

# Sustainable Urban Development Indicators: Misrata, Libyan Case

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**Abstract** — Sustainability indicators play a key role in putting the ambiguity of the urban development concept in a way that could be realized and accordingly measured. This paper develops a set of indicators for a local city based on the study of the experiences of a number of quintessential international institutions and organizations for measuring urban development. It analyzes the ethics and concepts of measuring sustainability in terms of the main system, subsystems, and the Orientation theory for the system's classification. The paper develops a model based on studying these systems. This model investigates the three aspects of the environment in local cities; the Built environment, the Natural environment, and Human Well-being. The paper applies this model to the city of "Misrata", Libya. The findings were used to validate the proposed model measuring the achievements of urban development using local indicators.

**Index Terms:** Urban Development, Sustainability Indicators, Local city, System.

## I. INTRODUCTION

Growing interest raising the awareness of environmental issues is now a concern of developed and developing countries alike. Because Cities are witnessing unprecedented changes due rapid urbanization and globalization. At issue, is the how to overcome environmental degradation without giving up on the economical and social developmental needs of the populace at large. . In addition, how is it possible to insure future generation's ability to live without any threat of natural resource and energy depletion. This can be done if urban development sustainability is considered priority, and by making sure that measuring processes are implement to support sustainable development. This study will try to produce and develop the indicators for measuring local development. by tracking the ethics and concepts of measuring sustainability, considering international experiences for producing and developing indicators. Hence, the developmental process indicators are to be measured at the local city level. The test this set of indicators selected in local city, Through the data and information in Misrata, In the end, hope to reach out for two objectives: a) To what extent has the city considered sustainable development? b) Are the selected sets of indicators able to give us an overview of local sustainable development?

## II. SUSTAINABILITY MEASURING INDICATORS:

Indicators clarify the extent to which sustainably is

affective, then we can judge where sustainability is reached or not. Also, the effects of dealing with the environment appears when we consider how fast resources are being consumed, how waste is generated and the speed by which waste can be converted into resources [1]. Indicators are crucial even when considering life in general, e.g. a smile is indicative of amicability, gray clouds indicated the possibility of rain, high temperature indicates sickness and high unemployment is an indicator of social problems. [2]. Single indicators are ineffective and hence, a set of varied indicators must be used to achieve specific goals and to evaluate sustainability [3].

## III. BASIC ORIENTOR THEORY OF SYSTEM AND RELATIONSHIP TO SUSTAINABILITY INDICATORS

(How can this theory be used to choose appropriate indicators to measure sustainable development?).

### A. Orientor Theory

This theory analyzes the differences of specific ecosystems based on hypotheses associated with the changing effects of the environment and its ecosystems. These hypotheses enable individuals to connect complex behaviors, as well as, connecting the necessary environmental interactions responsible for the evolution of ecosystem. It also enables us to monitor bundles of information through extracted conclusions. [4]. According to Müller F. et al., Ecological Orientations are essential for finding indicators that can be used to sustain healthy ecosystems. While Orientor Theory, has a strong relation with the principles of sustainability, through which its development can be explained. Thereafter, we can infer sustainable development indicators. [5].

### B. Essential Concepts – System:

Systems are composed of connected elements, which allow certain functions within its structure. In addition, we can explain these functions by presenting them to the system. A system has specific boundaries for input and output which gives it certain character and independence. See fig.1 [2].

### C. Systems' Classification:

Systems can be classified through the following determinants: [2, p.21]

- *Static systems:* They do not interact with their environment and do not change. Examples: a rock or a chair.
- *Metabolic systems:* They require a throughput of energy, matter or information to exist. Examples: a waterfall, a flame, a radio or a motor.
- *Self-supporting systems:* They have the ability to secure necessary resources (matter, energy and information).

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Examples: simple organisms or exploration robots running on solar energy.

- *Selective systems*: They can respond selectively to environmental challenges. Examples: organisms responding selectively to light, heat, water, acidity, and .... etc.
- *Protective systems*: They can protect themselves from adverse influences. Examples: organisms using or even constructing shelters.
- *Self-organizing systems*: They can change their system structure to adapt to changes in their environment. Examples: plants, animals, ecosystems or human organizations.
- *Non-isolated systems*: They modify their behavior in response to the presence and activities of other systems. Examples: competing predators or firms.
- *Self-reproducing systems*: They can reproduce systems of their own kind. Examples: body cells, populations or human organizations and culture.
- *Sentient systems*: They can experience pain, stress, emotions, and so on. Examples: animals and humans.
- *Conscious systems*: They can reflect about their actions and subsequent impacts. Examples: humans and primates.

