Evaluation of Urban Land Development Direction in Kabul City, Afghanistan

Ahmad Sharif Ahmadi, Yoshitaka Kajita

Abstract—Kabul, the capital and largest city in Afghanistan has been experiencing a massive population expansion and fast economic development in last decade, in which urban land has increasingly expanded and formed a high informal development territory in the city. This paper investigates the urban land development direction based on the integrated urbanization trends in Kabul city since the last and the fastest ever urban land growth period (1999-2008), which is parallel with the establishment of the new government in Afghanistan. Considering the existing challenges in terms of informal settlements, squatter settlements, the population expansion of the city, and fast economic development, as well as the huge influx of returning refugees from neighboring countries, and the sprawl direction of urbanization of the Kabul city urban fringes, this research focuses on the possible urban land development direction and trends for the city. The paper studies the feasible future land development direction of Kabul city in the northern part called Shamali basin, in which district 17 is the gateway for future development. The area has much developable area including eight districts of Kabul province, and the vast area of Parwan and Kapisa provinces. The northern area of the Kabul city generally has favorable conditions for further urbanization from the city. It is a large and relatively flat area of area in the northern part of Kabul city, with ample water resources available from the Panjshir basin as a base principle of land development direction in the area.

Keywords—Kabul city, land development trends, urban land development, urbanization.

I. INTRODUCTION

KABUL, the capital and largest city in Afghanistan is located in the eastern section of the country. Kabul city is estimated to be the fifth fastest growing city in the world [1]. The city population has increased from approximately 1.5 million in 2001 to around 4.9 million people by 2015. Rapid urbanization is taking a heavy toll on a city which was originally designed for around 800,000 people, according to the Kabul city first master plan (1962-1964). An estimated 70% of Kabul's residents live in informal or illegal settlements [3].

Urban land expansion in Kabul city depicts four growth periods. However, the characteristics of urban land expansion were not identical among different periods. During the first growth period (1962-1978), the city experienced the slowest growth speed of 3.3 km^2/year, which corresponds to a 4.87% annual urban growth rate. Likewise, the second growth period

Ahmad Sharif Ahmadi, Graduate student of Civil Engineering Department, Urban and Transportation planning, Tokai University. (Phone: +81-70-21-777-106; E-mail: ahmadsharifahmadi786@gmail.com).

Yoshitaka Kajita, Associate professor, Department of Civil Engineering, Faculty of Engineering, Tokai university, Hiratsuka, Kanagawa, japan. (E-mail: yokaji@tokai-u.jp; Phone: +81-463-58-1211; Fax: +81-463-50-2045).

(1978-1992) has similar temporal changes. The growth period of (1992-1999) depicts a moderate speed stage of urban land utilization in the study period [2].

Finally, the most recent period (1999-2008) illustrates the fastest ever urban land growth stage of the city. This stage is accompanied with the inflow of migrants from neighboring countries. Since 2002, more than 5.8 million Afghan refugees have returned home, 4.7 million of whom were assisted by UNHCR, which strictly influenced urban land expansion in Kabul city [5].

Apart from the fastest urban land growth stage since 1999, the gross domestic product (GDP) of Afghanistan started to grow rapidly after 2001, and the average annual growth attained 10.7% during 2002-2006, which significantly influenced urban land expansion in Kabul city [4].

The urban land expansion in the city forced the Afghanistan government to expand the Kabul city territories. In 2005, the city area was consisting of 14 districts (Districts 1-16, except districts 13 and 14). The jurisdiction of Kabul city was expanded in January 2005 by the agreement between the Ministry of Interior, the Kabul provincial governor and the Kabul city mayor. The city population increased to 2,721,000 with 22 districts [2].

During that time, Kabul city was continuously growing, and from 1964 to 2008, urban territories have enlarged 14 times. Although, some papers and reports have focused on discussion of the urbanization and urban development in the city, still less attention has been paid with regards to the urban land development direction of the city. Therefore, this study aims to analyze the urban land development direction of the city to best manage the future growth of the city [2].

This study aims to achieve the following objectives:
1. To evaluate the city population distribution in the fringe districts of Kabul city.
2. To explore the settlement development of Kabul city in the fringe districts.
3. And finally, to analyze the urban land development direction of Kabul city.

II. KABUL GEOGRAPHICAL LOCATION

Kabul city was originally established as an oasis along the east-west trade route and developed also to link Central Asia in the north with coastal areas in the south. With the establishment of national territories in the modern world, Kabul was naturally linked through the national road network with the seven neighboring countries: Tajikistan, Uzbekistan, Kyrgyzstan, Turkmenistan, Pakistan, Iran and China.

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Kabul is located between latitude 34°31' North and longitude 69°12' East at an altitude of 1800 m (6000 feet) above sea level, which makes it one of the world's highest capital cities. Kabul is strategically situated in a valley surrounded by high mountains at the crossroads of north-south and east-west trade routes. Fig. 1, illustrates the terrain map of the Kabul city area, which is surrounded by huge mountains to the east and west side.

The development of Kabul city over the millennia has been supported, among others, by two very important factors. One is the geographic position along the east-west and the north-south trade routes, and the other is the water resources of the upper Kabul basin [3].

Fig. 1 Kabul city area terrain map. Base map source: Esri, Digital Globe [16]

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III. DESCRIPTION OF THE STUDY AREA

In this study, three municipal districts of Kabul city (district 17, district 18 and district 20) have been considered to analyze the urban land growth direction of the city. All these municipal districts are located on the outer skirt of the city, or in other words, they are situated at the very fringes of the city (Fig. 2).

