Solutions for Sustainable Urban Development in Duhok City

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ABSTRACT

The aim of this research is to provide key concepts and solutions to contribute to the sustainable urban development in Kurdistan cities. The city of Duhok as an example of other cities in the region has faced dynamic urban growth in the last decades as a result of the unstable political and economic conditions in the Region. The research will study the current challenges of urban development and its impact on the city of Duhok, in order to set some effective strategies towards a sustainable city. The trend of the urban development in Duhok and the main challenges in the context of sustainability principles will be studied and analyzed. Based on the literature review, a checklist of variables is defined to explore the potential opportunities that can be used to respond to these challenges. The results and outcomes of the study indicate that there is an urgent need to adopt new strategy of sustainable urban development focusing on diverse compact development, efficient land use, energy efficient transport and urban design to advocate sustainable development and to avoid urban sprawl.

KEY WORDS: Urban Development, Sustainability principles, Compact Development, Duhok City.

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1. INTRODUCTION

Theoretical Background

Cities in developing countries are growing rapidly. The main worldwide urban growth challenges are: high population growth, housing shortage, urban sprawl, deterioration of urban environment, inadequate infrastructure and traffic Congestion. Urban sprawl is the major feature of fast-growing cities. It is usually accompanied by many serious problems including inefficient land use, high car dependency, low density and high segregation of uses (UN Habitat 2014). Sustainable development is defined in the report of the World Commission on the Environment and Development (WCED 1987) as "the development that meets the needs of the present without sacrificing the ability of future generations to meet their own needs". The principles of Sustainable development require balancing three dimensions of environmental, social and economic aspects. Environmental sustainability can be achieved through passive and active urban planning and design strategies, while Social Sustainability can be achieved through providing the required amenities to improve community social life and economic Sustainability can be achieved by creating jobs for operating efficiencies of various commercial and social activities. The three dimension of sustainability are balanced in UN Habitat sustainable development (SDG) goal 11 to make cities safe, inclusive, resilient and sustainable by 2030 (UN Habitat 2015).Many researchers confirm that urban planning and design play a major role to direct the urban growth towards sustainability (Frey 1999, Carmona 2001, Jenks-Jones 2010). The effective spatial function and physical structure of the city influences its environmental and socio-economic sustainability (Frey 1999). On the other hand, seven criteria for urban sustainability are identified by Jabareen (2006), which are high density and adequate diversity, sustainable transport, compact and mix use land use with greening and solar energy. Other key principles of sustainable development are identified by Carmona (2001) to be integrated in urban design including resource efficiency, diversity and choices, human needs, pollution reduction, land use intensification and self-sufficiency from individual building to city and region. This will lead to environmental, social and economic benefits (Jenks-Jones 2010). Based on this Background this research is trying to identify the challenges of sustainable urban development in Duhok city. The main research objective is to evaluate the current trend of urban development within sustainability principles at the aim of providing urgent solutions and key concepts towards sustainability to accommodate the future urban growth effectively.

2. URBAN D EVELOPMENT CHALLENGES IN DUHOK

Duhok city as one of the major cities in Kurdistan is a highly urbanized area. The city has rapidly expanded in the last decades (Fig 1). (73.2%) of its population are living in the urban areas (Directorate of Statistic in Duhok City, 2013). The rapid urban growth has led to increase the demand of land to meet the need of

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the growing population. The urban expansion trend is directed towards the plain area on the western and eastern sides. Urban centers of Duhok governorate have increased from 10 urban centers in 1947 to 29 urban centers in 2010. The expansion towards the suburbs led to reclassification of 14 of the surrounding villages into urban area in the last decades and this led to uncontrolled urbanization process at the edge of the city. The new master plan added 11 suburban area to the city boarder (Municipality of Duhok, Master Plan report 2008)

