

## RESEARCH PAPER

# Influences of Environmental Quality and safety & security on the Liveability of Residential Complexes in Erbil City

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### ABSTRACT:

Liveability is a place based theory that makes the city a great place to live, it seeks to plan our living communities to promote good health, support the social cohesion and create safe and secure environment for the residents. This research seeks to examine the influence of two factors on liveability; the environmental quality and safety & security and their related issues. Five residential complexes implemented by the investment sector and located in different geographic locations in Erbil city are chosen as case study samples. The study employs an interrelated measuring tool by using spatial analysis check list and questionnaire survey with the residents. Results of the statistical analysis showed that significant differences were found between the residents satisfaction about their living environment in term of the studied factors, while non-significant differences were found between the results of both measuring tools used.

KEY WORDS: Liveability; Environmental Quality; Safety and Security; Spatial analysis; Residents' satisfaction.

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## 1. INTRODUCTION

Livability is one of the recent vital theories on the level of urban planning, liveability among developing countries' cities is a concerning issue and paid less attention (Beiglu *et. al*, 2019). It is regarded as an indicator of quality of life and urban quality issues in the urbanized areas (Giap *et. al*, 2014). Rapid and often unplanned urbanization has become a global phenomenon that increased the exposure of people and urban assets to higher degrees of attention to liveability (Beiglu *et. al*, 2019).

In Kurdistan region, a rapid growth of urbanization and urban development have been launched as a result of the approval of 175 housing projects in Kurdistan Region during the period from 1/8/2006 till 28/7/2019, which 86 housing projects of them are located in Erbil province (Board of Investment, 2019). As a result the city is facing numbers of challenges in term of environmental degradation, also in adequate shelters and poorly maintained environmental and physical infrastructures (Ibrahim *et.al*, 2015). Moreover, the rapid urbanization as well as the lack of planning regulations affected negatively on residential land use which are more likely to have less open spaces and more load on infrastructure (Shingali and Malaika, 2016; Ibrahim *et.al*, 2015 ).

### 1.1 Definition of terms:

Many terminologies and definitions associated with quality of life have been used to define the liveability, Flint in 2013 defined liveability as a part of the community and mentioned that

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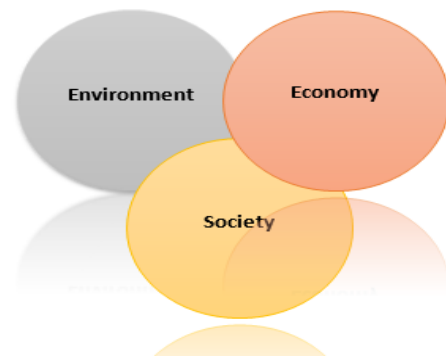
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Community liveability refers to the environmental and social quality of an area as understood by inhabitants, It is the sum of factors that add up to a community's quality of life including the built and natural environments (Flint, 2013). Livability could be result of summation of many factors that add up to a community's quality of life which consist of the built and natural environments, economic prosperity (Partners for Liveable Communities, 2011). To summarize the term 'liveability' refers to the living condition of the place, reflects the people's evaluation about their living environment and the extent to which the place is fit to live or not.

### 1.2 Dimensions of livability:

The (National Research Council, 2002) of America, classified the liveability dimensions in to three essential groups, namely Social, Economic and Environmental dimensions, in the same context Aguiar and his colleagues in 2018 confirmed that physical social and economic dimensions as the main characteristics of urban liveability (Aguiar et.al, 2018), see figure 1. Heylen in 2006 indicated that Liveability refers to four dimensions: the quality of the dwelling/building included (acoustic isolation, density, comfort/size and maintenance), the quality of physical environment including the level of services and facilities, the quality of the social environment, resident characteristics and finally safety of the neighborhood. Others introduced another dimensions of liveability that are characterizing the urban areas and classified them in to seven groups which are: built and natural environment, economic prosperity, social stability and equity, adequate physical infrastructure, public health, safe streets and finally the educational opportunity (Tomalto and Mallach, 2015). According to Appleyard and his colleagues liveability has two distinctive dimensions that are: performance dimensions and prescriptive dimensions, the former one focuses on both the qualities and measures which are descriptive criteria of liveability while the latter one describes policy interventions and final status of outcomes, in other words performance dimension describes what should be measured whereas prescriptive dimension provides guidance for implementation such as more affordable

housing and wider transportation choices (Appleyard *et.al*, 2014)