Kabul city is comprised of 22 districts. District 17 is located in the north-western part of the city along the national highway leading to Mazari-Sharif. Its territory is largely outside the upper Kabul basin, while the Shakar Dara district is located in the upstream of the Panjshir basin. It is separated by hills from district 11 in the east and district 14 in the west. Only the national highway links the district with the rest of the city, but the suburbanization from the city toward the northwest is proceeding along the highway. Thus, the area is becoming the corridor for development to the north. Fig. 2 expresses the location and territory of district 17 in the Kabul city district map.

District 18 is located in Dehsabz district on the western side of the Bagram road. Together with district 19 on the other side of the road, it constitutes the expansion area of the Kabul city urbanization proceeding from district 9 in the south. The district encompasses most rural settlements developed earlier with agriculture, including the old capital of the Dehsabz district, Tara Khel. District 18 was annexed to Kabul city in 2006; however, some administrative disputes between the Dehsabz district and the Municipality still exist. The settlements in the district are only semi-urban, and the urban administration may not be appropriate to serve the residents.

Traditional communities of the old settlements are undergoing change, as more people have moved in and the urbanization pressure from the city center increases. Fig. 2 expresses the location and territory of district 18 in the Kabul city district map.

District 20 is the southern-most district of Kabul city (Fig. 2). It occupies largely the area between the upper Kabul and the middle Logar rivers in the eastern part of the Char Asiab district. It is separated by hills from district 6 and district 7 in the northwest. It also shares short borders with district 8 in the north and district 22 in the northeast. District 20 was recently established and its administration began to operate in 2004 [4].

IV. LAND SOURCES OF CONFLICT

Urban development in Afghanistan would have to deal with among other things, with damaged and degrading urban infrastructure, rapid population increase due to the return of refugees and rural-to-urban migration, proliferation of informal and illegal settlements on hill sides and steep slopes as a result of the lack of effective master plans, and the aggravating urban environment and sanitation. These problems are most serious in the capital city of Kabul. Development in Kabul would benefit from a new approach. Kabul's main problem is not housing, but access to land and provision of infrastructure. Only 0.5% of the Kabul population is considered homeless, including 10,000 people living in tents and 5,000 living in the ruins of destroyed buildings. Therefore, the key issue for the government is not providing housing, but promoting the legal and regulatory framework for land development and its required infrastructure [5].
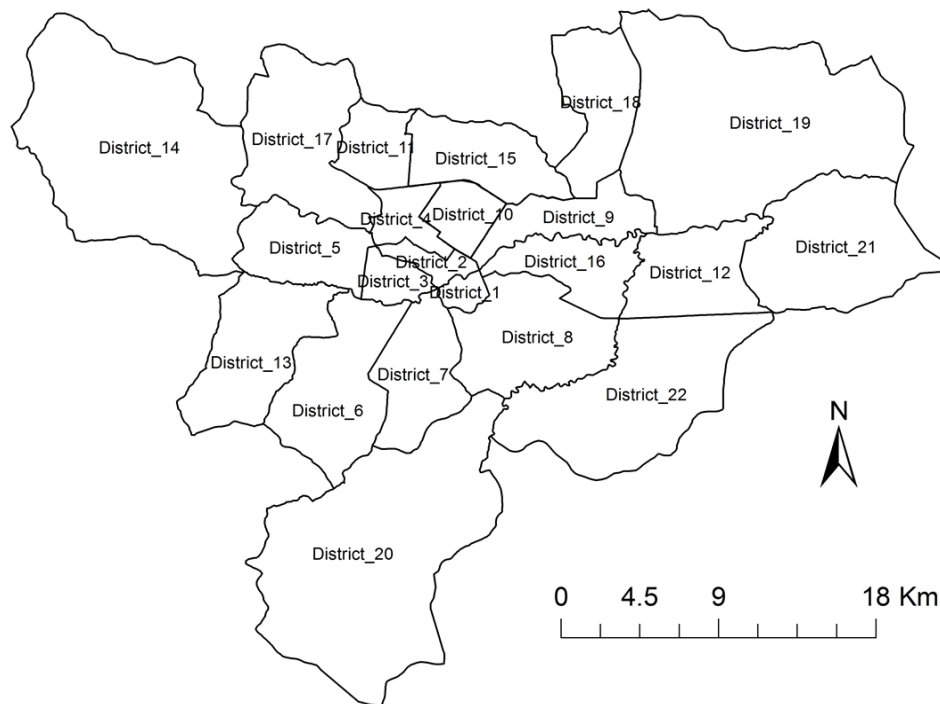

Fig. 2 Location and territory of districts 17, 18 and 20 in Kabul city district map

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Based on a population estimation of Kabul city, and based on the study for the development of the master plan for Kabul metropolitan area in 2009, the city is estimated to have a population of 4.9 million by 2015. The key spatial and visual impact of this growth has been the informal development of land on hill sides and steep slopes. The majority of Kabul's new migrants are informally housed. The above-mentioned inconsistency (rapid population increase, rural-to-urban migration, and informal settlement) in the city push toward the possible land development direction. The medium term possible land development direction is in the eastern part of the city, but in the long term, the only possible land development direction would be toward the south and northern plateau of Kabul city.

V. DEVELOPMENT DIRECTION FOR FUTURE EXPANSION AND INFORMAL SETTLEMENT

A. Population Expansion

Kabul has been growing at a fast pace. This is a result of increasing:

- Migration from rural areas,
- The return of Afghan refugees (since 2002) from surrounding countries, and
- The migration of internally displaced persons (IDPs).

