

# Urban sprawl: An empirical analysis for Konya Province-Turkey

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## **Abstract**

This study aims to determine the drivers of urban sprawl, additionally environmental impacts and socio-economic impacts of urban sprawl for Konya province in terms of three central counties. A comprehensive questionnaire, consistent with Analytical Hierarchy Process (AHP) technique, was designed to get the knowledge, experiences, values, interests and suggestions of experts as the key stakeholders of urban development regarding the urban sprawl problematic occur in the city. A total of 73 local authority experts participated into the survey. The findings show that urban sprawl was accepted as a threat for Konya by the experts. Macro-economic factors such as economic growth was envisaged as the primary driver of urban sprawl. The absence of upper limit for controlling urban sprawl has been highlighted. Thus, “Development of long-term integrated plans promoting sustainable development and the limitation of urban sprawl” was proposed as the most useful precaution for combating urban sprawl that could be taken by stakeholders. On the other hand, “conserving agricultural lands” was admitted as the most significant precaution at the scale of local authorities and Ministry of Environment and Urbanization for combating urban sprawl. Experts’ overall evaluations regarding the level of urban sprawl explicitly show that Karatay was the most sprawled county conversely Selçuklu. The applied methodology also separately enables the weights of urban sprawl effect factors for each county. Results revealing the drivers, effects and the dimensions of urban sprawl in Konya are useful for local municipalities to route urban expansion in a sustainable manner.

## **Keywords**

Analytical hierarchy process (AHP), Impacts of sprawl, Konya, Sustainable development, Urban sprawl.

## 1. Introduction

Uncontrolled and sprawling growth in physical space is one of the primary problems of metropolitan cities (Serdaroğlu Sağ and Karaman, 2014). During urbanization, urban areas began to change as a response for changing living conditions and growing population. Consequently, cities began to exploit and make the maximum use of the natural areas to suffice the rising living standards of the people (Rezefar and Kramaz, 2014). One of the major effects of rapid urban growth is urban sprawl (Clara, 2008) which is responsible for changes in the physical environment, and in the form and spatial structure of cities (Bhatta, 2010). Today, urban sprawl is one of the contemporary issues of cities all over the world (Kumari, 2015). Resnik (2010) states that urban sprawl is an increasingly common feature of the built environment in the United States and other industrialized nations. Urban sprawl is a longstanding phenomenon. According to experts, urban sprawl is a phenomenon that began in the United States, although it is now seen to a lesser but still significant extent around the world (Daniels and Lapping, 2005). The phenomenon is one of the most important types of land-use changes currently affecting Europe (Couch et al., 2007). Sprawl dates back to the late 1800s, when suburbs popped up outside major cities on the East coast of the United States (Hoyt, 2008) and it accelerated greatly during the last half of the 20th century (Frumkin, 2002).

Urban sprawl has become a controversial issue raising numerous concerns due to the negative impacts it creates on a person's health, the environment, wildlife habitat, and economic disparity among several other issues in terms of sustainable urban development (Davodi-Far, 2014).

### 1.1. Definition of urban sprawl

Urban sprawl is commonly used concept to describe spatial expansion of urban uses into rural areas. Sprawl was described as 'the physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas' by the European Environ-

ment Agency (2006a). Urban sprawl has been at the centre of current debate on urban structure. In the literature of urban planning or urban economics, there is a big debate on even the definition of urban sprawl itself (Kumari, 2015). Despite the fact that there are several definitions by the authors, their joint view is that urban sprawl occurs as a result of with uncontrolled (Jander, 2013; Kumari, 2015; Majid and Yahya, 2010; Terzi and Bölen, 2010; Traversi and Camagni, 2005), uncoordinated (Kumari, 2015; Terzi and Bölen, 2010), unplanned (Kumari, 2015; Majid and Yahya, 2010; Terzi and Bölen, 2010; Traversi and Camagni, 2005), and rapid peripheral growth of cities in a discontinuous manner, leaving urban voids and spreading onto (Polidoro et al., 2011) surrounding precious agricultural/rural areas (European Environment Agency, 2006a; Polidoro et al., 2011; Suzuki, 2015; Weerakoon, 2014) and urban sprawl leads to unsustainable urban expansion patterns (Traversi and Camagni, 2005) via destroying open spaces (Bhatta, 2010; Traversi et al., 2010) and putting valuable wildlife habitat and species at risk (Suzuki, 2015) and leads to inefficient spatial planning (Correia and Silva, 2015).

Correia and Silva (2015) have defined sprawl as 'the development of low-density mono-functional urban forms on rural areas surrounding urban agglomerations, centered on private car and road infrastructure and without effective spatial planning'.

Urban Sprawl refers to the outgrowth of the urban area, caused by the uncontrolled and uncoordinated and unplanned urban growth along the periphery of the cities, along highways, and along the road connecting a city (Kumari, 2015).

According to Traversi and Camagni (2005) a central component of most definitions urban sprawl is the uncontrolled spreading out of a given city, and its suburbs, over more and more rural or semi-rural land at the periphery of an urban area. They have pointed out that the sprawling process of expansion is typically disordered, unplanned, leading to often inefficient and unsustainable urban expansion patterns. Additionally, differently from traditional

urban expansion, the migration-more densely populated-is directed from core to towards the periphery of urban settlements.

### 1.2. Characteristics of urban sprawl

Urban sprawl is thought to be the antithesis of progressive urbanism. This uncontrolled outspread cheap haphazard housing threatens the future of entire regions (Jander, 2013). Sprawling cities are the opposite of compact cities-full of empty spaces that indicate the inefficiencies in development and highlight the consequences of uncontrolled growth (European Environment Agency, 2006a).

The urban sprawl phenomenon is largely characterized by patchy, scattered and strung out, segregated-single-use and automobile-oriented (Litman, 2015) urban fringe development with a tendency for discontinuity (European Environment Agency, 2006a; Litman, 2015) and extensive mix of residential, commercial, transport and associated land uses (European Environment Agency, 2006a) with random population densities in rural perimeters. Sprawl refers to commercial development in corridors (Polidoro et al., 2011) and regional, consolidated, larger services (shops, schools, parks, etc.) require automobile access (Litman, 2015). Galster et al. (2001) proposed 8 dimensions that characterise sprawl: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses and proximity.

### 1.3. Causes&catalysts of urban sprawl

Causes&catalysts of urban sprawl differ region to region. Therefore, it is essential to determine causes forcing urban growth and the causes that are responsible for undesirable pattern or process of urban growth, for the analysis of urban growth towards achieving a sustainable urban growth.

Bhatta (2010), who has comprehensively discussed the causes&catalysts of urban growth and sprawl, argued that increase in urban population, independent decisions of the competitors (government and/or private), expansion of economic base, industrialisation (transition process

from agricultural to industrial employment), speculation, expectations of land appreciation at the urban fringe, land hunger attitude, legal disputes (e.g., ownership problem, subdivision problem, taxation problem, and tenant problem), physical geography, underpricing of urban infrastructure, lower living and property cost, lack of affordable housing, demand of more living space in the countryside, lesser controlled and loosely regulations in countryside, transportation routes to the countryside, road width, single-family residences, transition from joint family to nucleus family, credit and loan facilities to buy homes, government developmental policies, lack of proper planning policies, country-living desire, housing investment, and large lot size encourage excessive spatial growth of cities. Polidoro et al. (2011) tackles the characteristics of urban sprawl in three heading: (1) Sprawl as land-use standard. (2) Sprawl as a consequence of land-use. (3) Sprawl as a result of government structure/actions.

### 1.4. Impacts of urban sprawl

Sprawl have various environmental, socio-economic positive and negative impacts (benefits and costs) to the urban and rural population. However, the environmental and social costs of urban sprawl phenomenon are increasingly attracting attention in spatial planning.

