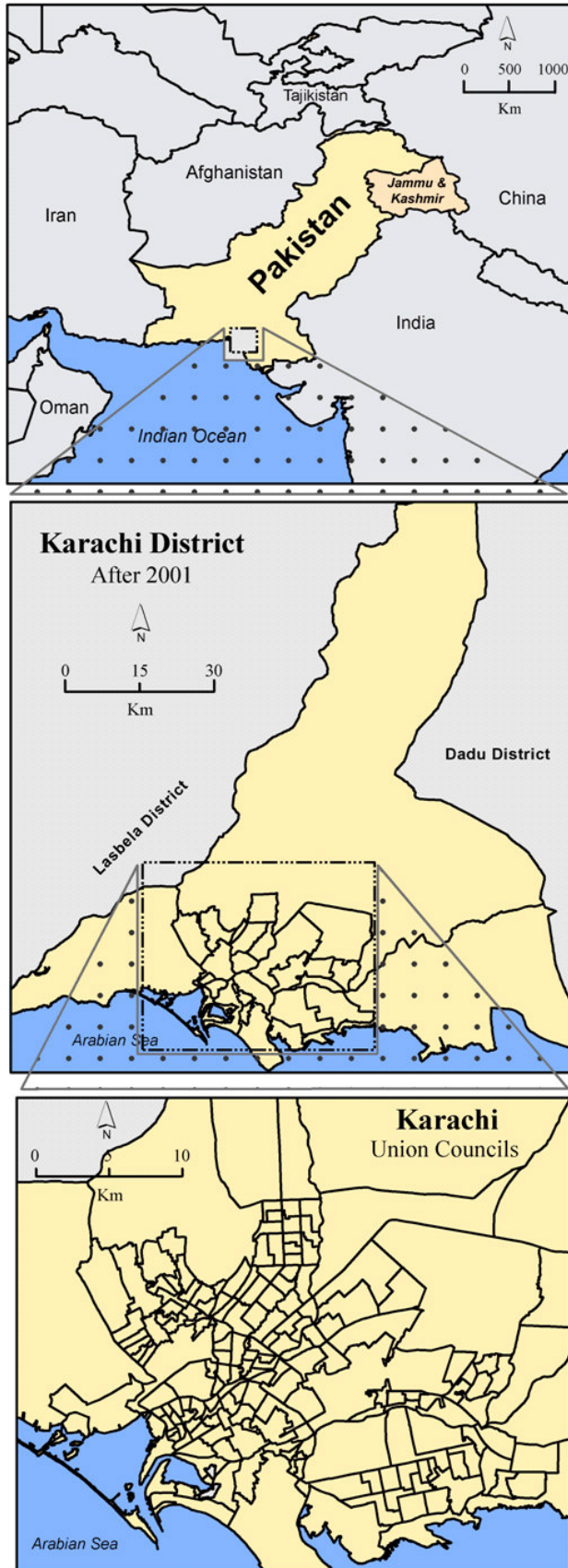


Figure 1. Karachi and its administrative structure.

organizational structure of the CDGK is quite detailed and complex (Figure 2).

Physiography and climate

Physiographically, Karachi can be divided into two broad categories: the hilly areas in the north and west and an undulating plain and coastal area in the south-east (Figure 3a). The north-western hilly portion is covered by the Kirthar Range, which lies north-and-south and is connected with the Pabb Range, which extends northward and is parallel to the Kirthar Range. Most of the hills range from 400 to 800 feet in height. From Southeast of the city to the North, there is another series of low hills, which is extending north-westward. These hills are 96 to 200 feet high. Three major rivers such as: Malir, Layari and Hub, flow through Karachi which marks the physical characteristics of the city. The Malir flows in the east of Karachi, the Layari flows through the heart of the city and the Hub lies 30 km to the west and flows along Karachi Lasbela boundary. South of the city is connected with Arabian sea, whereas the east-south-east lies in a vast expanse of mud-flats, sandbanks and mangrove swamps, intersected by a complicated system of ramifying creeks and inlets (Pithawala et al., 1946).

Karachi can formally be considered as a region with temperate climatic conditions with generally high humidity that intensifies the conditions for the dwellers, in which the relative humidity varies from 58% in December (the driest month) to 85% in August (the wettest month). Karachi endures a long hot season from March to October and in July and August, temperatures are moderate because of monsoon winds. The winds in Karachi for more than half the year, including the monsoons, blow south-west to west, while the wind in winter changes to east and north-east. Average wind velocity in winter is 6.5 miles per h which in overall, is considered as low wind. Rainfall in Karachi is meagre as well as quite variable. Its geographical location is not favourable to receive even sufficient seasonal monsoonal rainfall. Average rainfall is less than 200 mm. Maximum is received in July and August, but is irregular. During recent years, a certain change in the rainfall has been observed with an average of over 250 mm and it may rain heavily within a short span of 48 years. There are some local disturbances due to conventional currents and contrasts of weather conditions, such as high temperatures, diurnal ranges and differences in humidity, which cause thunderstorms, dust storms and squally weather during the transition stage between the two seasons, such as March to May and September to November (Pithawala et al., 1946; Arsalan, 2002) (Figure 3b).

