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Determining the Indicators of Sustainability to Be Achieved in New Cities and Urban Communities

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Abstract
Indicators are one of the effective mechanisms for achieving and measuring the targeted progress of urban communities at their different levels towards the desired and planned results for development, and to determine the indicators of sustainability to be achieved in new cities and urban communities. Some sustainability rating systems for residential neighborhoods in different countries will be studied, as well as the Egyptian Rating System (Gprs). And extracting the most important indicators and determinants of sustainability that you use to evaluate buildings and residential neighborhoods, as well as studying some other aspects that help to reach the sustainability indicators that are required to be achieved at the city level, and through this, the most important sustainability indicators will be reached and limited as basic indicators for achieving and measuring sustainability in new cities and urban communities, and it is possible to add or delete Indicators, including according to the nature of the cities (tourist - industrial – coastal-….) .

Index terms - indicators of sustainability, sustainable development, sustainable urban development

1- **Measuring development** :
There is a famous saying in management science that says (what cannot be measured cannot be managed). Therefore, indicators are considered one of the most effective mechanisms for measuring the extent of targeted progress of urban communities at different levels towards the desired and planned results for development. On the other hand, these indicators represent, in their entirety, a solid and realistic ground for the decision-making process. Efficient development (4). In terms of its effectiveness in measuring development rates, it presents a standard numerical vision that can be calculated and integrated into equations and compared to cities or other countries periodically so that it gives a clear picture of the state of development. Or a regression in achieving the goals of sustainable development plans for urban communities.

2- **The importance of sustainability indicators**:
Development indicators serve many purposes. They measure and track the rate of achievement in implementing development strategies, policies, and programs in a city or region. They provide the decision-maker with comprehensive and integrated information about the reality of the current situation in his city or region. They act as a guide for him in setting goals and priorities for development plans6. It also raises warning signs early in the implementation of any development plan or strategy, and through it a comparison can be made between urban communities transversely (across different places) or longitudinally (across different time periods), and it also raises the level of citizen awareness of the reality of development in His city or region, and the indicators represent the analytical aspect of planning. Therefore, their credibility and stability are vital when choosing them as planning tools. In order for the indicators to be successful in their mission, they must be an effective guide in the process of changing society's priorities, in the process of decision-making and policy-making, as well as in The behavior of individuals and institutions .

3- **Measuring performance in urban management (concept-importance) and its relationship to development indicators:**

3-1-**The concept of performance measurement**:

It is the collection of data in an organized and objective manner to determine the efficiency and effectiveness of services and to achieve the desired goals. (7)

3-2- Performance measurement is linked to development indicators as follows:

The lack of measurable quantitative indicators weakens the planning process and directs efforts to achieve these goals.

- Focusing on traditional oversight is no longer sufficient to judge the real performance of many public sector agencies, which weakens the accountability process and makes it lose its desired role in reform and development.
- Quantitative measures of government performance are considered a basis for including the administrative and institutional dimension in development plans and calculating budget estimates required to meet the activities of each agency.
- Quantitative measurement of the performance of government agencies that pushes them to make efforts and make good use of resources to achieve the specified goals with the required efficiency and effectiveness.
- The increasing difficulties facing financing, which require new ways to improve performance and the existence of indicators that facilitate the process of measuring and directing performance and controlling and rationalizing aspects of expenditure (6).

4- Principles of Key Performance Indicators : (9)

Comprehensiveness: The set of indicators should include all aspects of smart sustainable cities, and the assessment indicators should be aligned with the subject being measured, i.e. information and communication technology and its impact on the sustainability of cities.

Comparison: The KPIs should be defined in a way that allows data to be scientifically compared between different cities according to different stages of urban development, which means that the KPIs should be comparable in time and spatial.

Availability: KPIs should be quantitative, and historical and current data should either be available or easy access.

Independence: KPIs with the same dimension should be independent or nearly orthogonal, ie overlapping KPIs should be avoided as much as possible.

Simplicity: The concept of each indicator should be simple and easy to understand for urban stakeholders, and the estimation of the accompanying data should also remain intuitive and simple.

Timeliness: This principle refers to the ability to produce key performance indicators commensurate with emerging issues in building smart sustainable cities.

