ICT approach to bridge the smart city designing and planning gap

Norah Farooqi

College of Computer and Information Systems, Umm Al-Qura University, Makkah, Saudi Arabia.
nsfarooqi@uqu.edu.sa

Abstract: The available discussions about smart cities and their applications are mainly driven by the administrators and the technologists all along with secondary inputs by the urban designers and the architects. Many smart city technologies applications depend mainly on ICT. Urban Designers and architects think that they don't put great attention neither for the physical form or the shape of the city nor to the social culture and the political environment in which it will dwell. The currently existing discussion about smart cities focuses on the type of the socio-spatial consequences which it engenders is neglected. This paper proposes an idea which declares that ICT can not only be used by the technologists and administrators, but also by the architects and the urban designers which will practically minimize the large gap in this current mainstream discourse. This paper will also help researchers and planners in the field of designing and planning which will facilitate its usage by putting this new approach in consideration and applying the proposed principles.

Keywords: IoT, ICT, Spatial configuration, Typological configuration, Socio-spatial consequences.

1. Introduction

Nowadays, cities play a main role in the system of the national administration which gives them the power to shape the future appearance of the planet. And since the idea of smart cities is outspread and became very popular, cities now are pursuing to be smart. [1]

ICT is used by smart cities for the application and enforcement of the smart strategies and also for gathering and transferring those gathered information to a diversity of users. That's why smart city is considered to be joining multiple and various sides of residing in an urban area, and also the connection between different concepts like intelligent city, wired city, information city, virtual city, knowledge city, digital city and so on. Thus the great use of ICT increases the smart city part in gathering and transferring the information, data and knowledge which influences the everyday life and developing the quality and the credit is to e_services, and a greater participation of the residents in city governance with a proactive role due to the e_participation and the e_democracy. [2]

Smart city as a term can be defined in a resilient and useful way by being described as a city that uses the digital technology in the reinforcement of the local management, long term planning and designing or administration. This activity is of multi-stakeholders which include prevailing of tools by several units of businesses, governments and citizens. [3]

Since smart cities have place minimal in the present scope of physical cities up for the grabs, thus, concentration is mostly on the cases of the power dynamics of data, a fresh, fast changing and also the modern landscapes. [4], [5].

A description of smart city can be that they are cities where clever administration of natural resources and energy are done effectively leading to a high life quality.

Ecology, design, technology and sustainability are considered to be the main concepts which combined together due to searching for environmental solution because of the growing passive people's effect on the environment lately.

For the sustainability of the cities, technological and ecological sustainability have to be combined so as to guide the principles of ecology to the process of decision making from planning to designing [6] where Urban Designing is considered to be the process of creating the form and the shape of the city including the infrastructure, the public spaces, the community facilities, the landscapes and the transport, while the structures of the city such as the zones, the standards, the building codes and the neighborhoods are considered to be the Urban Planning.

This paper is divided into five sections: the introduction is the first section, the second section is

the ICT intersection all along with City Designing and City Planning and the third section is talking about how Urban Designing and Urban Planning benefit from ICT and IoT. The fourth section handles what should be put in consideration when IoTis being used for Urban Designing and Planning. In the fifth section, principles related to technology in Urban Designs took place, A discussion took place in the sixth section, and then we conclude the paper in the last section including future work.

2. The Intersection of Ict, Smart City Design And City Planning

There is a link between ICT and the Urban form, however it is an indirect linkage which depends on several factors, primacies, local characteristics and needs of the residents, the forces of the global market, the economic shifts either national or international etc. In addition, it is a two-way linkage, in which each side influences the other in a symbiotic way.

Previously, although it was an indirect relation between ICT and Urban form, but it was more complicated to understand and the studies were of a long term.

Nowadays, no one can neglect the ICT application potentials. The applications of smart cities in some branches are very successful and well understood like in the management of water or transportation. Urban design and planning practice applications are still uprising, however, they show promising leads. [10], [11], [12].