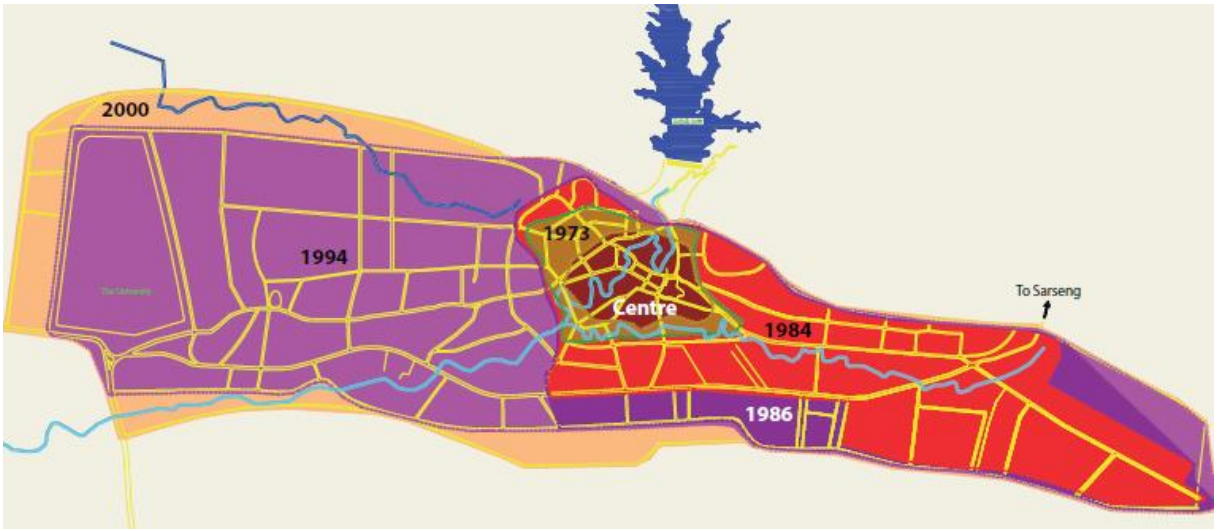

Fig 1: The historical development Model of the city of Duhok ((Municipality of Duhok, Master Plan report 2008)

This expansion of the city has led to a loss of agricultural land, increasing pollution and urban sprawl, an inefficiency in providing infrastructure, increasing poverty and informal housing.

2.1 Rapid population Growth and urban sprawl

The city of Duhok has experienced a rapid population growth from 250,000 inhabitants in 2007 to 340,400 inhabitants on 2013 (Directorate of Statistic in Duhok City, 2013). The Master plan expected to have 720,000 inhabitants by 2030 ((Municipality of Duhok, Master Plan report 2008). Abdulsamad, K (2011) points out that Duhok city has faced a high population growth after 2006 as a result of displacement of large number of Iraqi citizens from the central and southern areas to the city due to the security and the economic developments in Duhok. The new development will need housing, access to transport, schools, shops and services. The demand for housing in Duhok city increased from 43,032 units in 2012 to 50,600 units in 2017 accordingly, 1500 units per year are needed to cover the growing wave (Mumtaz, 2012). The unbalanced population density is another main challenge, which is varied from 370 persons/ha in the city center area and less than 50% in the newly developed area. The absence of a clear land use policy and effective planning system, have caused uncoordinated, uncontrolled urban growth and urban sprawl (Omer, M. W. and Raswol, L. 2016). (Fig 2) shows the urban sprawl of the existing built up area.