**Figure 1** Dimensions of liveability (National Research Council, 2002)

### 1.3 Spatial scales of Urban Liveability:

Kashef in 2016 conducted an analytical review about urban liveability, he synthesized the dimensions of urban liveability which presents the linkage and relationship among environmental, economic and social dimensions, and he produced a conceptual model based on natural systems and built systems that captures the intellectual building blocks of urban liveability. Urban liveability is categorized in to three spatial scales, the first one is related to the city level whereas liveable city is defined as habitable and fit to live (Ruth and Franklin, 2014), such indexes were created to rank cities in term of liveability like Mercer and Monocle that adopt safety and environmental issues as forefront assessment indicators (Takahashi et.al, 2018). In regarding to the neighborhood level as a second spatial scale of urban liveability. Liveable neighborhoods according to the AARP (American Association of Retired People) and Public Policy Institute liveability seeks to promote creative policies that address residents' desire to live safe & secure, age friendly and healthy neighborhoods and communities, it is considered the first tool to asses and measure liveability at the neighborhood level based on the following seven categories: Housing, Neighborhood, Environment, Health, Transportation, Engagement and Opportunity. Public space level was categorized as the third spatial scale of urban liveability. Nasution & Zahrah in 2014 concluded that the enhancement of the public open space will create a better perception to overall quality of life while

the functional factor was the most significant factor that affects people's satisfaction. Ali and Ali (2018) confirmed that liveliness of the public open spaces is related to the safety of the place. Based on the previous literature urban liveability based on three spatial scales, various indicators have been addressed that impact the liveability of the community and make it a desirable place to live. Figure 2. Summarizes the main dimensions and indicators of liveability according to the previously mentioned studies and literature

#### **1.4 The Scope of the Study:**

This study will scope on environmental quality and safety & security factors and its influence on the neighborhood's liveability.