URBANIZATION AND DEMOGRAPHIC PROGNOSIS

It is a cosmopolitan city, inhabited by people with culturally

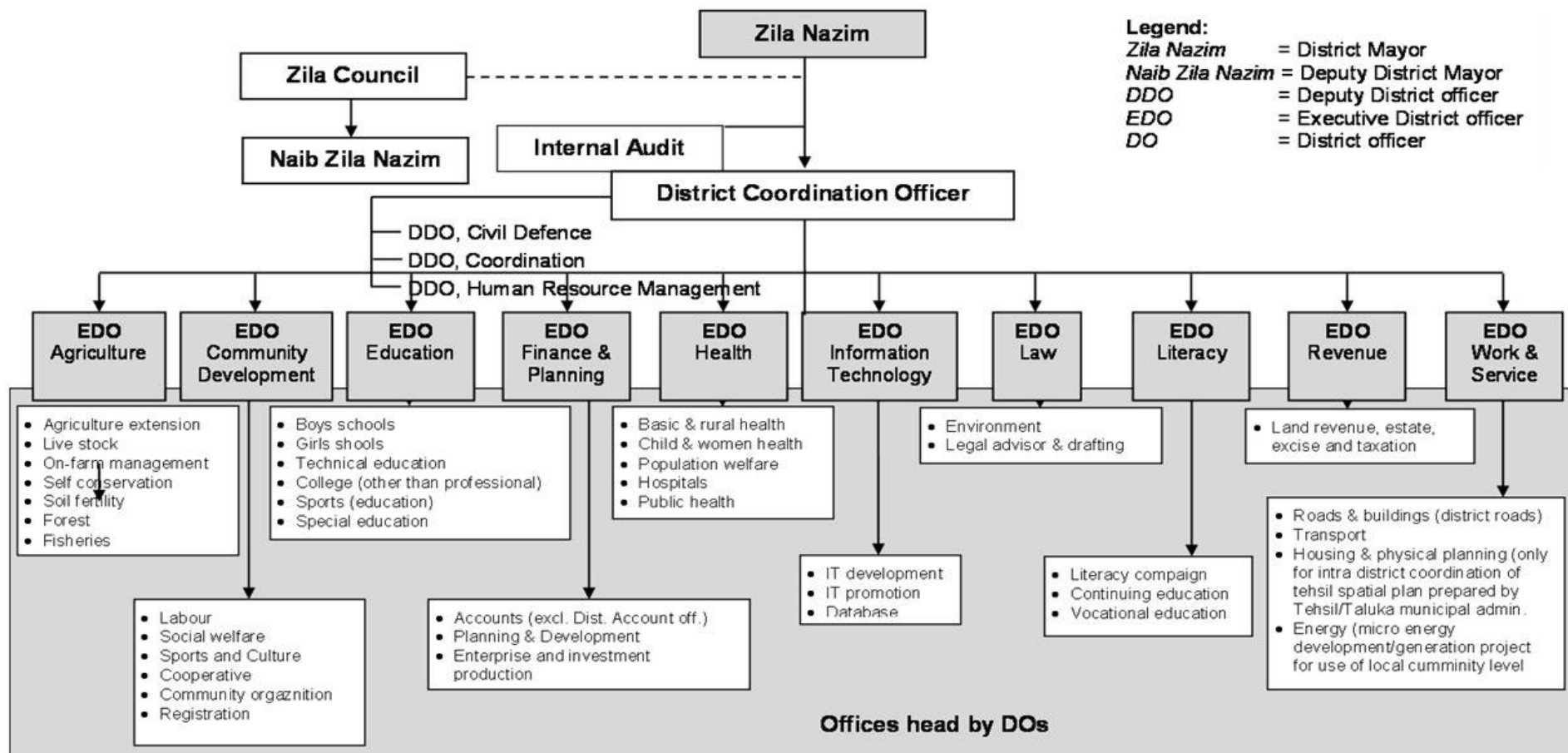


Figure 2. Organizational Structure of the City District Government. Source: NRB-GOP (2001).

enriched background and a sense of social commitment. The city covered about 8.3 sq.km in 1946 (Afsar, 2001), where the population was reported to be 0.43 million in 1941 census (Hasan, 1999). Now, this mega city along with its suburbs spreads over 3,530 sq.km having an estimated population of 18 million (CDGK, 2007) (Figure 4). Karachi, by population, is now among the ten

largest cities in the world. UNDP (2008) estimates only five cities of the world that have crossed 16 million mark until 2007 and Karachi bears a population of 12.1 million. This fact has already been nullified by the CDGK and reported a population of 16 million in 2006 (Hasan, 1999). It shows that the population explosion is far more than the expectation of expert demographers.

Almost 94.8% population lives in urban area, which indicates about 17,325 people per square kilometre population density on an average (GOP, 2000). Table 1 indicates the population growth from 1931 to 1998 and local estimates up to 2020. Karachi has passed through phenomenal physical and demographic changes since the creation of Pakistan in 1947 (Rehman, 1983). Apart from the

