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A Conceptual Framework for the Utilisation of ICT in Participatory Planning

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1 ABSTRACT

Sustainability as one of the most recognised principles in urban and environmental planning, which include not only the economic and environmental dimensions but also social factors. In order to measure social sustainability, different criteria are mentioned in various research. Some have recently emphasised participation, social engagement, and social participation. These terms convey a shared meaning of participation of lay people in planning and managing their city or neighbourhood. Participation in planning has social justice implications, which leads to social stability. From another point of view, participatory planning increases personal power for those who engage, and reinforces democratic values. Stakeholders' participation in the planning process can be implemented by different means, changing from distributing the questionnaire to holding a communicative meeting led by planners and similar experts. emerging communication technology brings about new capabilities of engaging stakeholders and lay people in urban and environmental planning. New technologies, such as Information and Communication Technology (ICT) and Big Data, provide extensive and easy participation of people in policy-making decisions that govern their cities. Far-reaching comprehension of the way people use and interact with the environment is an important factor for decision makers and planners. The aim of this research is to explore the potential of technologies available to lay-people at different scales of urban planning. From this exploration, the capability of technologies Will be assessed for their ability to accurately interpret people's perception of, and interaction with the environment.

Keywords: Social sustainability, Participatory planning, Perception of the environment, ICT, Big Data

2 SUSTAINABILITY AND PARTICIPATION

2.1 Social sustainability

Sustainability has different subsets, all of which are important for a comprehensive realisation. Since the introduction of planetary sustainability, social sustainability has largely been neglected (Woodcraft, Hackett, & Caistor-Arendar, 2011). Social sustainability is defined as “a process for creating sustainable, successful places that promote wellbeing, by understanding what people need from the places they live and work. Social sustainability combines design of the physical realm with design of the social world – infrastructure to support social and cultural life, social amenities, systems for citizen engagement and space for people and places to evolve” (Woodcraft et al., 2011). Various indicators are mentioned in scholarly research to measure the success rate of social sustainability. There are differences between traditional and recent indicators in term of that represent the level of social sustainability achievement.

traditional indexes concentrate on static analysis based on statistical data, and the new metrics have moved toward combinations of indicators that represent quantitative and qualitative measures of social sustainability. These new indicators are based on sustainable principles and objectives that emphasise the "deliberative and reiterative participation process involving a wide array of stakeholders and local agents" (Colantonio, A. and Dixon, T. 2009). Participation is also regarded as one of the dimensions of social coherence and social justice that are in the domain of social sustainability (Griessler & Littig, 2005). Therefore, stakeholder engagement is now a shared characteristic of many research undertakings within the sustainability sciences (Brombal et al., 2018).

2.2 Participation

Although participation can occur in different forms and activities (Dempsey, Bramley, Power, & Brown, 2011), a corporation in social activity, it plays a crucial role in urban planning since it provides fundamental infrastructure for further social participation. The definition of the social sustainability presented by Woodcraft et al. (2011) can be regarded as sensible. The definition has an emphasis on the combination of designing the social and the physical world which would lead to the future engagement of people in other social activities. However, the combination of a social and physical world could not be reached without the consideration of participation. without people to participate the planner cannot understand the real needs nor

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their interest for a place for social activity. Therefore, the recent indicators of social sustainability indicate "local actors and residents' perceptions as part of the overall measurement process" (Colantonio & Dixon, 2011). According to the new indicators and definition, social sustainability will be required when designing and planning public environments (combination of physical and social) involves participation of the all stakeholders in this process. Bringing together different stakeholders of a project has some political consequences since it distributes the power of decision making among a greater variety of groups (Bechtel & Ts'erts'man, 2002; Berman, 2016). In consequence, from a political view, by reflecting the preferences and desires of the lay people, the process of participatory planning empowers the people and reinforces the pillars of democracy. However, Limited levels of the participation (Berman, 2016) devalues the participatory process. Significant Participation, on the other hand, provides legitimacy by the public, which gives approval to the decisions (Berman, 2016).