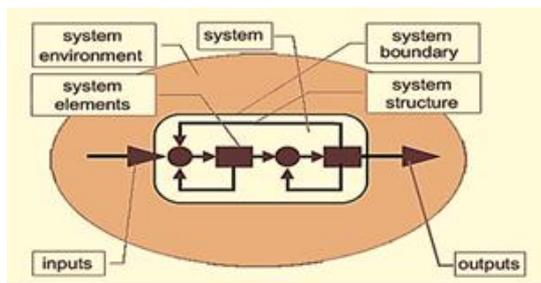


Figure 1. The system reacts with its own environment through the inputs and outputs of the system [2].

D. Oriantor star orientation Quantification of Biesiot:

The meaning of the Biesiot through the oriantor star referred to in fig. 2 the following facts: [2]

- The classification of Biesiot is an indicator for the percentage of the two time specific rates of the change in the specific amount. First response rate, Second : threat-rate or the time of rest verses the time of comfort
- If the response rate is bigger than the threat rate in this case the system can deal with the specific threat .but if the response rate is smaller then will be a sign of the threat the regime's survival.
- Using the classification rate Biesoit is to express the satisfaction of the basic oriantor of the system, and also to express the provision of the measuring indicators of Biesiot directly constitutes the survival of the regime ie. (Sustainability) and if any of the indicators is less than one so the system will be threatened.
- The status of system scalability survival become clear by drawing the values of the indicator values on the rays figure (hands) tend star as mentioned in the figure.

As we observe in the fig. 2, the circle in the middle of the diagram, on the surface the value represents one, the system is viable (sustainable), inside the circle the value is less than one, is not viable (no sustainability).

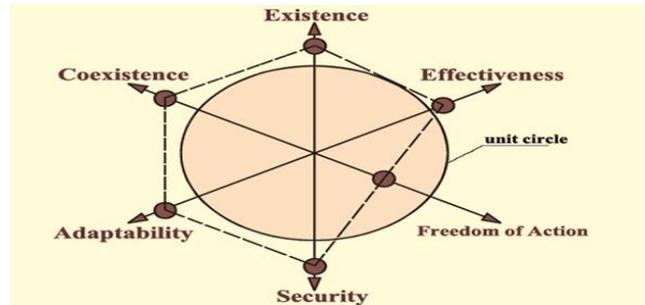


Figure 2. Star Trend for Indicators' Classification Biesiot [2].

IV. APPLICATION SAMPLE: THE CITY OF SEATTLE SET OF INDICATORS:

The Seattle indicators are all quantitative, on a local scale, and based on locally available data. This set of indicators (short names only) is presented in an oriantor-based scheme that corresponds to the three essential, functionally defined subsystems, i.e., the human, support, and natural systems. for example, seen in Fig. 3, the indicators for basic oriantor adaptability (A), in which the indicator "adult literacy" is used as a measure of the adaptability of "human capital" because it correlates with level of education and the ability to adapt to new challenges. The indicator "vehicle miles traveled and fuel consumption" is used to represent the adaptability of "built capital," where the dominance of road transportation indicates a limited ability to adapt the support system to, say, a fuel shortage. The indicator "biodiversity" measures the adaptability of "natural capital," i.e., species and genetic diversity, when it comes to maintaining the functions of the natural environment under changing conditions. [2] & [6].