5- **The concept of innovation in determining public administration indicators**:

Finding a successful, creative and unique solution to serious problems or a solution to old or already existing problems and introducing elements or a combination of serious elements that contribute to finding innovative solutions or an important change in a traditional work method, and finding indicators that can be quantitatively and qualitatively measured to evaluate those solutions, and innovation is not a closed solution, but It is an open solution that is changed by those who adopt it. It has several types (institutional - organizational - operations - concept.(

8From the foregoing, it is clear the importance of having measurable indicators that help urban management achieve development goals, the role of measurement in it and the importance of innovation, and that it is a means to improve the quality of life for all citizens. And its importance in indicating and monitoring the extent of progress of these societies towards achieving their goals. It also deals with the process of building indicators in society.

6-Digital transformation and its importance towards achieving sustainability in smart cities : (10)

The set of people-oriented tools for the digital transformation of cities and communities supports the development of strategies and planning for the digital transformation of cities and communities to promote a

sustainable, inclusive, resilient and improved quality of life for residents of new cities and urban communities .

A figure showing the digital transformation of cities and the connection of businesses and activities to electronic devices and sensors.

Source : https://www.nile.eg/

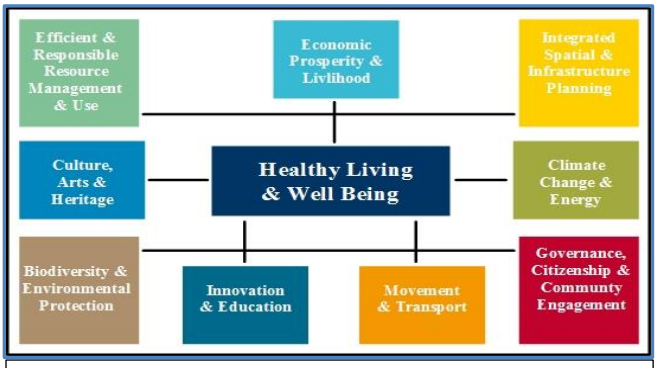


Figure (1-2) shows the main elements for achieving sustainability
Source :Thinking about Healthy Living, by Dr. Donal O'Gorman, Dublin City University, available http://www.fifthprovince.ie/blog/thinking-about-healthy-living-dr-donal-ogorman-dublin-city-university, available at 10/3/2013.

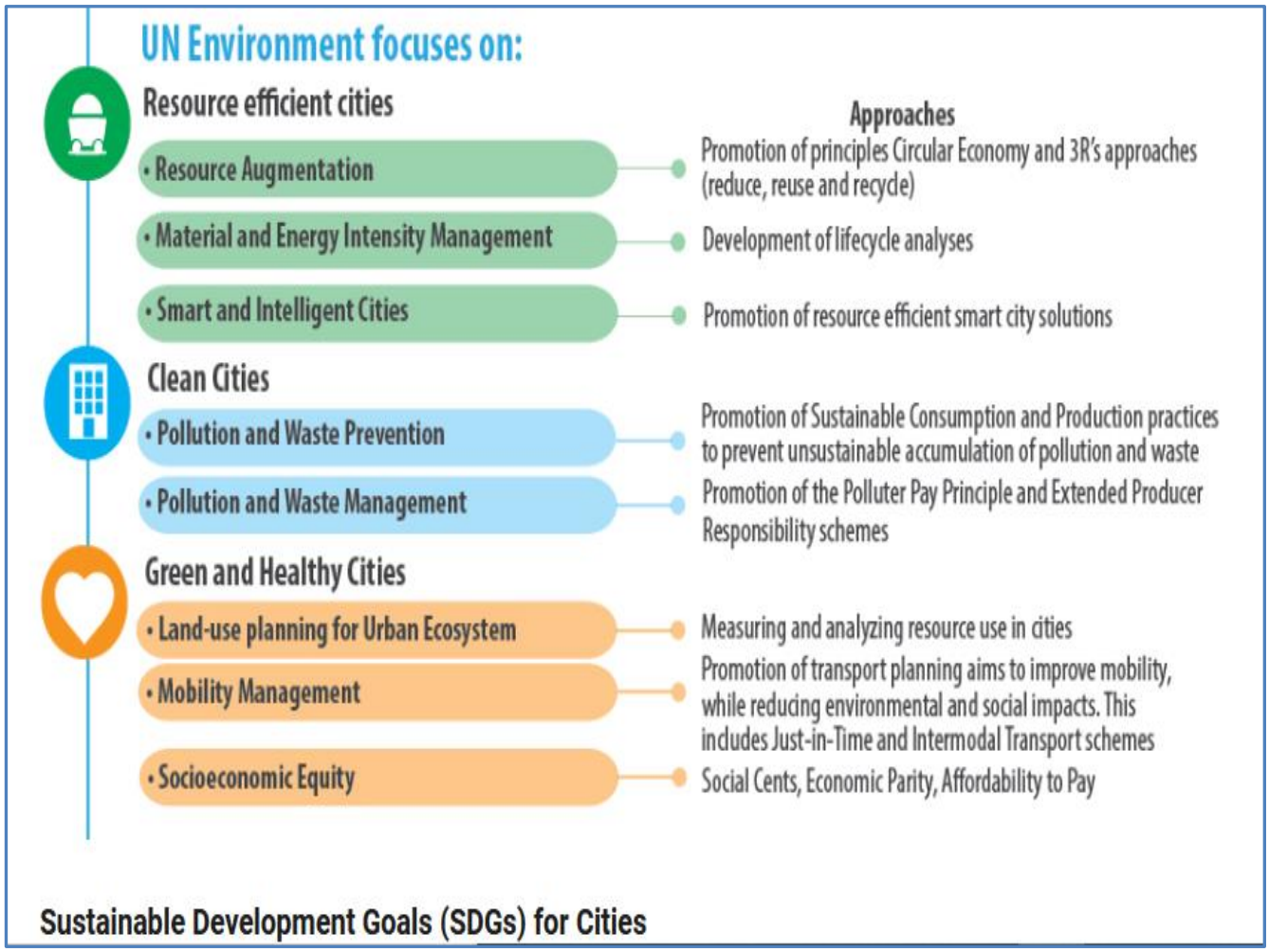
7- **Sustainable urban planning** :