Churchman (2002) states that participatory planning changes planning from a more procedural process to a process more concentrated on context and content. "Such an approach requires the planner to begin the process on more of a microlevel and from there to build up to more of a macrolevel" (Bechtel & Ts'erts'man, 2002). This means that participatory planning has a more local attribute than regional and national implications. However, starting the work from a microlevel like a residential District, that inspires specific set of neighbourhood values would have suggestions and implications for the macrolevel in accordance with both planning and process principles (Bechtel & Ts'erts'man, 2002). Berman (2016) believes that participation and engagement of the people in the planning process means extracting the local knowledge. He translated the local knowledge as local desires and needs, local cultural values and social customs with environmental problems and nuisances.

Moreover, "local knowledge contains elements whereby locals perceive, measure, and evaluate their environment; solve problems; and ascertain new information, including processes whereby knowledge is produced, stored, used, and transmitted" (Berman, 2016). Here are some cues that can differentiate the various kinds of participation. The understanding of people's desires and needs would differ in term of methods and tools from understanding how people perceive, measure and interact with their environment. Horelli (2002) explains that interpreting the relationship between human behaviour and the environment is based on three different levels of individual, communal and societal regulation. "Communal regulation means the opportunity of a group or local collective to influence environmental issues, for instance, through participatory planning; societal regulation takes place as regional policy zoning laws or urban policy programmes. Individual regulation can be seen as the subjective appropriation of the environment and the processing of this experience in which the setting and its cues are used as a means of psychic self-regulation" (Bechtel & Ts'erts'man, 2002). The individual regulation refers to the psychical and mental process in which a person regulates his/her behaviour or action in the physical, social or natural environment. According to different considerations of human attributes in participatory planning we can divide the participation process into different types. The use of people's desires and preferences in a deliberative and communicative method can be considered one type of participation. Evaluation of perception and realisation of individuals and their behaviour in the urban context is another type of participation. In contrast to the latter which, is more active participation, the former is more passive.

The aim of planning in this framework is to comply with the needs and intentions of the participants. (Berman, 2016, Bechtel, 2002 #29,) Therefore, based on the goals of participation the process would differ and consequently the method and the tools that would be applied would vary. Horelly (2002) defines the participatory planning as a " social, ethical, and political practice in which individuals or groups, assisted by a set of tools, take part in varying degrees at the overlapping phases of the planning and decision-making cycle that may bring forth outcomes congruent with them" (Bechtel & Ts'erts'man, 2002).

2.2.1 Dilemmas of participation

During the engagement of lay people in the planning process, some important issues are arising. The scale of people participating in the planning process is an important matter since the main goal of participatory planning is to have an exact delegation of the community who would be the representatives of their society. In the planning process, the planner usually deals with people in terms of aggregated populations. "Planners tend to be wary of the microlevel, because it will make things even more complicated than they already are. It is easier to work with macrolevel statistics that are readily available than to try to generate microlevel

data" (Bechtel & Ts'erts'man, 2002). However, this method sacrifices many desires of the different constituency groups since each group of people has its own preferences and needs. The participatory process usually has marginalised minority groups of the society like women, young people, and elderly; however it is more representative of the diversity that composes the general society (Bechtel & Ts'erts'man, 2002). Lack of experience and knowledge of planning is another barrier for effective public participation. This deficiency has been recognised as a reason for the reluctance of engaging the public within urban planning (Conroy & Evans-Cowley, 2006; A. Wilson, Tewdwr-Jones, & Comber, 2017). "There are two problems here: one is that there are no developed tools for how to accomplish this goal, so each planner tries to work out a strategy on his or her own. The second the problem is that physical plans are usually expressed in two-dimensional drawings rather than in words, and it is very difficult to express the reasoning behind the plan and all of the considerations that went into the final product presented in this way" (Bechtel & Ts'erts'man, 2002). To overcome these kinds of shortcoming a wide variety of tools and techniques exist and can be applied to participatory planning. Traditional tools like questionnaires and survey are less communicative than the new emerging tools such as augmented and virtual reality. In this paper, the potentiality of using the advances in the information and communication technology for two different kinds of participation planning will be discussed.