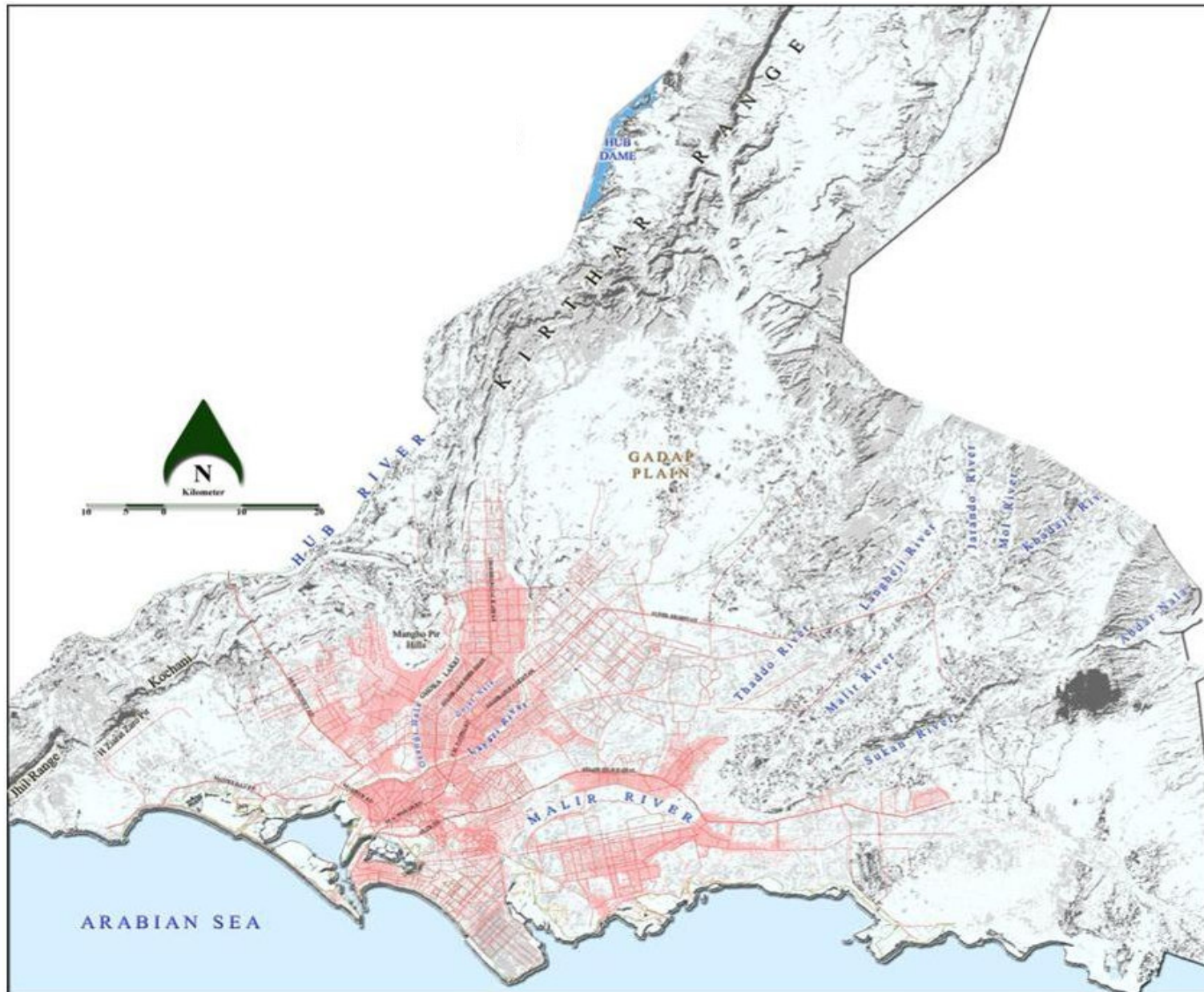


Figure 3a. Physiography of Karachi (Source: Arsalan, 2002).

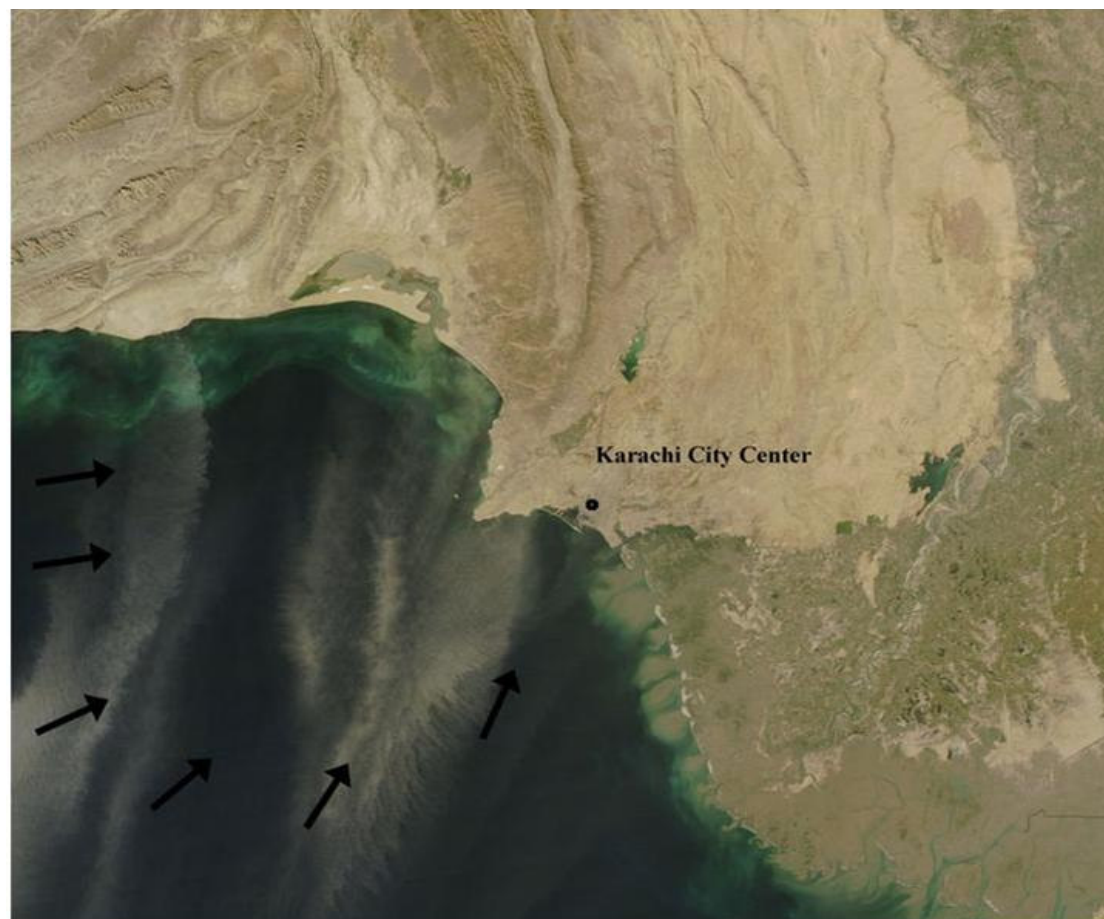


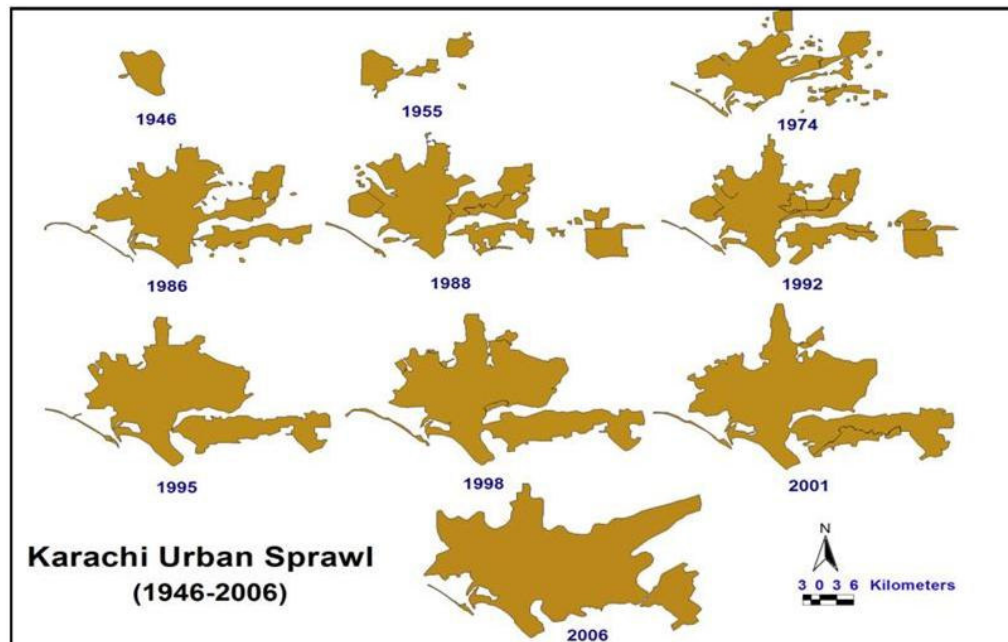
Figure 3b. Dust storm is moving towards Karachi. Source: NASA (2008). Satellite sensor: MODIS. Date taken: 15 November, 2008.

spurt in population that it has experienced, the intra-urban distribution of population has also changed phenomenally. During the last three years, the pattern of the population growth has changed a lot where the demographic statistics are difficult to be estimated. As such, there are huge numbers of migrants which are moving

towards Karachi from the North and North-Western areas due to instable law and order situation. Furthermore, the recent floods in Pakistan have caused a movement of large population from rural areas to the urban centres and Karachi is among the cities receiving the largest number of immigrants. There is no

official figure, but a rough statistics of different NGOs suggest that the city must be crossing 20 million marks. It is not only suppressing the social environment, but the natural environment which is environment which is unable to handle this abrupt influx of people is also under pressure.