A sprawling city creates environmental, social and economic issues affect the city, its region and the surrounding rural areas (European Environment Agency, 2006a). Environmental impacts of urban growth and extent of urban problems have been growing in complexity and relevance, generating strong imbalances between the city and its hinterland (Bhatta, 2010). It increasingly creates major impacts on the environment, on the social structure of an area and on national and local economies. (Couch et al., 2007; David Suzuki Foundation, 2003). Urban sprawl, once thought of as just an environmental issue, is currently gaining momentum as an emerging public health issue (Pohanka and Fitzgerald, 2004). There is a strong relationship between sprawl and its adverse effects on public health (Bray et al., 2005; Resnik, 2010; Suzuki, 2015).

The urban sprawl's resource impacts have been quantified and monetized in many studies. Concerns largely focus on negative consequences for residents and the local environment. There is substantial evidence that urban sprawl causes major and severe environmental and socio-economic costs/impacts.

Costs of sprawl mostly mentioned in the relevant literature are;

Environmental impacts such as; land conversion from farm and wild lands to housing and commercial development (Burchell et al., 2002); destruction of natural resources/agricultural lands (Couch et al. 2007; European Environment Agency, 2006a; Weerakoon, 2014); loss of soil biodiversity & natural capacity (European Environment Agency, 2006a; Maier et al, 2006; Polidoro et al., 2011; Rezefar and Kramaz, 2014); increases in resource use (European Environment Agency, 2006a); destruction of forests and consuming/reducing open-space areas (Bhatta, 2010; Couch et al. 2007; David Suzuki Foundation, 2003; Rezefar and Kramaz, 2014; Travisi and Camagni, 2005); diminution of landscape quality (Jaeger et al., 2010); ecosystem fragmentation (Couch et al., 2007); biodiversity (native flora and fauna) damages (David Suzuki Foundation, 2003) due to loss of agricultural land; imposing stress on ecosystems through noise and air pollution by the increased proximity and accessibility of urban activities to natural areas; displacing agricultural activities to the less productive areas (European Environment Agency, 2006a); disruption of farm economies due to the complaints of suburbanites about the odors, the dust, the pesticides, fertilizer, and the other externalities of agricultural production (Keene, 2001); destroying the wildlife (David Suzuki Foundation, 2003; Gurin, 2003; Hoyt, 2008; Resnik, 2010); loss of water permeability due to increased impervious areas (Frumkin, 2002) such as parking lots, roadways, driveways, residential areas, roofs, lawns and sewer lines (Gurin, 2003); water quality and quantity declines by increasing the amount of surface runoff (Daniels and Lapping, 2005; David Suzuki Foundation, 2003; Frumkin, 2002; Haase and Nuissl, 2007; Hoyt, 2008;

Resnik, 2010); interfering with the recharge of groundwater (David Suzuki Foundation, 2003); esthetic degradation of landscape (Couch et al. 2007); eliminating the link between city-dwellers and the hinterland (Gurin, 2003) due to reduced open spaces; encouraging the growth of the oil and gas sector and emissions (Couch et al. 2007; Rezefar and Kramaz, 2014; Travisi et al, 2010) due to increased transportation demands (Daniels and Lapping, 2005; Gurin, 2003; Hoyt, 2008; Rezefar and Kramaz, 2014); the increase of abandoned and polluted lands (Rezefar and Kramaz, 2014); growing consumption of energy due to the increasing consumption of land and reductions in population densities (Gurin, 2003); contributing to climate change (David Suzuki Foundation, 2003; Gurin, 2003) and air pollution (Camagni et al. 2002; Daniels and Lapping, 2005; Ewing and Hamidi, 2014; Gurin, 2003; Pohanka and Fitzgerald, 2004; Resnik, 2010; Travisi and Camagni, 2005; Travisi et al, 2010) via excessive energy consumption in building roads or tracks and transportation (Gurin, 2003); having little regard for the natural environment (Gurin, 2003), and

Socio-economic impacts such as; promoting unimpeded and disorganized growth (Jaeger et al., 2010); monotonous suburban landscapes (Bhatta, 2010); destroy of urban and rural charm by replacing the unique qualities of places with the universal sameness characterized by roadside franchises thus creating places are lack of sense of place (Gurin, 2003); generating more segregated residential areas due to income and exacerbating urban social and economic divisions (European Environment Agency, 2006a); lifestyle changes (Couch et al., 2007; European Environment Agency, 2006a) such as raise in the number of households, greater consumption of resources per capita; higher disparities on wealth and loss of sense of community (Correia and Silva, 2015); neglecting urban centres (Couch et al., 2007); segregating houses from shops and workplaces (Gurin, 2003); increasing the distances between destinations, thus increasing per capita vehicle travel (Litman, 2015); increasing the auto-

mobile dependency (Daniels and Lapping, 2005; Gurin, 2003; Pohanka and Fitzgerald, 2004); high traffic of streets (Rezefar and Kramaz, 2014); raising local public-service costs (Bhatta, 2010; Burchell et al., 2002; Correia and Silva, 2015; Couch et al. 2007; Polidoro et al., 2011) such as providing police, fire, sanitation, snow removal (Gurin, 2003), emergency response (Ewing and Hamid, 2014), garbage recollection, recycling, urban cleaning, mail delivery, street light (Correia and Silva, 2015), school busing, and public transportation etc. services in low-density areas; higher costs of construction, management, operation and maintenance of infrastructures such as laying sewer, water and gas pipes, and building roads, electric grids, utility, school, etc. in suburbs (Camagni et al. 2002; Correia and Silva, 2015; Gurin, 2003; Polidoro et al., 2011); higher taxes for all municipality population due to the heavy financial burden (infrastructure&service costs) for municipalities (Couch et al., 2007); increased vehicle travel and associated costs (Travisi et al, 2010); lack of social capital (Ewing and Hamid, 2014); raised private-vehicle commute distances and times (Bhatta, 2010; Ewing and Hamid, 2014; Hoyt, 2008; Pohanka and Fitzgerald, 2004; Suzuki, 2015); underutilizing the infrastructure due to large urban voids and vacant lots (Polidoro et al., 2011); distributed production (Couch et al., 2007); real estate development costs (Burchell et al., 2002); issues of scale (Couch et al., 2007); energy inefficiency (Bhatta, 2010; European Environment Agency, 2006a; Gurin,2003); variations in residents' quality of life such as poor air quality and high noise levels (European Environment Agency, 2006a); hazards and stress-related mental health and/or physical health problems (European Environment Agency, 2006a; Resnik, 2010) including obesity (Couch et al. 2007; Ewing and Hamid, 2014; Pohanka and Fitzgerald, 2004; Resnik, 2010), diabetes, higher cardiovascular disease rates (Couch et al. 2007; Resnik, 2010) due to physical inactivity/ the sprawl lifestyle (Ewing and Hamid, 2014), higher asthma and other lung disorder rates (Hoyt, 2008; Pohanka and Fitzgerald, 2004; Resnik,

2010) due to greater air pollution (Pohanka and Fitzgerald, 2004), increased heat and quantity&quality of drinking water decline (Gurin, 2003); higher probability of motor vehicle crashes (Gurin, 2003); congestion (Travisi and Camagni, 2005); pedestrian injuries&-fatalities and anxiety due to increased danger and stress of long commutes (Frumkin, 2002); social isolation-the degradation of social relations, isolating the elderly, etc. (Frumkin, 2002; Morris, 2005); greater tendency for depression (Morris, 2005).

