



Urban planning: integrating smart applications to promote community engagement



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ABSTRACT

Through the last decades, the development of technology was rapid. As a result, changes in a series of sectors of human life have been observed. One of these sectors is spatial planning, where new applications contribute towards its skillful application. Especially, in the sector of public participation in urban planning procedure, an urge of motivation of the public is noted in order to participate as an active participant who collects data, creates maps, suggests ideas and, finally, accepts or not a design proposal.

In that context, this research paper investigates how new technologies contribute in the promotion of community engagement in urban planning. In a parallel manner, this paper attempts to locate the effects that are expected to have technologically advanced applications in participant planning in the local community. In order to examine the above issues, an international literature review occurs and institutional guidelines towards this sector are investigated, in European level. Furthermore, the investigation of case studies is utilized in order to establish a guide of line practices and locate the effects that presented similar policies in societies that implemented them. All the above contribute to an ex-ante evaluation of the application of such practices in Greece, in order to find out how much usefulness will their integration provide to the procedures of spatial planning of the country.

1. Introduction

Rational planning has been criticized during 1990s and 2000s, with respect to its effectiveness and democratic nature. Its emergence in the 60s and 70s, according to Wassenhoven (2002), “was accompanied with unfortunate claims of comprehensiveness and scientific objectivity” (p.30) Indeed, through this systemic approach of planning, its implementation in strictly predetermined phases and the theoretical acceptance that all these elements that constitute the city must be examined in unison, often mistaken predictions are formulated and therefore the suggested interventions do not reflect the needs of the citizens of each area (Georgala and Krommyda, 2015). According to Allmendinger (2009), the prototype of comprehensive rational planning that prevailed for at least 3 decades after 1950 (Aravantinos, 2007), was soon heavily criticized for two more reasons: (a) the demand of a large quantity of data, which often, were not utilized at the suggestion and (b) the conventional participation of the public (Aravantinos, 2007; Georgala and Krommyda, 2015). The above reasons, in collaboration with a series of

economic, social, political and technological reasons (Creighton, 2005), lead to the abandoning of that model and the transition towards the model of strategic planning. The sentence of Hall (1996) is characteristic, caricaturing this issue: “In 1955, the typical newly graduated planner was at the drawing-board, producing a diagram of desired land uses; in 1965, she or he was analyzing computer output of traffic patterns; in 1975, the same person was talking late into the night with community groups, in an attempt to organize against hostile forces in the world outside”.

The strategic planning did not completely replace rational planning, rather, new practices came to complete the broader vision in reasoning and practice of urban planning. These practices, according to Aravantinos (2007), have a common characteristic that they allow the participation of citizens in planning practice. Indeed, with the passing of the years, urban planning embraces concepts that are mainly man-centered (Pouzoukidou, 2000). Bigger and bigger importance is given to inform the citizens (Krommyda and Stratigea, 2017; Kaukalas et al., 2015; Kassios, 2002; Vlastos, 1998) and their active participation in decision making, which is considered a corner stone of democracy (Von Heland et al., 2015). Thus,

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the character of modern urban planning is more social than morphological (Prigou, 2016). According to Wilson et al. (2017), reinforcing citizen voice in planning can bring in many advantages in local communities.