The number of households in 2005 was about 2.1



Year	Area (km ²)	Area change (km ²)	Source (Image/Map)
1946	8.35	--	Pithawala et al., 1946
1955	104.26	95.91	Aerial Photograph, 1955
1974	286.30	182.04	Land Use Map, KDA, 1974
1986	402.97	116.67	SPOT XS, 1986
1987	461.22	58.25	Land Use Map, KDA, 1991
1992	516.47	55.25	Landsat TM, 1992
1995	681.52	165.05	Karachi Guide Map, SOP, 1995
1998	695.93	14.01	SPOT XS, 1998
2001	726.15	30.22	SPOT XS, 2001
2006	785.45	59.30	Quick Bird, 2006

Figure 4. Karachi urban sprawl (1946 - 2006). (Source: Kazmi et al. (2008).

million and by 2020, it would increase to 3.9 million, which means an increase of 1.77 million households at an average size of 7 persons per household. Even at a decreasing average annual growth rate (from 4.15% in 2005 to 3.5% in 2020), the increase in absolute terms is staggering and will put heavy pressure on the physical, infrastructural, financial and institutional systems of the city. Literacy has also increased considerably and the male-female literacy gap has decreased substantially, especially in the younger generation. In 1972 and 1981, 51.18 and 55.04% of Karachiites, respectively were literate, while in 1998, the figure is 67.42%. In 1972 and 1981, 45.02 and 48.84% of women, respectively were literate as compared to 62.88% in 1998 (Hasan, 1999). Average household monthly incomes are estimated between Rs. 3000 and Rs. 5000 (US\$ 50 - 85), which is mainly due to a huge number of immigrants that remains unemployed for longer times and earn their living by doing irregular jobs like masonry or labour at the small scale industry which are always too less paid.

Karachi has grown nearly 25 times since 1947 and is growing at the rate of about 5.4% per annum (Afsar, 2001; KDA, 1991), making it one of the fastest growing cities of the world (Azad, 2007). Besides, migrants from other cities and rural areas of Pakistan and a large number of migrants from Afghanistan and Bangladesh have settled in the city with a smaller part from the Myanmar (Burma). This has resulted in the massive exponential growth. In 1972, almost 63% of the population lived within ten kilometres of the city. By 1981, this had declined by 52%, as the population growth shifted to the ring located between eleven and 20 km from the centre. At present, over one half of Karachi population live more than 10 km from the city centre. The city of Karachi has grown from the old town and the port at the sea outwards along radial avenues that connect all city segments to the port. There are a few means of circumferential movements. A major growth has been observed along major arterials because of commercial enterprise development. Further, the vertical growth has

Table 1. Population statistics of Karachi 1931-2020.

Years	Population	APGR (%)
1931	263.565	-
1941	386.655	3.70
1951	1.068.459	11.50
1961	1.912.598	6.05
1971	3.515.402	5.00
1981	5.437.984	4.96
1998	9.856.318	3.52
2002 ^a	11.364.707	3.02
2005 ^a	15.120.000	4.15
2010 ^b	18.529.000	4.05
2015 ^b	22.594,000	4.05
2020 ^b	27.550.000	3.50

Source: Handbook of population census, GOP (1985)
^aEstimated population using annual population growth rate (APGR). ^bProjected population by CDGK-MPGO (2007).

vertical growth has been increased during the last two decades, thereby increasing the population density of the city. Multi-storey buildings and residential apartments are getting more common as they are perceived to be comparatively safe as residence or office.

URBAN ECONOMY AND SOCIO-ECONOMIC TREND

Together with Bin Qasim port just 50 km from the city center, Karachi accounts for more than 95% of Pakistan's foreign trade, 30% of its industrial production and 60% of the total revenue (Hasan, 1999). The head offices of the main industries and offshore offices of the international companies are setup in Karachi and its stock exchange is one of the most important business centres of South Asia. A total of 94% of the total income tax and sales tax of Sindh province is collected from Karachi, which ultimately contributes to 70% share in Pakistan's tax collection. However, Karachi has 4,500 industrial units in the formal sector. The major industries are textile, leather, paper, marble, ceramics, rubber, plastic, glass, iron, electronics, pharmaceuticals, food products, agricultural and dairy products and stationery. Many of these industries are export-oriented (Hasan and Mohib, 2003) and the economic base is increasingly shifting from manufacturing to services. Manufacturing growth is slowing due to security problems, inadequate electrical power supply and high informal payments required to establish and maintain a business (CDGK-MPGO, 2007). As a result, the manufacturing share of metropolitan output has decreased from 37% in 1985 to 18% today.

In the meantime, the service industries have been growing recently at about 8% yearly and now represent a substantial part of gross metropolitan product. A major growth has been observed in financial services, banking and retailing. Investment from the foreign banks in this

sector has totally changed the credit market as well. It has also resulted in the emergence of exchange companies, a boom in the stock market and consequently in stock brokering, investment management and financial advice. The most serious area of the business has been the real state during the last decade and the land value in the city has increased dramatically as much as 5 times from the last decade. The metropolitan economy is fast growing at an impressive rate, probably somewhat higher than the national GDP growth rate of 6 to 7% per annum. The future of Karachi's economy lies primarily in the growth of the tertiary sectors which is serving its own residents and those of a bulk of Pakistan. Karachi will expand and consolidate its role as the financial, trade and transport hub of the country. Knowledge-based industries and real estate and construction sectors will also play major supporting roles in the future economic growth of the city.