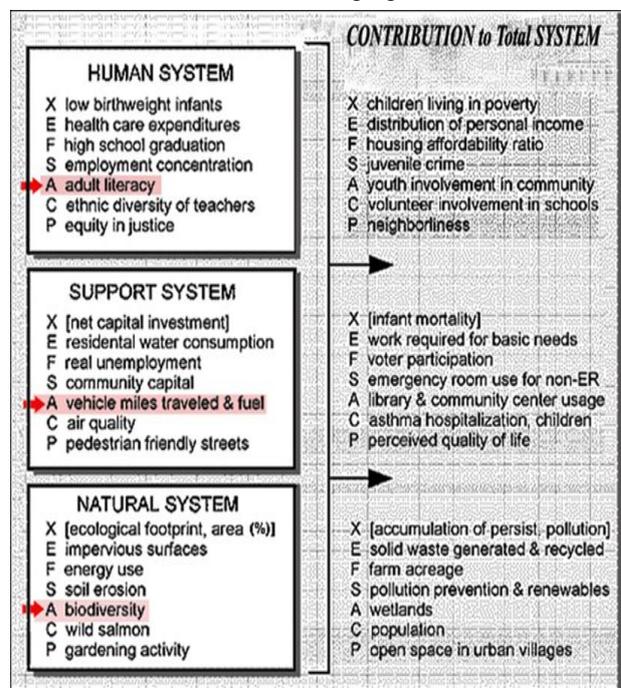


Figure 3. the sustainable development indicators of Seattle. [2] & [6]

V. THE INTERNATIONAL EXPERIENCES FOR PRODUCING AND DEVELOPING THE INDICATORS:

Examples: Sustainable Development Committee indicators (CSD), The Organization for Economic Co-operation and

Development Indicators (OECD), Global City Indicator (GCI), Sustainable Social Index (SSI):

#### A. CSD Indicators

These are set of indicators have been carried out by the UN for Sustainable Development. They consist of (50 main indicators, 46 other indicators) divided into 14 subjects and the most important characteristics of this set is its flexibility, and also can be calculated in most of the countries as the data is easily available or it is provided during a period of time at a reasonable cost.

#### B. OECD Indicators:

These indicators were carried out by the Statistical Office of the OECD, They consist of (111 indicators) divided into 37 sub- subjects, accordingly 12 main subjects, and its important characteristics is that they cover all the aspects of the welfare, they cannot be calculated on a comparable scale, and cannot be accumulated in one individual degree.

#### C. GCI Indicators:

These indicators were carried out by the International Bank with a company for some of the cities and consultant organizations, they consist of (26 main indicators, 27 support indicators) divided into 22 subjects and its important characteristics is its suitability for all the cities in spite of Geography, Culture, wealth, Economical forces.

#### D. SSI Index

These indicators were carried out by the sustainable Social Foundation; they consist of (24 indicators) divided into 3 subjects and then 8 categories and its important characteristics is its concentration on sustainability in general, on the national and regional levels, and they cover the human and environmental welfare, and the economical welfare is not the purpose

### VI. THE METHODOLOGY OF SELECTING THE LOCAL INDICATOR FOR URBAN SUSTAINABILITY

#### A. Stage - Setting goals

The purpose of producing and developing a set of indicators is to measure local urban development and to know our position regarding sustainability? This is an attempt to measure the un-measurable (L.D. Arthur's article "Measuring the Unmeasurable"). The difficulty is in the fact that human society is dynamic and sustainability is a balance through time. For this reason, indicators are used as procedures to process sustainability. [7].

#### B. Stage - Determining and selecting theoretical frame for the indicators:

To produce and develop indicators for measuring urban sustainability, we must select one of a number of dynamic frameworks. A framework has been developed "Theme - Integrated Systems" for this research based partly on: a) "Theme-based framework" which has been chosen and approved by CSD in 2001 [8]; b) "Bossel Mehtod", which incorporates Orientor Theory, and is used to evaluate system sustainability (total system and subsystems). [2] & [6].

The "Theme - Integrated Systems" is based on the

following principles:

- The City (Urban Environment): has a multitude of systems that are incorporated and subdivided into three main subsystems: Build Environment System, Natural Environment System and Human Well-being System. (fig. 4).
- With respect to this research, quantitative data was used exclusively after the approval of the selection of the indicators that measure urban development. "Case Study: Misrata"
- With respect to this research, local and international standards have been incorporated to develop a reference line graph by which local indicators were compared in order to determine the city's sustainability.
- Local indicators have been weighted differently to allocate importance to each of indicators so as to reach appropriate sustainability. "Case Study: Misrata"



Figure 4. Urban Environment System and Sub-systems. (source: the Author)

### VII. STAGE - DETERMINING SOME CONDITIONS

#### A. Standards or Thresholds

When sustainably, of the practical development process, is measured, there is no specific point or breaking point or a threshold of stoppage in order to sustain development. However, if we reach a close point of multiple thresholds, then, we would be in the right direction to reach sustainability. If we don't reach a close point, then, the developmental process would be in danger. Furthermore, if we choose appropriate thresholds in correspondence with indicators, we could accomplish sustainability. Standards are created to measure and judge the process of development, e.g. the World Health Organization's (WHO) standard of air quality it 50 micrograms per cubic meter, within a 24 hour period (PM10 of 50 micrograms per cubic meter) which can be a standard of this indicator. [9].