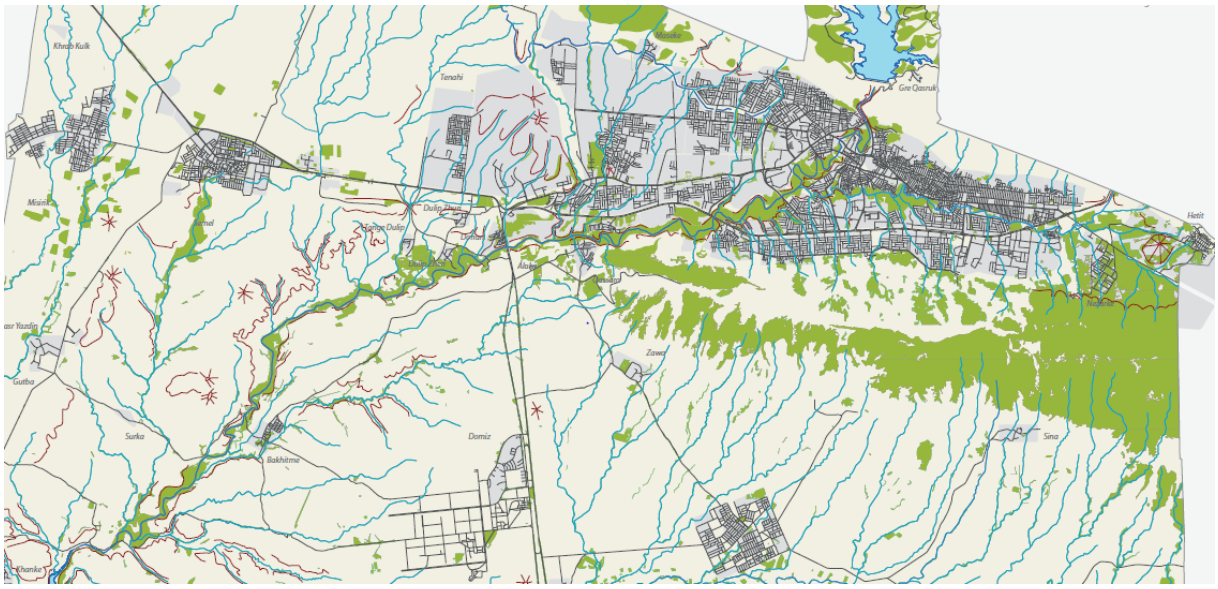

Fig 2: Shows the existing built up area and urban sprawl (Municipality of Duhok, Master Plan report 2008)

2.2 **Duhok Master plan Target**

To control the rapid urban expansion, the local government prepared a new Master plan (2008-2032) for the city of Duhok, which was designed by German company (Vossing). The main objectives and goal of the master plan are: high quality, diversity of the living environment, efficient and integrated transportation network, high quality architecture and urban landscape with healthy environment. (Municipality of Duhok, Master plan report 2008). (Fig 3) shows the model of urban development of the city, which emphasizes the utilization of existing green vegetation surfaces and Duhok River as the basis for an open space system and green corridor, which shapes the character of the city. However, the implementation of the master plan requires allocation of adequate budget, legal framework for land management and sufficient institution capacity (Omer, M. W. and Raswol L. 2016).

Fig 3: The urban development Model of the city of Duhok ((Municipality of Duhok, Master Plan report 2008)

3. METHODOLOGY

The theoretical part of the research depends on literature review to define the concept of sustainable development and its main components to identify research variables and measurement indicators. The practical part based on the analysis of the available map and data in addition to on site observation to identify the current situation and the challenges facing the city development. The current urban development will be evaluated by urban planning experts through a check list, which is prepared based on the theoretical part of the research. The check list consists of four sections including following sustainability indicators; efficient land use; efficient transport; diversity and energy efficient urban devlopment. Each section has a set of statements related to sustainable development (table 1). The checklist was sent to twenty urban planning experts, who are either university professors, lecturer, architects or practitioners from Duhok municipality, who are involved in the current urban development plan. The experts checked the trend of urban development in Duhok in alignment with sustainability indicators with agree, partially agree or disagree. The results of the assessment provide guidelines and implication to promote the urban sustainability in Duhok.

Table 1: Check List of Research s Indicator and Variables for assessing the Urban Sustainability (Author)

Indicators		Statements related to the Variables
1.	**Efficient Land use**	• The city land use advocate compact development • The site selection for various use is well studied to avoid loss of agricultural land • The provision of services infrastructure is easy to access • There are compatible development of diverse mix land use activities
2.	**Efficient Transport**	• The transportation network make an easy access • The public transport is available and easy to access • The connectivity within the city is well considered • The traffic congestion is solved • There are various mode of traveling available (driving, walking, biking)
3.	**Diversity/housing**	• Various building and housing types including affordable housing are considered • Variety of physical environment within housing area to achieve visual richness (Architecture, Landscape elements, Human activities) • The development promotes mix used neighborhoods
4.	**Energy Efficiency**	• Urban and building design are energy efficient (minimum resources consumption, land, air, water) • Green space and farmlands are well preserved • The city is walkable and biking friendly

4. RESUSLTS AND DISCUSION

The finding discussion is focused on the results of expert's check list survey to evaluate the alignment of the current urban development in Duhok with the defined Sustainability indicators. The results of the check list assessment (table 2, fig 4) show that the urban development of Duhok has facing a number of challenges in sustainability context. The findings show that the disagreement of the experts about the alignment of the urban development trend in Duhok with sustainability principles is high. The Energy efficiency has the highest percentage of the disagreement (56%). The Land use efficiency has the second-high level (52%). The third one has the efficient transport indicator (48%). This indicates that there is a need to align the urban development strategies with sustainability. The following part of the research will discuss the results of each indicator including its sub indicators to define the guidelines to promote urban sustainability in Duhok

Table2: The results of the evaluation (Author)