3 ITC AND PARTICIPATION

Traditional tools and methods to facilitate the general publics participation in the urban planning process Traditional tools and methods to facilitate the general public's participation in the urban planning process include interview, questionnaire, and observation. Each of these methods continues to have an advantage if limited to the initial stage of the study (Bechtel & Ts'erts'man, 2002). However, these methods are not efficient because of their sampling limitations along with spatial and temporal scopes. They cannot cover nor comprehensively represent the complexity of human behaviour and social interactions. In comparison to the new methods of research, surveys, interviews, and observations are more cost-effective, but they are not so reliable because of the subjective bias and observer influences (Huang, Lin, & WU, 2017). Moreover, enormous work of the investigators makes these tools exhausting. Based on Carver, Evans, Kingston, and Turton (2001), traditional means of participation require prolonged discourses between organisations and the public. They enumerate the following barrier for traditional participation "It takes time, familiarity, and confidence with bureaucratic procedures, personal contacts in key places, money for campaigns, and private transport in order to attend meetings" (Carver, Evans, Kingston, & Turton, 2001). Therefore there is a need for using more intelligent ways that can efficiently and quickly collect data. The era of information and communication brings about promising kinds of tools and facilities for investigating and exploring the interaction between the city and its inhabitants. Through these advances, from various forms of participatory planning emerge. Information and communication technology (ICT) provides fundamental infrastructures that enable the city to turn into an intelligent entity which is able to incorporate different functional dimensions through the flow of datasets. Progress has led to the introduction of new concepts namely smart cities. "Various international cases present alternative approaches to the smart city, while they capitalise the Information and Communication Technologies (ICT) for multiple purposes, which vary from simple e-service delivery to sophisticated data collection for municipal decision making" (Anthopoulos & Vakali, 2012). Anthopoulos (2012) declares that the smart city and urban planning are responding to their requirements in an interactive, beneficial, and supportive interrelation. several mutual meeting points can be recognized based on the argument that the smart city architecture consists of four different layers. They are: user layer, service layer, infrastructure layer and data layer. In the user layer the smart city meets all planning dimensions through the participation of the stakeholders. In the service layer, intelligent transportation aligns with the planning principles, and e-democracy services facilitate public consultations with open dialogue. these factors influence planning, and express local requirements. However, infrastructure layers must conform to planning policies and planning should develop the smart cities uniformly across regions for coherent development. "Finally, the smart city's data layer must be kept up to date with accurate planning information, in order to deliver efficient and effective e-services to the local community" (Anthopoulos & Vakali, 2012). Rathore, Ahmad, Paul, & Rho, (2016) describe another model of the smart city with a 4-tier architecture which coincides with Anthopoulos' model but gives other valuable insights for the smart city from the ICT point of view. In the first tier, data is generated and collected from various resources. Because of these data produced through various tools and devices are heterogeneous and vary in format, the point of

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region and periodicity. The second and third tiers are two intermediate layers that transmit and process collected data respectively. In the last tier, the data is interpreted in order to use the result and produce a report. Implicit in these two definitions of the smart city are the roles of individuals or groups that can deliver new implications and adaptations within the participatory planning. In the Anthopoulos model, the individuals, or groups, are producers of the data layer, and consumers are the user layer of data. the Rathore model people are present at the first tier as producers of data. These various the roles (producer and consumer—users and stakeholder) can play in the smart city lead us to the definition of two different sorts of participation, namely active participation and passive participating.

Each of these kinds of participation would satisfy different goals of participation. The existence of the stakeholder at the first layer as a generator of the data would be useful in a kind of participation when the subject of the study is human behaviour and human interaction with the environment. As previously discussed, since this kind of participation deals with human behaviour like perception, it does not consider people's desires. Therefore, in this kind of participation with respect to the different roles of people as being passive producers of data. Conversely, active participation requires the preferences of the people to be considered in parallel to other sources of data (i.e. the extent of air pollution or the amount of water storage) and included within the decision-making (consuming the data).