As a starter, there is an intersection that occurs between the three of; urban designing, urban planning and the idea of smartness where they intersect at three levels. This is presented Figure 1.

First of all, the use of smart technologies for the assistance in the practice of urban designing and planning. Accessing and reaching the information by Google Earth is an example that has changed the path and tactic to spatial designing. Moving through the scales by the urban designers and planners can be done easily when this access is in a combination with other tools such as Google street view. With such valuable information, standardization and calibration of urban spaces can be done, all along with their attributes as well by the means of understanding and observing the reviews of the users, the patterns preference, density, hydrological patterns, footfalls, calculation of the permeability of large territories and also the stimulation of financial analysis. [13], [14], [15].

Secondly, designs creation for the available smart urban spaces would be the upcoming involved part of smartness. The future will need the adaptation, flexibility and cleverness of the available spaces to multidisciplinary and the diversity of requests and desires from a smart global society. It must be put in

consideration that the use of space will be affected and influenced by the technological changes, but not only that, the typologies of available spaces in the city will also be affected as well.

Some questions and concerns came up such as the matter of online shopping and whether it will make the traditional shopping areas more profuse. The hugely incorporated data centers as well as the control rooms, will they become the novel modern government centers?
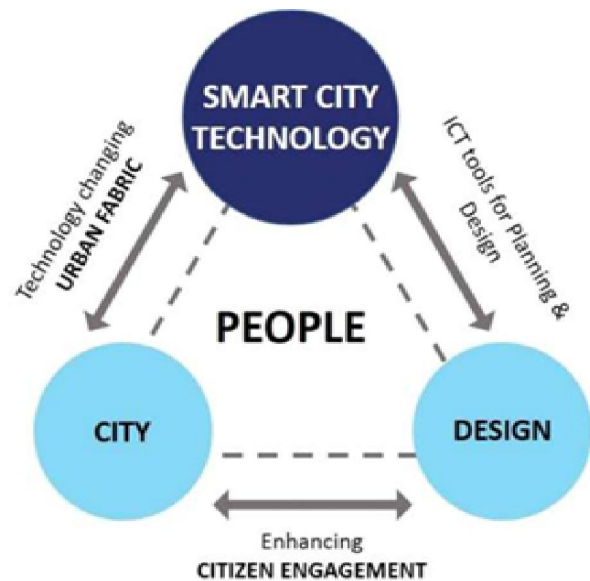

Figure 1 shows intersection of ict, smart city design and city planning [10]

Will ICT applications alternate the urban agglomerations economics?

Urban public spaces form can be adapted by the Urban Designing for catering of a networked society, multiple usages of the public realm spaces and for the creation of the dynamic meeting spaces.

Third of all, the created chances by the interactive technology pervasiveness let the citizens to take part in the space making which can be completely unpredictable. [7], [16], [17].

3. The advantages of ICT as well as IoT in Urban Designing and Urban Planning

It is obviously clear that ICT nowadays has many benefits for urban designing, planning and the processes of management which can be well illustrated in the available maps, data and assessment models which are becoming a widespread collective legacy and heritage in an increasing way.

The combination of GIS with wiki based technologies [8], [11], web and sensors is a greatly productive way to develop and upgrade the constructional interaction opportunities interaction

between the skills, the policy makers and the residents within the procedure of urban planning.

Among consumers and professionals, cloud technologies are very well known - permitting habitual and uniform updates straightaway from the original source out of a constant incorporation of decentralized databases.

Systems which depend on Geo-references are considered to be prime and major to the process of decision making at the regional level and the local level, which makes the decisions of entrepreneurial actors and institutes much easier such as in sharing the land knowledge as well as in supporting and promoting the speedy tract of managerial procedures.

The shared databases motivate the public-private collaboration and funding projects by guaranteeing the contributions of multiple utilities, or by making the information, data and the convenient feasible studies obtainable for the technical office. The interaction of the local partners with the international channels out of an increasing process of shared planning and regulations is being reinforced by ICT.