Since the late 1990s, Kabul has experienced massive population growth. Between 1999 and 2002, the city's population grew at 15% per year and was estimated at approximately 3 million in 2004. Growth was remaining at about 5% (about 3% natural growth plus 2% migration) for the next few years [5].

The study for the development of the master plan for Kabul metropolitan area in 2009 put the estimated population for Kabul city 4,007,131 by 2008. Thus, the population in 2015 can be derived from (1) [6].

$$P_{tn} = pt \, (1+r)^{n} \qquad (1)$$

Considering r = 3% annual growth rate, base year population P_t = 4,007,131 and time period n = 7 years, the population of Kabul city is estimated P_{tn} = 4,928,265 in 2015.

B. Informal Settlement

Informal settlements pose a major challenge for planned the urban development of Kabul, as they account for some 80% of the city's urban population and 70% of the residential land area. This situation is due directly to the lack of an effective master plan, but in fact, it is more deeply rooted. Illegal land occupation and informal land sub-division are still rampant in Kabul, as widespread poverty still exists in the city. Focusing on the status of the land, the informal settlement is classified into four categories in Kabul city.

1. Settlements on public lands.
2. Settlements where most houses were built on privately owned lands.
3. Settlements where most houses were built on lands grabbed directly or bought from land grabbers.
4. Settlements where there is a murky legal situation [3].

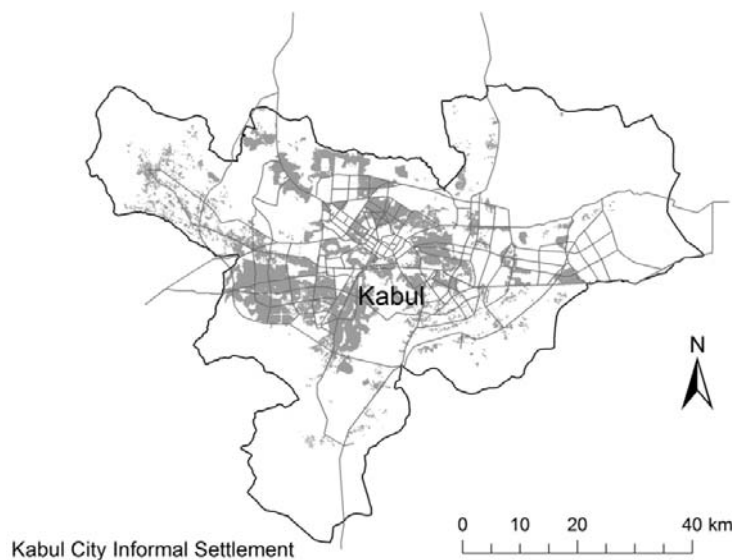Fig. 3 illustrates the informal settlement areas of Kabul city in 2008.

Fig. 3 Kabul city informal settlement map 2008. Source: Capital Region Independent Development Authority (CRIDA) [12]

VI. DATABASE AND METHODOLOGY

A. Database

For this study, some spatial data/GIS data, and multi annual socio-economic data have been collected from different sources to analyze and detect the urban land growth direction in Kabul city based on the annual population and urban growth rates between 2000 and 2016 in Kabul city. The data used in this study are shown in Table I.

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TABLE I
DESCRIPTION OF THE DATA USED IN THIS STUDY

Data type	Year	Source	Process
Satellite images			
Landsat 7 (ETM+)	10/2000	US Geological Survey (USGS) [15]	Geometric correction, Enhancement & Classification
Landsat 8 (ETM+)	6/2016	Same as above	Same as above
Ortho mosaic image	2011	Kabul Municipality (KM) [14]	-
Socio-economic records			
Kabul city population census	2016	Central Statistic Organization (CSO) in Afghanistan [13]	-
Economic development report	2008	Capital Region Independent Development Authority (CRIDA) [12]	-
Natural environment and social development report	2008	Capital Region Independent Development Authority (CRIDA) [12]	-

B. Spatial Data Characteristic

In the spatial data section, two scenes of Landsat Enhanced Thematic Mapper (ETM+) imagery have been collected from United States Geological Survey (USGS). The first Landsat 7 (with 9 spectral bands) image was acquired in October 25, 2000, and the second Landsat 8 (with 12 spectral bands) image was acquired on June 7, 2016. In the GIS data section: city territory and municipal districts territory data of Kabul city have been gathered from the Kabul Municipality (KM) and Capital Region Independent Development Authority (CRIDA). The population scene statistics of Kabul city districts have been acquired from the Central Statistic Organization (CSO) of Afghanistan.

C. Urban Growth Analysis and Change Detection

Urban growth is a spatially-conditioned process, and the outcome at one location is partially affected by the events of its neighboring locations. The mapping of urban growth is different than the mapping of urban areas. Urban areas can be detected and mapped using a single temporal image, that is, an image from a specific date. However, the mapping of urban growth necessitates a minimum of two temporal images; since it means the mapping of changes between two dates. This process is often called changed detection; the process of identifying difference in the state of an object or phenomenon by observing it at a different date [7]. Through GIS, various techniques and methods can be applied to measure the spatial changes of urban areas and urban growth. However, in this study, the image classification and post classification tool was utilized in spatial analyst to quantify the spatial and temporal changes of the urban areas and urban growth.

D. Land Use/ Land Cover Classification

In the image classification process, supervised image classification method has been chosen to apply to the Landsat images to determine the land use categories. The maximum likelihood classification was employed in this image classification method to detect the land use/land cover types.

