The Mechanisms of Achieving a Smart city

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Abstract:-

Today, our world witnesses changes, notably population growth and the economy, which are concentrated in urban areas through the emigration from suburbs to urban. These changes mainly affect environmental resources and the entire infrastructure, especially in the city centers. However, energy consumption in cities is 75% out of global energy consumption. Especially the consumption includes waste in energy consumption and transport, resulting in a rapid improvement in the standard of living and an unprecedented rise in urbanization and urbanization. This growth in urbanization requires effective control of the consumption of resources and infrastructure, development of the traffic system control pollution, energy consumption. The problem of research has emerged in the absence of conventional solutions to address the problems of high growth in urbanization, specifically, the absence of a clear methodology on the use of smart strategies to manage urban issues. The structure is based on three phases: First: Current challenges for the Smart City and Sustainable City: The second phase is the working areas of the Smart City; and the third is an applied study of selected models.

Keywords— Smart city , Sustainablilty , Urban transformation , Urban Democracy decision .

Introduction

Technical development that accompanied the end of the twentieth century and the beginning of the twentieth century, which has encouraged the emergence of ICT impact on the form of life and the performance of the various activities, which was produced a community that relies on knowledge and digital technology and leads various activities through virtual means, instead of the usual means [1]. This kind of societies has been associated with the emergence of changes in the urban structure, and this led to the emergence of cities rely on information and communications and artificial intelligence techniques, called smart cities[2] , allows communities to develop their capacities at various levels and technical areas of smart city . The smart city applications include several fields, including services, industry, the environment and the

economy; also play an important role in finding solutions to the determinants of urban issues, Immigration and rapid improvement in living standards lead to the achievement of an unprecedented rise in the levels of urbanization. However, this level of urbanization requires control of effective resources and infrastructure development, and control of traffic congestion and pollution levels; the complexities of social and economic that came with the process of urbanization increase the impact of challenges. It is therefore considered to absorb and apply the concepts of smart city - which is the most important component technology indispensable. Also, the increase of these problems is considered as the aim of this study that role the smart cities applications to find solutions to these problems.

Phase One: current challenges of smart city and Sustainable city

1-1 smart city

In the following, we look into five developments that can be seen as the seeds from which the concept of Smart Sustainable Cities has grown.

1-1-1 Climate and Environmental Issues

The change in climate is the most urgent issue that the world faces these days. Also reduce the global warming effect that caused by greenhouse gases (CO2). The pollution cities are the main resource for these gases in over the world. it shall take measures to reduce the factors that causing pollution so must be developed solutions for these issue[3] .

1-1-2 Urbanization and urban migration

More than half the world's population already occupies urban spaces.in 2050 the estimations show that number could be doubled once or twice. This population increase is a result of people's desire to rebuild their lives in cities according to the growing number of opportunities. That growing in Urban residents bring more challenges because of the increment in their requirement [4].

1-1-3 Information and Communication Technologies

Realize the humanity pushing on global ecosystems increase the concern about sustainability evolution, Urbanization is the result of people moving to the communities, and the development of information and communication technology is usually understood to be a technological development. Technology, invented to keep track of increased market activity in the Middle East about six thousand years ago, and that this made it possible for cities to grow. Later than that, it supported the most advanced communications technology displayed on the phone's shape and telegraph urban growth which makes it possible to trace the increasing complexity of urban industrialization. It was for the development of information and

communication technologies have a tremendous impact on how people live their lives and how they work or how they manage their time[5].

1-1-4 Globalization

Networks in the worldwide workforce, institutions and information may also be implications for cities. Economic and social structures are changing and the needs of urban policy to adapt their strategies to these new circumstances. This means international cities between cooperation and competition and positioning. The measures taken should not serve the sole purpose of appearances, but must focus on the social, economic and spatial and structural aspects of the internal as well as[6].

1-2 The Concept of Smart City

The idea about smart city is based on sequence of operations that start with analysis of the facts, Planning and review of performance, it is so important to relies on database could provide high technique and information to access to the right decision for example the data that extract from people through communications facilities has the great impact on final decision which called the urban democracy decision by activate the society participation.