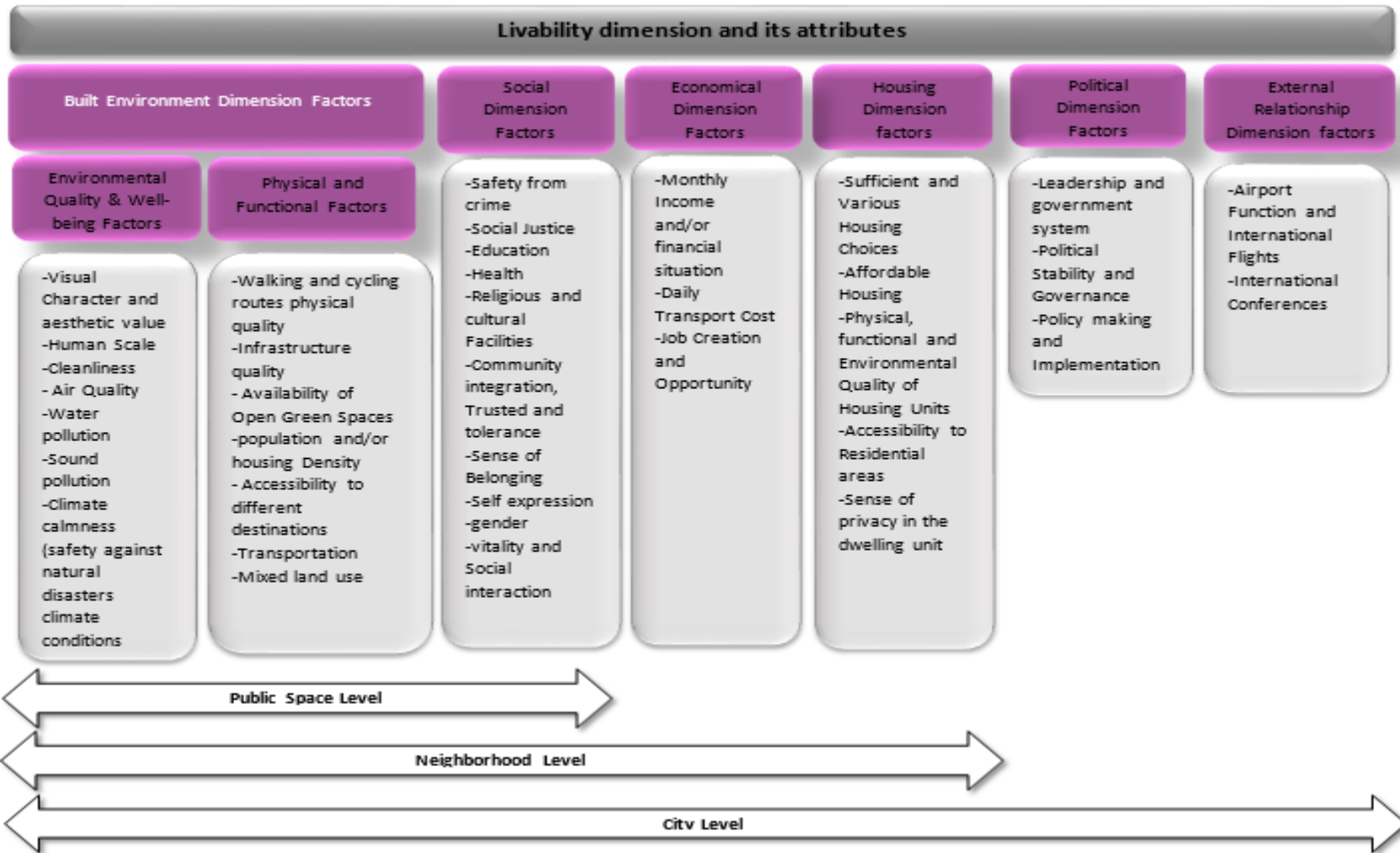
##### **1.4.1 Environmental quality:**

The environmental quality is an important indicator for livability studies as it has a direct effect on human activities and opportunities by creating a healthy physical and social environment (Bigio and Dahiya, 2004). According to European Environment Agency a pressure on urban environment and threats on people's well-being and health may be created if the environmental issues are neglected through urban planning process (European Environment Agency, 2015). One of the most environmental problems that are facing the urbanized areas is the air pollution according to the location of pollution source such as the waste collection & management areas and the industrial land use zones, therefore, selecting a suitable location for them has been always unsolved subject for human as the improper place causes water, soil & air contamination, at the local level- in Kurdistan Region no instructions or regulations have been presented regarding to the buffer zone of any pollution source, regarding to the instructions provided by the Department of Environment of Iran land fill (or any waste management zone) must be placed at a distance of 10-15km from the city (Derakhshandeh & Beydokhti, 2014). In addition, environmental problems are matching with hygienic, economic, aesthetic & environmental quality desired by the public (Xue et. al, 2010). In term of pollution sources the current study will focus on the presence of any pollution source within the studied areas as well as the distance between the studied residential areas and the pollution sources in Erbil city (the waste collection zone, northern industrial zone and the southern industrial zone) to be assessed according to the regulations in this

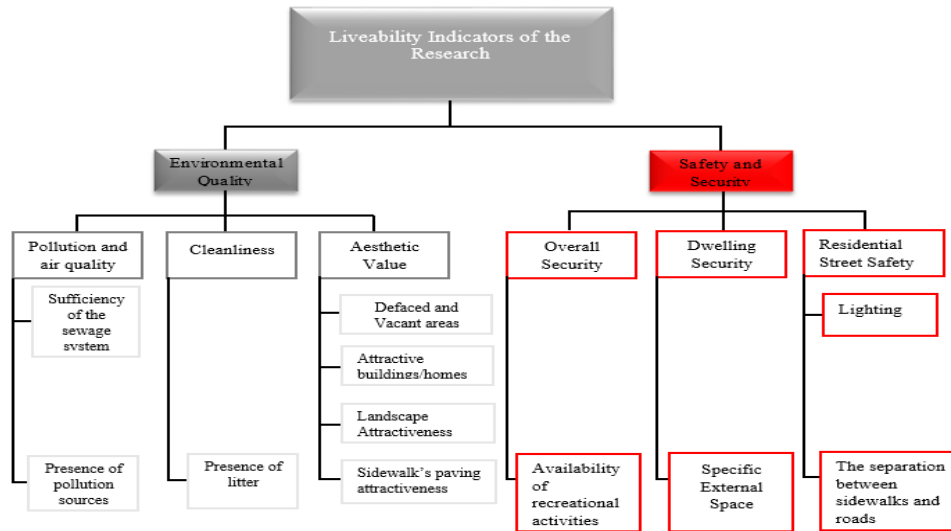
term, moreover, the aesthetic value and cleanliness are based as indicators.

##### **1.4.2 Safety & Security:**

In October 2016, the Third United Nations Conference on Housing and Urban Sustainable Development was held, and the "New Urban Agenda" was released, urban safety was considered as one of the most influential factors to evaluate cities in term of urban liveability (Lihu et. al, 2020). Based on Maslow's hierarchy of needs, the aspect of safety indicator is considered as the second most important factor after the physiological needs, this hierarchy indicates that one will not attain life satisfaction if the absence of threats to safety is not guaranteed, accordingly the perception of safety is a critical aspect in achieving quality of life. Crime prevention tactics are suggested for residential environments in urban areas including building fences and walls, creating territorial spaces, increasing outdoor lighting and installing guard booths and surveillance cameras (Sakip et.al, 2013). Figure 3 shows the current research indicators.



**Figure 2** Liveability dimensions and its indicators as conducted from previous studies and literature according to each spatial scale (the researcher)



**Figure 3** Liveability Indicators of the current research (the researcher)

**1.5 Research Problem**

The majority of the previous studies have been conducted abroad, more over Beiglu and his colleagues stated that ‘more research is required to see how liveability issues are experienced and assessed in urban neighborhoods in developing countries’ (Beiglu et. al, 2019). Therefore, the liveability issue in Erbil city is uncertain and questionable. (In this regard, there is a lack of considering research and investigations in Erbil city about the influence of environmental quality and safety & security on liveability), therefore, the main objective of this study is to clarify the role of the environmental quality and safety & security on the liveability presence in Erbil city residential complexes. According to the above the research problem is: there is no evidence if the local’s satisfaction about the livability of their residential complexes matches the livability as measured through the spatial analysis when the assessment includes many levels indicators to use both of the measuring tools in evaluating the studied areas that are located in different geographic locations in Erbil city in term of their liveability.