Sustainable urban planning is the process that achieves and works to create sustainable residential communities, especially cities, and it includes sustainable construction as well as creating a social and economic system that supports sustainable development, and sustainable urban planning is a multi-dimensional process, and the decision-making process in it differs from normal planning methods, and this means transition From the decision-making process on the basis of a specific specialization or a specific sector to a more comprehensive process that takes into account all aspects and different dimensions, takes great importance on the opinions of the local community and motivates citizens to share their opinions, as well as the decision-making process depends on the volume of available data, which has become abundant in light of technological development and Ways to collect data in what is known as big data.

8- **Sustainability indicators to be achieved in the new cities**:

Governments seek to achieve indicators of sustainability in new cities, which reflect positively on their lifestyle, as well as work to achieve the quality of life of the population and motivate them to participate in

the management of cities by giving opinions, volunteer work and interaction with the city administration by evaluating the services provided to work on its development and improvement of its course on an ongoing basis.



A figure illustrating the sustainable development goals in the new cities.: SDG 11: Sustainable Cities And Communities
Source : Worldwide known sustainability rating systems | Download Table (researchgate.net)

In order to determine the indicators of sustainability to be achieved in new cities and urban communities, some sustainability rating systems will be studied in different countries, as well as the Egyptian Rating System (Gprs), and the indicators and determinants of sustainability that you use to evaluate buildings and residential neighborhoods will be extracted and their compatibility with them will be determined in order to determine the determinants of sustainability to be achieved in New cities and urban communities.
In order to achieve these goals, it is necessary for the new cities and urban communities management system to be able to manage all activities, services and facilities efficiently and in a manner that achieves sustainability indicators on an ongoing basis. Sustainability elements, which in turn is concerned with the operation or maintenance of a facility or service within the city, which reflects in a positive way on the quality of life, which is the largest goal that countries and governments seek to achieve. And adjust the planning according to the results.