A large segment of Karachi's population, roughly 40%, is afflicted with poverty. The living conditions of the deprived section and its economic well being are therefore a major concern, as these have an impact on the environment and growth potential of the city. Karachi's population is diversified in terms of ethnicity and economic conditions. However, in terms of economy, there have been major setbacks. Employment has fallen from 33.43% in 1981 to 27.58% in 1998 and there are no estimates available for the informal sector. However, 75% of the working population is employed in the informal sector (Scholz, 1983). In recent years, a link between formal and informal sectors has been established with the Formal sector sub-contracting work to informal establishments. The worst affected is the age group of 60 and above where employment has fallen from 33.25 to 18.74%. There is a serious need of job for the senior citizens of the country where the retirement age is 60 and the retired people have no alternatives to make their living. Roughly, 75% of the households fall in the category of poor and low income groups and 25% constitute the middle and high income groups.

The 'city' has been facing some serious challenges of ethnic conflicts since 1971, after Indo-Pak war, and the local demographers was proclaimed to have around 2 million Afghan refugees, who during different times entered the city for employment propose but settled here forever. The Indian migrants of 1947 (locally called 'Mohajirs' – speak 'Urdu' language) are the dominating social group which highlights the need to curtail the influx of these illegal migrants. Their strong opinion often results in riots, thereby ending in no results. Now, the city comprises clearly, several divided areas of distinct social groups. Each of these areas is inhabited by certain minority and sometimes restricts the movement of people from other social groups. The authorities have to face serious challenges for the implementation of city development plans because of the rejection of certain governmental policies by specific ethnic group. In turn, the need and struggle for resources put enormous pressure on the

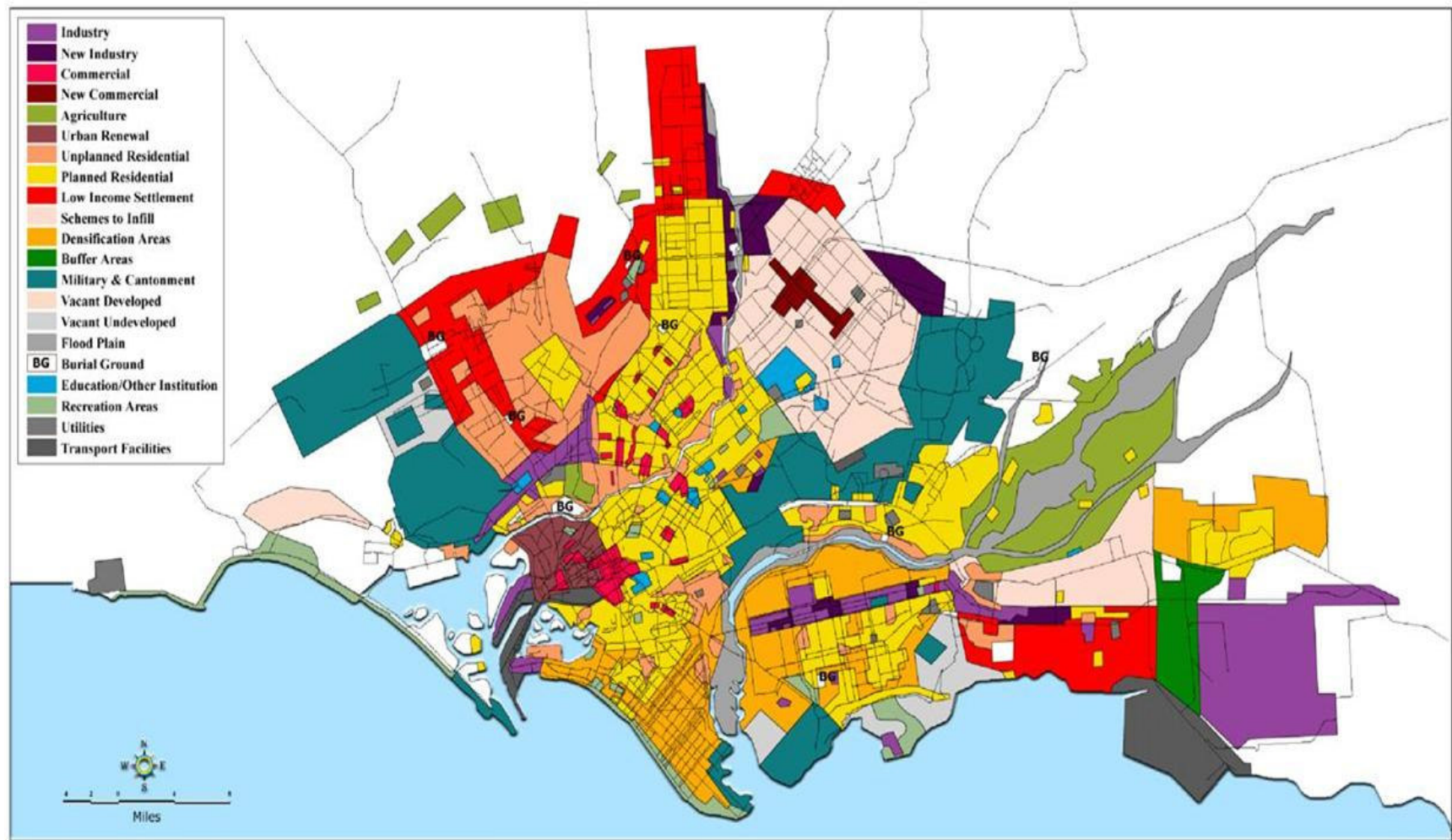


Figure 5. Karachi projected land-use for 2000 (Source: KDA, 1991).

INFRASTRUCTURE AND ENVIRONMENT CHALLENGES

Urban land use and spatial data

Karachi, being a megacity, has typical characteristics

of a city in the developing world that has a very complex landuse (Figure 5) which could not be classified as per internationally existing classical models (Qureshi and Breuste, 2010) (Table 5). The landuse is fragmented and the gradient index is so low that the spatial phenomenon and

landuse characteristics of any specific type could not be demarcated easily (Qureshi et al., 2010a). It is mainly because the city developed in several phases.

Influx of different cultures as a result of immigrants and changes in the political administrations

Table 2. Urban land use of Karachi.

