Smart-technology in city planning of post-war cities

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Abstract. The aim of the paper is to define what role can play smart city technology in the reconstruction of post-war cities for example in Syrian Arab Republic. The smart city concept offers different opportunities for different countries. The implementation of smart city technology concepts, especially in post-war cities, faces different challenges and if a given smart city solution can simply transplanted from one city situation to post-war cities. This paper will discuss some of these challenges. The immediate need for cities reconstruction in the post-war countries is to provide adequate urban infrastructure to meet the increasing pace of urbanization after war. In the process of meeting infrastructure demands, smart technology applications provide a way for such cities to achieve leapfrogging after war. Smart technology will able to plan better in the areas that affected by war, post-war cities with smart city's ability to analyse large amount of data. This will allow for proactive maintenance and a better planning for the future, having a smart-technology means that the post-war cities can move forward, and use data collected to make meaningful changes in city plans. Lack of finance and well-developed business models in post-war countries, make the challenge difficult and is often to maintain legacy infrastructure systems, which cannot be abandoned due to cost, space and other considerations unlike other countries that they respond to the sustainable development and needs of society. While technology in the form of smart city is an integral part of a smart city, it should only be seen as an enabler to meet the needs of the people of the city and the need to localize this technology. Smart technology should be chosen with a deep understanding of people’s needs, lifestyles, behaviours, and cultures. Ultimately, smart technology in planning post-war cities requires the participation of local communities for success.

1. Introduction

Over half of the world’s population lived in urban areas in 2010, and by the year 2050 this figure is expected to increase to three quarters. With the enormous rapid urbanization and rise of population, city planners and governance are required to find solutions to manage an escalating number of technical, social, physical, and organizational issues arising from complex congregations of people in urban areas \cite{1}. One major issue is the increasing of conflicts around the global, since 2004 there have been thirty active armed conflicts. While civilian in these urban areas have been severely affected by this surge warfare, they have suffered more recently, in relative terms, than during any other period. The pressure to maintain the physical infrastructure and political administration of a post war cities experiencing such profound urban flux after war makes cities increasingly vulnerable to internal stress and, faces many challenges. These continuing ruptures to the social and fiscal fabric of the world’s societies challenge us to rethink not only how cities after war will be understood, but also how people
are to survive and thrive in large urban cities and have a better life [2]. Also, the rapid urbanization creates an urgency and imperative for cities to find smarter ways to manage the accompanying challenges—e.g., traffic congestion, air pollution, high crime rate, difficulty in waste management, and so on for the reconstruction of post-war cities [1]. The major aim of smart cities as a concept is to manage and organize a complete city via embedded technology, which explains this concept has recently become very broad. The main element that makes all the premises of a smart city functional is smart technology, making the smart city dependent solely on this factor, leading to improved services to both the government and citizens. Not only this, but also a smart city is capable of resolving many of the challenges of a city to improve the quality of life in it via smart technology, such as providing smarter economic growth, and even smarter government administration, and smarter services to the citizens [3]. The idea of smart cities, however, is still rather new and growing, making its concept wide. For this reason, examples of smart cities can largely vary in terms of size and type, and every example has its distinctive features, along with its unique historical path of development, current situation, and future.

The cities which call themselves ‘Smart’, or are labelled as such by others, vary enormously. Many definitions of the Smart City focus almost exclusively on the fundamental role of technologies and the ICT in linking city-wide services. The use of ICT tools in post can help to manage, analyse and disseminate geographic information that can be used effectively for contingency planning, disaster assessment and post-war response and reconstruction [3]. The remainder of this paper is organized as follows. The next section provides an overview of the Smart City and Smart technology as a transformation opportunity for post war cities. The discussion section describes the concept of smart cities in Arab world. Then the following section reports the opportunities and the role that can play smart technology in the reconstruction of postwar cities in Syria. The final section addresses challenges of this transformation and presents conclusion.