**1.5.1 Research Objectives**

1. To objectively measure the studied liveability indicators through the spatial analysis check list of the studied residential complexes
2. To compare the satisfaction degrees of residents with the studied liveability indicators using a questionnaire survey in the studied residential complexes

3. To determine if a match exists between the objective spatial analysis results and the subjective questionnaire survey measurement of liveability
4. To specify the highest and lowest level of liveability of the studied residential complexes

**1.5.2 Research Questions**

1. Are there differences in the actual presence of the environmental quality and safety & security indicators as measured by the spatial analysis checklist amongst the studied residential complexes?
2. Are there differences in the residents’ satisfaction degree about the environmental quality and safety & security indicators amongst the studied residential complexes?
3. Are the results of the spatial analysis matching with the results of the questionnaire survey’s results in term of the studied liveability indicators?

**1.5.3 Research Hypothesis**

1. Differences are shown in the actual presence of the studied factors of liveability by using the spatial analysis checklist amongst the studied residential complexes
2. The satisfaction of Residents’ about the studied liveability factors amongst the studied residential complexes varies.
3. Matching exists between the results of the spatial analysis and the questionnaire survey.

**2. Research Methodology**

This research was conducted in five residential complexes in Erbil city, the research was based on two measuring tools that included: spatial analysis checklist as most geographical inquiries on liveability have been based on objective measures (Saitluanga, 2014) and questionnaire survey as it is preferred for planning and policy purpose as it is providing more valuable feedback (Ibrahim and Chung, 2003). In this study the scoring value of the spatial analysis checklist ranges from (1 for highly inefficient and 5 for highly efficient). Visual field survey and ArchGIS software are based as a supportive tool for the spatial analysis and measuring the distance between the studied residential complexes and the pollution sources in

the city to calculate the final scoring values of the studied indicators, see table 1. Regarding to the questionnaire survey as a second measuring tool a Likert scale ranging from ‘1-5’ is used for rating the statements that related to each studied factor denoting ranges from ‘1’ highly dissatisfied to ‘5’ highly satisfied ‘2, 3 and 4’ represent dissatisfied, neutral and satisfied respectively, a pilot test for the questionnaire among small cross section of the population was conducted to refine the final questionnaire form before implementing the formal survey, see table 2.

**Table 1. Spatial analysis Checklist’s Results of the Studied Areas**

<b>A. Environmental Quality</b>	
1. Availability of toxic fumes &/or pollution source <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">A1</span>	3.2 Frequency of garbage Collection <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
2.Sewage system availability and maintenance <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">A2</span> The average score of below Mentioned aspects	<b>B. Safety and Security</b>
2.1 Availability of storm water drainage system <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	4.Controlled entrances by guarding points <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">B4</span>
2.2 Maintenance condition of storm water pipes <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	5.The neighborhood is not overlooked on isolated area <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">B5</span>
2.3 Grey water drainage system <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	6.The availability of lighting in public Spaces, roads and sidewalks <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">B6</span>
3.Cleanliness <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">A3</span> The average score of below Mentioned aspects	7.Availability of enclosed fence for each dwelling unit <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">B7</span>
3.1 Availability of Garbage cans <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	8.Presence of traffic control device (speed bumps, stop signs) <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <span style="border: 1px solid black; padding: 2px;">B8</span>



**Table 2. Questionnaire form**

Questionnaire Form						
Complex Name .....			Complex location			
HD: Highly Dissatisfied N: Neutral HS: Highly Satisfied D: Dissatisfied S: Satisfied						
NO.	Indicators	Degree of Satisfaction				
1.Environmental Quality		HD 1	D 2	N 3	S 4	HS 5
1	There are no polluted and bilge water puddles					
2	There are no bad smells in the neighborhood					
3	There are barely exhaust fumes while walking in my neighborhood					
4	The neighborhood is absent of litter					
5	There are no incomplete buildings or vacant areas that decreases the attractiveness of the neighborhood					
6	The form of the neighborhood buildings is attractive					
7	The landscaping of the neighborhood is attractive					
8	The sidewalks of the neighborhood have proper paving patterns					
2. Safety and Security						
9	You can walk safely at night in the neighborhood					
10	There are outdoor recreational activities & amenities that makes the residents feel safer during the entire day.					
11	Each dwelling unit has an enclosed external space that increases the sense of safety					
12	There is a sufficient lighting in the neighborhood that increases the sense of safety at nigh					
13	There is a separation between pedestrians and vehicles that increases the safety in busy streets					

**2.1 Sample Selection**

Investment housing projects were selected in this study as they represent the largest percentage of newly implemented residential projects. The selected residential complexes were characterized as single housing units, completely constructed complexes and the complexes are occupied by the local residents. Total of 250 households were interviewed by distributing 50 form for each residential complex to get a valid feedback about the residents’ satisfaction about their living environment in term of the studied factors, SPSS (Statistical Package for Social Sciences) software was used to analyse and tabulate the data. The selected residential

complexes as shown in Figure 4 were as following.