However, even nowadays that an agenda about communicative and collaborative planning theories developed academically for over 30 years (Wilson et al., 2017), it is not easy to achieve high percentage of public participation (Falco and Kleinhans, 2018; Münster et al., 2017; Holman and Rydin, 2012; Kyriakidis, 2012). The factors that support that fact are the strictly determined procedures, where in countries like Greece, are often typical ones (Bakogiannis et al., 2018a) and characterized by immaturity (Bakogiannis et al., 2018b) because of lack in participatory culture (Athanasopoulos and Stratigea, 2015), bureaucracy (Brabham, 2009), the rigid language (Wilson et al., 2017) and loss of public trust in politicians and local authorities (Giering, 2011; Gadou and Qaazi, 2010). Indeed, due to the fact that traditional participation techniques are mainly used in the Greek planning system, like consultations, people and mainly youngsters do not spend their time for participating in such community meetings. According to a survey by the Transportation Research Board, USA (2011 in BRT Planning Guide, n. r.), lack of time for public participation consists of one of the main challenges that planners should face. In most cases, they cannot understand the terminology or the process and there is a strong belief that the amount of the potential influence of the public is quite small; thus they are unwilling to participate in the process. Public cynicism and distrust of the process can arise and building trust within the community is required. And while the nature of procedures consists of an important parameter in order to urge citizens to participate in planning, nevertheless, an obsession in non-digital participation methods - often termed "traditional" (Wilson et al., 2017)- is observed, despite the fact that there are many available modern tools of community engagement (LeDantec et al., 2015). BRT Planning Guide, n. r. 10.3 Challenges to Public Participation [Online] Available at: <http://brtguide.itdp.org/branch/master/guide/public-participation/challenges-to-public-participation> [Retrieved March 9, 2019].

In this research paper such tools are presented. Special emphasis is given in specific practices that apply in the context of implementing Sustainable Urban Mobility Plans, which demand a high level of participation according to the Directions of the European Union (EU) (Bakogiannis et al., 2018b). Such tools are related to the collection of citizens' opinions through web-platforms as well as data by using crowdsourcing applications.

The aim of the specific research is the creation of a guide of good practices about the way smart applications for the promotion of participatory planning process can be applied. This paper deals with suggestions on how public participation could be enhanced towards the implementation of Development Plans and Sustainable Urban Mobility Plans (SUMP) that consist of challenging planning initiatives. SUMP, in combination with new Development Plans, aim to address transport related problems in a more sustainable way (Papaioannou et al., 2016) and thus, to improve the quality of life in Greek cities. Research questions that are attempted to be answered are: In what degree the use of smart applications helped the enhancement of participation and therefore the improvement of social prosperity and development? How much satisfaction can be drawn from such tools exclusively in the planning process?

2. Theory

The rise of Web 2.0 and social media through the last years has significantly transformed the way people communicate with each other (Münster et al., 2017; Spil et al., 2017; Grenier and Kudo, 2016; Stratigea, 2015; Kubicek, 2010). This change concerns mainly the supplementary function of communication through new technologies and, in contrast with what utopians and distopians say, is not characterized solely from positive or negative impacts, respectively (Wellman et al., 2001) (Wellman et al., 2001). emphasized that "internet use increases the participatory capital". Indeed, the easy access to information gives the

capability of better understanding space issues (Stratigea, 2015), and therefore the maturation of social groups. New opportunities are uncovered with the bloom of participatory planning through tools that support e-Planning and e-Participation.

E-participation is more and more used since many tools have been developed. Public Participation Geographic Information Systems (PPGIS) offer the opportunity of e-participation of the public, by which use of maps for the improvement of public's information as well as the collection of spatial data is done, with the public's contribution (Craig et al., 2002; Papadopoulou and Giaoutzi, 2014; Somarakis and Stratigea, 2015). In that context, Volunteered Geographic Information (VGI) (Goodchild, 2007) and crowdsourcing (Surowiecki, 2004) come to the fore. According to Goodchild (2007), VGI defines the user-generated geospatial content that is produced to satisfy different human needs like administration, commerce and economy as well as social networking. VGI consists of a version of crowdsourcing, according to Goodchild and Li (2012), since in most cases, has taken the form of georeferenced point- and line- based data accompanied by short oral descriptions, photographs or video (Coleman et al., 2009). In crowdsourcing applications, the crowd is the collective of users who participate in the problem-solving process. According to Surowiecki (2004), "under the right circumstances, groups are remarkably intelligent, and are often smarter than the smartest people in them".

In Europe, such practices are more and more used during the last years (Bakogiannis et al., 2018b; Schweizer et al., 2011). In urban planning level, through participatory tools, it is easier to analyze the current situation of urban areas in different scales and sectors as well as to propose a design plan in the city and neighborhood level or even in the one of a specific urban space.