#### B. The Indicator weight or heaviness:

Weight or importance indicator in the specific place and time, or the weight value of the indicator or weight heaviness also. Accordingly in respect with using weight for the indicator - in this study- we will use an approach or a method of the "Questionnaire", based on: Delphi method: it is a way to restructure a set of effective practical communication in letting a group of individuals or experts to deal with a complicated problem. The main purpose of this method: to get a consensus of reliable opinions from a group of experts, through a series of intensive questionnaires interspersed with reactions for the views raised. [10]. and the technique will be as follow: put the selected set of indicators in the

questionnaire paper that includes (five levels of importance) and to be distributed on a group of experts: that they should have the knowledgeable and experience of the development processes and methods of strategic planning with respect to sustainable Urban development. Also, have a background and knowledge of the area of study. Through their answers for the questionnaire, we will conclude the weight of the selected indicators, In the study area "Misrata".

### C. Indicator selection:

According to the objectives and characteristics of the Urban Environment system in our local small and medium-sized cities, and consistent with the objectives of this study, the following basic principles were determined for the indicators selection:

- The indicator are selected which related to the urban environment, specifically, which have a relation with the place and environment in terms of social fluctuations which covers three elements of the system (Built Environment-Natural Environment-Human Welfare)
- The Importance: comes from where the indicator is directly related to the urban or population policy and related services, and should measure the results directly.
- The limited number: but the total in the content in terms of measurement and consistent with the privacy of study especially the time limitation and the capabilities to provide the data that cover the real image of reality, and then the number is limited and carefully selected.
- Easy Indicators: In terms of measurement and data are easily available and for a relatively long-period for example some data is ideally suitable for measuring sustainability but it is not available in all cities and lack of 'long-terms' statistics, such as the underlying gas emissions.
- Cost-Effective collection: The data collection cost should be at a reasonable cost for the selected indicators. At the same time, the indicators that have been selected, its data is available at the legal authorities and which are believed to be perfectly assembled.

### D. Transforming the quantitative data into a method to draw indicators:

Quantitative value units of each indicator were converted into another value that was used to create one amalgamated star shaped chart / graph of indicators. With regards to "Case Study: Misrata" the method was as follows: a) Determination of a value of each indicator (1-10) was based on obtained data after comparing it with local and international standards. for example, With respect to Misrata, the public green area per capita was, 9m<sup>2</sup> / per person. If we compare this to local and international standards, the value would be 4 degrees from a scale of 1-10. This was applied on all selected indicators. b) it will be Multiplication the value (1-10) that get each indicator in the weight or value of the indicator for the local City "Misrata". c) A graph / chart was developed after establishing actual values of each indicator in Misrata. It indicated a trend / path that reflect the needs of the city. [11] & [2].

## VIII. STAGE – INTRODUCTION ABOUT MISRATA CITY

The city of Misrata which has been known as: "Tobaktis, Zat-El-Remal, Zat-El-Shatekain" is one of the many commercial center established by the Phoenicians on the

north western regions of the Libyan coast, in 10th BCE. see Figure No. (4), Geographical location of "Case Study: Misrata", it is located in the north western region of Tripoli on the Mediterranean coast. The city center is 4 km south of the coast and 210 km east of city of Tripoli, and ca. 820 km west of Benghazi. The coastal highway passes through Misrata's southern section and it is the artery that connects eastern and western Libya. Misrata lies between the coastal agricultural zone to the western and southern desert zone, which makes it a stopping point for those who are traveling the northern coastal highway. In addition, it is an access point for all as it has a natural seaport "Qasr Ahmad Port" [12].