The practice of Urban Planning and Designing can profit from the tools of ICT which are used for fixed steady and various collection of data, analysis of data, simulation and mapping.

The technology of smart city makes it applicable to improve the power as well as the range of the tools which are already being used. Applications of ICT of central smart planning protocols are illustrated in figure 2 which are used through sectors, user groups and scales etc.

Figure 2: Smart Planning Protocol [13]

When technology is being used for Urban Planning and designing, the aim is not to make the process automated or to decrease the part and function of the designers and the planners, but the goal and the aim is to help in the decision making process. The Urban planning which is aided and supported by the available data on the city movements, developments and residents can produce plans founded on a

comprehensive and deep perception of the cities and reasonable decision making. Opportunities in achieving goals in planning and designing are provided by ICT where these opportunities weren't possible before.

4. Things to be put in consideration during the use of iot for Urban Planning and Designing

Related to IoT, technologies applications that can make the passive objects automatic, dynamic and reactive being related to response and sensation are countless. A framework of IoT is presented in figure 6 in a high level preview.

A network is being provided by IoT for the interconnection between people, applications, objects and things and thus, allowing management, remote controlling and also integrated and interactive services, and as a result, many things can be remotely controlled and monitored, the decisions to be taken can be of more accuracy and the complicated tasks can be done in shorter time.
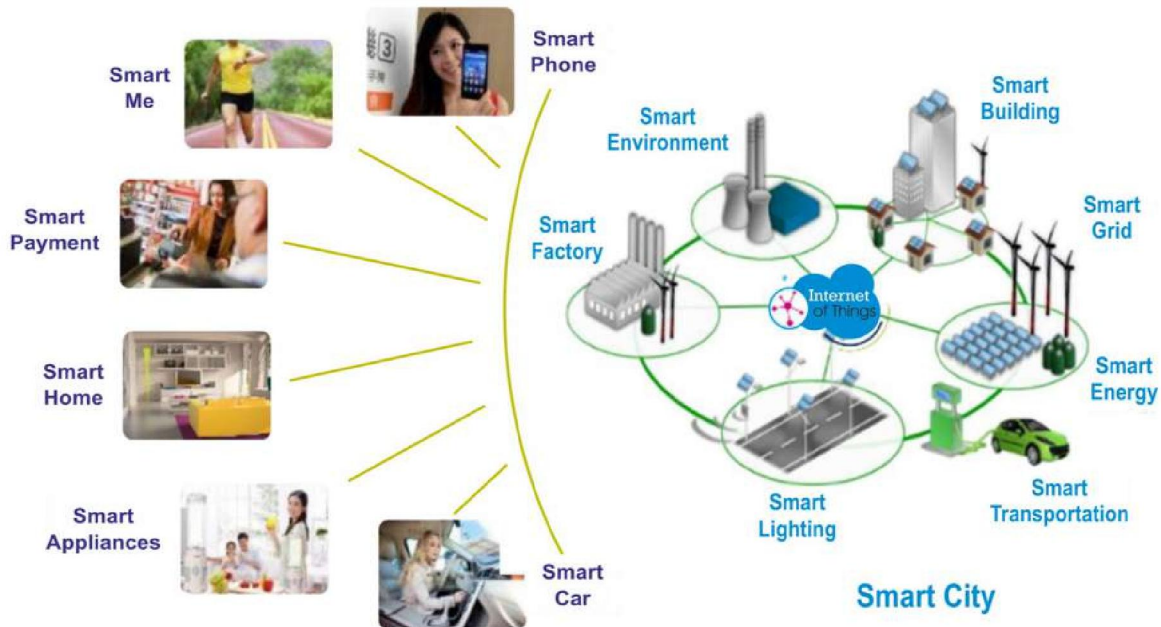

Figure 3: The Internet of Things (IoT) Ecosystem [8]