1. **Dream City** is located in the city centre
2. **Italian 2 City** located on Masif Salahaddin Road;
3. **New Azadi** Project located on Bahrka Road;
4. **Ashti 2** City located on Koya Road;
5. **Altun City** located on Kirkuk-Bansllawa Road.

The selected residential complexes are located in different locations in Erbil city to determine the in equalities between them in term of the studied indicators, the process of assessment (as previously mentioned in sec.2) based on both check list by scoring the sub indicators that related to each studied indicator and the questionnaire survey with the residents.

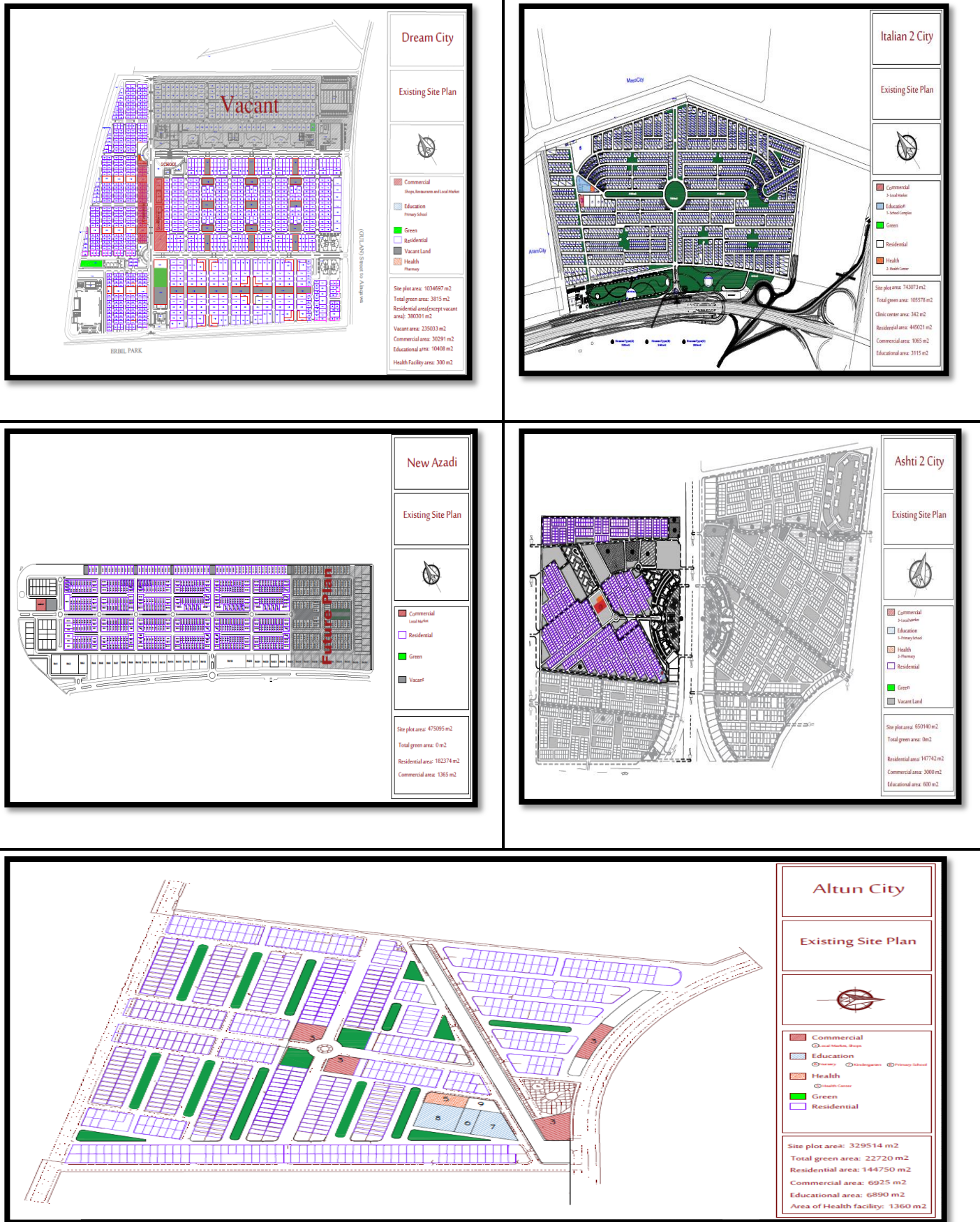


Figure 4: The Selected Residential Complexes



The scoring values of the tested indicators (environmental quality and safety and security) are provided in Table 3.