Group*	Category	Area (Sq. km)	Percent
Economic	Industrial	67	7.42
	Agriculture	50.9	5.63
	New industry	48	5.31
	Commercial	10.7	1.18
	New commercial centres	4.9	0.54
Infrastructure	Recreational	14	1.55
	Transport facilities	13.5	1.49
	Utilities	8	0.89
	Education	7.7	0.85
	Burial grounds	3.2	0.35
Residential	Planned residential	163.7	18.12
	Schemes to infill	98.8	10.94
	Low income settlements	82.7	9.15
	Unplanned residential	70.1	7.76
	Densification areas	47.8	5.29
	Urban renewal	11.2	1.24
Special purpose	Military areas	121.3	13.43
	Vacancy undeveloped	16.7	1.85
	Buffer areas	14.3	1.58
	Vacancy developed	1.9	0.21
	Flood plain	47.1	5.22
Total		903.5	100

*Groups and categories as defined by KDA (Source: Arsalan et al., 2006).

has diversified its functional effectiveness, though it never reduced throughout its rich history. The only other cities, which can be compared to Karachi in this respect is Phnom Penh (in Cambodia), Hanoi and Da Nang (in Vietnam) (Kazmi et al., 2008; Scholz, 1982). It is worth mentioning that classical western central business district (CBD) never existed (1999), CDGK-MPGO (2007) and many others. A city developed without plans could not bear one because of varying multifunctional land uses (Table 2), while low income settlements together with unplanned residential areas make 16.91% of the total land use.

These are the areas which are mostly occupied by the squatter settlements, challenging the environment and authorities. Furthermore, the recreation area which is 1.55% of the urban land is too less than the requirement of this gigantic city. Only 18.12% of planned areas reveal that the city does not bear a classical mode of development.

Rapid urbanization has asserted ginormous stress on the city's ability to provide sufficient urban services for dwellers. To meet the challenges of this fast growing city, five master plans were formulated since 1923. None of them was backed with legal cover, resulting in urban sprawl, wide spread Katchi Abadis/slums and gross

deficiencies of required infrastructure/utilities, constraining the potential and opportunities of Karachi City District Government Karachi (CDGK) (2007). The last master plan is formally called "Karachi strategic development plan (KSDP) - 2020". The KSDP 2020 has a legal status under Section 40 of the Sindh Local Government Ordinance 2001 Grimm et al. (2008), for guiding city's growth in a planned and coordinated manner. It was published in 2007 and has been used as the major source for the development of this paper. Urban development in Karachi has remained fragmented, and coordination among various agencies responsible for plan formulation and implementing plans, schemes and projects have been lacking (Khuhro and Mooraj, 1997). For planning of Karachi, KDA has developed 58 analyses zones in Karachi (KDA, 1991) which were used in several environmental and planning studies. More than 25 urban planning agencies are providing services to the citizens, but they lack coordination. Coordinated efforts may be improved if their databases are of higher quality and designed with data sharing in mind. Raza (2001) developed comprehensive details of agencies which are potential users of the spatio-temporal datasets and none of the agencies has in-house ongoing digital mapping

Table 3. Users and owners of spatio-temporal data; with their updating and usage.

Department	Master Plan and Environmental Control Department (MPECD)		Directorate of Planning and Urban Development (DPUD)		Traffic Engineering Bureau (TEB)		Karachi Water and Sewerage Board (KWSB)		Pak Telecommunication Department (PTC)		Karachi Electric Supply Corporation (KESC)		Sui Southern Gas Company (SSGC)		Sindh Katchi Abadi Authority (SKAA)		Survey of Pakistan (SOP)	
	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up
Maps	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up	U	Up
Base map	1		1		1,2		1		1		1		1,5		1			1
	Ur		Ur		Ur		Ur		Ur		Ur		Ur		Ur		O	
Landuse	1	5							1				1		1,5			
	B						B		Ur				Ur		Ur			
Layout Plans	2	1,2	2	1,2	1		2	1,2	1,2				1		2,3			
	B		B		B		B		Ur				Ur		Ur			
Street	1	1	2		2	1							1		1			
	B		Ur		Ur				Ur				Ur		Ur			
Water supply	1										1	1						
	Ur										B							
Power supply	1												1	1				
	Ur												B					
Sewer	1																	
	Ur																	
Telephone connection	1								2	1,2								
	Ur								B									
Gas connection	1														1,2	1,2		
	Ur														B			
Guide map	1																	1
	Ur																Ur	
Planning Zone	2																	
	Ur																	

User, Ur; User and Owner, B; Owner, O; Occasionally /As and when required, 1; Daily, 2; Weekly, 3; Once a year, 4; Once in five years, 5; Frequency of Use, U; Frequency of update, Up. Source: Raza (2001).

projects. Nine major agencies/departments are selected by Raza (2001) to assess the need for spatio-temporal data and these agencies use a variety of maps in terms of spatial and temporal scales. First, the functions of these agencies/departments are summarized and then the information content in these departments is discussed. This forms the information flow matrix in terms of data owners and users of this information. However, special emphasis is given to the temporal nature of the

information. Table 3 gives a general overview of the use and update frequency of spatio-temporal data.

Transportation

Being the nation's largest city, with financial, commercial and manufacturing capital, Karachi is the hub of transportation. Total length of road network in Karachi is

Table 4. Total number of vehicles in Karachi.

Year	Total no. of registered vehicles	Annual increase	Monthly increase	Daily increase
2002	1.113.917	30.640	2.553	84
2003	1.177.315	63.398	5.283	174
2004	1.280.349	102.934	8.578	282
2005	1.431.994	151.745	12.645	415
2006	1.610.757	1.78.763	14.897	489
2007	1.809.500	198.743	16.562	545

Source: Khan (2008).

more than 9,500 km which accommodates about 1.81 million vehicles. The number is increasing by 16,562 per month Table 4. That is why the travel speed in most parts of the city is 30 to 40 km/h. Peak travel speeds in the core areas can be 15 km/h or even lower, while daily traffic volumes on major arteries are generally 70,000 to 180,000 vehicles (CDGK-MPGO, 2007). Every working day, 24.2 million person-trips are taken in Karachi. Public transport (buses) is thought to provide 50 to 60% of all trips and private transport account for the remainder. There is exasperating disparity between the number of seats available in buses and the passengers, as indicated by the current passenger seat ratio of 1:34. Unfortunately, there are 500 - 600 fatal road accidents in Karachi each year, most of them involving pedestrians and motorcyclists. However, accident severity index has risen to 45%.

Although, the maintenance of Karachi's roads has been poor and problematic until late 90s', the situation has substantially improved after the devolution of new local government. The new local government has been so affected through construction of flyovers, underpasses, remodelling of intersections and road rehabilitation. To cater for the heavy traffic to and from the Karachi port, two logistic by-passes have been completed, and for the same purpose, the Lyari expressway is being constructed. These would well serve an integrated logistic system. There were no expressways in operation in early 2007, but construction of the Lyari expressways (following the Lyari River) is almost complete. The road begins at the north of Karachi City Port and west of the central city and runs northeast between Lyari and S.I.T.E. districts crossing other populated areas of Karachi.