TEC released some technical reports, these eleven reports present elaborate studies related to IoT in the verticals of different cities [9]. The effect of IoT on urban designing and planning is predicted to become a revolution and cause changes regarding the way citizens, governments and businesses react in interaction with the physical world. The disturbance level occurred will cause a considerable effect in developing the life quality of all individuals. However, the management of city by the integration between IoT and the systems of the city will demand numerous considerations such as clear strategies of data management, attracting the ecosystems of the local data, the leverage of the present physical assets, concerns of privacy, security and transparency. The effect of IoT applications on the concepts of Urban designing needs more accurate studies and examinations.

5. Principles Related To Technology In Urban Designing

The literature of smart city is full of different definitions, however, the definitive answers to some questions as "what is the criteria that makes a city to be smart?" or "when does a city become smart?" emerge categorically. These answers are very essential and necessary to the form of Urban of the Brownfield as well as the Greenfield cities because the smart city is a process of urbanization not a product, which means that smart cities are created, they don't emerge.

Different and multiple principles revolve around the urban designing and technology, these principles include:

The consideration of the Urban Life before the consideration of the Urban place, and the consideration of the Urban place before the consideration of technology.

The Urban communities: Deliberation on the plans regarding the upcoming developments have to completely achieve the power and the abilities of the social media, other available technologies and the virtual words to guarantee that the affected communities are provided with the most immersive chance possible in its widest range to be able to participate and share in their designs.

Transport: The plans of transport which are upholding new evolutions have to show that they did not only supply the requirements of the traditional transport, but they also provided what could be produced and formed by the business models online and the various social technologies.

Smart machine functions identification: It provides a faster and much precise results across and inside of the city agencies, build up processes and an infrastructure for the collection of data, analysis, interpretation and integration, etc.

The identification of complementary information functions as well as the recognition of the city agencies to use automation such as the combination of data analytics in the systems of the planning support and the improvement of the processes of planning that co-create, inform and collaborate with community.

The creation of agencies for innovation-fostering which has the ability for technological understanding, organization and operations of the agencies and across them, so as to create partnership and lead to the initiation of the projects that have the ability in supporting the economics of the city, the social and the environmental objectives.

Avoidance of lock-in by using open sources and open data platforms instead of the formats of the proprietary data and by the copartner-ship structuring where there is no single technology provider and also no technology dominates.

The establishment of clear objectives and the assessment of Return Om Investment (ROI) from the perspective financially and non-financially for the evaluation of the smart initiatives and also for the justification of the investments – the sequence of development and investment for a careful plan regarding the necessary backbone infrastructure implementation or using certain technologies.

There are some principles for Smart City Designing that have to be followed [10]

Some of these principles are: That the Urban life is to be considered before the Urban place which has to be considered before technology. [10]

Flexibility demonstration has to be done over a long time frame.

If any new development is going to be done, then there must be an ensured connection wired and wirelessly across the whole development.

Any new development's information system has to have an interoperability confirmation inn general from IT systems, and specifically from the physical infrastructures, the environment and the smart cities.

6. What can make a city to be smart?: Discussion

Many new smart cities are built and constructed from the scratch (Greenfield) like in Abu Dhabi there is the Masdar city and in South Korea there is the Songdo IBD.

Citizens will not simply go and live in a city because of the available capabilities of technology, they will actually decide according to what the cities have to provide and offer regarding culture, economics, environment and society.

Prevalently, smart initiatives are so many for existing the Brownfield cities worldwide. Some ideas about smart cities and initiatives found globally such as in Japan, Nagama City where the smart city there has reduction in thee ICT cost, efficient management and improvement in the operations of network.

Also in China, the smart cities there placed an effort to improve the national economy and there was a transfer in the city infrastructure and information technology where they became more competitive.

And in India, ICT was used for command center for the management of the city.

The smart city of IBM in Rio can be a good application and an illustration since the whole city has a complete coverage and an intensive network by providing cameras and sensors all over the city, thus, controlling the vital necessary functions is possible as well as the centralized monitoring.