### 3. Results and Discussion

#### 3.1 Results and Discussion of the spatial analysis check list

**Table 3. Spatial analysis Checklist’s result of the studied areas**

Factors  Neighbourhoods	Environmental Quality									Safety and Security						
	A1	A2			Average	A3		Average	Total Average	B4	B5	B6	B7	B8	Total Average	
		2.1	2.2	2.3		3.1	3.2									
Altun City	1	2	2	4	3	4	3	4	2.6	1	4	4	4	1	2.8	
Dream City	2	4	4	4	4	3	3	3	3	5	5	5	3	4	4.4	
Italian 2 City	3	5	5	4	5	5	5	5	4.3	5	2	4	4	5	4	
Ashty 2	5	1	3	4	3	4	4	4	4	5	3	1	4	1	2.8	
New Azadi	3	4	4	4	4	4	4	4	3.6	5	2	5	1	4	3.4	
<b>Total average scoring value of each indicator</b>	Environmental Quality									<b>3.5</b>	Safety and Security					<b>3.48</b>

#### 3.1.1 Analysis and Discussion of Environmental Quality Indicators

To analyse the environmental quality of each complex, the researchers identified the average mean score for the related sub-indicators (A1 to A3) to indicate the final scoring value that represents this indicator for each complex, as shown in Figure 5.

A complex with a higher scoring mean value means that the complex seems to promote health which is enhancing the overall quality of life, while the lowest scoring value is supposed to presence of pollution source within the residential area and poor quality of both sewerage system and the cleanliness. The average scoring values of all the selected complexes were as follows: Italian 2 City, 4.3; Ashti 2, 4; New Azadi, 3.6; Dream City, 3 and Altun City, 2.6

The result confirmed that the highest average scoring value was recorded for Italian 2 City, in term of existence of pollution source “3” scoring value is recorded (as the pollution source is

existing along one of the Italian city borderline from the exterior side, but in term of sewerage system and cleanliness “5” is recorded as the distributed and maintained storm water pipes are covering more than 80% of the complex as well as the efficiency of garbage collection services. The lowest scoring value 2.6 represents the poor environmental quality of Altun city according to the existence of pollution source within the complex and poor sewage which cause an environmental risk for the residents.



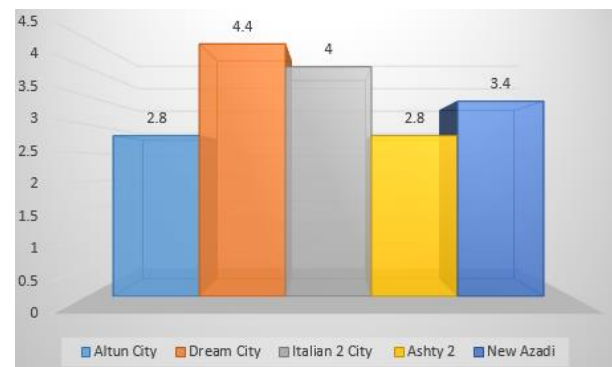
**Figure 5** Average scoring values of Environmental Quality indicators for each studied area.

**3.1.2 Analysis and Discussion of Safety and Security Indicators**

Safety and security indicator is scored based on five sub-indicators (B4-B8) by using various techniques as mentioned before (GIS & field visual survey). The average scoring values for these indicators were calculated for each case study, as shown in Figure 6.

The maximum scoring value was recorded for Dream City with a scoring value of 4.4, according to this result we can say that Dream city is the safest and the most secure one, according to its location in the city center zone, it is surrounded completely by occupied area of residential, commercial & institutional uses, also in term of controlled entrances the complex does not have any through pass traffic or uncontrolled entrances. Moreover the majority of Dream city’s public spaces and residential streets are covered with lighting and traffic control devices which increase the sense of both safety & security, While both of Altun city & Ashti 2 recorded the minimum scoring value (2.8) amongst the studied samples, according to Altun city the entrances are not controlled & there is a lack of traffic control devices (less than 10% of the residential streets are covered), while in Ashti 2 there is a lack of both street lighting & traffic control devices, moreover Ahti 2 is surrounded by isolated area from two sides, all that affected negatively on the overall scoring value. Italian 2 city is rated as the second one as the complex is surrounded by non-occupied area from three sides (not completed & suspended residential projects). New Azadi project recorded 3.4 scoring value, it seems to has a fair level of safety & security as it is surrounded with non-occupied area from three sides, moreover the entrance is controlled by guarding points & camera and about 75% of the streets are covered with lighting & traffic control devices. The scoring values illustrate a clear image that all the selected residential complexes hold between fair and efficient level of safety and security and no one of them scored (1) or (2). As a result, creating more liveable residential environment affected by two main aspects: firstly: the vitality of the surrounded area, secondly: the presence of such a features like the lighting, controlled