In order to collect environmental information that can be used in the analysis of the current situation of urban areas, applications like HackAir have been developed (Moumtzidou et al., 2016). This specific application consists of an open platform that collects air quality data from various sources including official open sources and citizens (sky-depicting photos and low-cost sensing devices that people build on their own) (Kosmidis et al., 2018). Apart from its contribution to better reading the problems of urban areas, the use of the application as well as the development of the appropriate data base are expected to contribute to the environmental awareness of people to easily set up air quality monitoring networks and engage in planning procedure in an active way (Satsiou et al., 2016). Proportionate projects are completed in numerous cities around the world, as noted by Moumtzidou et al. (2016), with characteristic examples the Amsterdam Smart Citizens Lab, AirTrick and CITI_SENSE.

Another environmental parameter recorded during urban planning process is that of noise. Given the fact that only large cities are obliged to monitor noise by creating noise maps, crowdsourced noise mapping consists another alternative. Aletta et al. (2016), Margaitis et al. (2015), Pödör et al. (2015), Pödör and Révész (2014) and Garcia-Marti et al. (2014) argue that it is fundamental to use data derived from crowdsensing and crowdsourcing for monitoring noise levels.

The following table presents the role of natural factors in planning. Lein, (2003), Nieuwenhuisen, (2016).

Common tools are often used for data collection regarding traffic loads and land uses. Data originated from "GoogleMaps" and "OpenStreetMap" platforms contribute to the calculation of traffic as well as the development of land uses, correspondingly. In some cases, "OpenStreetMap" platform, except from mapping land uses, it also presents data of special interest like urban equipment (lighting pillars, benches, traffic lights, wheelchair ramps, etc) and meta-data regarding the characteristics of buildings in each study area (Basiouka et al., 2015).

Beyond, however, the information collection tools, another type of web-platform has been developed in order for citizens and urban planners to discuss about the future of the city. Such an example is Nexthamburg which was kicked off in 2009 (Anastasiou, 2015) and is an independent citizen-based think-tank initiative. A similar web-platform is CoUrbanize which was used in many American cities in order for

stakeholders, associations, businesses and investors to express their ideas on projects, promoted in these cities (Siangliulue et al., 2016).

Experience gained from the examples presented above, reveals that the use of innovative participation tools can make easier the communication between decision makers and citizens in order to produce successful urban spaces. Citizens actively participated at the cases presented in the research papers presented above, resulting to reduced time and cost of the urban planning procedure.

Based on the above, the next unit examines two case studies in Greece, where such participatory tools were used in the context of completing Sustainable Urban Mobility Plans (SUMPs).

3. Experimental

The case studies research are the Municipalities of Kallithea and Kozani in Greece. It should be noted that this research is not approved by a relative ethical committee because there was not such a committee at the time the research was conducted. The Case studies Research: The Municipalities of Kallithea and Kozani in Greece was conducted in 2017, while ethics committees in Greece were set up by law in 2018 (Law 4521/2018 published in Official Government Gazette issue A38 date 02.03.2018, articles 21, 22, 26).

However we feel the obligation to declare that the Case studies Research respected totally human rights, autonomy of participants, their personal data as well as the need to preserve natural and cultural environment. Also, the researchers respected every principle of research integrity and they kept all the criteria of good scientific practice.

Fig. 1 presents a location map of Greece modified in such a way to show (approximately) the location of Kozani and Kallithea. Kallithea is part of the Athens Metropolitan area. It is located in the interim between Athens and Piraeus and according to the last census, the resident population accounts for 100,641 inhabitants and is the most densely populated municipality of Greece. Kozani is located in the Region of West Macedonia, Greece and its population is 41.066 residents (2011 census).

Generally.

With local government activities, local economic development is advancing faster as investments accumulate and external economies are created that transform the local and wider market.

Additionally a Municipality, through a healthy and properly designed development policy may achieve elevation of social, cultural, even though educational level of its citizens as they come in touch with new ideas, new standards are being created, new life trends and the citizens themselves take personal initiatives.