## IX. STAGE – THE INDICATORS SELECTED CHARACTERISTICS AND THE DATA IN THE STUDY AREA

### A. Natural Environment – Indicators

**Energy Consumption:** indicator - *Electricity consumption per capita per year:*

Energy is an important element in the development process. Rapid growth of the economy, demand for higher quality of life, then a larger increase in the consumption and that include the consumption of electricity. There is a connection between energy use and household spending on Electrical appliances. [14]. Diversified household electrical appliances. The most important household appliances powered by electricity: (Water Heater – refrigerator and Fridge -TV – AC). We conclude through the mentioned info that the individual consumption in the year during the period (2005-2010), and the average came: 5789 Kilo watt /p/year with (0.0025 %) [15]. As for comparing the individual consumption with the standards or the thresholds, principals and local and international specifications so the indicator takes (9.5 degrees) on (1-10) measurement in area of study.

**Water Consumption:** indicator - *Water consumption per capita per day:*

Water is one of the most important resources that life depends on it entirely. The person's share decreased the availability of fresh water all over the world from 16800 m<sup>3</sup> in 1950 to 7300 m<sup>3</sup> in 1995. [16]. In the area of study "Misrata"; There is large scarcity in the quantities of fresh water to supply the city and especially in the period in the latter. Noting that the area of study has got number of sources of water from: (Old Wells water, Tawergha wells –Sea water desalination station, industrial river water). and we conclude through the data given from (2010-2004 ) the average of water consumption came (243 liters/ person/ day), [17]. As for comparing the individual consumption with the standards or the thresholds, principals and local and international specifications so the indicator takes (5.5 degrees) on (1-10) measurement in the area of study.

**Pollutants:** indicator - *Household Waste per capita per person:*

According to the waste guide frame in the United Kingdom (EC/ 98/ 2008), identifies the waste as: "it is any material or thing which was thrown away by its owner or intend to or was asked to throw it" [18]. ]. While the amount of waste production of solid household waste in some cities accordingly: in some developing countries (1.44 kg/day/person), but in some developed cities is (0.96

kg/day/p.), [19]. In the area of study "Misrata"; The household solid waste often consists of: organic materials, paper, glass, metals, plastics, ... and others. There was a study on the mentioned area during 2005, 2010 on the amount of solid household waste: it ranges between (0.75 – 1.2 kg/ day/ p.) [20]. As for comparing the individual consumption with the standards or the thresholds, principals and local and international specifications so the indicator takes (4 degrees) on (1-10) measurement in area of study.

**Pollutants:** indicator - *proportion of population who are served with safe system for sewage collection:*

The presented indicator here indicates sewage water, Sewage and rates connection to the public network, to treatment stations of sewage water. All the standards show to safely dispose sewage water 100%. Sewage flow rate should be around 75% from the water consumption. [21]. In the area of study "Misrata"; Small number of connected homes with sewerage network. With the need to pay attention to what the sewage water may happen from many kinds of pollution in the region and this what many of studies aroused in area. We conclude through the data given that in 1980 the population was 70000 and the ratio of the people served by the network (18%), but in 2006 the population was 174456 and the ratio of the people served by the network (34%). [12] & [13]. It is observed that there is an improve in the area depending on the period, but it is considered away from the standards or the thresholds, principals and local and international specifications so the indicator takes (1.5 degrees) on (1-10) measurement in area of study.

#### B. Human Wellbeing – Indicators

**Individual Wealth:** indicator - *Personal disposable income:*

The personal disposal income is the total amount of the personal income minus the current personal tax. In the definitions of national accounts is personal income minus current personal tax equal personal disposal income (PDI). Minus personal expenses which includes large segment from the personal expenses, consumption expenses, savings, determines the capital of the individuals (Individual care) have a definite role in identifying the possibility of the public consumption [22]. In the area of study "Misrata"; With regard to this study, this indicator was measured through a questionnaire of a random sample in the area of study, and the categories were divided into 4 categories: "the first less than 400 L.D and the second from 400 – 800 L.D, the third from 800 – 1200 L .D and the fourth 1200 L.D" [23]. We conclude from the given data that the third category is the one which took high rate 59%, and because this indicator doesn't have the standards or local and international thresholds. Also because the ratio has become closer to the middle so the indicator takes (3 degrees) on measure of (1-10) in Area of study.