9- **Sustainability assessment systems in different countries around the world**:

9-1- Inventory and compilation of sustainability indicators for a group of global sustainability assessment systems as well as the local assessment system to determine the most frequent and important indicators: (3)

Rating System	Countries	Year of Launch	Organization(s)
LEED	International	1998	US Green Building Council (USGBC), Canada Green Building Council (CGBC)
Green Globes	US and Canada	2002	Green Building Initiative (GBI), BOMA Canada, ECD Energy and Environment Canada
LBC	International	2006	International Living Future Institute
BREEAM	International	1990	Building Research Establishment (BRE)
SBTool	International	1996	International Initiative for a Sustainable Built Environment (iiSBE)
CASBEE	Japan	2001	Japan Green Build Council (JaGBC)
Green Star	Australia	2003	Green Building Council Australia (GBCA)
ESGB	China	2006	Ministry of Housing and Urban Rural Development of China (MOHURD)
BCA-GM	Singapore	2005	National Environment Agency
HK BEAM	Hong Kong	1996	BEAM Society

A figure showing the sustainability assessment system for residential neighborhoods in different countries around the world.

Source :Green Building Rating Systems as Sustainability Assessment Tools: Case Study Analysis: IntechOpen

Category		Sustainability indicators	local standard	international evaluation standards					
			GPRS	DGNB	N	PEAR	CASBEE	BREEAM	LEED
environment and biodiversity	Heat island phenomenon	Reducing the phenomenon of heat islands	*	*	*	*	*	*	*
	earth / soil	Rehabilitation of contaminated land	*			*		*	*
		Soil protection		*			*		*
	Favorite sites	the appropriate site for development operations	*		*		*	*	*
	ecosystem networks	ecosystem networks				*	*	*	
	Atmosphere	Earth's atmosphere	*		*		*		
	Protect green fields	Protect green fields					*	*	*
	Avoid flooding	Avoid flooding					*	*	*
	aquatic environment	Preserving water bodies	*	*	*	*	*	*	*
		Groundwater conservation					*	*	*
	Biodiversity	Habitat protection (plants-fauna)	*	*	*	*	*	*	*
		Protecting the environment from pollution	*	*	*	*	*	*	*

resources	energy	Energy efficiency	*	*	*	*	*	*	*
		Reliance on renewable energy sources	*	*		*	*	*	*
	water	Efficient water use inside buildings	*	*	*	*	*	*	*
		Efficient water use outside buildings	*			*	*	*	*
		Rainwater management		*	*	*	*	*	*
	Building materials	Regional building materials	*			*			
		Use of local building materials	*			*	*	*	*
		Reuse of building materials	*		*	*			*
	Waste management	Efficient waste management	*	*	*	*	*	*	*
ruling administration	Awareness and participation	Awareness and participation	*	*	*	*	*	*	*
	Transparency	Transparency		*				*	
	local institutions	local institutions			*				
the local economy	employment	employment			*			*	*
	investment	Local investment in local products	*	*	*	*	*	*	
	local production	Cultivation of food products		*	*	*			*
Transportation	Public transport	connected street network		*			*	*	*
		Access to public transportation	*	*	*	*	*	*	*
		Public transport services					*	*	*
	cycling network	cycling network		*			*	*	*
		Cycling facilities					*	*	
	Car parking	Car parking spaces					*	*	*
	Pedestrian paths	pedestrian path network		*		*	*	*	*
place industry	public spaces	public spaces		*		*	*	*	*
	Close to work	Close to work						*	*
	density	Density to reduce flight distance			*	*		*	*
	Overall design	Overall design		*	*	*	*	*	*
	communication	communication		*	*	*	*	*	*
	green buildings	green buildings			*			*	*
	green infrastructure	Integrated infrastructure system	*	*	*	*	*	*	*
	Accompanying	Availability of services and facilities		*		*		*	*
	Disasters	Disaster prevention					*	*	
	Hassle	Reduce noise pollution	*	*			*	*	*
	Mixed uses	Mixed uses		*		*		*	*
local community	education	education					*	*	*
	the health	Preserving the public health of citizens	*		*		*	*	*
	Diversity	diversity within the neighborhood		*		*		*	*
	housing prices	Affordable housing			*			*	*
	Safety	Safety		*	*	*	*	*	*

	heritage	heritage	*		*		*		*
	the culture	the culture	*	*	*	*	*	*	
	ID	ID		*				*	
innovation	innovation	innovation	*		*	*	*	*	*

9-2- **Quantifying and comparing sustainability indicators in sustainability assessment systems for residential neighborhoods in different countries around the world and the Egyptian assessment system :**

And by studying the previous table and using the comparative analytical approach of indicators related to residential neighborhoods in the international evaluation systems and the Egyptian evaluation system (National Center for Housing and Building Research, 2019) and by identifying the indicators that were repeated in more than one system and taking into account the Egyptian case and the indicators that the evaluation system focused on We extract a list of indicators and fields and arrange them according to their importance and frequency, as in the following table:

9-3- **A final list of evaluation indicators for residential neighborhoods according to the international evaluation standards and the local standard:**

Classification	Sustainability indicators for residential neighbourhoods
environment and biodiversity	Air pollution rate
	The technique used for environmental remediation of contaminated soil
	The influence of the topographic factor on site selection
	Mitigating the effect of urban heat island phenomenon
	The mechanical technique used to purify polluted water bodies
	Extinction rate of threatened species of plants and animals
resources	Designing the building with the passive solar design system for the residential groups
	Percentage of reliance on renewable energy sources
	The rate of water consumption inside the building
	The amount of recycled waste
	Percentage of waste water consumption (gray water) outside buildings
	Use of local building materials available on site
	Use of recyclable and reusable building materials
Transportation	A network of pedestrian paths
	Degree of dependence on public transportation
	Percentage allocation of a connected network of bicycle paths
	The degree of connectivity within the neighborhood
place industry	General void ratio
	A design that takes into account the needs of children, vulnerable groups and the elderly
	Distributing services within the appropriate walking distances for the residents of the area
	Availability of services and facilities
	Integrated infrastructure system
	How close the uses are to each other

	Mixed land uses
	The means used to mitigate the noise sources on the site
	percentage of green spaces
the local economy	**Growing food products on balconies or on rooftops**
	The availability of job opportunities through the cultivation of local products within the neighborhood
local community	**Design with safety in mind**
	Heritage preservation
	Preserving cultural identity
	Disease prevalence rate within the residential community
	The extent of diversity within the neighborhood
ruling administration	**The degree of participation of community members in planning for the future of the residential neighborhood**
	Participation of NGOs
innovation	**Innovation in design and construction industry**

Since the city consists of a group of interconnected residential neighborhoods that are different in construction, social and economic levels, we may find some residential areas with a high level of luxury and quality of services, and some other residential areas or neighborhoods of a medium level and others of an economic or popular level, but they are in As a whole, the city whose management seeks to achieve sustainability indicators.

Therefore, the sustainability indicators that were listed in the previous table are what is required to be achieved at the level of residential neighborhoods, so they are considered the basis on which we will build until we reach the sustainability indicators that are required to be achieved in the new city.

10- **Studying the determinants and other aspects that affect the sustainability of the city**:

10-1- **United Nations Sustainable Development Goals**: (5)

The sustainable development goals set by the United Nations (seventeen goals) are the compass that directs development programs in most countries towards achieving sustainable development. They can be summarized as follows:

- Poverty eradication.
- Complete eradication of hunger.
- Good health and well-being.
- Good education.
- gender equality .
- Clean water and sanitation.
- Clean and affordable energy.
- Decent work and economic growth.
- Industry, innovation and infrastructure.
- Reducing inequalities.
- Sustainable cities and communities.
- Responsible consumption and production.
- Climate action.
- life under water.
- life on land.
- Peace, justice and strong institutions.
- Contracting partnerships to achieve the goals.

An image showing the United Nations Sustainable Development Goals, which are in line with Egypt's Vision 2030 .Source : https://arabstates.unwomen.org/ar/what-we-do/sdgs .

From studying the goals of sustainable development of the United Nations and the efforts of governments to achieve them, it is possible to add some indicators of sustainability that are required to be achieved in the city to ensure that the urban management in the city is directed towards achieving these goals to the indicators previously reached at the level of the residential neighborhood as follows:

- Good level of education.

- Support programs for preserving heritage and culture.
- Raising the level of the local economy.
- Responsible consumption and production.
- Social Justice .
- Gender equality and reducing inequalities.

10-2-**The components and characteristics required to be available in smart sustainable cities:**

From studying the characteristics and components of smart cities and sustainable cities, we find that despite the different priorities and purposes of smart cities, they all share three main features as follows:

- Infrastructure of information and communication technology.
- The carefully defined integrated management framework for the smart city.
- smart users.