Particularly today the role that Municipalities are asked to play has



Fig. 1. Location map of Greece. A modification has been added (only in this paper) to the original map in order to show (approximately) the location of Kozani and Kallithea. Please refer to: https://commons.wikimedia.org/wiki/File:Greece_location_map.svg#filelinks (licence to copy, distribute and/or modify this document is provided in the above link).

major importance. Economic, political and technological developments have to the internationalization of society and the economy, and the strengthening of local communities. According to the above the basic policy axes of Greek Local Administration should be:

- Quality of life – Offer of new services which will improve the standard of living of citizens.
- Protection and improvement of the environment, both natural and urban.
- Emphasis on education, continuing training and technology as new demands emerge that change Municipalities' priorities and capabilities to provide services.
- Creation of the necessary social infrastructure and building of a social network which will actually cover the basic needs of citizen.
- Turning to healthy entrepreneurship activity and implementation of investments with utilization of local resources and offering services that private sector refuses to provide creating thus, new jobs (Delitheou, 2018).

3.1. Study area

The case studies selected are two municipalities for which there is an on-going SUMP process. This criterion has been assessed as important because such a plan is a planning tool that it: (a) is promoted by the European Union (EU) and there are increased interest rates on local bodies to implement it, (b) must be implemented through participatory processes during various stages of its implementation, (c) aims to develop sustainable, economic, compact and sociable urban areas.

One more criterion used, is that of the location of the municipalities. The use of two municipalities with different characteristics would contribute to the extraction of different conclusions for each one of them. Thus, a municipality that lies in the metropolitan complex of Athens and one provincial municipality were chosen. Beyond the differences observed in residential network level as well as spatial interactions with close regions, a differentiation in the density and structure of the population is observed, since the municipality of Kallithea is urban while the municipality of Kozani includes urban as well as peri-urban areas.

3.2. Methodology

In the context of SUMP's implementation for the two mentioned municipalities by the Sustainable Mobility Unit of the National Technical University of Athens, a combined participatory planning methodology was used in two main phases of the planning process: (a) analytical stage, where reading of problems and opportunities of the area is attempted as well as data collection and evaluation are demanded (b) proposal stage, where spatial imprint of the vision of decision makers is done as well as specific solutions that satisfy, above all, the residents are demanded.

Thus, in the first stage, residents were asked to contribute in the collection of environmental data and more specifically noise data with the use of their smartphones. In the second stage, the research team asked the residents to present their ideas based on problems they observed in their area. The collected information was hanged up in a web-platform where each citizen could present his/her idea in a text or image and determine the intervention point on the map. The qualitative information gathered, was quantified through word clouds method (Bakogiannis et al., 2018c) and evaluated in order to ascertain the needs and desires of residents. It should be noticed that the word cloud diagrams were generated through the wordclouds.com website (<https://www.wordclouds.com/>).

The way in which the above procedures were implemented, the time needed, the interest of public as well as the information gathered, allow the extraction of conclusions regarding their application in Greek reality. Through the above process, the answer of research questions and the setting up of a catalogue of participatory processes good practices for the

implementation of SUMP's are attempted.

3.3. Results

On the first step, volunteers used their smartphones in order to collect data. The volunteers participated in the research upon invitation and they had no hearing or vision problems. Due to the fact that the research took place in both of the cities was a pilot one, a small number of volunteers were invited. 7 citizens in the Municipality of Kallithea and 3 volunteers in the Municipality of Kozani. The data collection was carried out with the help of volunteers (crowdsourcing), who used their smartphones. On the subject of the profile of volunteers participated in the research in Kallithea, four men and three women (total seven individuals), with an average age of 36.7 years, participated in the study. Four of them (57%) are working in the private sector, two are retired (29%) and one is student (14%). Four of them (57%) have grown up in Kallithea and currently reside in the area. Two volunteers (29%) have grown up in Kallithea and currently reside in adjacent municipalities. However, they are visiting Kallithea for personal or professional reasons, on a regular basis (3–4 times a week). Only one volunteer has not grown up in Kallithea and resides outside of the study area. Finally, in regards of the educational attainment of the volunteers, 43% hold master's degrees, 43% are graduates from a university faculty, while 14% attends a degree on a university faculty. In Kozani, three young volunteers (2 women and one man) participated in the research. The volunteers participated in the research, upon invitation, and they had no hearing or vision problems.