However, the Lyari expressway is about 17 km in length. Similarly, the Northern Bypass road forming a wide semi-circle beyond the north of urban Karachi is almost complete. It connects the RCD road at the north of Baldia with the NBP interchange on the superhighway north of cantonment. The RCD Highway, if often constrained, provides an important link to Karachi Port Trust. Three national highways connect Karachi to the northeast (Super Highway to Hyderabad and Punjab), southeast (National Highway to Badin) and northwest (RCD

Highway to Quetta). All these terminate at Karachi Port Trust (CDGK-MPGO, 2007).

Karachi has two major sea-ports: Karachi Port trusts in the south and Bin Qasim in the east of the core area of Karachi. All the major international trade has been done through these ports. Quaid-e-Azan international airport is one of the largest airports of South Asia, with an average use of 10 million people per year. Karachi is connected with railways up to the northern areas and operates a comprehensive railway network that connects the Agricultural Punjab Province with the Province of Sindh. There are about 13 stations in Karachi accommodating the flow of 45 - 50 thousand people daily.

Environmental quality

Environmental studies have been reported by several researchers (Qureshi and Breuste, in press; Kazmi et al., 2008; Qureshi et al., 2007; Mehdi et al., 2002; Hasan, 1999; Zaidi, 1996, 1990; Kazmi, 1995; Ahmed, 1994; Shaikh et al., 1990) which reveals Karachi as one of the most vulnerable cities prone to face the environmental challenges of this century. Still there is an acute need of research to be done on aspects where the dynamics of environmental conditions could be coupled, empirically with the human systems. Changing climate has also raised several issues, for instance, water resource management in urban areas because of the major local disturbances like irregular heavy rain falls and thunder storms during cyclonic conditions. It is an important area of future research where the city is expected to suffer problems. Ever increasing vehicles, congestion of traffic, high rise buildings and increased population density have raised the issue of air quality a lot. Arsalan (2002) divides Karachi into five risk zones. The 'very high risk' and 'high risk zones' cover more than 18 sq.km of the area which covers the main areas of urban activity in Karachi (Figure 6). A population that is little less than one million always have to suffer the aftermath of polluted risk. These, being the most congested areas of the city, show that the noise level has risen as high as 30 to 35 dB (A) above the tolerance limits (Zaidi, 1990). SEPA (1994) highlighted auto

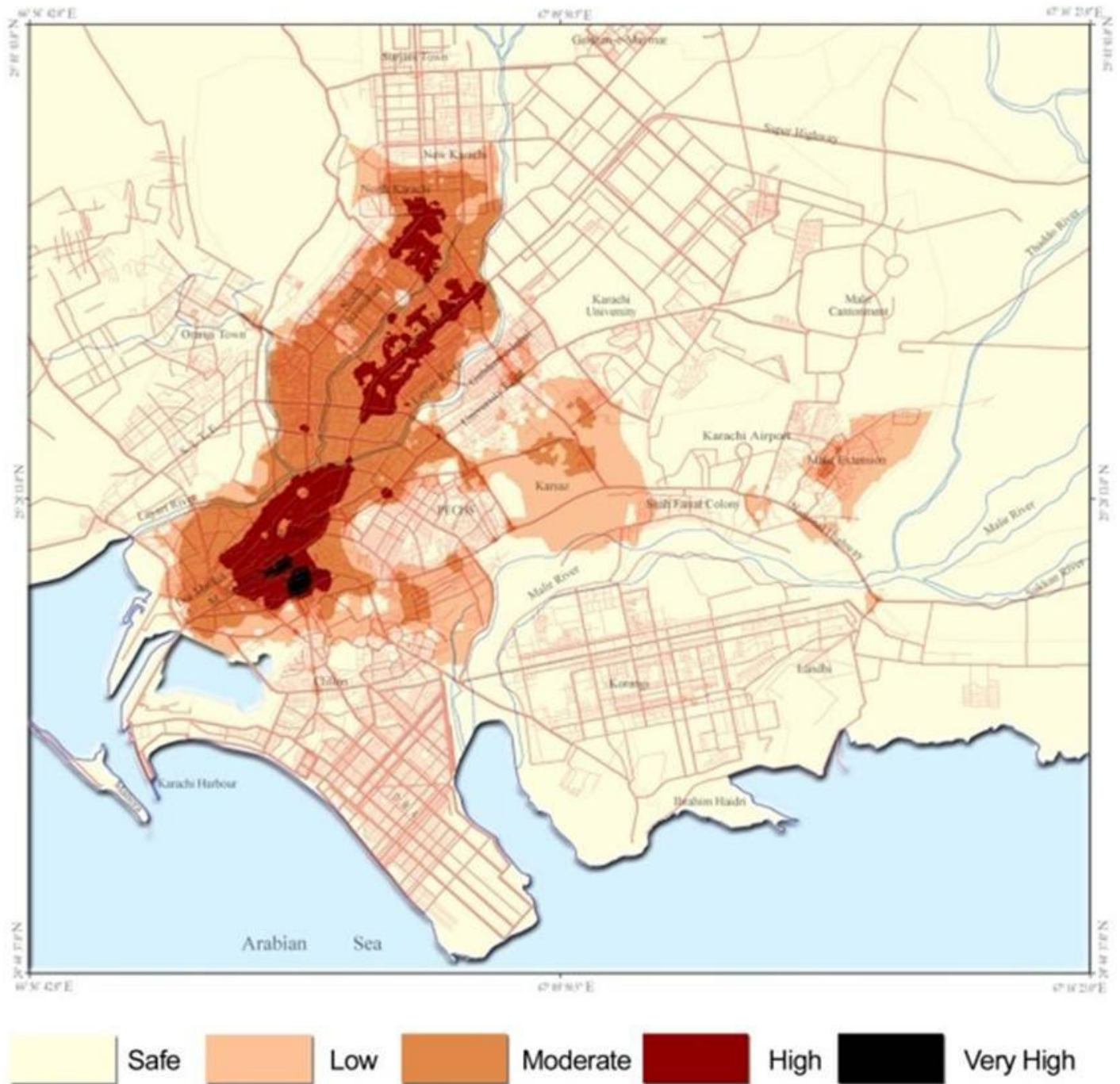


Figure 6. Risk of air pollution to the dwellers of Karachi (Multi-criteria risk assessment) (Source: Arsalan, 2002).

auto rikshaw, trail motorbikes and fag (pressure) horns as responsible for this high level of noise in the city. It is further reported that the areas in the vicinity of the city center seem to be suffering the same level of noise pollution, which are not among the very high risk areas of air pollution.