**Health:** indicator - *Life expectancy at birth in years:*

Life expectancy at birth indicates the average of expected number of years to be lived by the new-born if the prevailing patterns of mortality rates in a specific age group remained in the birth the same throughout the life .Most of life expectancy of a child at birth is an indicator for the mortality and health care circumstances [24]. ]. In the area of study "Misrata"; Generally in Libya, this indicator is measured Intervals and periodically is a

period not that close. We conclude through the given data that the average is (72.5 years) during the period from 1990-2007. [25], recently it is increased and this is a proof of the improvement of the medical services. As for the comparison of this indicator with the standards or the thresholds, principals and local and international specifications so the indicator takes (4.5 degrees) on measure of (1-10) in Area of study.

**Education:** indicator – *Student/ Teacher Ratio:*

Student ratio is defined to the teacher. i.e., the average number of students full time in at primary school for each teacher for full time, with agreeing on the beneficial effects of the small sized classrooms and the ratio of the teacher to the student, and its effect on the academic achievements of the students in the primary school, and this ratio is the important variable for measuring the human capital, the quality of education, the effects on the economy to invest in education, [26] & [27]. In the area of study "Misrata"; pre - university Education stage is divided into two stages : First: basic education and its period is 9 years (11.25%) student/ teacher. Second: Secondary and its period is 3 years (7.74%) student/ teacher. [25]. We conclude: through the data of the area of study is the large disparity between the basic education and the secondary education and this could be good because the secondary stage came to be the low value. regarding to the comparison between these ratios with the standards and the local and international thresholds this indicator takes (3.5 degrees) on measure of (1-10) in Area of study.

**Culture:** indicator - *Number of cultural establishments per 100,000 populations:*

Cultural institutions has become one of the important elements in the communities, particularly urban community of which due to population growth and increase in the proportion of youth and leisure time. There is a relation between cultural institutions and structure of age and education level and professional activity and general social structure in the city .As an example the library in the city should serve all age groups in the community. In the area of study "Misrata"; Culture centers are very few not only the quantities but also the qualitative, however we can keep tracking its numbers and its proportion of the population, as they were 3 cultural centers (culture city Center, Alzawraq, Almahgoub), population of inhabitants (138857 - 27926 - 25972) respectively. [28]. We conclude: From the data of the area of study and comparing them with the standards of the local area and considered to be good or more than good, i.e., two of them good or specifications (70%). but, as for the last one of specifications it were under level. So this indicator takes (4.5 degrees) on measure of (1-10) in Area of study.

#### C. Built Environment – Indicators

**Urbanism:** indicator - *Ratio of Land Consumption to Population Growth:*

This indicator measures the consumption of the land, i.e., the increase in the urban land area of versus the increase of population. in other words, population growth with time needs land to build residential buildings and services, from the observation, that the area of study, the urban crawl on the area of the land in recently and as a result of several factors. We conclude: through the data in the area of study, the increase in the population proportion was (149%), against which the increase in space was (195%) for the period (1980-2006), and this considered a big difference represented

1.3%. in spite of the comparison of the real situation for the year 1980 with the expectations for the year 2000, according to the standards of all the services in the area of study the rate 0.6% . [12]. The increase better than the decrease in the first, and this is the proof that the proportion of the land consumption against the population growth in fact it is very big, accordingly, this indicator takes (9 degrees) on measure of (1-10) in Area of study.

**Housing:** indicator - *Rate of Urban density per hectare:*

Urban density is the ratio of total population in the urban area to the total area. [29]. Urban density can be used as an indicator on the extension or overcrowding. therefore have the ability to be useful in relation field of study between: Built Environment, Natural Environment, and Human well-being. In the area of study "Misrata"; we conclude through the data that the urban density in 1980 (27%). But in 2006 (23%) and 2010 (15%). [12]. It is observed that there is a decrease in density overtime, and this is evidence that the increase of the urban land in the meantime there is a decrease in the population in the hectare. As for comparing this ratio with the standards or thresholds or the fundamentals, local and international specifications, so this indicator takes (2 degrees) on measure of (1-10) in Area of study.