The data collection process took place through a systematic sampling. Sampling points were selected using a 200 × 200 m. grid of points. Volunteers were asked to regularly collect information about crossing places at specific times within the day (morning, afternoon and evening). Then, they had to upload the information in an open-source app (OSM or MyMaps) in order to be available online. This data-set was used in order for the research team to create noise maps (Fig. 2) by using GIS software.

Results seemed reliable enough to draw conclusions about the existing situation in both cases. Indeed there was a correlation of noise values with the road axes and the traffic they serve. On the contrary lower values were observed in areas where building density is smaller and the number of trees larger. In parallel a correlation was made between land use and noise levels and it was found that in residence areas, noise levels are lower than those in central areas. However there were land uses (Hospitals for example) that were situated in areas more annoying than they should be.

This fact in combination with the matter of school integration in the city was examined in order to reduce problems. However, research constraints, such as data capture failure (recording at ground level rather than the projected height of 4 m, recording on a main road and sometimes at a certain distance, recording for a short period of time), were evaluated. Consequently, although some particularly large values were recorded at both cities it does not mean that people are actually exposed to them.

An important element in both case studies is that volunteers have positively evaluated the training (whenever it was needed), they had and the recording procedure. In their evaluation, which was conducted through an interview with the participants, most of them stated that they would be interested to participate in similar future efforts. However, it was made clear that they would prefer data collection not to be conducted with a systematic way, which means by measuring at specific city spots which were defined during meeting between volunteers and researchers (Fig. 2), but based on their daily programme. Among the motivations that prompted them to accept to participate in the procedure they included their interest for the improvement of their city's image (sense of belonging), the development of individual skills and the gain of new knowledge, exploitation of their free time for community's gain and meeting other people (socialization) (see Table 1).

In the second stage, it was asked from citizens to contribute to the city planning using a web – platform which was developed for each city

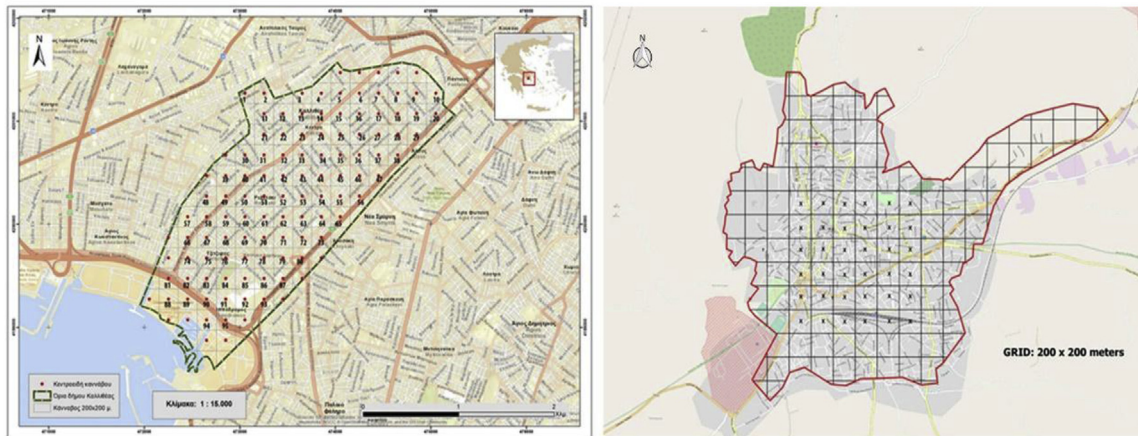


Fig. 2. Specifying of spots of systematic sampling, that they were the basis for the organization of information collection with crowdsensing/crowdsourcing tools. The panel on the left presents noise spots at municipality of Kallithea and the panel on the right presents noise spots at municipality of Kozani.