In this process, a four land use categories system was designated as urban land/built up area, agriculture area, bare land, and mountainous area. As there have been three areas of focus in this study, the raster image was first clipped within the study area jurisdiction and then the process of image classification started on each individual district satellite image. Three sample areas were set for each district separately to account for accuracy assessment of land use types.

E. Annual Urban Growth Rate

One of the urban growth indicators used in this study is defining the annual urban growth rate. This indicator was used to explore the extent, trend, and magnitude of urban land expansion and analyze the spatial and temporal difference of urban land expansion in the study area. Urban growth rate is defined as:

$$AGR = (UA_{i+n} - UA_i) / nUA_i \times 100 \qquad (2)$$

AGR indicates the annual urban growth rate, UA_{i+n} is the total urban land area or built-up area of the considered unit to be calculated at the time point of $i + n$, UA_i is the urban area or built-up area of the considered unit at time i, and n is the interval of the calculating period (in years).

VII. RESULT

A. Directions of Kabul City Development

Future and further urbanization of Kabul city would best be guided to the north and the east of the city. Urbanization to the west is constrained by the mountainous topography and the need to protect the agricultural and resort areas. The urbanization to the south should not be encouraged as it constitutes the upper Kabul basin. Only limited urbanization may be pursued in the south on the condition that the local groundwater would be used, once the availability is proven [8]. In the medium term, there is still a large amount of underdeveloped land immediately to the east of the city that can accommodate an additional 1 million people [9].

B. Northern Development

In the long term, the only real possibility to accommodate Kabul's growth is on a plateau to the north of the city, on the other side of the mountain range. However, given the large densification potential and the ease of filling up the existing built-up area, immediate expansion of the city into this area would be premature.

The north part of Kabul city is called Shamali, which mainly comprises of three provinces: Kabul province in the initial part, Parwan province, and Kapisa province area. The northern area within Kabul province constitute: Dehzabz, Shakardara, Mirbachakot, Guldara, kalakan, Farza, Istalif, and Qarabagh districts. Chaharikar, Jabalussaraj and Bagram are small cities within the Parwan province, and finally, Kohistan and Mahmud Raqi are in Kapisa province territory, and are surrounded in a basin by huge mountains from the north, east and west; thus, restricting the future development of the area.

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Since 2006, the Afghan government has been involved in planning a city in Dehsabz (north-east of Kabul existing city) area, which is called (Kabul New City), with close assistance from the Japan International Cooperation Agency (JICA) - both technically and financially. Kabul New City is approximately 1.5 times larger than the existing Kabul city, and it is mainly located in Kabul province and occupies a small area of Parwan province in the northern part. The site is surrounded by the Khawaja Rawash, Safi and Marko mountains. The city has a total area of about 740 km^2, with 440 km^2 of developable area to provide accommodation for about 3 million people within 30 years [3].

Fig. 4 indicates the location and territory of Kabul New City (KNC) within Dehsabz area. The next section will look at the distribution of population of the three districts.

C. Population Distribution

District 17 contains fast growing areas along the national highway going to Mazari-Sharif. Many people have been recently relocated from the city together with some businesses and markets. The population is projected to increase significantly in the area. Population increase in the area along the national highway is inevitable, and a residential-commercial complex is developing to guide more orderly urbanization, rather than allowing urban sprawl. Commercial areas have been developing rapidly along the national highway with many informal shops partly relocating from the city center [10]. The district population growth profile based

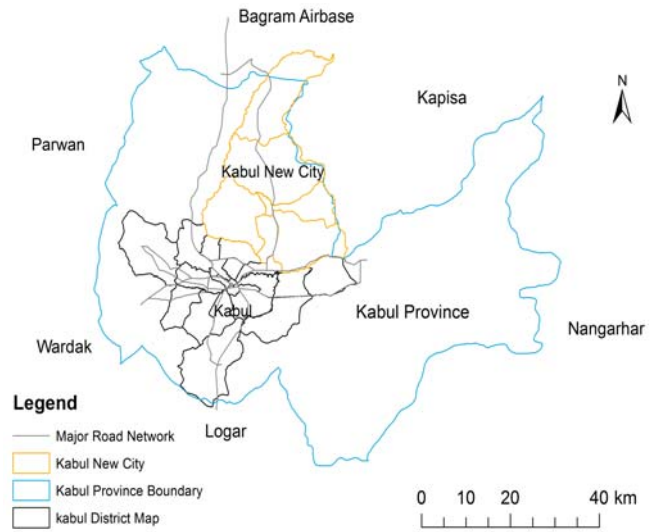on the Central Statistics Organization (CSO) in Afghanistan is shown in Fig. 5.