**Public Space:** indicator - *public green area per capita:*

Green Zone "is the area that does not include any buildings and paved areas, and include vegetation, whether trees or plants" [30]. The average of public green space (meter square) per person, indicates or shows the total green space for all the open areas for the public in the city. In the area of study "Misrata"; we conclude through the data given that the share of the person in 1980 was (38 m<sup>2</sup>/p), but for 2006 was (9 m<sup>2</sup>/p). [12]. When we compare them with the local standards, they will be included but if we compare them with the standards or the international thresholds, they will be low, so the indicator takes (4 degrees) on measure of (1-10) in Area of study.

**Public Transportation:** indicator - *Ratio of car ownership per 1,000 persons:*

The increase of population and the expansion of urban areas has resulted the increase in the means of transportation. It has become a part of the daily life in the urban areas, and providing the access and mobility that is required by the society and economy, but in the meantime it raises the threats for the environmental quality and human welfare. [16]. Along with its benefits transportation presses on the human health and environment in variable ways, like the emissions of the emission exhaust contributes in polluting the air in the urban areas. [31]. In the area of study "Misrata"; has witnessed a rapidly growing number of cars recently, it has become 24860 car in 1996 at rate one vehicle per 8.5 (or 10 vehicle for 85 person), and also in 2006 reached 81474 vehicle at rate 3.3 person (or 10 vehicles for 32 person). [32]. We conclude from the data given that the escalation of car ownership until it reached in the last period to 384 vehicles / 1000 person, and when we compare it with a developed country particularly and the average was 613 vehicles / 1000 person so the indicator takes (3 degrees) on measure of (1-10) in Area of study.

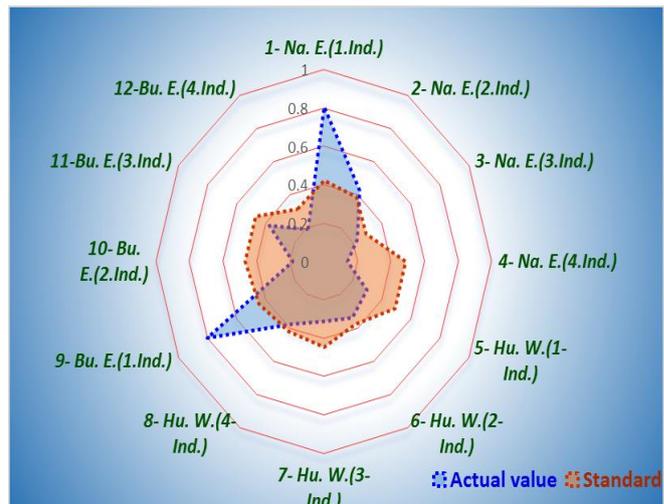


Figure 5. A Diagram shows the real value of indicators in the area of study. (source: the Author).

Table 1. population and area of the area study "Misrata"

	Year 1980			Year 2006			Year 2010		
	population	Area (ha)	% Person/ha	population	Area (ha)	% Person/ha	population	Area (ha)	% Person/ha
Misrata city	70 000	2 611	28	174456	7 695	23	191215	7 695	25
Mayor of Misrata	118000	118310	1	272891	118310	2.31	299541	118310	2.53

Source: (Bakeer, M. A., 2006) & (PolSERVICE, 1980, Vadeco).