Accordingly, the process of participation of people in the smart city can be divided to three levels: 1) the layer of generating and collecting data; 2) the layer of processing and analysing collected data; 3) the layer of interpretation and decision making. In the following sections, each of these levels is discussed.

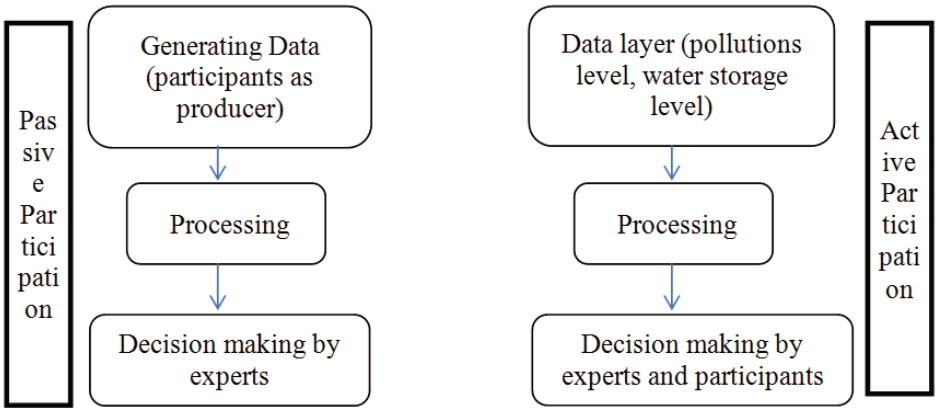

Figure1: The hierarchical levels of participatory planning in the smart city

3.1 Information and data gathering

The Wireless Sensor Network (WSN) throughout faultless distribution and integration into the urban infrastructure created a digital skin over the city (Jin, Gubbi, Marusic, & Palaniswami, 2014). Embedded and pervasive devices in an appropriate platform will generate and share the huge amount of data and information to fortify the city for planning and development (Rathore, Ahmad, Paul, & Rho, 2016).

These kinds of data that are produced by smart ubiquitous devices which are communicating with each other provide a massive amount of data that is referred to as Big Data. " This type of Big Data analysis provides a better understanding and useful information about the future as well as about planning and development, thus providing us insight into Big Data" (Rathore, Ahmad, Paul, & Rho, 2016). With an increasingly urban population inhabiting cities in the future billions of smart devices will communicate to each other which, in turn, produces huge amount of big data. "Hence, in analysing the data based on user needs and choices, cities would become even smarter" (Rathore et al., 2016).

Different sorts of big data like volunteered geographic information (VGI) create the possibility of expanding the engagement due to the spatial normativity that exists in heterogeneous platforms (Tenney & Sieber, 2016). For this purpose, "The combination of location-aware mobile devices and Internet connectivity allow for easy reporting of infrastructure problems or provision of feedback on events" (Tenney & Sieber, 2016). The developments of indoor positioning system (IPS), for example, Wi-Fi positioning technology, brings about new possibilities for spatial behaviour research in order to understand how large crowds of people are occupying space, interacting in space, and redefining space (Huang et al., 2017). Therefore these kinds of smart city and big data facilitate data analysis and management of the events that occur in the urban spaces

such as human behaviour (Vlachokyriakos et al., 2016). "Compared to traditional environmental behaviour investigation methods, IPS system is capable of fully covering the entire investigating area" (Huang et al., 2017). Therefore this method of aggregating data has usefulness especially in the neighbourhood area which is the most appropriate scale of participatory planning. These state-of-the-art tools bring about advantages in the passive participation where people behaviour is under the study. In this way the public is presented as data without the need of distracting people in their lives and involving them actively (Cardone et al., 2013). Tenney and Sieber (2016) explain that passive participation posits an indirect relationship between citizens and officials. "Inherent in these methods of participation are techniques that can utilise unstructured data, behaviour-analytical algorithms, and distributed computing infrastructures to collect, transform, and extract relevant social signals from massive datasets from a variety of sources"(Tenney & Sieber, 2016). Arguably, Duperrin (2014) believes the shift to the digital mediated participation would be preferred by the public. "It is not participation that wearies people, nor its lack of sense, but its active nature. It requires time (without being sure to get anything in return) and attention. No one denies the advantages of information sharing but employees do not understand why it requires extra work and citizens are happy about the benefits they get from the use of collective data (even unconsciously) but won't spend their life behind their screen to provide a predictive, analysing and proposition machine with ideas, feedbacks and experiences" (Duperrin, 2014).