Fig. 4 Kabul New City (KNC) location within Kabul province
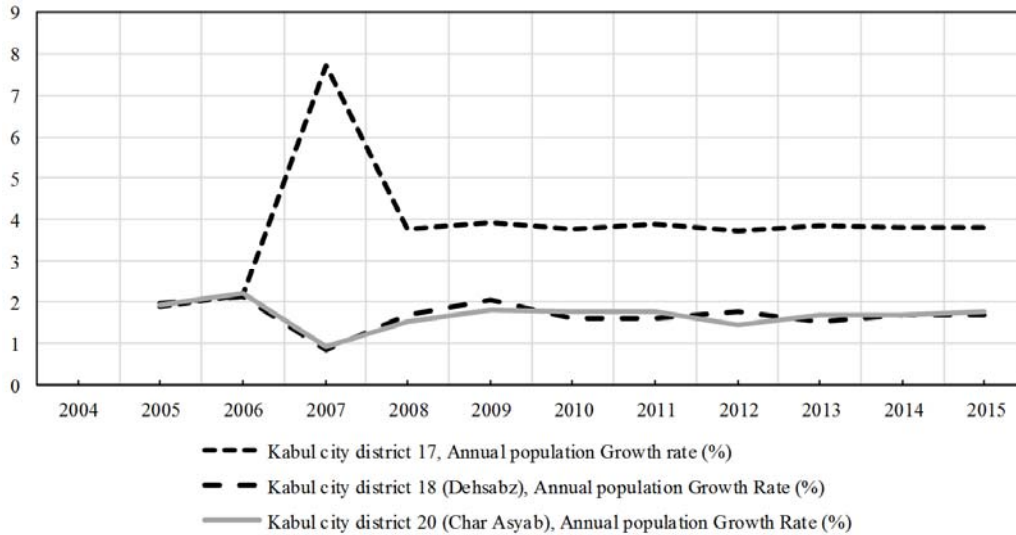Source: Capita Region Independent Development Authority (CRIDA) [12]

Fig. 5 Population growth of Kabul city districts 17, 18 and 20

Most of the residence in the district are from the northern provinces. Many people have moved from the city center recently, and more city people are interested in lands and houses in the district. The district has experienced various population growth rates from 2004 to 2015, with an average 4.7% annual population growth rate based on the (CSO) population estimation (Fig. 6).

As it seen from Fig. 5, the district had a minimum population growth rate of 1.9% between 2004 and 2005. This

growth was at the time when Kabul city territory was being expanded and district 17 was included within the city's jurisdiction. The district had the sharpest population growth of 7.7% between 2006 and 2007; this is the time when urban development actively took place and a majority of Kabul residence and a majority of those from neighboring provinces moved into this district. After 2007, it seems that not enough and conspicuous fluctuation has occurred in the population growth of the district since 2015, and the growth rate remains

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at approximately 3.8%. For the entire period from 2004 to 2015, the district experienced an average annual population growth rate of 4.7%.

Districts 18 and 19 are located in the Dehsabz district on both sides of Bagram Road. This area constitutes the expansion area of the Kabul city urbanization proceeding from district 9 in the south. This area encompasses most rural settlements developed earlier with agriculture including the old capital of Dehsabz district.

The population profile for district 18 is not available, as this municipal district was a part of Dehsabz before 2005, and the Central Statistics Organization (CSO) still provides the demographic information for this area. Since, district 18 was under the jurisdiction of Dehsabz, the population profile of this district is used in this study to calculate and predict the population growth rate of district 18.

Fig. 5 shows that district 18 had the highest population growth rate of 2.0% and 2.1% in 2005 and 2006, respectively, while it experienced a minimum growth of 0.8% in 2007. After 2007, the district population growth has slowly increased to 2% and continued approximately invariant until 2015. For the entire period, the district has recorded a 1.8% demographic growth rate (Fig. 6).

District 18 is rural with some semi-urban communities. Water supply relies on local groundwater for drinking and drainage water conveyed from the Kabul city via a canal for irrigation. Residents here suffer from chronic water shortages and the district has no electricity supply from the grid. The densities of all the roads and major roads are lower than the averages in the city. There are five primary and secondary schools, as well as two high schools in all the villages, but there is only one public serving the district [4].

District 20 is the most southern district in Kabul city. This district was recently established and its administration started to operate in 2004. As with district 18, the population profile for this district is also not available from the CSO, as it was part of the Char-Asyab area prior to 2004. Since, district 20 was a part of Char-Asyab territory, the population profile of this territory is used in the study to estimate the population growth rate of district 20.

The demographic trend in district 20 is approximately in the same as district 18 (Fig. 5). The district had the highest growth rate of 1.9% and 2.1% in 2005 and 2006, respectively. The district experienced the highest decrease of 0.9% in 2007, followed by almost constant growth since 2015. Likewise, for district 18, during the entire study period this district had 1.8% growth rate (Fig. 6).

Fig. 5 provides a comparison of the overall demographic trends for all three districts (districts 17, 18 and 20). It shows that the population growth rate is dominant in district 17 after 2006 in comparison to two other districts of 18 in north east and district 20 in the south of Kabul city. In fact, the high population growth rate of district 17 from 2004 to 2015 represents the current settlement of the people, urban land development direction and the feasible future urban land development direction of the city toward district 17 in the capital city of Kabul.
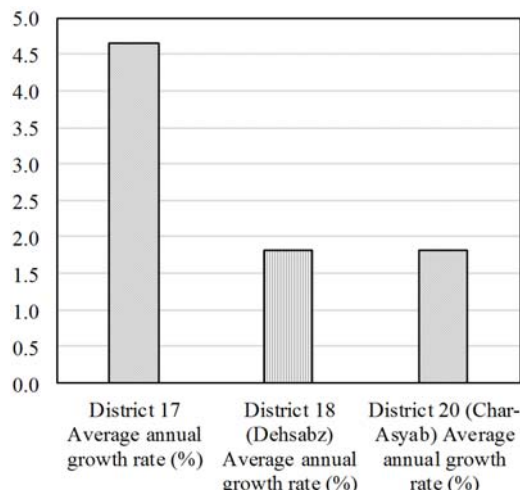

Fig. 6 District 17, 18 and 20 population growth comparison

D. Spatial Changes of Urban Land Use/Land Cover

For the entire study area (districts 17, 18 and 20), the urban land growth has been evaluated from 2000 to 2016, to evaluate the urban land expansion of Kabul city. The results from the urban land expansion studies show that since 1999, urban land growth has the highest ever rate in the city. Kabul city territory has expanded from 14 to 22 municipal districts. Of all the newly established districts since 2005, three districts (district 17, 18, and 20) in which urban land has been continuously developing has come under analysis to explore the urban land development direction in the city

1. District 17

This district is situated in the north-west part of the city along the national highway leading to Mazari-Sharif. The district covers a large area of about 56 km². The land use in the district has been classified into four land use categories and two sets of land use maps, 2000 and 2016, were prepared for the district (Fig. 7 (a)).