In view of the previous items, we find that the first item, which is the information and communication technology infrastructure, is one of the main items required to be achieved in smart cities or fourth-generation cities, as these cities depend mainly on information and communication technology in the areas of managing and operating all facilities, as well as interacting with society and monitoring all facilities remotely. By using sensors, cameras, and sensors, and collecting this data in control rooms to analyze it and make decisions on its basis, as well as to control the appropriate timing to prevent problems from occurring, as well as using smart card technologies to collect bills and payments and renew subscriptions and licenses, which facilitates these procedures for citizens, which reduces movements and daily trips Which has a positive impact on the environment by reducing car exhausts, as well as regularity in the performance of services and achieving the quality of life for residents. As for the third item (smart users), users must have the required technical skills that allow them to interact with smart services and make maximum use of them. The role of smart cities extends to include training residents to use smart devices as they should.

10-3- **Structure of urban management in some sustainable cities globally**:

From studying the administrative structure of some sustainable cities globally, an example of which is the city of Dubai, and with a focus on sectors related to city management and directing them towards sustainability, we find that the existence of a management capable of implementing and activating sustainability indicators is very important. At the city level, the importance of sustainable urban management is evident in terms of working to implement the master plan. The city shall follow up on its implementation, inspect on site, and review drawings and designs before issuing licenses to ensure the implementation of sustainability conditions for all buildings and facilities, whether at the design stage, preparing plans or during operation.

10-4- **Sustainability indicators to be achieved in new cities and urban communities:**

By studying and listing the sustainability indicators required to be achieved in residential neighbourhoods, and studying some other aspects that help to reach the sustainability indicators required to be achieved at the city level, the United Nations Sustainable Development Goals have been studied, the components and characteristics required to be available in smart sustainable cities, the urban management structure in some sustainable cities globally and through The most important indicators of sustainability to be achieved in new cities and urban communities were reached, and they are confined to the following table:

sector	Indicators of sustainability to be achieved in new cities and urban communities	Notes
environment and biodiversity	Air and soil quality	It was derived from the sustainability indicators of the residential neighbourhoods
	Flat distribution and site coordination	
	Water quality	
	Biodiversity	
Resource control and recycling	Energy efficiency	It was derived from the sustainability indicators of the residential neighbourhoods
	Water efficiency	
	Waste recycling	
	Resource Management	
transportation	Bicycle and pedestrian networks	It was derived from the sustainability indicators of the residential neighbourhoods
	City connectivity	
	Organizing public transportation	
The quality of the place	Organizing and beautifying public spaces and green spaces	
	Facilitating the movement of children, people with vulnerable groups and the elderly	
	Services, facilities and infrastructure	
	Land uses	
	Reduce noise and audio pollution	
	Improve the visual image of the city	
the local economy	Resource management and development of economic opportunities	It was derived from the sustainability indicators of the residential neighbourhoods
	Job opportunities from local projects	
	Responsible consumption and production	It is derived from the United Nations Sustainable Development Goals
the society	Heritage and culture	It was derived from the sustainability indicators of the residential neighbourhoods
	Public Health	
	Safety standards and parameters	
	Social activities	
	Social Justice	It is derived from the United Nations Sustainable Development Goals
Community participation	Community participation	It was derived from the sustainability indicators of the residential neighbourhoods
	NGOs	
	Activating boards of trustees and unions of occupants	
Innovation and renewal	Innovation and scientific research	It was derived from the sustainability indicators

		of the residential neighbourhoods
Information and Communication Technology	Information and communication technology infrastructure	It was derived from the components of smart cities
	User training	
	Software and technical support	
	Center for Geographic Information Systems	
Coordination and relationships	Coordination with the local administration	It was concluded from a study of the method of overcoming problems and the causes of deficiencies in the management
	Coordination with local units	
	Relationships with the higher level of urban management	
	Relations with executives and people	
	Relations with ministries	
	Relationships with utility companies	
Urban management	(electricity - water - gas - sewage)	It was concluded from a study of the urban management structure of some sustainable cities in the world (Dubai).
	Studies and urban plan	
	sustainable executive planning	
	Public projects and their conformity with the determinants of sustainability	
	Evaluating the sustainability and safety of buildings	It was concluded from a study of the urban management structure of some sustainable cities in the world (Dubai).
	Human Resource Management	
permanent operations center	Financial management (sustainable economy)	It was drawn from a global study of the management and operation of sustainable cities
	Crisis Management Centre	
	Monitor and control center	
	Facilities and Services Follow-up Center	

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