entrances and speed control devices. Accordingly, the first research question about the differences in the actual presence of the studied liveability indicators in the selected residential complexes is answered. In terms of Environmental Quality, Italian 2 City recorded the maximum scoring value of 4.3, whereas Altun City recorded the minimum scoring value of 2.6. With regard to safety and security indicator, Dream City achieved the maximum scoring value of 4.4, and the minimum scoring value for both Altun City and Ashty 2 City was 2.8. According to the conducted results the validity of the first research hypothesis is proven.



**Figure 6** Average scoring values of Safety and Security indicators for each studied area

**3.2 Results and Discussion of the Questionnaire Survey**

**3.2.1 Analysis and discussion of the degree of residents’ satisfaction about the environmental quality indicators**

The statements that were tested the environmental quality indicator in the questionnaire were included pollution source & air quality, cleanliness and aesthetic value. The statistical descriptive results of environmental quality amongst the studied complexes indicate that the total mean score depended on the residents’ view was 3.21 with a standard deviation of 0.84. The maximum value of the respondents’ agreement about environmental quality was recorded in Italian 2 city 3.96 with a standard deviation 0.53, while the minimum mean 2.26 with a standard deviation 0.87 was recorded for New Azadi complex. The means of each Ashti 2 city, Dream city and Altun city were 3.47, 3.32 and 3.03 respectively as shown in Table 4. The ANOVA result was (F = 50.120, p<0.05). Accordingly, a statistically significant difference exists amongst

respondents' satisfaction from the studied areas in regarding to the environmental quality indicator.

**Table 4. Descriptive Analysis and One-Way ANOVA of Environmental Quality Indicator**

Indicator	Case Study	N	Mean	Standard Deviation	Standard Error	F-test	p-value
Environmental Quality	Altun City	50	3.03	0.80	0.11	50.120	0.000*
	Dream City	50	3.32	0.48	0.07		
	Italian 2 City	50	3.96	0.53	0.07		
	Ashti 2 City	50	3.47	0.24	0.03		
	New Azadi	50	2.26	0.87	0.12		
	Total	250	3.21	0.84	0.05		

\* Significant at level (p< 0.05)

**3.2.2 Analysis and discussion of the degree of residents' satisfaction about safety and security indicators**

The statements that were tested safety and security indicator in the questionnaire were included the availability of recreational activities, dwelling's unit security and residential streets safety. The result indicates that Italian 2 city scored the highest degree of residents' satisfaction about the safety & security indicator. While New Azadi recorded the lowest degree of residents' satisfaction about it. On the other hand the scoring value of Dream city, Ashti 2 city and Altun city were slightly less than the scoring value of Italian 2 city as shown in table 5, this satisfaction is related to the high security level all over Erbil

city. The result of ANOVA test was (F=50.420, P< 0.05). Accordingly, the result illustrate that there were statistical significant differences amongst the respondents from the studied complexes in respect to the safety & security indicator.

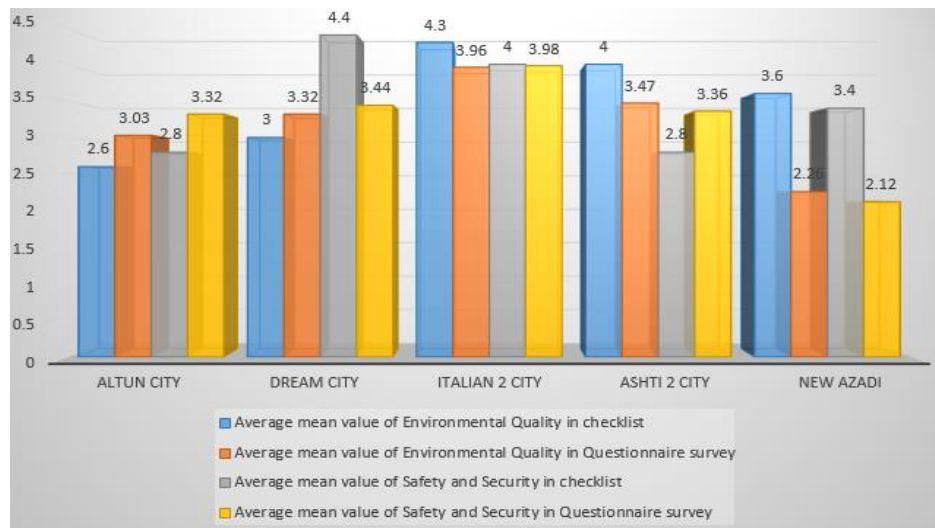
From the aforementioned results of the degree of residents' satisfaction with the environmental quality and safety and security indicators, the second research question about the difference in

the degree of residents' satisfaction with the studied liveability indicators amongst the selected residential complexes was answered and the validity of the second research hypothesis is proven. Figure 7 presents the outcomes of both measuring tools amongst the studied areas.