In 2000, bare land has the highest share of approximately 58% in the district. The second biggest share of 36.6% is made up of the mountain and hill areas. The agricultural land, located mainly in the north part and the Agricultural Institution of Ministry of Agriculture Irrigation and Livestock (MAIL) is located at the southern end part. The built-up area and agriculture lands are the two other land use types, they had the lowest share of 2.9% and 1.7%%, respectively, in the district.

Compared to the 2000 land use map, it has been detected that in 2016 land use that urban land/built up area has the highest jurisdiction of 33.2% in the district after the mountain and hill areas. On the other side, bare lands have declined to 23.4% from 58%. This growth of these settlements or the built-up area in the district expose the highest change of land use to urban land/built up area. Thus, in the period from 2000 to 2016, the urban land/built up area had the highest annual growth of 0.65%. Before comparing the growth of this district with the other two districts, it is necessary to provide an assessment of the two other districts land use characteristics.

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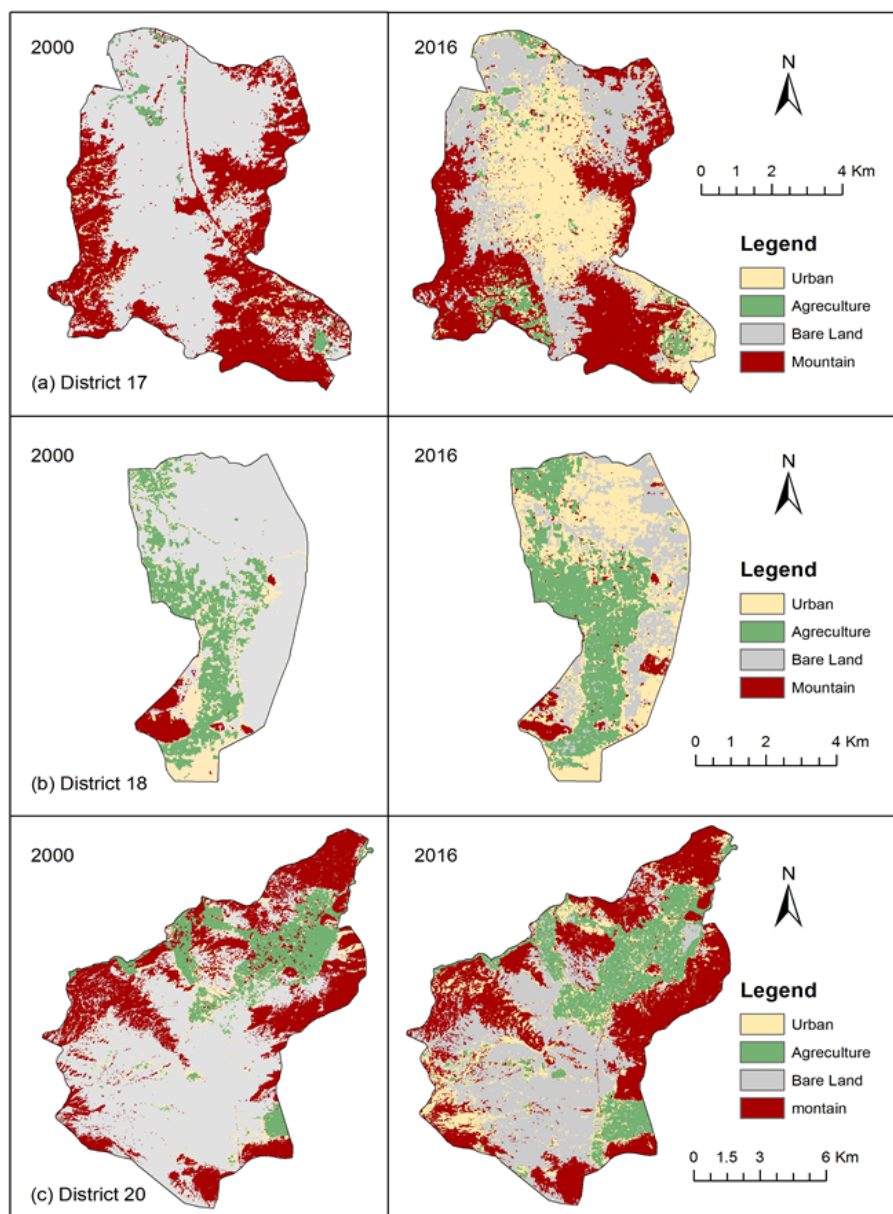International Journal of Urban and Civil Engineering
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Fig. 7 Kabul city districts 17, 18 and 20 land use maps in 2000 and 2016

A small planned residential area exists at the southern end of district 17. In the north of the area, there are old informal houses developed 80-100 years ago, and an unplanned residential area in the middle of the district which is about 20 years old. Also in the middle of the district, another residential area was developed formally by the Ministry of Urban Development (MoUD). A farmers' town is developing in the north, while some public facilities such as graveyards and power sub-station are also located in the southern area. The district has been experiencing most disorderly urbanization in recent years along the national highway because of good access from the city center. There is only a small planned residential area at the southern end of the district. The district office is having difficulty in controlling illegal building construction and street shops. Commercial areas have been developing rapidly along the national highway with many informal shops partly relocating from the city center. Also, automobile markets have developed along the highway with the permission of the Municipality. A new bus terminal is located at the beginning of the national highway [4].