2. Background

To integrate two technologies together that will improve a country’s economy, one must understand the essentials of those technologies, the uses, the benefits and the advantages.

2.1. Smart Cities

The phrase “smart city” was coined in the early 1990s to illustrate how urban development was turning towards technology, innovation, and globalization. Cities around the world dedicate resources to redevelop their existing communities, (‘brownfield’ sites), to connect to other cities (regional development), and to develop new urban sites (‘greenfield’ sites or planned smart cities) [4].

The definition and conceptualizing of smart cities is still in progress as the very concept is still emerging up to the present time [5], which is why the term ‘Smart City’ is still debatable as there are not enough studies exploring this matter. However, with the uplift of technology, in addition to advances in information systems and communications, it is possible to distinguish many important key components that can be considered necessary to reach a complete definition of the concept of smart cities. For instance, it is widely accepted that the prevalent use of Information and Communication Technologies (ICT) is a feature that characterizes smart cities [6].

The concept of ‘Smart’ City varies among cities and around the globe. Requirements of different cities may depend upon local factors and its objectives, but a sustainable smart city should have forms of smart communication/ ICT infrastructure, smart mobility, smart living, smart economy, smart environment, smart governance and smart citizens. It is also not about technology providers offering solutions, but integrating solutions, proving interoperability and cohesion among systems within a city in full collaboration with all stakeholders involved [7].

Why should a post-war city be transformed into a smart city?

There is a believe that development and sustainability of conventional cities will be affected by a variety of challenges during the next decades. For instance, the fast-growing populations and the polarized economic growth which will demand more areas that are taken by people, in addition to the environmental discharge, the requirements of sustainability, and instability of global economy [6].
Polarized economic growth, which requires more areas that are occupied by people. Social changes caused by migration and changes in the structure of resettlement [8]; Environmental imbalances arising from the growth of the city and the requirements of sustainable development [9,10]. Environmental imbalances arising from the growth of the city and the requirements of sustainable development Instability of the national global economy.

2.2. Smart technology.

One of the factors that influence smart city initiatives is the technology, a smart city relies, on a collection of smart computing technologies applied to critical infrastructure components and services. Smart computing refers to a new generation of integrated hardware, software, and network technologies that provide IT systems with real-time awareness of the real World and advanced analytics to help people make more intelligent decisions about alternatives and action that will make the city a better place for living [6,11]. There are three major components that define smart technology: data is generated and assembled by ICT systems; data is converted into usable information by analytical tools; the collaboration, innovation, and the application of that information by organizational structures in order to find solutions to public problems [12].

According to the Smart Cities Council, “a smart city uses information and communications technology to enhance its livability, workability, and sustainability.” The term ‘smart cities’ does not hold a holistic meaning obtained by the integration of particular functions of a city; it is actually used to mark out new original aspects available to a city that are based on the use of ICTs. These aspects can be linked to the economy, the local population, the governance, the participation of citizens, etc. [13]. Another way that smart cities have been vastly characterized is as utilizing ICTs to find solutions to problems in a broad range of public policy domains, which includes healthcare, education, security, energy, waste management, public administration, transportation, and more. For example, ICT systems are capable of collecting and aggregate data from the environment, then analyse it to allow putting it in use like post war destruction of Homs city in Syria the in Figure (1). It is also predicted that ICT system is going to take an essential part in solving the upcoming problems of the urban living cities after war, which makes it a major driver of the smart city initiatives. It is even possible to change the urban landscape of a city by integrating the ICT with development projects, which in turn offers many opportunities of enhancing both the functionality and management of a city [6,11,12].

Despite proclaimed advantages and benefits of ICTs in improving the services of the city in several fields, their impact is still unclear especially in the reconstruction of post war cities. Indeed, they can improve the quality of life for citizens, but they can also increase inequalities and promote a digital divide. Thus, city managers and planners should consider certain factors when implementing ICT with regard to resource availability, the current situation after war, capacity, institutional willingness and also with regards to inequality, digital divide and changing culture and habits [6, 11].