### 1.5. Policies against urban sprawl

It is essential to incorporate all adverse effects of sprawl (from environmental, socio-economic effects to health effects) into policy making (Frumkin, 2002). Smart growth is thought to be a rational way to create a planned community, and avoid the issues associated with urban sprawl (Daniels and Lapping, 2005; Frumkin, 2002; Hoyt, 2008; Resnik, 2010). Smart growth is defined as a policy framework that fights against sprawl via promoting an urban development pattern characterized by higher density- increased density (Resnik, 2010) via density bonuses, inclusionary zoning, incentive zoning, land assembly, graduated density zoning etc. (Qureshi and King, 2015)., adopting more contiguous and more spatially compact development to minimize farm and ecologically productive land displacement (Litman, 2015), protecting natural resources-open spaces (Hoyt, 2008; Keene, 2001; Resnik, 2010) and heritage features from development impacts, maximizing land permeability of lots to absorb rainfall (David Suzuki Foundation, 2003), mixed land-use (Bhatta, 2010; Resnik, 2010) and clustered activities policy instead of isolated islands (Bhatta, 2010), creating walkable neighbourhoods thus increasing physical activity (David Suzuki Foundation, 2003; Resnik, 2010), adopting planning policies that reduce greenhouse gas and smog causing emissions (Bhatta, 2010; David Suzuki Foundation, 2003) such as limited road construction (Resnik, 2010), providing environmentally friendly multi modal transportation policies

supporting walking, cycling and public transit (Hoyt, 2008; Resnik, 2010), reducing society's private automobile dependency and more fossil fuel consumption and thereby pollution, etc. (Bhatta, 2010), limitations imposed on infrastructure (David Suzuki Foundation, 2003; Keene, 2001), more diverse and affordable housing options (Litman, 2015), avoiding to create spatial/architectural & socio-economic segregation/ heterogeneity via planning between central city and periphery (European Environment Agency, 2006a), limiting growth at the metropolitan fringe (Keene, 2001), encouraging inner city revitalization to promote environmental justice (Keene, 2001), adopting local urban growth boundaries contribute to more-compact regional growth (Burchell et al., 2002) and effective, coordinated regional planning.

This study aims to determine causes & consequences of urban sprawl in Konya from the perspectives of local authority experts as the implementer actors of urban planning process. The study contributes to achieve a sustainable urban growth in Konya city via determining the causes that are responsible for urban sprawl process, evaluating the consequences or the impacts of urban growth, and developing policies in response to sprawl.

## 2. Materials and methods

This study aims to identify the causes & consequences of urban sprawl being experienced by a rapidly growing urban area in Konya, lost its productive agricultural lands due to rapidly growth despite the city is commonly being known as an agriculture city and is called as 'crop storehouse' of Turkey. The methodological framework includes the use of Analytic Hierarchy Process (AHP) in evaluating the impacts of urban sprawl via prioritizing urban sprawl effect factors with the pairwise comparison technique compatible with AHP. Additionally Google Earth images were compared to show the dimensions of urban sprawl in three central counties (Karatay, Meram and Selçuklu) of Konya.

### 2.1. The study area: Konya

Konya is among the most economically developed agricultural and industrial cities of Turkey. Konya is wheat / cereal warehouse of the country. The city is also important with its natural and historical riches. Çatalhöyük, one of the world's oldest settlements and a UNESCO World Heritage Site, is in Konya. The city was the capital of the Anatolian Seljuks and Karamanoğulları. Konya is one of the Turkey's most important industrial cities. Konya is the largest province in terms of its surface area and the seventh most populous city in Turkey (Figure 1).

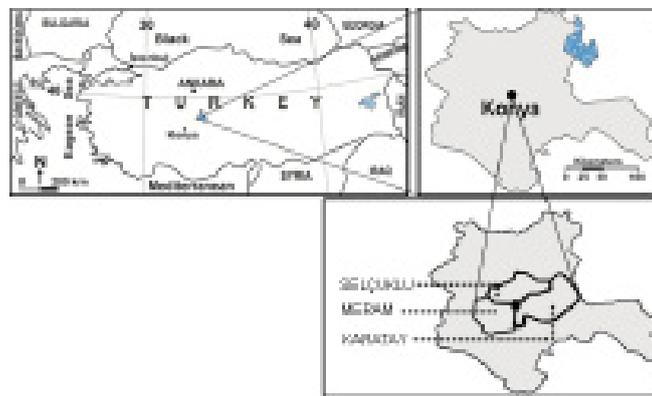


Figure 1. Location of Konya city in Turkey

According to TUIK's 2019 data, 2.232.374 people live in Konya, consisting of 31 counties. The population of Konya's central counties (Karatay, Meram, Selçuklu) is 1.346.330 (60.3% of Konya Metropolitan Area) in 2019. Selçuklu is the most crowded central county (29.69%) than Meram (15.43%) and (Karatay (15.18%) (Table 1). The city has a rapid population growth from 1950s and this raising growth still

Table 1. Konya Metropolitan Municipality central county populations

Years	Karatay		Meram		Selçuklu		Konya Metropolitan Municipality	
	P	%	P	%	P	%	P	%
2009	235.958	23.52	292.422	29.14	474.993	47.34	1.003.373	100.00
2010	242.495	23.41	298.169	28.78	495.363	47.81	1.036.027	100.00
2011	251.272	23.40	305.331	28.43	517.188	48.16	1.073.791	100.00
2012	256.455	23.15	311.312	28.10	540.119	48.75	1.107.886	100.00
2013	286.355	13.77	333.988	16.06	565.093	27.18	2.079.225	100.00
2014	295.332	14.00	340.817	16.16	584.644	27.72	2.108.808	100.00
2015	302.392	14.19	343.384	16.12	604.706	28.38	2.130.544	100.00
2016	308.983	14.30	346.366	16.03	622.846	28.82	2.161.303	100.00
2017	315.959	14.49	345.813	15.86	639.450	29.33	2.180.149	100.00
2018	323.659	14.67	342.315	15.52	648.850	29.42	2.205.609	100.00
2019	338.976	15.18	344.546	15.43	662.808	29.69	2.232.374	100.00

Source: TUIK-Address Based Population Registration System  
 \*With the enactment of the Metropolitan Law No. 6360 in 2013 the authority and planning limits of the metropolitan municipalities have become the provincial property limits.  
 \*\*P: Population

continues. In this process, the city has tended to spread outwardly due to the lack of a specific natural threshold (Akseki and Meşhur, 2013). Konya metropolitan area has three central counties: Karatay, Meram and Selçuklu. The plans, having been laid out since 1966 in Konya province, have directed the urban development toward the north in order to preserve the fertile agricultural lands in the south. However, a large amount of agricultural land has been built on due to the economic policies and tools which were insufficient to save agricultural lands in contrast to urban pressure. Konya's urban area expanded greatly after the 1950s. After the 1970s, a large amount of agricultural land, approximately 15.000 hectares, was urbanized (Akseki and Meşhur, 2013).

## 2.2. Method: Analysing urban sprawl via AHP

AHP is a commonly used multi criteria analysis technique to resolve complex decision-making processes which include multiple criteria, scenarios, and factors. AHP is a mathematical method for analysing complex decisions with multiple criteria (Bozdağ et al., 2016). It has been translated into the level of analysis by Thomas Saaty. The technique has become a widely known and used method for solving discrete multiple criteria problems (Saaty, 2001).

AHP is applied to the decision problem after it is structured hierarchically at different levels, each level consisting of a finite number of elements (Srdjevic, 2005). Fundamentally, AHP works by developing priorities for alternatives and the criteria are used to judge the alternatives (Saaty and Vargas, 2012). The estimation of the priorities from pairwise comparison matrices is the major constituent of the AHP. The importance or preferences of the decision elements are compared in a pairwise manner with regard to the element preceding them in the hierarchy (Mikhailov, 2000).

In this study an analytical hierarchy for Konya city to evaluate urban sprawl process (in terms of reasons and effects) based on AHP to estimate a global value for each (Yavuz & Baycan, 2013)

central county has been structured. In this framework AHP methodologies carried out in five stages (Figure 2):

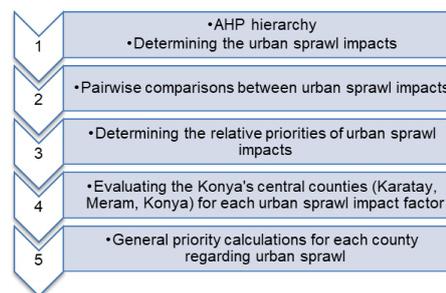


Figure 2. Flowchart of AHP methodology

**1st stage**—developing AHP hierarchy: The aim of AHP application is to measure urban sprawl for three central counties of Konya city. Thus, urban sprawl impact groups are described in six categories: Loss of environmental resources, efficiency of compact areas vs. sprawled areas, natural, protected areas and rural environments, the quality of urban life and health, social impacts, economic impacts. Additionally, these impacts are detailed. Table 2 shows the urban sprawl effect factors.