1-3 Definition of smart city

There is no comprehensive definition for smart cities from the practical side it mean the technology evolution or management expressions. "A Smart City is more than a digital city. A Smart City is one that is able to link physical capital with social one, and to develop better services and infrastructures." [7]. Smart city is combination of technologies and governmental vision aim to improve urban city services. Smart city is methodology that governments choose to improve the fact that service in the city by using the available information and communication technology tools.

Smart City is a vision, idea to change the way of work and live and to develop strategies stems from the understanding of the problems of the city and the Principles of smart cities as possible be applied to existing cities, not only developed cities and understanding the guideline principles of the Smart City that will enable us to develop a gradual and sequential solutions to address the city's problems and provide a better life by the specific vision of the future for a city .it's the process of integrating the physical, spatial, digital and human worlds as parts of program to update the city .

1-4 Smart City Goals

Sustainable development ,Resources preservation by the rationalization of energy consuming and Provide better quality of life through achieving justice in employment opportunity for everyone[8].

Phase TWO: ACTION FIELDS OF SMART CITY

2-1 The Fields That Related to Smart City

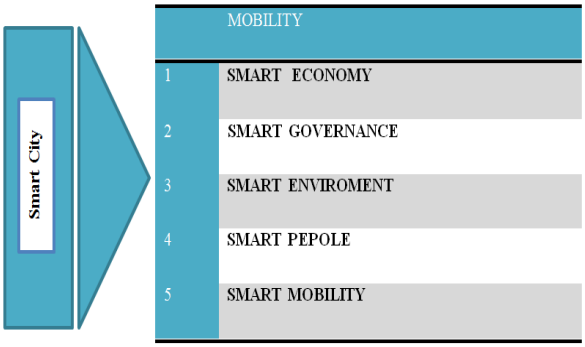


Figure 1 smart city fields

Reference (Eiburs Program Ascimer.Assesing Smart City Initiatives for the Editerranean Region-European Investment Bank)

2-1-1 Economy

Smart economies support many activities and care about many fields like education, qualification, research and Encourage invention and creativity. Continuous acquisition of knowledge and transfer, as well as local and global networks are the key components to produce creative [9].

2-1-2 Smart Governance

Change in management of administrations operations and coordination encouraged by smart government. The administrations made itself open up to the investment and promotes the cooperation among local organization units also support business, research, civil society, and other local authorities in which the implementation of projects rely on that cooperation. One of the most common objectives for the smart government is provide transparency by make the digital data available and facilitate contribution to people in making decisions[10].

2-1-3 Energy and the Environment

One of the major concerned for city administrators is limit the consuming of energy and raw material resource however using smart developing technology solutions and networks for supplying and discarding processes, energy, mobility, infrastructure and buildings. Establish transparencies procedures by using smart meters that could measure the actual consumption of energy.

2-1-4 People

Using technology to improving in people life style is not everything the social dimensions should be considered too, therefor the main focusing should be on education, lifelong learning, culture, health, safety of individuals, plurality of society and social consistency. Provide urban day life encourage inventions and creativity and capacities for people's city, without networking and self-management the idea of smart city will be worthless. The idea of implement smart city is highly related to human citizen. Smart city principles give more ability to people to express themselves however the involvement of citizens in the smart city initiative through training courses and activities social awareness.

2-1-5 Smart Mobility

Smart mobility include use innovative traffic and transport infrastructure in a way that maximum efficiency by keep resources and through new technologies. the concept of smart mobility based on Accessibility,

affordability and safety of transport systems as well as compact urban development also usability facilities make people easy to turn to green integrated transport systems which is environmentally friendly Encouragement to share transportation rather than use private cars is considered very important these day.

2-2 Indicators Extraction and Comparison

The Extraction Indicators from the Comparison between the smart city and Sustainable city See Table No.1

Table. 1 shows illustrates the indicators extraction depend on (Eiburs Program Ascimer.Assesing Smart City Initiatives For The Mediterranean Region- uropean Investment Bank).