The water management is also another issue for the dwellers as the amount of water provided to the people is

short by about 35%. It is mainly due to losses in transmission from leakages, friction and large scale unauthorized diversion or thefts. Furthermore, there is no specific system for managing the rain water and as such, it runs off into the drains of waste water in Karachi. About 60% of the households are connected to the supply network. Water demand and supply does not equate each other. Most of the *Karachiites* receive water during

fixed hours of the day and almost all major localities fulfil their need by requesting addition of water tanks. Moreover, there is need to pay for the service. Water quality remains a question of all time. Water treatment facilities are not enough for this gigantic population and about 60% of water is filtered and the rest is only disinfected through chlorination. Still the consumers could not get the appropriate quality of drinking water. Khan et al. (2005) collected multiple samples from major water reservoirs of Karachi and all samples were tested in the laboratory which proved 'unfit for human consumption'. Furthermore, the net sewage flow is estimated at 388 million gallon per day. Approximately, 9,000 tons of solid waste is generated each day. By the year 2020, the solid waste generation may have approached 16,000 to 18,000 tons each day. It could seriously affect the health of the urban dwellers if the issue is not addressed systematically (CDGK-MPGO, 2007).

Squatter settlements

Karachi was included in a famous title "Planet of Slums" by Davis (2006), though criticised a lot by others (Angotti, 2006). It is mainly because, more than 50% of the city population lives in squatter settlements (GOP, 2000), which are locally called *Katchi Abadis* (English equivalent: unpaved settlements) or slums: two classified definitions by the local government based on the legal setting and physical characteristics. Hasan and Sadiq (1998) have presented an indicator based study by classifying the settlements into socio-economic and structural classes. These settlements are one of the most important challenges for the authorities which are officially reported as 539 in number with approximately 415,000 housing units (SKAA, 2001). According to surveys and statistical projections, some unofficial estimates suggest about 702 Katchi Abadis in Karachi (Hasan and Mohib, 2003). Social settings appear to be quite identical in both types of squatter settlements allied to low-quality housing, poverty (mainly because of unemployment), disruption of community cohesion and other deteriorating urban conditions that led to the poor health standards of the people.

REBIRTH AND FUTURE

The formulation of CDGK has brought new life to Karachi. One of the most important plans of the CDGK is the development of Karachi Strategic Development Plan 2020 (CDGK-MPGO, 2007) under Tameer-e-Karachi Program. There is no surety of the exact execution of the plan, but it is to set out a strategic framework and overall development direction and future pattern of the city over the next 13 years. From 2001 to 2007, two local governments were elected. First, one was led by Naimatullah Khan, who is succeeded by Syed Mustafa

Kamal. Both the Mayors (locally called *Nazim-e-Ala*) have set a new tone of urban development by involving the several foreign donors and people of the city. There is a set of public-private partnership schemes where the money has been invested from the local and international investor. They will earn certain benefits for some years and then the development belongs to the CDGK. There are certain changes that have been observed in the infrastructural development of the city. Roads have been refurbished, new signals have been implemented at traffic junctions, flyovers and underpasses have been constructed at busier traffic corridors and model/public parks have definitely changed the outlook of the city. These new installations and renovation has strong appreciation among the common masses, although most of these development activities created several ecological problems as well (Azad, 2007; Qureshi et al., 2007; Khan, 2006; Dawn, 2006). Apparently, 'urban renewal' definitely needs some development and Karachi seems to be under the pressure of these developments.

The most complex challenge for the CDGK is the new federal government which has reduced the right of authority for the City Mayor and the several interim projects that are abandoned. It is formally declared as mainly because of the financial crisis and the development funds, which are always reduced in most of the countries to cope with such challenge. However, same has been imposed for such projects which were about to be inaugurated for the Karachiites. This situation has created confusion as most of these projects were at the verge of completion, and a pause at such a stage could put the local government at the back foot. Now, the whole situation is taking more time than expected and the people, who were already under the pressure of inflation and chaos in the country, are so tempted with the bonanza of the possible development. If the government delays its decision in this regard, it will highly be condemned by the people and the city which was flourishing more than ever before may be set back to the former awful conditions.

CONCLUDING REMARKS

Karachi, with a set of sea ports, is an important city in terms of its geo-strategic location. Its role in mobilizing the trade between Europe, Middle East and Asia will be more significant because of the newly developed port city near Karachi. A new trend of public-private partnership has attracted a lot of money into the development initiative. It has not only provided the infrastructure and facilities to the people, but also, the job provision is an important aspect of it. During the late 90s, Karachi was an important city for numerous world renowned software development companies as they invested and outsourced their projects in the local software houses in Karachi. Unfortunately, a sudden boom in this sector made it

saturated and Karachi lost its standing in the software development market. Pithawala (1946) wrote in his book:

“Like all other cities, Karachi must have some kind of planning before it is too late. Already, it has reached a stage when an extensive ‘improvement trust’ under the Town Planning Act will have to be instituted to make alignments of many old roads and cross-roads and their corners, to remove congestion in the old town and neighbouring areas, to provide well-planned houses for the poorer labour class, to remove the obstacles of warehouses and godowns in the heart of the city, to relieve Bunder Road of some of the traffic load, to look to the drainage difficulties and to protect the city against fire, earthquake, seaquake, disease, etc.”

These are the problems that have now made Karachi a hub of ecological problems, though it was all reported more than 60 years ago, but there was no practical reaction from the authorities. Recent activities show betterment in the overall situation, but the planning and development work needs more ecological and environmentally sustainable development. A recent study by Salman et al. (personal communication) assessed the performance of these development activities and their analyses showed a clear improvement and success in the development activities in the transportation sector with publicly appreciated improvement in the road network of the city. Furthermore, the city has been installed with a new water provision and sewerage system which is expected to solve the ever-growing problems of the city dwellers. Land-use and housing issues are still among those addressed comparatively less by the authorities. Nonetheless, least has been done to control the problems related to the physical environmental quality which is challenged and continuously outraged by 2 million vehicles and heavy industry in Karachi.

A holistic approach from Mehdi et al. (2002) shows that more than 50% of the Karachiites believe that the development is timely and they are not expecting sustainability in the future. There is an acute need of such studies where the urban ecosystems can be studied, both on the basis of the structure and function that could later cater for the studies of services that the ecosystem provides. Karachi is like a mini-Pakistan in itself which could be turned to a much better urban landscape through good governance and better alertness of Karachiites regarding problems of their city. Sustainable initiatives are the need of time as the city has the ‘resources’, which if used appropriately, will make the city a globalized complex of economic activity and growth.

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