	Indicators	Agree	Partially Agree	Disagree
1	Land Use Efficiency	26%	22%	52%
2	Efficient Transport	20%	32%	48%
3	Diversity/housing	22%	35%	40%
4	Energy Efficiency	18%	26%	56%

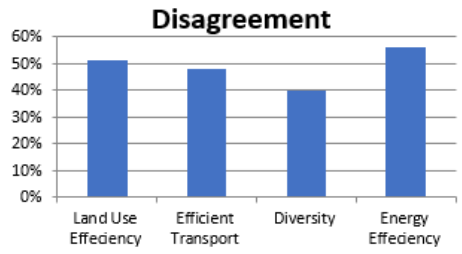

Fig. 4: Shows the results of the indicators (Author)

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4.1 Efficient Land Use

The main challenge of urban development is to use the land efficiently and balance the development with preservation of open space and natural area. The findings show (table 3, fig.5) that the land use development in Duhok is not efficient. There is a high level of disagreement (60%) about the compactness and the efficiency of the site selection for various land uses (65%). Meanwhile less than half (40%) disagreed that the provision of the services is easy to access and there is (45%) disagreement about the compatibility in the development of diverse mixed land use activity. The Compact urban forms would reduce urban sprawl, protect agricultural and lead to more efficient land use, therefore the new growth should be close to the existing transportation hubs and commercial areas to promote mixed land use.

Table3: The results of land use efficiency (Author)

Indicator1: Land use	**Agree**	**Partial Agree**	**Disagree**
The city land use advocate compact development	25%	15%	60%
The site selection for various use is well studied to avoid loss of agricultural land	20%	15%	65%
The provision of services infrastructure is easy to access	40%	20%	40%
There is compatible development of diverse mix land use activities	20%	35%	45%

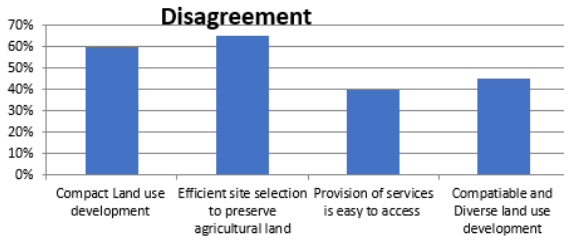

Fig.5: Shows the results of indicator:1 (Author)

4.2 Efficient Transport

The providing of integrated transport networks with a focus on enhancing public transport and various transport choices such as cycle and walking routes is an essential principle of sustainable development. The finding shows that there is lack of efficient transport and variety of travel mode (table 4, fig. 6). 65% of the experts agreed that the development is car oriented and more than half (55%) of them agreed that traffic congestion is not solved. Only (45%) disagreed that the public transport is available. The main public transport in Duhok is Taxis and they are easy to access.

Table 4: The results of the Efficient Transport indicator (Author)

Indicator 2: Efficient Transport	**Agree**	**Partial Agree**	**Disagree**
The transportation network makes an easy access	35%	30%	35%
The public transport is available and easy to access	20%	35%	45%
The connectivity within the city is well considered	15%	50%	35%
The traffic congestion is solved	15%	30%	55%
There is various mode of travel available within the neighborhoods (driving, walking, biking)	15%	25%	60%
Reduce car-oriented development	20%	15%	65%

There is an urgent need to increase walking as the basic mode of transportation to provide healthier life style. This can be achieved by providing well-designed pedestrians, sidewalks and bike ways to encourage pedestrian rather than car driving.

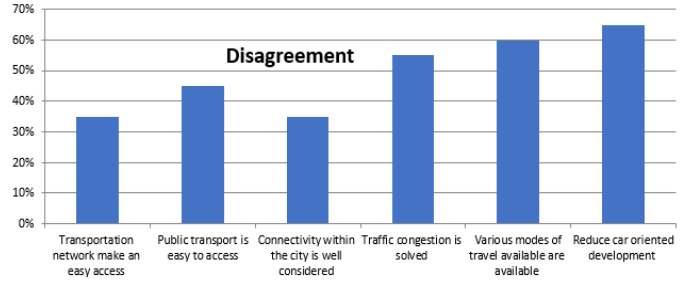

Fig.6: Shows the results of indicator 2 (Author)

4.3 Diversity/ Housing

The diversity and variety of physical environment provides opportunities to the residents to meet their needs. The city of Duhok has a lot of natural landscape features that could be enhanced by diverse and mix use urban design to enrich the physical environment. The finding indicates (that there is lack of affordable housing (55%). (40%) agreed that there is lack of diversity and mix use compatibility in housing planning. There is a need for more diverse housing types such as multifamily housing as well as providing affordable public housing (table5, fig 7)