The peculiarity of the development of the cities in Syria during the modern period determines the consequences of the war, which caused the destruction of industry, agriculture, and objects of the country's historical and cultural heritage. To implement the program of restoration and territorial development of cities, the concepts of a smart city will be very useful. Currently, tourism is considered one of the creative directions of developing the economies of countries, which was developed in pre-war Syria. In connection, there is an obvious need to identify the extends of destruction of historical sites, as well as the development and implementation of a program for their restoration, in addition to the reconstruction of urban development, which provides for the preservation of urban and national identity. The implementation of these tasks should be based on information technology.
3. Discussion

In the Arab countries there are two common transformation to create smart and sustainable cities, the Greenfield model and the Brownfield model, only 3 Countries with successful strategic plans and regulatory framework on use of ICT technology for transition to smart and sustainable development in various spheres. In the recent years the instable situation, several conflicts and political developments effected the economic performance and development. Syrian Arab Republic haven't embraced the concept of smart cities, the current situation and because a several common challenges with other Arab Countries include:

a) Inadequate sustainable financial investment in smart city projects
b) Political instability and high rate of youth unemployment.
c) Inadequate ICT infrastructure; technological obsolescence.
d) Difficulty in citizen adjustment to new ways of accessing services [7].

The road map towards Smart Sustainable Development in post war reconstruction process as Syria before war didn’t have smart city initiative and in the current situation it's difficult to build the concept of smart city without it, smart-technology can play a big part in the post-war planning especially the ICT technology that depend upon national action. Therefore, there is need for the Arab countries to mainstream the smart-technology and national targets into their national development plans and strategies. Through ICT the integration between the technologies can be achieved or at least made easier as the sharing of information among them can be fast and accurate. To assess the effectiveness of various scenarios for the development of post war urban settlements, different technologies are used, like the big data processing systems in the reconstruction, that will require different technologies like integration with GIS, time series data processing, utilization of equipment structure and combination with modelling and simulation. For which it is expedient to accumulate in urban information systems after war. This will ensure access to them by governance and residents of damaged areas, which will increase the interest of the local community in the reconstruction programs in the cities [7].

Figure 1. Damage assessment showing targeted destruction of Homs city, 2014
4. Opportunities

Several opportunities for smart technology that can be used to support a post-war city restoration, and these will be discussed in this section. These opportunities will be very beneficial to any post-war cities that would utilize it for their reconstruction, safety and development.

ICT one of the smart technology that can play an important role during the disaster prevention phase, Geographic Information Systems (GIS) as part of ICTs technology give the opportunity for mapping and analysis local hazard. It can help to identify and illustrate evacuation routes for people that live in such areas as well as to locate housing, business and structures that are at risk like in Figure (2) of Baba Amr with destroyed or damaged buildings, Homs city, Syria, 2012.

The use of ICT can aggregate, create, and integrate data, delivering a comprehensive set of information, appropriate for each end user. Real-time information on the changing climate can support risk assessments, strengthen early warning systems and ICTs provide information dissemination and opportunities for urban planners to assess risks and work with future scenarios, thus contributing to the city's adaptive capacity, including its ability to design and implement both preventive and reactive measures [7].

One of the main components of the smart city technology is the security system to manage the crowd, traffic, data privacy, building code as a result of natural and man-made disasters. A distinctive feature in ensuring the security of the cities of Syria is the need to develop maps of territories where the threat of the consequences of the war remains: explosions of remaining mines and unexploded ordnance. This will ensure the safety of the population and the carrying out of restoration work these factors would make a city safe and secured for a citizen to live in after the war [14].