Here it is asserted that big data and its related technologies will be solving the problem of marginalisation in participatory planning. Big data by VGI and by harnessing massive datasets claims that it is providing a solution for the sampling problems, which are situated as being representative of entire populations (Kitchin, 2014).

3.2 Processing

"Traditional data analysis tools and techniques cannot be used because of the massive size of a data set. Sometimes, the non-traditional nature of the data means that traditional approaches cannot be applied even if the data set is relatively small" (Tan, Steinbach, & Kumar, 2013). Data science and software engineering have already provided the necessary facilitators for processing information in the huge amount like big data. In the processing level, the data produced through the first level will be evaluated so that we can see this layer (processing) as receiver of inputs that produces outputs upon these inputs. "It is often argued the adopting data-driven approaches and computational methods remove the requirement of getting too involved with dealing with the raw data" (i.e. VGI) (Tenney & Sieber, 2016) therefore the process is comprised of converting raw data into useful information (Tan et al., 2013). In this regard, machine learning algorithms and data-driven approaches are applied to discover the knowledge that is disguised in the inputs and to produce results and insights in term of outputs. "Artificial Intelligence in various guises is commonly used in applications to understand and adapt user behaviours" (Chin, Callaghan, & Lam, 2017). In this level, many different behavioural patterns of the people can be aggregated and clustered in the different classifications. "Various classification algorithms have been explored, the majority of which has centred on harvesting, processing and visualising personal information, either via explicit (user input) or implicit (device tracking)" (Chin et al., 2017). Classification can be regarded as a process of learning a targeted function for assigning the given dataset to specific predefined features such that the model can be used to predict the classification of a novel instance whose classification is unknown (Tan et al., 2013). Resch and his colleagues (2016) in a participatory research used tweets to assess citizen's perception of the city. In this research, a semi-supervised learning algorithm was applied and instructed to categorise tweets of residents based on the contextual emotion of the tweets which have similarity in spatial, temporal and linguistic dimensions. (Resch, Summa, Zeile, & Strube, 2016). With this classification, they were able to depict the spatial distribution of the emotions in the city which, in turn, was interpreted as an environmental influence on citizen perception.

The features of these algorithms are enumerated as being predictive, acting in real-time and learning from existing circumstance for making better decision in the future (Winter, 2015).

However, some debates around the usefulness of algorithm arise when the transparency of its function is considered. Algorithm can be assumed as a set of functions that is running in a procedural way for solving a problem. These procedural steps are so interconnected that it makes it difficult to recognise when a function ends and another starts (Tenney & Sieber, 2016). These characteristics, besides the closed source and proprietary services of software, are defined as black boxes (Duperrin, 2014). Therefore relying on these

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opaque black boxes may to some extent compromise the advantages of democratic aspects of participatory planning. "The primacy of control in this data-driven realm of big data analytics is bestowed onto the algorithms that often act behind the scene, out of sight from both the citizen and the city official" (Tenney & Sieber, 2016)

Classification can be regarded as a process of learning a targeted function for assigning the given dataset to specific predefined features so that the model can be used to predict the classification of a novel instance whose classification is unknown