Table 5: The results of Diversity/Housing indicator (Author)

Indicator 3: Diversity/ Housing	Agree	Partial Agree	Disagree
Diversity of housing types including affordable housing are considered	15%	30%	55%
Various physical environments with visual richness are considered	30%	45%	25%
The neighborhood development promote diverse mix uses	20%	30%	40%

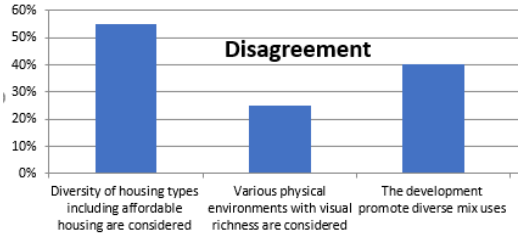

Fig 7: The finding of indicator:3 (Author)

4.4 Energy Efficiency

The sustainable urban development advocates efficient energy and minimize resources consumption to create environmentally friendly communities. The finding shown in (table 6, fig 8) confirms that the urban development is not energy efficient and there is a high consumption of natural resources, which lead to increase pollution and has negative impact on the city environment. The results indicate that the urban development is not energy efficient.

Table 6: The results of the energy efficiency indicator (Author)

Indicator 4: Energy Efficiency	Agree	Partial Agree	Disagree
Urban and building design are energy efficient	20%	25%	55%
Green space and farm land are well preserved	15%	30%	55%
The city is walk-able and biking friendly	15%	20%	65%

The disagreement is more that 50% regarding the city walkability and biking friendly as well as the preservation of green spaces. More than half of the experts (55%) agreed that urban and building design in Duhok is not energy efficient and has negative impact on the environment. 55% of the experts agreed that there is an urgent need to preserve the green and farm land and 65% agreed that there is lack of comfortable walkable route in the city.

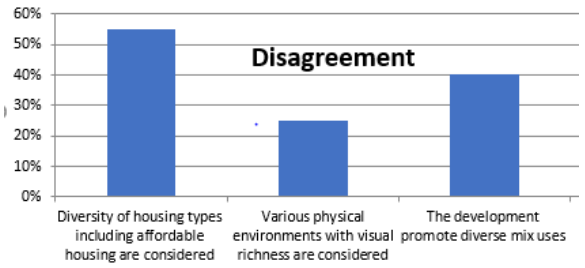

Fig. 8: The results of indicator 4 (Author)

5. CONCLUSION

The city of Duhok is growing rapidly. The huge urban growth is accompanied with environmental, social and economic problems. The main challenges of sustainable urban development in Duhok are the high population growth and unbalanced urban development. The expansion of the city towards the suburbs led to uncontrolled urbanization process at the edge of the city, loss of agricultural land, increasing pollution and urban sprawl, inefficiency in providing infrastructure and increasing informal housing. The research assessed the trend of the current urban development in alignment with sustainability principles. The Findings of expert's assessment show that there is an urgent need to adopt the principle of sustainable development. The efficient land use, energy efficiency urban and building design, efficient transport and providing diverse choice for residents are the main important target of the city planning authority. Developing a vital mix use area and emphasize place making are important components of sustainable design, which focus on compact urban development to reduce urban sprawl, protect agricultural and lead to more efficient land use. The new development in the suburban areas can be more efficient by considering the natural landscape and preserving the open space, which will contribute to improve the environment and reduce flooding, improve ground water and avoid heat island in the city. There is an urgent need to increase walking as a basic mode of transportation by providing well-designed pedestrians and sidewalks for people to walk and enjoy landscaping or biking rather than car driving.

6. RECOMMENDATION

The following recommendations are to be considered by the local architect, urban planner and other stakeholder:

- Integrating Sustainable development goals in urban planning strategies
- Applying sustainable urban development methods by using a good transport network, green area, dense and mix used communities

- Developing regulation as well as urban and building codes for sustainable development regarding green area and building material to reduce negative impact on the environment
- Create attractive places that are environmentally and socially encouraging people to use it
- provide integrated transport networks with a focus on enhancing public transport and cycle routes
- Increasing transport choice towards pedestrian oriented area by designing comfortable pathways and sidewalks for people to walk and enjoy landscaping and reduce car dependency

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