2. District 18

This district is located on the north-western part of the city in Dehsabz area along the Bagram road and adjacent to district 19. The district has flat area of about 33.9 km². Same as district 17, the land in this district has been classified into four land use categories, and two sets of land use maps, 2000 and 2016, were prepared for this district (Fig. 7 (b)).

First, to evaluate the land use in 2000, which is similar to that of district 17, where bare land has the highest share of approximately 57.4% in the district, with the second biggest share of 23.25% given to agricultural areas. Orchards, mostly

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grapevines, account for 58.2% of the agricultural land use, according to 2008 studies, and the remainder is used for rain-fed agriculture due to insufficient supply of water conveyed from the Kabul city center by a drainage canal. Conversely, this district has a small area of mountain and hills in its territory, amounting to 4.7%.

After the big share of bare land and agriculture land, urban land/built up area comprise of a 13.4% share in the district in 2000, in which the majority of built up area is situated adjacent to agricultural lands.

Looking at the land use characteristics of the district in 2016 (Fig. 7 (b)), remarkable changes can be observed. In a comparison to the 2000 land use map, it has been detected that in 2016 land use urban land/built up area has the highest jurisdiction of 37.8% in the district. The second largest area of 34.7% is occupied by agricultural land. Of all the land in the district, most of the bare land was converted into other lands, resulting is a decline in bare land has been decreased from to 22.3% in 2016, from 57.4% in 2000. As a result, the urban land/built up area has an annual growth of 0.11% in this district. After assessing district 20, all three districts will be compared in terms of the annual urban land growth rate to determine the final results.

District 18 land is generally flat and constitutes clay desert. The clay is used for brick kilns located along the Bagram road. Limited grassland or pasture exists to support nomads. The Paymonar new town project is planned with 6,000 lots on 380ha at the southeastern corner of the district. There are few nomads, as grassland or pasture is limited; while agriculture is the traditional activity, many people now commute to the city center.

3. District 20

This district is located in the most southern part of the city far from the two other districts. District 20 has the largest land area of all the districts in the Kabul city with 143.6 km² area. In the same approach as districts 17 and 18, the entire land area in the district has been designated into four land use categories, and two sets of land use maps for 2000 and 2016 have been prepared for the district (Fig. 7 (c)).

GIS analysis shows that in 2000, bare land has been dominant in the land use of all three districts. This jurisdiction also had the highest proportion of about 50% bare land. Mountain area and agriculture land having 30.5% and 12.8% contribution, respectively, are in the second and third level of land use. A study in 2009 shows that, of all agriculture land, 77.6% was under irrigated crop production, 20.8% was for orchards, and the remainder for rain-fed agriculture. Irrigated agriculture is practiced in the flat land between hills where water availability and soil conditions are better to produce vegetables and fruits. Urban land/built up area having a 5.9% share of land use has the lowest contribution.

Although, the bare land contribution in the land use reduced from 50% to 33% in 2016, the bare land remains the dominant land use. The second highest contribution in the land use of the district is the mountain area which includes the hills surrounding the district and the large flat and unproductive

clay desert in the south. Agriculture and the urban land/built up areas have the lowest contribution of 17.4% and 13.6%, respectively, in 2016 land use.

The district is still dominantly rural with many small villages even in the southern clay desert. More organized settlements are found in the north between hills, including the district capital of Qaleh-ye Na'im and the Char Asiab village. A new town was developed by the private sector near the northern border next to the Char Asiab village. Another satellite town, Chehel-Dukhtaran, was developed in the middle along the Logar Road, providing 10,000 housing units. There is also an informal refugee camp with some 3,000 tents nearby [4].

After the analysis of the satellite images by GIS and land use/land cover classification in order to prepare the land use map for the three districts in 2000 and 2016, we will look at the urban land/built up area growth in the three districts. It seems that in 2000 all three districts had the lowest share of settlement area. As previously mentioned in the Directions of the Kabul City development title, the city is surrounded by huge mountains either form the east and west sides, thus restricting the future land development of the city toward these two directions. According to the geological situation of the city, land in the city can only develop either toward the north or south directions. Therefore, the two districts of 17 and 18 are considered in north part of the city and one district is considered in the southern part of the city to better analyze the urban land growth direction of the city. As shown in Fig. 8, it seems that between 2000 and 2016 that the urban land/built up area growth rate (0.65%) is dominant in district 17. However, district 17 had the lowest settlement contribution of 2.9% in 2000 land use. Districts 18 and 20 have only 0.11% and 0.08% urban land/built up area growth rate, respectively. Thus, this result can clearly depict that the urban land/built up or settlement area in Kabul city is developing more toward district 17 than districts 18 and 20. The urbanization trend toward district 17 also exposes the feasible future land development direction in Kabul city.
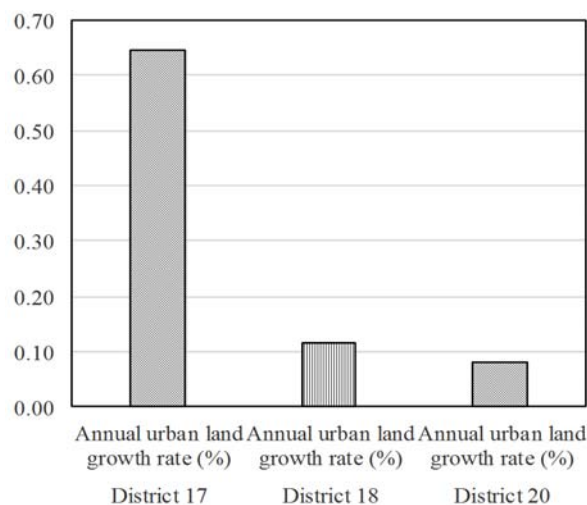