**2nd stage**—Pairwise comparisons between urban sprawl impact factors are performed using Saaty's (2008) nine-point scale (Table 3) separately within each urban sprawl impact group. The comparisons are used as input to the scope and then the relative priorities of urban sprawl impact factors are calculated using Eigen vector approach of AHP technique.

**3rd stage**— The next stage is calculation of a list of the relative weights, importance, or value of the urban sprawl impact factor groups (Loss of environmental resources, Efficiency of compact areas vs. sprawled areas, Natural, protected areas and rural environments, The quality of urban life and health, Social impacts, Economic impacts). In this process if “Loss of environmental resources” is absolutely more important than “Efficiency of compact areas vs. sprawled areas” and is rated at 9, then “Efficiency of compact areas vs. sprawled areas” must be absolutely less important than “Loss of environmental resources” and is valued at 1/9. These pairwise comparisons are carried out for all SWOT factors to be considered and the matrix is

completed. Relative priorities of urban sprawl impact factor groups are based on Eigen vector values of the pairwise comparisons.

**4th stage**—Evaluating the counties for each urban sprawl impact factor. At this stage, the relative priority value of each urban sprawl impact factor group is separately multiplied by the relative priority of each of the urban sprawl impact factors in this group. Thus, the overall priority value of each urban sprawl impact factor in related urban sprawl impact factor group is derived. This process is repeated for each urban sprawl impact factor groups. Finally, the overall priority values of all the urban sprawl impact factors of which total value is equal to 1 are obtained.

**5th stage**—General priority calculations -multiplying each priority of an alternative by the priority of its corresponding criterion and adding over all the criteria to obtain the overall priority of that alternative (Saaty, 2003)- for each county regarding urban sprawl.

**2.3. Urban sprawl questionnaire**

A comprehensive urban sprawl questionnaire within the scope of the research was performed to get the knowledge, experiences, values, and interests of experts, considered as the operators of urban development for the field survey. The survey was conducted in local authorities&official organizations related with urban development. The urban sprawl questionnaire consisted of two sections regarding the dimensions of urban sprawl in Konya. In the first section descriptive questions (occupation, institution, the places of work and home, transportation types, etc.) were asked, whereas in the second section, questions which were consistent with AHP, regarding drivers and environmental, socio-economic impacts of urban sprawl were asked. Urban sprawl survey conducted by European Environment Agency (2006b) was a good exemplary while designing the questionnaire questions. The cited questionnaire was adapted through improving after a comprehensive literature review and transforming it into a structure suitable to AHP methodology. For statistical analysis of the questionnaire, SPSS 16.0 (Statistical

Package for the Social Sciences) and a Microsoft Office Excel worksheet which makes AHP calculations possible were used. Descriptive statistics of participants were derived from SPSS. In order to evaluate the relation between the variables, chi-square test ( $\chi^2$ ) was performed.

**Table 2. Urban sprawl effect factors**

Factor groups	Factor	Factor
Loss of environmental resources	EE-1	Loss of land and soil
	EE-2	Consumption of concrete and other building materials
	EE-3	Expansion of quarries close to natural reserves
	EE-4	Loss of soil permeability
	EE-5	Loss of soil biodiversity
Efficiency of compact areas vs. expanded areas	CEA-1	Causing consumption of energy
	CEA-2	Increase in land related energy consumption
	CEA-3	Concentr. in CO <sub>2</sub> emissions
	CEA-4	Decline in public services
Natural, protected areas and rural environments	RI-1	Loss of natural habitats
	RI-2	Loss of rural agricultural areas
	RI-3	Increase in the use of water and fertilizer in less productive areas
	RI-4	Increase in water consumption in remote areas
	RI-5	More noise in rural areas
The quality of urban life and health	UCHE-1	Increase in air pollution
	UCHE-2	Increase in respiratory problems (asthma, etc. related)
	UCHE-3	High noise level
	UCHE-4	Traffic congestion
	UCHE-5	Residential areas, establishments and commercial centers being built both inside and outside with driving facilities
	UCHE-6	Reduction of availability and becoming an automobile-dependent settlement depending on the expanding urban areas
	UCHE-7	The loss of transportation options, inefficient public transport networks
Social impacts	SI-1	The absence of functional open spaces within the city
	SI-2	Increase in criminal, unproductive, recreational opportunities
	SI-3	Exacerbation of social and economic division
	SI-4	Segregation of residential areas
	SI-5	Less social interaction
Economic impacts	IE-1	Consolidation of poor quality neighborhoods in the inner city
	IE-2	Increase in household expenditures due to excessive long distances both going to work
	IE-3	Lack of a strong character
	IE-4	Cost of congestion for business in expanded urban areas with inefficient transportation
	IE-5	Additional costs of extension of urban infrastructures (transport, waste water ...) including utilities and related services, across the urban region
	IE-6	No savings in provision of water and sewage facilities

**Table 3. Scale of two-paired comparison at AHP (Saaty, 2008)**

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate Importance	Experience and judgment slightly favour one activity over another
5	Strong Importance	Experience and judgment strongly favour one activity over another
7	Very Strong Importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
9	Extreme Importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate Values	Intermediate values

**3. Empirical results**

**3.1. Urban sprawl problematic in Konya**

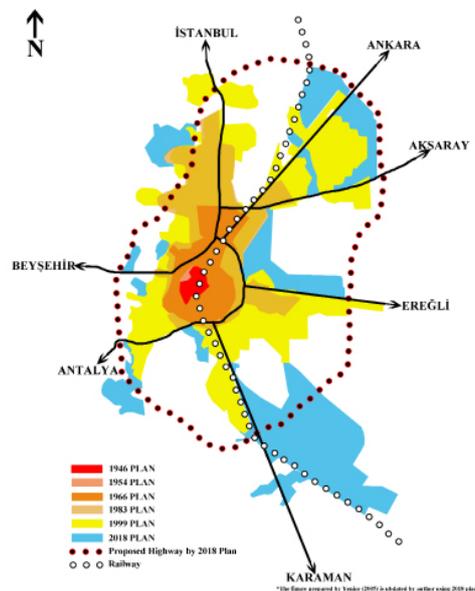
The city of Konya is situated in fertile agricultural land, in the east of the renowned Meram vineyards and the two dam lakes supplying water to the city. However, a large amount of agricultural land has been urbanized and almost the entirety of Meram vineyards has turned into a residential area remaining within the city. This area, the greatest part of which consists of trees and agricultural areas divided up into plots in the 1970s is currently used as a

residential area. On the other hand, the urban area is getting closer to the dam lakes on the west. These growths in the urban area of Konya reflect the typical characteristics of urban sprawl. After the 1970s, the city made a leapfrog development toward the north. Urban functions which raise the population such as Selcuk University campus, bus terminal, and industrial areas are situated in the north. In time, idle spaces have become as built areas and the building density throughout the city has decreased. Consequently, the city covers a wider area with lower density (Akseki and Meşhur, 2013). Karakayacı and Karakayacı's (2019) analyses, aimed to determine urban sprawl boundaries in Konya and to identify the factors of affecting farmland value of urban sprawl, indicated that urban sprawl expands towards to the fertile farmlands in the south.