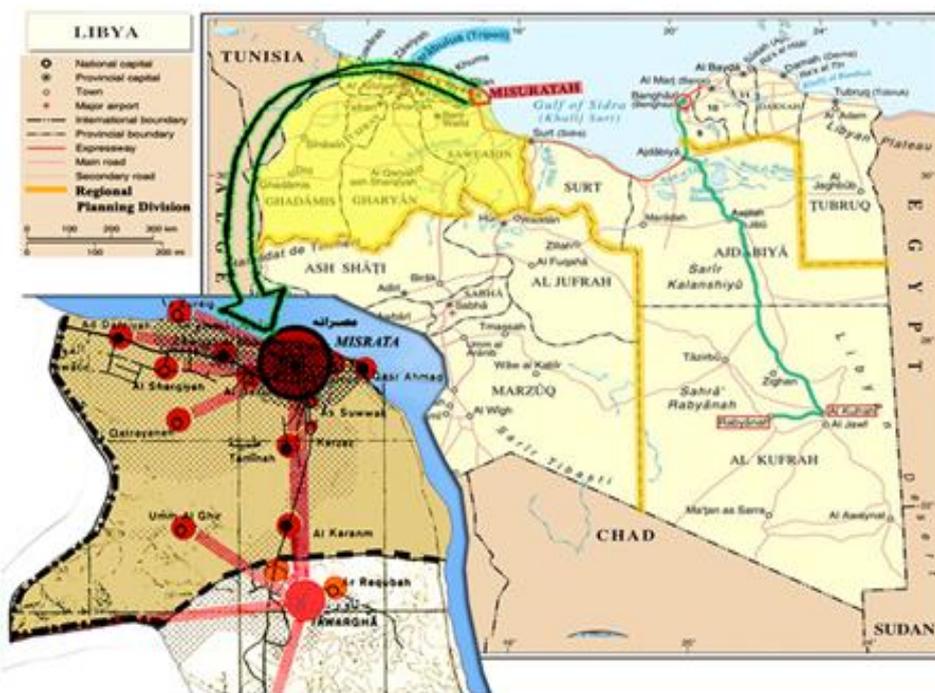


Figure 6. Geographical location, the area of study "Misrata".  
Source: (Bakeer, M. A., 2006) & (PolSERVICE, 1980, Vadeco)

Table 2. Urban Development Indicators and the value of the data in the area of study "Misrata"

(source: the Author)

	main topics	sub-topics	Indicator	weight	Indi. value	Actual value
Sustainable Urbanism Indicators – Local (SUI-L)	Natural Environment	Consumption	1. Electricity consumption per capita per year.	0.0847	9.5	0.805
		Consumption	2. Water consumption per capita per day.	0.0770	5.5	0.424
		Pollutants	3. Household Waste per capita per.	0.0580	4	0.232
		Pollutants	4. Percentage of city population served by wastewater collection.	0.0934	1.5	0.1401
	Human Well-being	Wealth	5. Personal disposable income.	0.0979	3	0.294
		Health	6. Life expectancy at birth in years.	0.0758	4.5	0.341
		Education	7. Student/ teacher Ratio.	0.0892	3.5	0.312
		Culture	8. Number of cultural establishments per 100,000 population.	0.0845	4.5	0.3803
	Build Environment	Urbanism	9. Ratio of Land Consumption to Population Growth.	0.0890	9	0.801
		Housing	10. Rate of urban density per hectare.	0.0936	2	0.187
		Public Space	11. Public green area per capita.	0.0934	4	0.374
		Transport	12. Ratio of car ownership per 1,000 persons.	0.0635	3	0.191

## X. CONCLUSION

The process of measuring development in a local city gives the opportunity to be more objective when using measuring tools (indicators). When indicators are used in proper context, they help in directing sustainable development. It also helps decision makers to choose alternatives within the development process. It is of importance to conduct studies, such as this one, before the commencement of local urban development to determine benefit / difficulties. Such studies help to determine the role of governmental and non governmental entities. In addition, studies help can help decision makers to select different policies for the overall developmental process. There are many consequences (indicators) that we can use in order to measure local urban development. How can we choose appropriate and sensitive components that have utmost importance? According to the above we can conclude the following points from this research:

- ❖ This research resulted in our understanding of local indicators to measure urban sustainability, by the utilization of international theories and experiences. It concluded: a city should be subdivided into three main systems (Built Environment, Natural Environment, and Human Wellbeing), which in turn are used to divide the indicators.
  - ❖ This research highlights the importance of understanding the system and of its related components as: total systems, subsystems, integrated systems, the viability of a total system is largely dependent on subsystem, complex system and sustainability which is the balance between systems.
  - ❖ To increase the effectiveness of local indicators was accomplished by weighing each indicator independently so as there will be a relationship between its place and time. Due to the dynamism of developing society, we considered the importance of the indicator and how it changes through time and place. Therefore, the weighted indicator is used to adjust the process.
  - ❖ In this research quantitative data of selected indicators was classified and presented graphically to measure local urban development of Misrata. Graphs / charts quicken the process of observation, comparison and understanding.
- In addition to the aforementioned, three crucial points are emphasized:
- Applied research / studies must be supported with respect to the development of indicators to measure sustainable local urban development.
  - We should create awareness raising programs that caters to different segments of society, so as to have comprehensive sustainable development.
  - The creation of a national institution that has local branches in small and medium sized cities is crucial. Data should be collected regarding their populace by using advanced technologies that will help to develop indicators and nutrition of data.

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