ASPECTS	CITY AXES	ACTION FIELDS SMART CIT	SMART CITY AREAS
Economic	INSTITUTIONS	GOVERNANCE	PARTICIPATION
			TRANSPARENCY
			PUBLIC AND SOCIAL SERVICES
		ECONOMY	INNOVATION
			ENTREPRENEURSHIP
Environmental	HABITAT	MOBILITY	TRAFFIC
			PUBLIC TRANSPORT
			ICT INFRASTRUCTURE
			LOGISTICS
		ENVIRONMENT	NETWORK AND ENVIRONMENTAL MONITORING
			ENERGY EFFICIENCY

Social	CITIZEN	PEOPLE	DIGITAL EDUCATION
			CREATIVITY
		LIVING	TOURISM & CULTURE
			HEALTH & SAFETY
			TECHNOLOGY ACCESIBILITY

PHASE THREE: Application Elected Study For a Research Study

3-1 Indicator tested on research samples

Find chose three fields to test the variables effectiveness on examples that elected global cities that ranked as smart cities.

The elected cities:

1- Songdo City

2- Masdar City

3- Fujisawa City

The elected action fields of smart city:

1- Mobility

2- Environment

3- People

3-3 Result of Indicators on the Research Samples

After testing indicators extraction within paragraph (3-1)) on samples as in Table 3 note:

Table. 2 Elected indicators applicable

3-2 Description samples elected for application

Elected three samples for cities to apply indicators extraction.

CASE STUDY NO .1
SONGDO IBD LAND (Song do International Business District) (IBD)
Songdo International Business District (IBD) is the greatest actual development in history. Built on 1,500 acres of land, the district is organized to contain 80,000 apartments. “This Free Economic Zone is envisaged as a major business hub between Japan, China, and South Korea, with 4,600,000 m2 of office space and 930,000 m2 of retail space. Computers have been built into the houses, streets, and offices as part of a wide area network.

ACTION FIELDS SMART CIT	SMART CITY AREAS	INDICATORS
MOBILITY	TRAFFIC	X1-1
	PUBLIC TRANSPORT	X1-2
	ICT INFRASTRUCTURE	X1-3
	LOGISTICS	X1-4
ENVIRONMENT	NETWORK AND ENVIRONMENTAL MONITORING	X2-1
	ENERGY EFFICIENCY	X2-2
PEOPLE	DIGITAL EDUCATION	X3-1
	CREATIVITY	X3-2

1	Songdo in 2012 , 20,000 residents , 25,000 workers $12 billion invested , 4 million SM completed or under construction (40% of total GFA),LEED-ND pilot program; LEED certification for individual buildings, Open and operating , Korea-U.S. Free Trade Agreement ratified by US Congress and Korean National Government . 
	
2	**SONGDO IBD MASTER PLAN** **Estimated Population**:61,500 people / 22,660 units **Estimated Employees**: 264,000 **people Office**:4 M Sq. Meters **Residential**:3.5M Sq. Meters (22,000 units) **Retail**:1 M Sq. Meters **Hotel**: 5 M Sq. Meters **Civic Space**:1M Sq. Meters **LEED-ND pilot program U-Life**: Ubiquitous technology platform .
	

3	**PUBLIC TRANSPORTATION** Efficient road systems are important for the movement of traffic in cities. Observing traffic both vehicular and pedestrian is essential for the workers of roads and transport access. Songdo presents different means of transportation through improved public transport and a network of cycle paths. The city is planned so as to residents need not walk more than 12.5 minutes to reach all services such as parks, shops, or transportation .	
		
4	**SUSTAINABILITY INITIATIVES** **WATER CONSUMPTION & RE-USE** Central park canal uses seawater instead of fresh water, saving thousands of liters of potable water per day. Potable water use will target a 90% reduction versus international baseline (re-use of treated greater from a city-wide central system). Potable water consumption in plumbing fixtures will target a 20-40% reduction based on the use type of the project. Storm water runoff will be reused Vegetated green roofs will reduce storm water runoff, and mitigate the urban heat island effect.	

Depend on: Song do website (http://songdoibd.com/about/#green)

CASE STUDY NO .2	MASDAR CITY

Masdar City in Abu Dhabi, in the U.A.E, It is being built by Masdar (Abu Dhabi Future Energy Company) & planned to be completed by 2030, Designed by the British architectural firm Foster and Partners and engineering and environmental consultancy Mott MacDonald, the city will rely entirely on solar energy and other renewable energy sources, with a zero waste ecology, The city is designed to be a hub for clean tech companies.