Akseki and Meşhur (2013) revealed that the urban area which emerged under 1966 plan increased by 191% by 1983, and the urban population has increased by 266% according to the planned period of land use dispersions. In the years 1983-1999, the urban area showed an increase of 440%, and the urban population growth remained at 27%. Depending upon the plans urban area has risen more than population growth. Consequently, urban density has decreased and the city has become automobile-dependent as there has been an urban sprawl above the population growth projected in the plans.

1/25.000 scaled Kon-Plan 2020, approved in 1999, is the first upper scale plan that forms Konya city's macroform. Master Plan, covering approximately 29.000 hectares, foresees the estimation of the urban population will be 1.8 million in 2020. 1999 plan envisages the settlement's size at the level of metropolitan city will be achieved via the development of new residential areas and also the addition of villages and towns to the city macroform (Figure 3). In this context, three sub-regions are planned for urban development aspects. The first is the north-north-west corridor on the highway Istanbul including Selcuk University Campus and its surroundings. The latter is northeast corridor which is developed

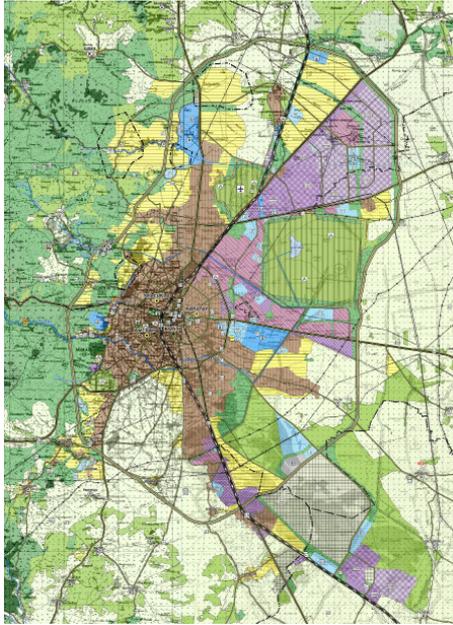
on Ankara and Aksaray highways and defined as teknopol area. The third is the southern corridor envisaged along the Konya-Eregli and Konya-Karaman highways (Yenice, 2012). But, the 2009 urban population has exceeded the plan's envisaged population for 2020 due to the rapid urbanization.



**Figure 3.** Development of Konya urban macroform

In 2018 a master plan which was at 1/100.000 scale is approved. Konya-Karaman Planning Region 1/100.000 Scale Master Plan Revision (Figure 4) was approved (Turkey's Ministry of Environment and Urban Planning, 2020). New settlement areas are allocated for increasing population due to urban transport system and density decisions are re-edited by this plan. According to this plan the Konya metropolitan city centre population is estimated as 2.354.753 [Karatay: 519.417 (22,06%), Meram: 509.312 (21,62%), Selçuklu: 1.326.024 (56,32%)] in the year of 2043 (Konya Metropolitan City Municipality, 2016) in the year of 2043. This projection means that in Konya, urban areas will go more and more increasing to supply the demands of projected population (additional 1.000.000 people) during two decades in future.

Nowadays Konya has become a vehicle-oriented city with growth&spread process in urban areas. The urban area from north to south has reached to 30

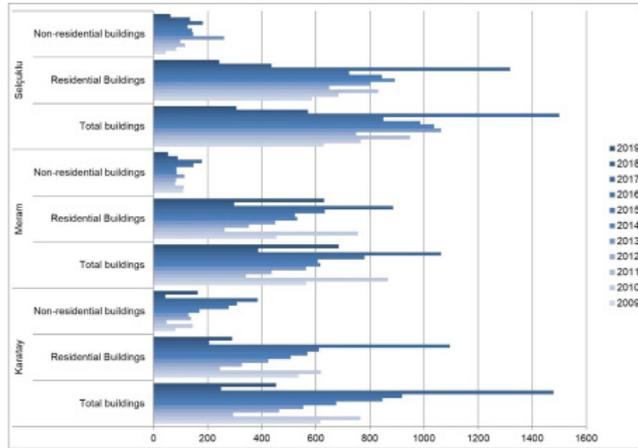


**Figure 4.** The envisaged urban macroform of Konya for 2043 via Konya-Karaman Planning Region 1/100.000 Scale Master Plan (Konya Metropolitan City Municipality, 2016)

km as well as the length of urban area from east to west has reached to 15 km. The problem of vehicle-oriented life between three central counties also goes for inside of the county. For example, residential areas at the northern of Selçuklu County have 17 km. distance to city centre. Additionally, residential areas located in the southwest of Meram County are 17 km away from the city center. As a result of extended macroform, the amount of motor vehicles has risen in the city. TUIK's data (2020) shows that vehicle ownership rate per thousand people in 2019 is 157 in Konya, which is above the Turkey rate (150 cars per thousand person) and Konya is located at 26th rank among other cities with this rate. The vehicle ownership rate per thousand people has increased by 40% (from 99 to 157) in the last decade.

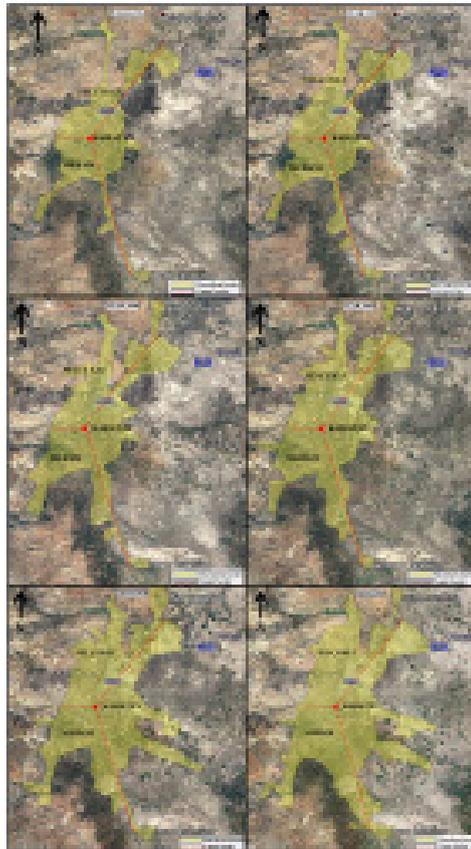
Construction has increased due to the population growth in the city center. According to TUIK data regarding construction permits in Karatay, Meram and Selçuklu counties in period of 2009-2019, the construction permits issued for Selçuklu (9.407; 40%) are much more than the construction permits issued for Karatay (7.317; 31%) and Meram (6.911; 29%). In the

last decade, residential construction permits issued for Selçuklu (8.009; 42%) is much more than the residential construction permits issued for Meram (5.776; 30%) and Karatay (5.431; 28%). Figure 5 explicitly shows the raise in construction permits in the period of 2009-2019.



\* Prepared by author using TUIK data

**Figure 5.** Development of construction permits in Karatay, Meram and Selçuklu (2009-2019)



**Figure 6.** Comparison of urban sprawl in Karatay, Meram and Selçuklu according to Google Earth data of 1994-2019

Figure 6 shows the rapid urban development and urban sprawl in Konya enabling a comparison of urban sprawl in Karatay, Meram and Selçuklu counties according to Google Earth data of 1994-2019 years.

**Karatay** is the county where traditional Konya urban texture is located in. There are 1-2 storey houses having semi-rural character at low density in the urban periphery. However, 6 and 8 storey, high density residential environment is being created in new settled and / or urban renewal areas. **Meram** is the county where population density has increased in recent years. There are residential areas at very low density in the county has a natural protected status. Multi-storey (more than 10 storey) houses are being built in urban transformation areas such as Ahmet Özcan and Şefik Can Streets also at the Havzan District. The residential areas have increased towards agricultural areas at the southern of the city and a social housing area named Gödene is planned in southwestern. **Selçuklu** is the latest constructed county of Konya where the high-storey buildings mostly exist in. The county contains two sub-districts in the center of Konya metropolitan area: Bosna Hersek and bus station sub-centers. The construction of the Selçuk University campus and large shopping centers caused the emergence of many subdivided lands in the city. Gated communities that use the land in a larger amount and which are not often added to the existing urban texture were observed in the continuation of this process. Ultimately, in the central-north direction urban voids were created due to the excess supply & underutilized residential areas & infrastructure. Bosna Hersek neighborhood has developed across the Selçuk University campus (east of Konya-Istanbul highway) exists in county boundaries at high-density. Beyhekim hospitals zone designed the north-western district of the city, urban bus station, stadium and shopping centers (such as Real, Kent Plaza, Novada Kulesite, Bera) are the upper scale planning decisions that attracts people to the area. Yazır neighborhood consists of prestige residences has the highest population density in Selçuklu county.