However, there are still the wonders about when can a city be considered smart.

The question of 'what would make a city that hardly harnesses any given technology without fail to be any smarter than a city of low-technology, or even a 'slow city'' has been proposed, however, there are no parameters, testing tools or standards that are specific, definite or even universally agreed upon.

The European United Nations Economic Commission, the International Telecommunication Union and the United Nation bodies all together made the creation of the "United for Smart Sustainable Cities" (U4SSC) which has released the KPIs (Key Performance Indicators) to Smart cities for the establishment of the evaluating criteria for the assessment of the contributions of ICT in making and transferring the cities to become more sustainable12 and smarter.

MoHUA which is the Ministry of Housing and Urban Affairs in India created some standards of Livability in the Cities13 for the generation of an Index of Livability with an amount of seventy nine indicators for rating cities. The standard indicators of

Livability are categorized and sorted into fifteen categories depending on the twenty four criteria found in the SCPs (the Smart City Proposals).

The intention is that those seventy nine indicators are going to contribute in "achievements of the Sustainable Development Goals of the United Nations".

For final computation of the Index, various weights are being specified to the four pillars of the thorough development and of the obtained City Livability Index.

Figure 4 shows an illustration of the entire process.

However, the available indicators are of an early stage to be used by administrations of a city, and also there is a lack of materials to be used for the Urban planning and a lack of Indicators to be used for the Urban Designing.

7. Conclusion and Future works

Lately, the idea of smart cities has widely spread, and every city is struggling to develop itself and become smart. And for a city to become smart, there must be Urban Planning and Urban Designing, however, there is a big gap between both steps, since Urban Designing is about the features designs of the city for the improvement if life quality and sustainability, while the urban planning is concerned about the city structures like the infrastructure, building codes and neighborhood.

Overcoming this problem was discussed in this paper by using ICT which is used by both administrators and urban designers, and thus the large gap has been bridged by using the ICT.

For Future works, more applications of the Smart City Design Principles with the aid of ICT will be done on different models which might as well include a Brown City, in a trial of compromising the plan and design which already existed to become more smart.
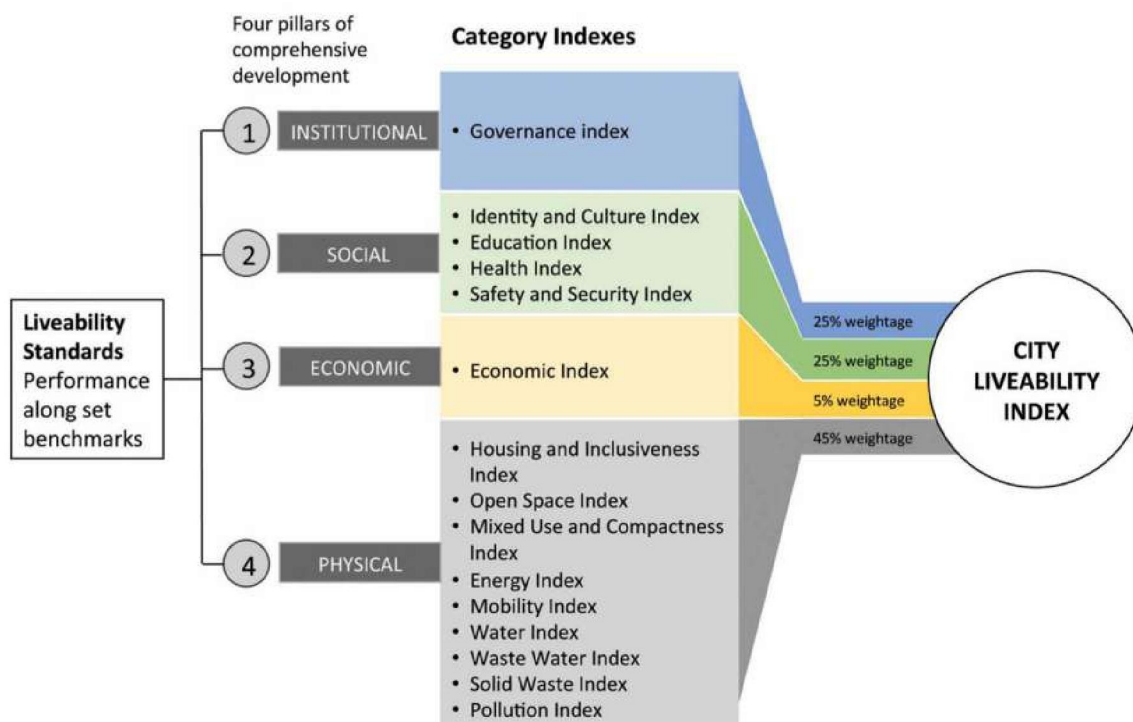