1

MASTER PLAN

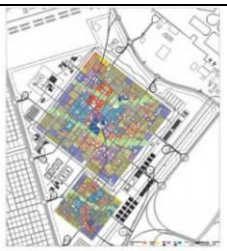
Site: 600 hectares -GFA: 3.8 million sq. m-60 %Residential-GFA: 2,282,881 sq. m-15 % Commercial-GFA: 574,256 sq. m-2 %Retail-GFA: 89,336 sq. m-12 %Community Facilities-GFA: 450,557 sq. m-11 %Light Industrial/R+D-GFA: 410,971 sq. m

-The residential concept for the Masdar Institute campus focuses on the creation of lively energetic neighborhoods.

-The Institute campus is formed around a hierarchy of streets and squares that make up the backdrop to an environment of integration, communication and cooperation.

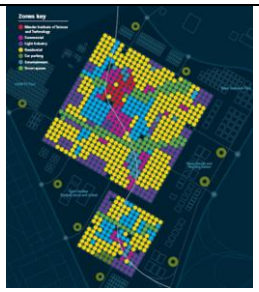
-High-density low-rise living is a major component of this low impact development and is vital in achieving a balanced socially and commercially sustainable campus.

- The marriage of traditional Arabic building practice and modern technologies satisfies demands for style, adaptability and flexibility, while keeping a sustainable footprint.


Concept - 2008


Master Plan - 2011


Development Strategy - 2013

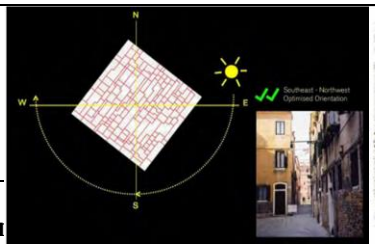


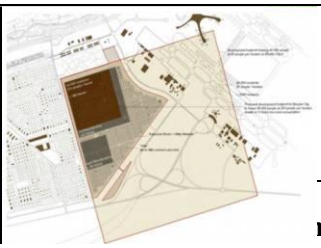
2

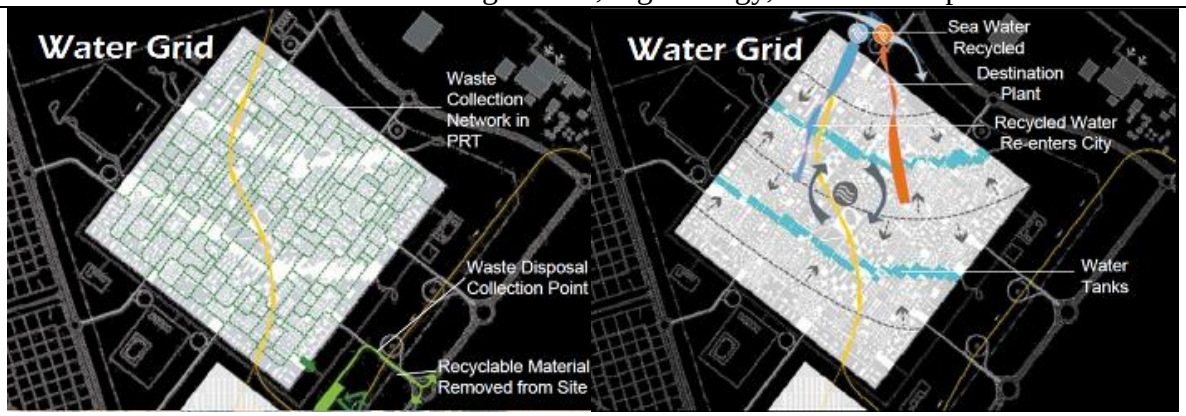
ENERGY MANAGEMENT

Masdar City minimizes energy consumption by deploying best commercially available international energy efficient techniques and setting stringent building efficiency guidelines in areas such as:

insulation, -low-energy lighting specifications, -the percentage of glazing (i.e., windows) -optimizing natural light, -installing smart appliances, ex: building management systems -a citywide energy management system that interacts to manage the electrical load on the grid – all along the system, from the utility to the consumer.