### 3.2. Descriptive statistics of participants

A total of 73 local authority experts participated in the survey. Questionnaires were performed with experts, such as archaeologist, environmental engineer, topographic engineer, economist, civil engineer, officer, architect, art historian and urban planner, working in local organizations. 84.9% of the participants were working in public sector, and 15.1% were working in non-governmental organizations (NGOs). Urban planners constituted the vast majority (46.6%) of experts.

Respondents mostly live in Selçuklu (45.2%), then respectively in Meram (38.4%) and Karatay (15.1%). Likewise, they mostly work in Selçuklu (47.9%), then respectively in Meram (38.4%) and Karatay (13.7%). The respondents generally prefer to live in the county of their workplaces ( $\chi^2=15,268$ ,  $df=6$ ,  $p=0,018 \leq 0,05$ ).

69.9% of respondents have automobiles. Private car (54.8%), buses (12.3%) and pedestrian (11.0%) are predominate transportation modes of residential-workplace transportation. Minibus and two vehicle options are at the level of 8.2%. Use of two vehicles during residential-work transportation are in the form of: 'transportation via two minibuses', 'transportation via two buses', 'transportation via bus and minibus', 'transportation via private car and bus', 'transportation via tram and minibus', 'transportation via pedestrian+bus' and 'transportation via pedestrian+private car'. There are significant differences in variables such as 'automobile ownership and transportation type', additionally 'transportation time and satisfaction level' regarding residence-workplace travels. The majority of respondents, have private cars (78.43%), ensure their residence-workplace transportation by private car. Automobile ownership is at the level of 50.00% for the respondent experts who go to workplaces on foot.

The majority of respondents reach to their workplaces in 15 minutes (27.4%), 20 minutes (21.9%), 10 minutes (21.9%). However, 12.3 % respondents reach to their workplaces over a period of 30 minutes. The average residence-workplace trip duration is about

20 minutes. Due to high rate (54.8%) of ‘access to the work by private car’, the transportation time is low. There is a statistically significant relationship between ‘residence-work transportation modes’ and ‘travel durations’ ( $\chi^2 = 1.614$ ,  $df = 66$ ,  $p = 0.000 \leq 0.05$ ). Experts reach to their workplaces in 20 minutes on foot. They live in the residential areas which are ‘far up to 30 minutes distances by private car’, ‘up to 45 minutes distances by bus’ and ‘up to 25 minutes distances by minibus’. The journey durations increase to 90 minutes when transportation is ensured via two vehicles.

### 3.3. Results of AHP based urban sprawl questionnaires

“The quality of urban life and health-UQ&H” (52%) is the most overrated urban sprawl effect factor groups by local authority experts. Additionally, significance of “Loss of environmental resources-ER” (17%) and “Natural, protected areas and rural environments” (17%) urban sprawl effect factor groups were emphasized at the second row (Table 4).

According to global prioritizations of local authority experts regarding the urban sprawl effect factors, the factor group of “The quality of urban life and health - UQ&H” has the most weights. In this group, **UQ&H-1**: Increase in air pollution is the most overrated urban sprawl effect factor. Furthermore they respectively supported the factors of; **ER-1**: Loss of land and soil, **UQ&H-3**: High noise level, **R-1**: Loss of natural habitats, **UQ&H-2**: Increase in respiratory problems (such as asthma), **UQ&H-5**: Residential areas, establishments and commercial centers being away from each other and separation with sharp borders, **UQ&H-8**: The ab-

sence of functional open spaces within the city, **UQ&H-9**: Increase in identical, unqualified, monotonous residential and **R-5**: More noise in rural areas (Figure 7, Table 4).

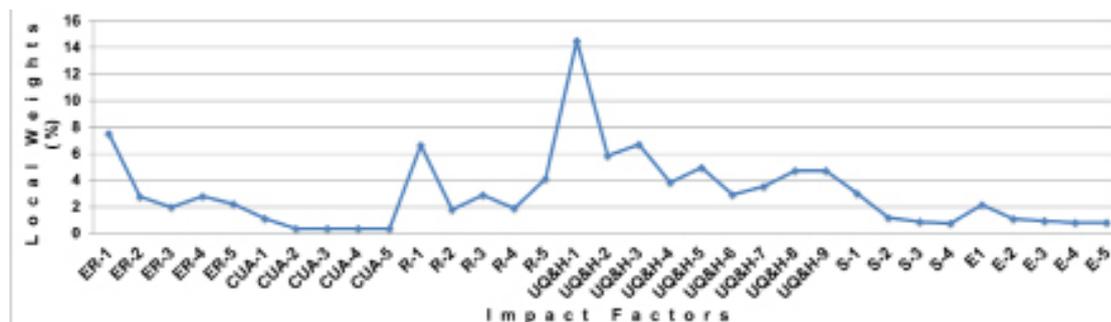
**Table 4.** Evaluations of experts regarding urban sprawl effects

Impact Groups	Weights	Factors	Local Weights	Global Weights	Priority	Stress	Behavior	
Loss of environmental resources	0.173	ER-1	1	0.076	0.003	8	4	8
		ER-2	2	0.028	0.008	8	8	8
		ER-3	3	0.009	0.023	8	8	8
		ER-4	2	0.028	0.008	8	4	8
		ER-5	3	0.009	0.023	8	4	8
Efficiency of transportation, residential areas	0.079	UQ&H-1	1	0.079	0.008	8	4	8
		UQ&H-2	2	0.026	0.008	7	2	8
		UQ&H-3	2	0.026	0.008	8	2	8
		UQ&H-4	2	0.026	0.008	8	2	8
		UQ&H-5	2	0.026	0.008	8	2	8
Natural, protected areas and rural environments	0.173	R-1	1	0.086	0.011	8	4	8
		R-2	8	0.016	0.003	8	4	8
		R-3	3	0.024	0.008	8	4	8
		R-4	4	0.016	0.003	8	4	8
		R-5	2	0.028	0.007	8	2	8
The quality of urban life and health	0.528	UQ&H-6	1	0.145	0.001	8	2	8
		UQ&H-7	2	0.028	0.008	8	2	8
		UQ&H-8	2	0.028	0.008	8	2	8
		UQ&H-9	2	0.028	0.008	8	2	8
		UQ&H-10	4	0.044	0.008	8	2	8
		UQ&H-11	8	0.009	0.001	8	4	8
		UQ&H-12	7	0.026	0.008	4	8	8
		UQ&H-13	8	0.009	0.001	4	4	8
		UQ&H-14	8	0.009	0.001	8	4	8
Social impacts	0.087	S-1	1	0.087	0.001	8	2	8
		S-2	2	0.026	0.001	8	2	8
		S-3	3	0.009	0.008	8	2	8
		S-4	4	0.007	0.008	8	2	8
Economic impacts	0.087	E-1	1	0.087	0.001	8	2	8
		E-2	2	0.026	0.001	8	2	8
		E-3	2	0.026	0.001	8	4	8
		E-4	4	0.009	0.008	8	2	8
		E-5	4	0.009	0.008	8	2	8
Factor Weights			Local	Global	Order			
Normalized local weights			0.6	0.6	24.1			
The ranking			1	1	2			

Degree of relationship	Number
Very low	1
Low	8
Medium	8
High	1
Very high	16

Global prioritizations of local authority experts regarding the urban sprawl effect factors show similar weight dispersions with local prioritizations (Figure 8, Table 4).