Figure 4: Livability Index [10]

References

1. Ghafoor Kayhan and Danda B Rawat; "Smart Cities Cybersecurity and Privacy" Elsevier, ISBN: 9780128150337, December 2018.

2. Dameri, R. P. (2017). Using ICT in Smart City, pages 45–65. Springer International Publishing, Cham.

3. Anthony Townsend(2017). Smart Cities: What Do We Need to Know to Plan and Design Them Better?, workshop sponsored by the Social

Science Research Council, held in Brooklyn on June 15, 2017.

4. Kitchin e et. Al (2017), "Smart cities, urban technocrats, epistemic communities and advocacy coalitions", The Programmable City Working Paper 26, http://progcity.maynoothuniversity.ie/.

5. Thakuriah P N et. al. (2016). *Seeing Cities through Big Data: Research, Methods and Applications in Urban Informatics*. (Springer)

6. Rukiye Gizem Öztaş and SELMA ÇELİKYAY (2018). Eco Design Principles for Sustainable and Smart Cities, IMCOFE, 2018.

7. Senior Professor and Head, Centre for Future Cities, SPA-New Delhi. 2014. "Smart cities go beyond just using tech tools." The Indian Express: Business,9 August, 2014, accessed October 16, 2018 https://indianexpress.com/article/business/busine ss-others/smart-cities-go-beyond-just-using-tech-tools/.

8. Technical Report, "M2M/IoT Enablement in Smart Homes," TEC-TR-IoT-M2M-007-01, Release 1.0, 2017.

9. Technical Report, "IoT/ICT Enablement in Smart Cities," TEC-TR-IoT-M2M-006-02, Release 2.0, 2017.

10. Technical Report, "Design and Planning Smart Cities With IoT/ICT," TEC-TR-IoT-M2M-006-02, Release 2.0, 2019.

11. Ali Alshaery, Reem Alshalawi, Mohmed Osama Khozium "Smart Cities: Integration of GPS and IoT Approach", Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ) K -MULTI: Issue (18), Apr (2019).

12. Norah Farooqi, Adnan Gutub, Mohamed Osama Khozium "Smart Community Challenges: Enabling IoT/M2M Technology Case Study", Life Sci J 2019;16(7).

13. M. Carta, Smart Planning Lab, 2014. [https://issuu.com/iaacbits/docs/maurizio_carta]

14. Carta, M. (2014). Smart planning and intelligent cities: A new Cambrian explosion. In Smart Rules for Smart Cities (pp. 123-132). Springer International Publishing.

15. Anna Roumiantseva, The Fourth Way: Design Thinking Meets Future Thinking, October 19 2016.

16. Batty, M. (2013). Big data, smart cities and city planning. Dialogues in Human Geography, 3(3), 274-279.

17. Ching, T. Y., & Ferreira Jr, J. (2015). Smart cities: Concepts, perceptions and lessons for planners. In Planning Support Systems and Smart Cities (pp. 145-168). Springer International Publishing.

2/29/2020