3	**INTEGRATED TRANSPORT** • Masdar City will be the first land-based city to operate without fossil fueled vehicles Walking, electric vehicles, cycling, PRT and LRT are the modes of transportation within Masdar City. With 40,000 commuters per day, Masdar City will have strategically placed parking areas for fossil-fueled vehicles. 
4	**WATER MANAGEMENT** • -Masdar city's water needs are less than half of a city like Abu Dhabi i.e. 145 let/person/day as compared to 350 let/person/ day BAU. • -However, this does not include water required for district cooling, which could double the amount of water required by the city. • -To achieve these lower consumption figures, the city is using highly efficient fittings, fixtures and appliances, smart water metres that inform consumers of their consumption, and smart metres to identify leakage across the system are already in use. -Master plan was to desalinate groundwater with solar energy, but for now water is piped in from one of Abu Dhabi's gas-fired, high-energy, desalination plants. 

Depend on: website of masdar city (http://masdar.ae/en/masdar- city/detail/masdar-city-at-a-glance).

Table. 3 Figure explains the research sample test results

	Indicators	X1−1	X1−2	X1−3	X1−4	X2−1	X2−2	X3−1	X3−2
1	Songdo city	●	●	●	●	●	●	●	●
2	Masdar city	○	●	○	○	●	●	○	○
3	Fujisawa city	●	●	●	○	●	●	●	●

Applied level
● Applied ○ not applied

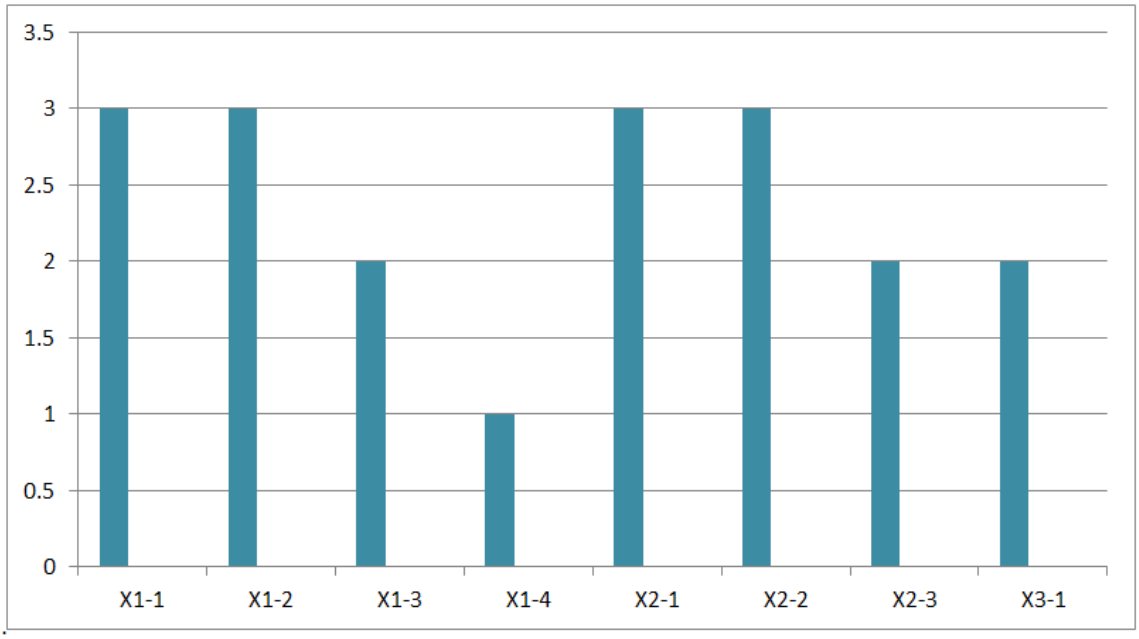


Fig.4 the results of indicators according to the elected project.