(Fig. 3). By this way, citizens as they were directly cognizant of their problems and needs suggest solutions at specific areas or spots on the map. The nature of the specific tool allows understanding of the city, contributing to analytic procedure, and in parallel inspires study group with ideas acceptable by local community. 93 citizens participated in Kallithea case study and 78 in Kozani (Table 2). Apart from the ideas they stated using verbal descriptions and images, they had the opportunity to interact with other users voting for some other idea that had been recorded. By this way the best ideas were highlighted, something that acted as a motivation both moral and material, since citizens who had the idea would accept rewards for their participation.

The conclusions from the ideas that were uploaded on platforms focus not only on the relation between drivers and pedestrians with public spaces but on the relation between drivers and walkers as well. Additionally the existed infrastructure is evaluated and solutions are being suggested for the improvement of mobility for everyone in an economic way.

Table 3 presents citizens' ideas categorized based on the categorization way chosen by them. It is obvious that the defense of the pedestrian movement was the core of ideas in municipality of Kallithea and the management of urban traffic in the municipality of Kozani. Although bicycle was not at the centre of ideas group of citizens through word clouds analysis which was conducted with data the phrases citizens wrote, it was found that bicycle was the most common word in given suggestions. Other words that were presented often in citizens ideas are "green spaces", "schools", "traffic" and "parking" as shown in Fig. 4.

The above conclusions show that participants' interest, apart from the public area turns to the proper functioning of specific land use, such as schools. This matter was set for discussion during crowdsourced noise mapping procedure, involving both study group and volunteers participated in the procedure. It was found that many ideas focus at the safety of students; travelling from and towards their schools, while there are many who point the need to enhance walkability and bikeability, which are measures of how friendly an area is to walking and cycling.

These findings are proportionate to a questionnaire survey which was conducted in both cities. The basic advantage of the questionnaire survey over the web platform is that it provides the possibility of participation to a larger number of population, since, even today the elderly have limited contact to new technologies. However, questionnaires often considered exclusively as a method of information collection and not a participation tool (Stratigea, 2015). However, even if this issue is overlooked and questionnaires are considered as participation tools, the disadvantage of people's participation through web – platform in relation with questionnaire survey, is short - termed considering that population's abilities in new technologies increase as time passes. This observation in combination with the increased use of digital media suggests that people's participation in such digital consultations will be increased in next applications.

Another disadvantage of the method is that no information can be obtained about the behavior of citizens, both pedestrians and drivers. Even though the specific information can be generated through questionnaire survey there is a possibility of questioning the results and the most reliable way is observation (visual research), which however is not feasible to be implemented in all cases for all the cities.

Besides, the purpose of such web-platforms is primarily to involve the public in the proposed design, not the collection of information, which is more appropriate for the interview, questionnaire and observation methods. In both cases the suggested interventions based on the ideas put forward. Planning focused on promotion of bicycle and giving of public places for pedestrians' movement and stand. Smart solutions suggested by citizens such as design of colourful an 3D crossings and the planting of terraces are ideas that, although they are not applied in the context of SUMP, are nevertheless stored in the ideas tank for future application by either a public or private entity. The fact that residents' and researchers' ideas are the same makes much more possible for these suggested interventions to be accepted.

Therefore the transition from the existed to the suggested is expected to be easier, having in mind the reactions encountered during decision making regarding creating sidewalks (pedestrianization) or limiting parking areas with typical examples of interventions at Voucourestiou and Ermou str. in Athens (Anon, 1996).

Finally, crowdsourcing methods application creates a precedent for reuse of the method. This time land use could be designed in order to observe a phenomenon and the function of the result as a marker. Thus, in the case of noise mapping, the development of volunteer groups that will contribute to the collection and publication of such information will contribute to the continuous monitoring of the phenomenon at city level. It will also give a chance of evaluation of interventions that will be implemented to produce measurable results and to encourage other municipalities to adopt corresponding practices.

Table 1
The role of natural factors in planning.