Fig. 8 Districts 17, 18 and 20 urban land/built up area growth comparison

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VIII. DISCUSSION

A. Factors Affecting Urban Land Growth and Development Direction

Several factors can have influenced on the urban land growth and development direction. Many factors are adopted and denoted for urban growth, and an increase in population is said to be the most important factor. There is a correlation between population changes and urban growth patterns. Two major factors are further identified to be responsible for urban growth; these are natural increase and rural urban migration. Another factor for urban growth would be rural unemployment, increased rural poverty, deteriorating living conditions, declining soil fertility and unchecked rural urban migration. All these factors are responsible for the movement of people from rural lands to the urban center [11]. Factors affecting the development direction, as a principle, are noted to be land availability, water resources, access to regions and countries, and topographical situation.

B. Policy Recommendation for Urban Land Development

An area wide land policy plan is a spatially explicit statement of a community's land development and environmental protection policies. It maps those areas of the region, county, or city-and-vicinity where transition from rural to urban development should occur to best accommodate growth and where redevelopment or significant infill should occur to accommodate change, it also indicates where development should not occur [6]. The initial policy for land development would be formulating land policy classification for the policy district.

It is required to formulate a specific land policy classification, the policy district in most plans today can be divided into three basic types: areas specified for urban growth, conservation areas and rural areas. In areas specified for urban growth, the urban settlement districts are where the plan directs most of the urban growth. They are often divided into already-developed areas and areas for transition from rural to urban uses [6].

The north part of Kabul city can best accommodate growth, as a rural-urban transition district in land policy classification. Considering a specific policy framework, it is required to arrange urbanization in new growth areas in the north part of Kabul city within such policy framework to best accommodate growth.

In developing countries, the most fundamental challenges for governments would be the rapid population growth of the city, as a result, the population is likely to expand at an unprecedented scale, and inhabitant's settlement necessity would be much greater, and they would struggle to find shelter where ever possible. On other hand, developing governments would likely not be able to provide shelter for all residence. Thus, this would lead residence to establish illegal settlements in the new growth areas even in hazardous or sensitive environmental areas. As a result, governments in the future would need to invest huge budgets for land readjusting and re-planning of the informal areas that were not being controlled.

Afghanistan is the country in which its capital, Kabul city, is confronting same challenges at a moderate scale right now, but it could be further problematic for both the people and the government if the involved planning organizations do not take serious steps towards an area-wide land policy plan for urban, transition and rural areas. As the city is spreading its territory, especially to the north, specific land policy plans should be considered in developing to control the sprawl direction of urbanization in urban fringe areas and prevent huge future compensation payouts.

IX. CONCLUSION

Capital cities, industrial cities, and business cities have always had the highest urban growth in comparison to other cities during the history of urbanization throughout the world. They change and expand in response to population growth, economic growth, migration from neighboring countries or from sounding cities and employment opportunities. This study evaluates the urban land development direction of Kabul city in response to huge urban expansion since 2000. The study assessed the patio-temporal characteristic of population distribution and urban land growth in the newly established and fringe districts of 17, 18 and 20 in Kabul city, in order to analyze the urban land development direction and feasible future land development direction.

The result indicates that all three districts of 17, 18 and 20 had approximately the same population growth rate of 1.9%, 2.0% and 1.9%, respectively, in the initial stage of the study period between 2004 and 2005. Between 2005 and 2006 they all also had almost the same growth rate of 2.2%, 2.1% and 2.2%, respectively (Fig. 5). After 2006, considerable change in population growth has been observed in the districts, in which district 17 experienced the peak growth of 7.7%, while district 18 experienced 0.8% and district 20 had only 0.9% growth rate until 2007. The results show a flood of people settled in district 17 from inner city and neighboring provinces and the tendency of the population continuously increased to reside in this district. After 2007, the population growth in the three districts virtually remain uniform, in which districts 17, 18 and 20 mostly experienced 3.8%, 1.7% and 1.7% population growth rate, respectively, until 2015. Generally, in the entire study period, district 17 experienced the total highest growth of 4.7%, district 18 had 1.8%, and district 20 also saw a 1.8% population growth rate.

If we investigate the urban land growth in all the districts, it seems that all three districts had the smallest proportion of urban land in the initial stage of the study period in 2000 (Fig. 7). Conversely, all had the highest contribution of bare land in the land use maps in 2000. Between 2000 and 2016 all three districts have considerably changed in their spatial distribution, for which a major amount of land has been occupied by built up area. Among all the three districts, district 17 experienced the fastest growth of urban land/built up area (0.65%) in the study period between 2000 and 2016 (Fig. 8); although, district 17 had the lowest urban land share in the land use among all districts in 2000.

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Hence, the results achieved from the population and urban land growth in all three districts between 2000 and 2016, express that the urban land/built up or settlement area is developing more toward district 17, than districts 18 and 20 in Kabul city. The urbanization trend and tendency in the direction of district 17 also interprets the feasible future land development direction in Kabul city.

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