3.3 Analysing and decision making

In this level, in passive participation analysing the results will be evaluated by the experts of the urban planning field, while in the active participation the primary decision makers are the stakeholders including lay people. Since the result is being produced at the previous level it would be in a form of figures and graphs that are understandable for the experts but not for the stakeholders. Therefore, this level requires to make some differences between the active and the passive participation in terms of representation of the results. For active participation, the different scenarios for the city or neighborhood should be represented in a comprehensible form for the participants. The novel visualisation tools and technique "with a high degree of interactivity ought to be important in creating opportunities for good communication that, in turn, can create higher participation in dialogue processes" (Billger, Thuvander, & Wästberg, 2017). Here the emphasis is on the visualisation feature as a means of decreasing the complexity of the professional terms in a comprehensible way for the lay people on the one hand, and on the dialogic and interactive process in order provide a basis for the participants to express their ideas and opinions on the other hand. This amounts to the integration of different functions in one platform able to provide a visualisation tool that supports communication and dialogue. Many 2D and 3D representative tools for the realisation of visualisation aims previously have been created. Virtual reality and augmented reality are two 3D visualisation tools employed in various participatory planning. In the case of virtual reality, display and test of different development scenarios of the built environment (Amirebrahimi & Rajabifard, 2012) or realisation of how different alternatives design elements will affect the city experience are examples of participatory planning. Augmented reality has great potentiality in the context of urban planning due to the fact that "it achieves a realistic representation in real time at the actual site of the proposed built environment" (Billger et al., 2017). Moreover, some game platforms were recently studied as visualisation tools that implemented criteria such as participation, interaction, realistic visualisation, learning effect and knowledge transfer (Billger et al., 2017). The improvement of the participatory aspect of planning in terms of inclusion through the use of the virtual reality and augmented reality was proved in the initial VR-Planning project. However, the engagement of the underrepresented groups and old people that are not familiar with using such technologies was not answered (Schrom-Feiertag, Lorenz, Regal, & Settgast, 2018). The use of the smart phone instead of other kinds of VR and AR (for example cave) as a pervasive and ubiquitous tool in everyday life can mitigate the problem of limited inclusion of people.

Worldwide accessibility to the internet is a great foundation for sharing the idea and information. It provide best platform for participation in urban planning (Wu, He, & Gong, 2010). Based on the IWS (Internet World Stats), by the June 2018 there were 4.2 billion internet users in the world and internet penetration rate was 55.1% across the globe (https://www.internetworldstats.com/). It shows exactly how massive is the dominance of internet in the societies. Therefore the dissemination of a platform through the internet would increase the probability of engagement regardless of geographical limitation which in turn will increase the likelihood of further participation. Online and web base virtual reality has opened up new forms of communication, interaction and collaboration for participation in urban planning (Jiang, Maffei, & Masullo, 2016; LEVY, 2011) Online virtual reality by capability of covering more people and stakeholder in spatial and temporal dimension can overcome the shortcoming of marginalisation some groups of the public (Bulmer, 2001). Another issue is the probable weakness of the computational power of the smartphone and even PCs that has been solved with cloud computing technology. Since Cloud computing is independent of location, users can access to the internet and services at anytime and anywhere. In online participatory planning, cloud base augmented or virtual reality can be applied. Therefore, this technology would be used as software tools for planning to disseminate the proposed design and stakeholder would be able to share their idea and communicate with each other. These kinds of VR and AR cloud base technologies gives the