1	Green spaces-Natural vegetation
2	Water surfaces-Hydrology-Soils
3	Sensitive habitats
4	Air pollution
5	Noise pollution
6	Environmental sensitive areas
7	Geomorphology/Geology and Topography
8	Climate
9	Hazards



Fig. 3. Crowdsourcing platforms developed in order for citizens to submit their ideas about the future of their cities.

Table 2

Data related to users participated in the crowdsourcing process.

	Kallithea	Kozani
Number of Users	93	78
Number of Ideas	41	42
Number of interactions ^a	221	121

^a Interactions were quantified electronically through the platform.

Table 3

Most common phrases and words in the word clouds developed.

	Kallithea (%)	Kozani (%)
Urban mobility management	15.0	20.0
Traffic Improvement	6.0	11.0
Urban green spaces	18.0	6.0
Walking	29.0	6.0
Cycling	11.0	0.0
Parking Policy	3.0	9.0
Interventions in Public Spaces	6.0	6.0
Public Transport	3.0	18.0
Accessibility	6.0	18.0
Other	3.0	6.0
Total	100	100

4. Conclusions

This paper approaches whether technologically innovative applications can contribute in promoting participatory city planning. On the occasion of the implementation of SUMP in the Greek territory, two municipalities (Kallithea and Kozani) were selected to be considered as case studies. In both cities, a mix of traditional and innovative tools was used. Indeed, for data collection were used questionnaire survey, interviews and the observation by the researchers of the SMU of the NTUA and also crowdsourcing techniques for noisemapping, air quality monitoring and traffic volumes monitoring. Correspondingly, citizens were expressed both through web-platforms and traditional consultations.

This paper focused on a procedure of collectable environmental data (noise recording) and the collection of ideas through web-platforms. Taking into account the way SUMP was implemented in both cities, people's participation and the results that were recorded, the following conclusions can be drawn:

- Participation in planning procedure is something that citizens wish. The degree of their participation is related with the degree of freedom they are given. Thus, their participation from their residence or work

and for a small time period increases the possibility of being actively involved. In that framework and in this phase there is larger number of participants in web-platforms where citizens are asked to present their idea shortly than in case of collection data through crowdsourcing.

- Data collection through crowdsourcing is being conducted correctly when a large number of volunteers participate in the survey. By this way volunteers are not asked to modify their daily routine but within this framework they collect the additional information. In the case of the studied cities, recording of noise levels was conducted by volunteers at a pilot level in order to determine the degree of their familiarity with the specific technique and their interest for participation in similar actions. For a more satisfying collection of accurate data, people's information is required in order to increase the use of the specific applications without suspicion.
- Data collection is a less interesting procedure in relation with the statement of suggestions. Citizens who face a specific problem, which they know well wish its immediate mitigation in the most desirable way for them. As a result, their sense of satisfaction increases and so does the sense of offer to the community.
- The main disadvantage of the application of crowdsourcing methods in Greece is the small degree of citizens' participation. This does not concern only crowdsourcing techniques but generally the participation in city planning. The experience shows that citizens who participate in corresponding traditional consultations are either representatives of agencies or they are affected by the plans. In the case of presented web-platforms residents contributed substantially by depositing their views on a map. Even though the number of people who participated was not very big, in pilot level it was satisfactory to draw conclusions. Thus, it is concluded that this innovative participation method was successfully implemented both quantitatively and qualitatively.
- For the improvement of citizens' communication method with research groups through web-platforms is believed that in the future should be paid attention to the following: (a) development of a complete profile of the participant where some specific personal information such as education and age will be recorded. (b) connection of platform with social media and GoogleMaps or OSM will allow better public information and suggestions, (c) interaction with citizens in order to have evaluation of the procedure and provide feedback regarding whether their ideas were heard in planning and implementation level.



Fig. 4. Word cloud analysis, based on the ideas proposed by the citizens of Kallithea and Kozani through web-platforms. word cloud analysis logo.

Declarations

Author contribution statement

Vassiliki Delitheou: Contributed reagents, materials, analysis tools or data; Wrote the paper.

Efthimios Bakogiannis: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Charalampos Kyriakidis: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data.

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The authors declare no conflict of interest.

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