After global prioritizations, experts have evaluated 3 counties for each urban sprawl effect factor (Figure 9).



**Figure 7.** Local prioritizations of local authority experts regarding the urban sprawl effect factors

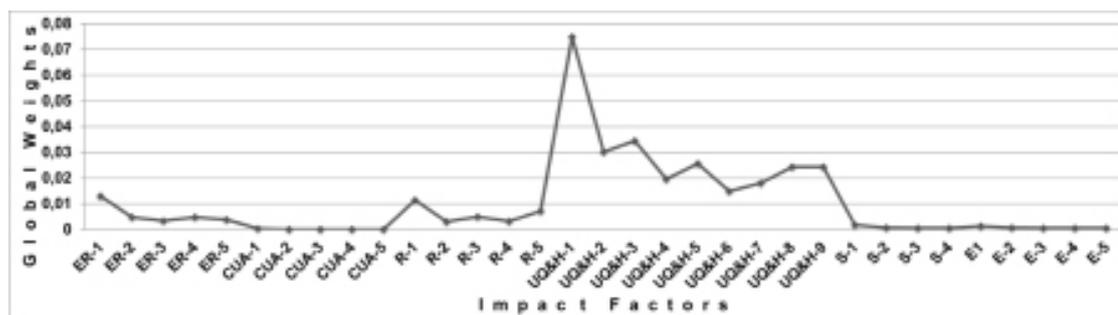


Figure 8. Local prioritizations of local authority experts regarding the urban sprawl effect factors

In context of 'Loss of environmental resources'; Selçuklu was at the first row with the rates of 'Loss of land and soil' (3.56%), 'Loss of soil permeability' (1.47%) and 'Loss of soil biodiversity' (1.16 %). Karatay has high rates in 'Loss of land and soil' (2.77%), 'Loss of soil permeability' (0.82%) and 'Loss of soil biodiversity' (0.65%), too. Expert evaluations showed that Meram was in a better manner in context of 'Loss of environmental resources' (Figure 9).

In context of 'Efficiency of compact areas vs. sprawled areas'; Selçuklu was at the first row with the rates of 'Growing consumption of energy' (0.51%), 'Increase in travel related energy consumption' (0.16%), 'Distance to public service' (0.14%) and 'Growing consumption of water' (0.14%). Karatay has high rate in 'Growth in CO<sup>2</sup> emissions' (0.15 %). While, Meram was in a better manner in context of 'Efficiency of compact areas vs. sprawled areas', Karatay and Meram have same rates in 'Increase in travel related energy consumption' (0.09%) and 'Growing consumption of water' (0.10%) (Figure 9).

In context of 'Natural, protected areas and rural environments'; Karatay, Selçuklu and Meram counties have equal share in the issues of 'Increase in the use of water and fertiliser in less productive areas' (0.95%) and 'Increase in water consumption in remote areas' (0.62%). The issue of 'Loss of best agricultural areas' was mostly observed in Karatay (0.65%), while the issues of 'More noise in rural areas' (1.69%) and 'Loss of natural habitats' (3.09%) were mostly observed in Meram county (Figure 9).

In context of 'The quality of urban life and health; Karatay has high rate in 'Increase in air pollution' (6.22%) problem. Selçuklu was at the first row with the urban sprawl issues of 'High

noise level' (2.86%), 'Traffic congestion' (1.63%), 'Reduction of availability and becoming as a automobile-dependent settlement depending on the expanding urban areas (1.13%), 'The absence of functional open spaces within the city (2.15%) and 'Increase in identical, unqualified, monotonous residential' (2.50%). Karatay, Meram and Selçuklu have same rate in 'Increase in respiratory problems (1.95%). The problems of 'Residential areas, establishments and commercial centers being away from each other and separation with sharp borders' (2.12%) and 'The lack of transportation options, inefficient public transport network' (1.59%) were mostly observed in Meram county (Figure 9).

In context of 'Social impacts'; Karatay has high rate in the issue of 'Concentration of poor quality neighbourhoods in the inner city' (0.35%). Although Meram and Selçuklu counties have high&equal rates in context of the issues of 'Exacerbation of social and economic division' (1.28%), 'Segregation of residential areas' (0.45%) and 'Less social interaction' (0.32%), Karatay has low rates in these problems due to its traditional structure (Figure 9).

In context of 'Economic impacts'; Karatay and Selçuklu have high&equal rates in context of the issues of 'Increase in household expenditure due to commute long distances from home to work' (0.79%), 'Additional costs of extension of urban infrastructures' (0.30%) and 'No savings in provision of water and sewage facilities (0.30%). Experts highly suffer from the 'Lack of a strong downtown' (0.41%) issue in Karatay and Meram. The issue of 'Cost of congestion for business in sprawled urban areas with inefficient transportation' (0.43%) was mostly observed in Selçuklu (Figure 9).

Through the two-paired comparisons of each urban sprawl effect factor group and urban sprawl effect factor, and also the evaluation of each county in the context of these urban sprawl effect factors, overall urban sprawl levels of Karatay (36.5%), Meram (34.4%) and Selçuklu (29.1%) counties (Table 4) were obtained. Expert evaluations indicated that Meram and Karatay counties have approximate sprawl levels. Selçuklu was accepted as the least sprawled county of Konya metropolitan area.

### 3.4. Expert views regarding urban sprawl problems

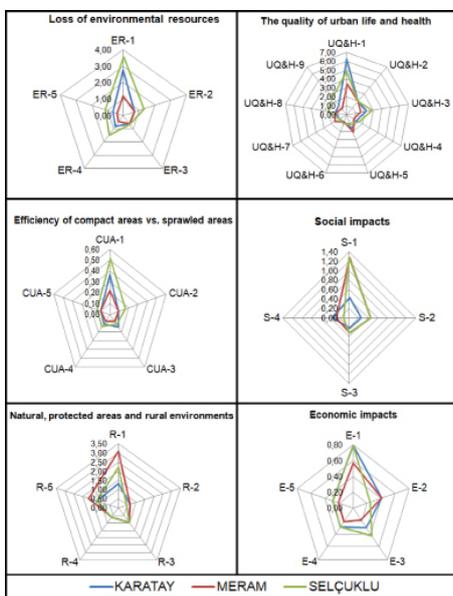


Figure 9. Urban sprawl effect factor evaluations (%) of experts for 3 counties

56.2% of experts accept urban sprawl as a threat to Konya city. 39.7% of respondents have answered the question of “Is there an upper limit to control urban sprawl in Konya city center?” as “yes”. They stated the existence of partial and insufficient limits (2.8%), control of sprawl via density decisions in zoning plans (1.4%) and protected areas (1.4%) as the limits to control urban sprawl in Konya. Research results show that acceptance of urban sprawl as a threat to Konya does not depend on variables such as ‘being from Konya’ or ‘the duration of being in Konya’.

Experts pointed out macro-economic factors (30.87%) as the primary cause of urban sprawl phenomenon. Additionally, they accept that “reg-

ulatory approaches” (16.54%), “micro-economic factors” (14.24%) and “problems in the city center” (12.44%) lead to urban sprawl. However experts have disregarded “residence preferences” (7.68%), “transportation policies” (8.48%) and “demographic factors” (9.75%) as a sprawl causing factor.

Experts indicated that the most useful precaution for combating urban sprawl that could be taken by stakeholders (public, private and NGOs) is “Development of long-term integrated plans promoting sustainable development and the limitation of urban sprawl” (23.71%). As well as they have overrated the strategy of “Policies for the re-use of derelict brownfield sites and renovate of public spaces to assist in the creation of more compact urban forms” (19.81%). Experts have emphasized the importance of this strategy limits the excess sprawl of urban macroform in future due to presence of the factories remain in city centre. Participants also emphasized the importance of stakeholder participation in the planning and implementation stages via supporting the strategy of “Identification of the key partners including the private sector and community, as well as local, regional and national government and their mobilisation in the planning, implementation and evaluation of urban development” (16.51%).