ability to the user to share the screen and control virtual perspective with other participants to cooperate on spatial planning issues (Shen, 2014 #128). For purposes of communication and discourse among participants, Web2.0 can be considered as well-developed and sufficient technology for fulfilling these aims. "Web 2.0 refers to the second generation of the Web, wherein interoperable, user-centred web applications and services promote social connectedness, media and information sharing, user-created content, and collaboration among individuals and organizations" (D. W. Wilson, Lin, Longstreet, & Sarker, 2011). The key words in this definition are user-centre content, information sharing, and collaboration. Based on this definition social medias like Facebook and twitter are kinds of web 2.0 which enhance and promote electronically social interaction among end users. Therefore a combination web 2.0 and visualisation tools and technique can be applied in order to engage people in a communicative and interactive way. Availability of various combinations of already mentioned technologies in different environments and on various devices will raise the opportunity of capturing people to urban planning. Integration of web-based virtual reality and web 2.0 technology will provide an interactive and communicative environment in which participant can roam around a 4d (including time) environment. Web 2.0's characteristic of this platform would provide an environment for sharing their idea and experience with writing a comment in relation to that environment. Here it would be possible that participant discuss with each other for finding a solution and decision-making. This composition of web 2.0 can be created from augmented reality, instead of virtual reality, to be applied on the smartphone for in situ. Implementation of this target relies on the smartphone since the smartphone is ubiquitous, inexpensive, mass-produced, internet connectable and currently has sold hundreds of millions per years. "This momentum ensures a large-scale in terms of number of users and broad geographic coverage" (Schmalstieg, Langlotz, & Billinghurst, 2008). Therefore, by using smartphone augmented reality people in city and near the targeted place for planning by putting their phone camera over a QR code can simply download an augmented reality application that superimposes the 3d model(s) of the proposed design(s) to the real site. This application benefiting of web 2.0 infrastructure would provide for users annotation associated with the proposed layout or selection of the various options from a pop-up menu. Here it would possible users move in the real world while seeing the proposed planning in a 3d form and annotations related to those virtual objects. Users will be able to add a comment and annotation in relation to other users' annotation or shows their agreement or disagreement, such they do on Facebook and Twitter. This combination of augmented reality and web 2.0 regarded as augmented reality 2.0 (Schmalstieg et al., 2008) which is an augmented reality that like web 2.0 its content is built by the users rather than by service provider. Use of smartphone and other kinds of smart devices for utilization augmented and virtual reality rather than other sorts will increase the chances of engaging underrepresented groups. For example, in the case of elderly people, working with ICT technologies has become easier by ever development of user interface. Every day, the interface of smart devices renders a simpler interacting ambient, therefore, the elderly or people who have less ICT literacy can benefit from such technologies too. In results, nowadays many elderly use mobile application for internet searching, social network and connecting with family and friends (Faisal, Yusof, Romli, Mohamed, & Yusof, 2014). Allen, Regenbrecht, & Abbott (2011) investigate the extent of public willingness in utilization smartphone augmented reality in participatory planning. the study revealed that participants in different age groups considered this system useful for participating in the urban planning project and "it did not require a high level of familiarity of the technology to understand the systems purpose and consider its potential utility…Participants in the field study showed an increase in their willingness to participate in urban planning events with the use of a smart-phone augmented reality system" (Allen, Regenbrecht, & Abbott, 2011). Moreover the augmented reality that will be designed for participatory planning should render a graphical and user-friendly interface which equipped with an instructor that illustrates its functionality step-by-step. The same platform can be designed in parallel for desktop users. Therefore people whether in a closed space or in an open space, whether with a personal computer or ubiquitous devices can participate in the planning.

According to these facts, it is seen that, in spite of some deficiencies, there are very well-developed equipment and facilities that can be utilised in combination to build up a communicative and interactive environment which, in turn, would embrace a large community of stakeholders for decision making.

4 CONCLUSION

The importance of participation in planning refers to the role that it plays in the realisation of sustainable development, especially social sustainability. The engagement of people in the process of development will

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guarantee the success of achieving the sustainability goals. In this research, we saw that based on the literature review we can define two kinds of active and passive participation. The advent of communication and information technology introduces the new concept of smart city that can engage stakeholders in the planning beyond conventional methods. The role that humans can play in the smart city provides new methods and tools for involving people in urban planning which is appropriate for both active and passive participation. Based on the use of ICT we divide participatory planning into the three levels of generating data, processing the data and visualisation and decision-making levels. Through this paper ICT potentiality for providing a platform for active and passive participatory planning was studied. It can be concluded that ICT provides a range of powerful tools and techniques which is supporting the participatory planning in all three proposed levels of urban planning. Benefiting of these kinds of technologies require the different initiative combination of these tools and technique which meet specific aims related to the specific level.

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