**Table 5. Descriptive analysis and one-way ANOVA test of safety and security indicator.**

Indicator	Case Study	N	Mean	Standard Deviation	Standard Error	F-test	p-value
Safety and Security	Altun City	50	3.32	0.81	0.11	50.42	0.000*
	Dream City	50	3.44	0.63	0.09		
	Italian 2 City	50	3.98	0.57	0.08		
	Ashti 2 City	50	3.36	0.30	0.04		
	New Azadi	50	2.12	0.92	0.13		
	Total	250	3.25	0.91	0.06		

\* Significant at the level 0.05 (p< or=0.05), n=250



**Figure 7** results of both measuring tools amongst the studied complexes

### 3.3 Comparison of the results of the spatial analysis evaluation and the questionnaire survey evaluation

A paired sample *t*-test was performed to examine the third research question regarding the correspondence between the results of the

checklist and the questionnaire survey. As shown in Table 6 and based on a significance

level of  $p < 0.05$ , insignificant differences occurred between the results of the checklist and the questionnaire survey in relation to the two selected liveability indicators. The *p* values for both tested pairs (Pairs 1 and 2) were more than 0.05. This result supports the accuracy and reliability of both tools and proves the validity of the third research hypothesis that states (**Matching exists between the results of the spatial analysis and the questionnaire survey**).

**Table 6. Comparison of the questionnaire and checklist results**

Comparison of the Questionnaire (Q) and Checklist		Standard			
(CH) results		Mean	Deviation	t-value	Significance (p-value)
<b>Pair 1</b>	Environmental Quality (Questionnaire)	3.208	0.628	-0.911	0.414
	Environmental Quality (Checklist)	3.500	0.700		
<b>Pair 2</b>	Safety and Security (Questionnaire)	3.24	0.682	-0.623	0.567
	Safety and Security (Checklist)	3.480	0.716		

\* Significant at level (p<0.05)

**4. Conclusion**

After analyzing and discussing the selected case study samples, the following findings were obtained:

- According to the spatial analysis check list the maximum scoring value is recorded for Italian 2 city in term of environmental quality and for Dream city in term of safety and security factor, while the minimum scoring value for both studied factors is recorded for Altun city.
- The questionnaire survey results showed that the highest mean value of residents’ satisfaction is recorded for Italian 2 city (located on Masif Salahaddin Road) for both studied factors which means this zone is characterized with the majority of best criteria and regulations to achieve the liveability concept, whereas the lowest mean value of residents’ satisfaction is recorded for New Azadi (located on Bahrka Road), therefore, more attention is needed for the complexes located in this zone in term of environmental quality regulations and safety and security measures to promote their level of liveability.
- Regarding to the above mentioned results differences exist in the actual presence of the studied factors amongst the selected cases which prove the validity of the first research hypothesis. Based on this achievements urban planners and designers can get benefits from the results through planning and designing process and follow the guide lines to achieve

the qualitative residential environment in any location in the city.

- ANOVA test results indicate statistical significant differences between the residents’ satisfaction which proves the validity of the second research hypothesis.
- As the results of paired sample t-test confirmed a corresponding between the results of both spatial analysis check list and the questionnaire survey the validity of the results of both tools are proven as well as the third research hypothesis is confirmed. Therefore, the check list can be used by the planners as a tool to evaluate and assess the residential complexes before constructions and implementations stage.
- The results extracted from this research can provide a support and contribution to diagnose the defects and shortcomings for the existing residential complexes which provide a reliable database for the upcoming residential projects to avoid repeating design errors.

**5. Recommendations**

- In term of Environmental quality the study recommends the following:
  1. Take in to account the environmental quality of the site as an important issue when identifying the residential land use locations in the city.
  2. Determine a buffer zone of urban waste land and industrial land use in the city to avoid the penetration by another land use in case of the future expansion of the city specifically for the residential land use to prevent any hazardous or



harmful conditions which negatively affects health.

- In term of Safety & Security indicator the study recommends the following:

1. Selecting sites for the residential complexes that are surrounded by an occupied area with mixed land use to increase the sense of security.

2. Using a sufficient lighting in the public spaces and streets of the residential complexes to rise the sense of safety.

3. Using a sophisticated technology to control the security situation of the entrances for the residential complexes such as cameras or any other digital tools.

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### Conflict of Interest

The authors declare that there is no conflict of interest.

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