The most significant precaution of local authorities and Ministry of Environment and Urbanization for combating urban sprawl has been pointed out as “to save agricultural lands” by the experts. They have also overrated the strategies of “more significant financial resources and regulations of the urban renewal policy” and “To control of illegal buildings”.

## 4. Discussion and Conclusion

Growing urban sprawl is a serious concern worldwide for a number of adverse environmental, spatial and socio-economic effects and is a major challenge on the way to sustainable land use (Jaeger and Schwick, 2014). Nowadays urban sprawl has become a common issue in Konya as a result of rapid population growth, too. The city has become a vehicle-dependent city with this growth&spread process

in urban areas. The applied questionnaire results reveal the drivers, effects and the dimensions of urban sprawl in Konya.

Most of the local authority experts (56.2%) were participated to the questionnaire, accepted urban sprawl as a threat to Konya. However, existence of an upper limit to control urban sprawl has been denied by majority (60.3%) of experts.

It is essential to understand the causes&catalysts of urban sprawl, which do not occur in the same way in all regions, for an efficient urban growth analysis in Konya. Determinations of experts regarding with the causes&catalysts of urban growth and sprawl in Konya are similar to the reviewed relevant literature in this study. Based on experts' views regarding the causes&catalysts of urban growth and sprawl "macro-economic factors", such as economic growth, are the primary (30.87%) important factors underlying urban sprawl phenomenon as argued by Bhatta (2010). Additionally, they accepted that "regulatory approaches" such as weak land use planning, poor enforcement of existing plans and lack of horizontal and vertical coordination and collaboration (16.54%); "micro-economic factors" such as rising living standards, price of land, availability of cheap agricultural land and competition between municipalities (14.24%); and "problems in the city center" (12.44%) lead to urban sprawl. However, experts have disregarded "residence preferences" as a driver of urban sprawl causing (7.68 %) on the contrary to Rezefar and Kramaz (2014).

Expert concerns regarding sprawl's adverse effects in Konya largely focus on environmental and socio-economic negative consequences for residents and the local environment in parallel with the reviewed literature. Experts have reached a consensus that urban sprawl's primary effects are associated with quality of urban life and health (such as high noise level, increase in respiratory problems, residential areas, establishments and commercial centers being away from each other and separation with sharp borders, the absence of functional open spaces within

the city, increase in identical, unqualified, monotonous residential, etc.) and the loss of environmental resources.

The analysis indicated that the most emphasized problems regarding urban sprawl in Konya city center by experts are;

- **In context of the quality of urban life and health: UQ&H-1:** Increase in air pollution in Karatay (6.22%), Selçuklu (4.84%) and Meram (3.46%); **UQ&H-3:** High noise level in Selçuklu (2.86%) and Karatay (2.23%); **UQ&H-9:** Increase in identical, unqualified, monotonous residentials in Selçuklu (2.50%); **UQ&H-8:** The absence of functional open spaces within the city in Selçuklu (2.15%); **UQ&H-5:** Residential areas, establishments and commercial centers being away from each other and separation with sharp borders in Meram (2.12%).
- **In context of loss of environmental resources: ER-1:** Loss of land and soil in Selçuklu (3.56%) ve Karatay (2.77%).
- **In context of in context of natural, protected areas and rural environments: R-1:** Loss of natural habitats in Meram (3.09%) and Selçuklu (2.21%).

Experts' overall urban sprawl evaluations via AHP (Table 4) highly differ from the data of constructed buildings (residential or non-residential) in last decade (Figure 5) and comparison of urban sprawl in three counties according to Google Earth data of 1994-2019 (Figure 6). According to the data of constructed buildings (residential or non-residential) in last decade the construction density was at the most in Selçuklu county than Meram and Karatay respectively in parallel with their populations (Table 1). According to the Google Earth data of 2009-2019 in terms of macroform expansion Selçuklu was the county where the most urban development observed than Karatay and Meram respectively.

However, AHP based comprehensive expert views regarding urban sprawl in Konya indicated that Karatay was the most sprawled county (36.5%) while Meram (34.4%) was secondly sprawled county and Selçuklu was the least sprawled county (29.1%). AHP

based comparative urban sprawl evaluation for three counties used in this study was enabled through the two-paired comparisons of each urban sprawl effect factor group and urban sprawl effect factor, and also the evaluation of each county in the context of these urban sprawl effect factors to **estimate a global urban sprawl value** for each central county. Thus, this difference is a natural consequence of the complexity of urban sprawl process (in terms of reasons and effects). AHP enables an effective multi criteria overall evaluation consisting many results, effects and priorities for this complex phenomenon.

Experts underlined the strategy of “development of long-term integrated plans promoting sustainable development and the limitation of urban sprawl” that could be taken by stakeholders against urban sprawl. Additionally, the strategy of “to save agricultural lands” was thought as the most significant precaution for combating urban sprawl that could be taken at the level of local authorities and Ministry of Environment and Urbanization. Therefore, definition of urban growth and services’ distribution are crucial regarding the defined problems and potentials for each county in Konya. It is essential to incorporate all adverse effects of sprawl into policy making. However, in the light of findings, development and effective implementation of policies to eliminate the primary negative effects of urban sprawl on loss of environmental resources and the effects associated with quality of urban life and health have great of importance. This study provides evidence that urban policymakers should also direct their efforts to policies that conserve ecological resources, create a sustainable built-up environment and raise the liveability.

The integration of economic development, infrastructure and growth management should be ensured and natural assets should be protected by planning to keep away from urban sprawl’s all kind of adverse consequences and ensure sustainable development. Agricultural fields which are significant for supplying of agricultural products to urban, sustaining rural life

and also for creating open space should be used in a balance of protection and development. In this framework, it is essential to limit the growing urbanization toward to the efficient agricultural areas and prevent new constructions in these areas. Additionally, density zones should be re-edited in the city to limit the growing urbanization. New residential areas should be planned in the areas close to existing settlements to provide more contiguous development, while higher density should be preferred to prevent land losses. Local authorities should adopt planning policies like infill development which allow both residents and the local authorities to conserve existing urban assets by building on vacant, abandoned, or underutilized land within the existing city limits to create coordinated and compact urban growth strategies.

Green infrastructure systems, supporting enhanced efficiency of natural resources, health&well-being (air quality and noise regulation, raising accessibility, better health conditions) land&soil management, low-carbon transport, water management, mediate the impact of urban populations on the natural environment. Thus, green infrastructure systems should be universalized in Konya to mitigate adverse consequences of sprawl. It is essential to optimize the accessibility all-over the city and create walkable neighbourhoods. Less fragmented, better integrated transportation modes should be encouraged throughout the city.

Results of this study, were derived via a structured analytical hierarchy for Konya city to evaluate urban sprawl process in terms of reasons and effects based on AHP to estimate a global value for each central county, illustrate the drivers, environmental, spatial and socio-economic effects and dimensions of urban sprawl for Konya city. However, the results also represent guidelines for other cities to manage urban growth due to the fact that similar environmental, spatial and socio-economic problems have increasingly being experienced in a significant part of cities. Additionally, the study presents a comprehensive&actual urban sprawl literature review. The findings provide a favorable systematic for the

key stakeholders of urban development to understand urban sprawl in terms of reasons and effects through exploring and identifying criteria, thereby to design effective policy solutions for combatting with urban sprawl and ultimately contributing sustainable development.

### Acknowledgement

The earlier version of this manuscript [consisting pre-findings of case study] titled “Analysis of Urban Growth and Sprawl in Konya (Turkey)” has been presented at ERSA - European Regional Science Association 55th Congress: World Renaissance: Changing roles for people and places, August 25-28, 2015, Lisbon, Portugal.

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