The collection of data that smart technology provide, using urban sensors and advanced analytics has the potential of providing post-war cities with access to a rich range of current spatial and environmental information. The primary task of this data is the development of inventory maps of historical objects. Attachment to which should be attributive information, containing a description of the object, its historical significance, damage at the time of inspection, photographic materials with reference to the location in the post-war areas. Using Information services, open communication platforms, virtual presence and other smart technology in post-war cities in Syria innovations offer opportunities to increase knowledge about engagement in and collaboration for preserving vital...
cultural heritage and historical objects. In addition, as the world becomes increasingly digital, there is also an emerging digital heritage - texts, databases, still and moving images, audio, graphics, software and web pages, among others for totally damaged objects. Many of these resources have lasting value and significance and should be protected and preserved for current and future generations after war. ICT can assist in development planning by tailoring development projects to local needs as well as communication access in the affected areas by war [7].

5. Challenges

The challenges can be classified into post-war period and technical, governance, organizational ones, which will be discussed in this section.

During the whole process of recovery and reconstruction in post-war cities, there are different types of smart technology like ICT tools that can be used as per the situation. However, in a large-scale disaster like wars, where countries seek international assistance, several challenges are inevitable and must be faced in the process of reconstruction and resolved. They include:

a) Duplication of data processing due to lack of coordination among reconstruction working teams
b) Not all post-disaster data is collected as per a plan, but rather in an improvised manner
c) Political, legal set-up of the governance: Certain countries prevent the use of high-tech ICTs without government approval.
d) Decisions relate to security [7].

Another set of problems are more social and organizational in nature rather than technical, physical or material. The types of these problems are associated with multiple and diverse stakeholders, high levels of interdependence, large number of refugees, competing objectives and values, and social and political complexity situation of the country after war. In this sense, city reconstruction problems become wicked and tangled [15]. Syrian Arab Republic like other Arab countries is currently facing a series of political, environmental, social and economic challenges on multiple fronts after the conflict. The dramatic increases in conflict, wars, violence and terrorism, make the Arab region over the years faced a number of socio-economic and political challenges that include poverty, exacerbated inequality, water and energy insecurity, an alarming number of refugees and internally displaced people, severe resource constraints and the financing gap, inadequate communication infrastructure, very low utilization of ICTs, lack of information, high cost of mainstreaming ICTs for smart and sustainable development [7]. In addition to socioeconomic and political issues that smart cities may face many problems through their development, but the most important is the technical issues. The technical challenges, along with the other issues like system interoperability, the right using of this technology, and cost-efficient technology, the issue of security and privacy is more basic to be addressed to achieve better utilization of this technical, physical, and material problems [1].

Weak local ICT capabilities, the statistics show that nearly all equipment is imported on Arab ICT procurement decisions. Recently the Arab region, affected by political instability have wicked economic performance and development, whether this instability domestic, regional or international. An extremely worrying trend in the region is the high incidence of conflicts increasing during the five-year period from 2009 to 2013, half of all Arab countries suffered at least one conflict, one of the highest rates in the world. As a result of this conflicts, the Arab region now accounts for the largest number of refugees [7].

The smart technology gives new opportunities for city governments, but traditional challenges around technologies still exist in government. The post war cities can have experienced financially insufficient support stemming from budget constraints, which ultimately arise from the economy downturn. Some city governments lose human resource, particularly technology staff, and others miss an opportunity to update and upgrade technical systems, that are pivotal to smart city initiatives. Citizen of the post-war cities have difficulty to use smart technology and the new ways of accessing services without city governance support, this prove the impact of “the right technology in the right time.” the technological challenges of government ICT projects are mostly organizational rather than technical in nature and citizen play an effective role in of this project [1].
6. Conclusion

Smart technologies are an effective tool in the implementation of the program for the reconstruction of the cities of the Syrian Arab Republic affected by the war.

The use of geographical information technologies and urban mapping will make it possible to identify historical places and zones of their influence in the planning structure of the city. To do this, it is necessary to justify the composition of both graphic and attributive information, which will be necessary and sufficient at the reconstruction stage, as well as further use in the implementation of the smart city concept. The barriers to smart city successes are often more organizational than technological. In most cases, cities need to consider the policies and administrative components that undergird, enable, and guide smart city initiatives.

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