3-3 Result of Indicators on the Research Samples

After testing indicators extraction within paragraph (3-1)) on samples as in Table 3 note:

By observing the table that analyzing examples according to the mechanics of smart city project indicators shows the following: The results showed that traffic and public transport and IT infrastructure with energy efficiency has achieved the highest percentage of its reliance on a comprehensive idea of the urban problems and solutions in view of the fundamentals of sustainable smart design of cities. This is the goal of research in enhancing the efficiency of energy use in cities and use a database as infrastructure essential for the operation of the city in a smart see fig. 4 .

3-4 analyzing the results of effective mechanisms through applied study

By observing Figure (1) Special analyzed the results of indicators according to the elected project shows the following: Most impact factor is

1. (The first indicator \ Traffic x1-1).
2. (The second indicator \ Public Transport x1-2).
3. (The fifth indicator \ Environment Monitor Network x2-1).
4. (The sixth indicator \ Energy efficiency x2-2) which is achieve the highest indicator.

By observing figure (4) that shows the analysis result conclude that (songdo, fujisawa) cities achieve the elected tops indications.

III Conclusion:

Regarding the point of view of the smart cities, every single city has a special attributes which must be taken into consideration in the processes of urban planning and development in which the aims and the vision of that city are being achieved, on the top, the challenges of transportation, climate changes and security in current time and in the future, because it is necessary to define an appropriate applications, technology and the strategies. Encouraging the integration of artificial smart techniques in the fields of transportation and services, evaluating the effect of technology, applications and strategies on citizens and measuring the efficiency degree of sustainability realization. Through the applied study for three international cities, the research has concluded the effect of transportation, environment and citizens indications for achieving the smart city and compares it with others.

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- fujisawa website (http://fujisawasst.com/EN/sslife/)

اليات تحقيق المدن الذكية

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الخلاصة: -

يشهد عالمنا اليومتغيرات عديدة ،من ابرزها النمو في السكان والاقتصاد وتتركز في المراكز الحضرية من خلال الهجرة من الضواحي إلى المراكز الحضرية، والتي توثر بشكل رئيسي على الموارد البيئية والبنية التحتية بأكملها وخاصة في مراكز المدينة، إلا أن استهلاك الطاقة في المدن يعتبر 75٪ من استهلاك الطاقة العالمي خاصة أن الاستهلاك يشمل نفايات هائلة في طرائق استهلاك الطاقة ونقلها، كما أدى التحسن السريع في مستويات المعيشة إلى ارتفاع غير مسبوق في مستويات التحضر أو الانتقال الحضري ان هذا النمو في مستويات التمدن يتطلب سيطرة فعالة على استهلاك المصادر و البنى التحتية ، تطوير النظام المروري ، السيطرة على التلوث و واستهلاك الطاقة . من ظهرت مشكلة البحث التي تتمثل في (عدم كفاية الحلول التقليدية لمعالجة مشاكل ارتفاع مستويات النمو في التحضر والتحول الحضري وتحديدا عدم وجود منهجية واضحة حول استخدام استراتيجيات ذكية لإدارة قضايا المدن). ويعتمد هيكل البحث علمي ثلاث مراحل: المرحلة الأولى: التحديات الحالية للمدينة الذكية والمدينة المستدامة، المرحلة الثانية: مجالات العمل للمدينة الذكية، المرحلة الثالثة: دراسة تطبيقية لنماذج منتخبة

من وجهة نظر المدن الذكي .ان لكل مدينة سماتها الخاصة التي يجب ان تؤخذ بنظر الاعتبار في عمليات التخطيط والتطوير الحضري بما يحقق اهداف ورؤية هذه المدينة، وفي مقدمتها تحديات النقل والتغير المناخي والامن الحالي والمستقبلي اذ بات من الضروري تحديد التطبيقات والتكنلوجيا و والاستراتيجية المناسبة لها تشجيع التكامل بين تقنيات الذكاء الصناعي في مجالات النقل والخدمات ،تقييم تأثير التكنلوجيا والتطبيقات والاستراتيجيات على المواطنين وقياس درجة تحقيق كفاءة الاستدامة اذ استنتج البحث من خلال الدراسة التطبيقية لثلاث مدن عالمية فاعلية مؤشرات (التنقل - البيئة- الناس) في تحقيق المدينة الذكية مقارنة بغيرها