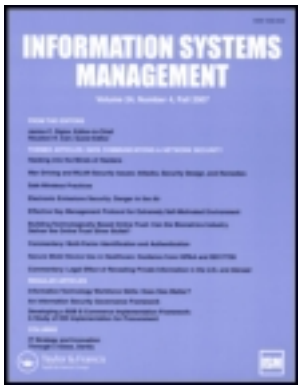

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Location-Based Services for Public Policy Making: The Direct and Indirect Way to e-Participation

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Location-Based Services for Public Policy Making: The Direct and Indirect Way to e-Participation

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This article investigates the areas of e-Participation and Location-Based Services and proposes services that facilitate citizens' participation in public policy making. When using these services, citizens will be alerted to relevant policies and public policy making when they are moving from one place to another. This article enhances the body of knowledge as it proposes: (a) a Location-Based Services classification, (b) a roadmap for Location-Based Services in e-Participation, (c) a classification of concerns and challenges in this area, and (d) direct and indirect location-based services in e-Participation for public policy making. The article opens new areas for research and highlights issues of concern and challenges.

Keywords e-Participation; location-based services; public policy making

INTRODUCTION

Public involvement in the public policy making (PPM) has become an integral aspect in shaping the relationship between governments and citizens (Roberts 2004; Tsochou, Al-Yafi, & Lee, 2012). It is argued that citizens' participation (i.e., electronic participation [e-Participation]) is one of the main building blocks in democratic decision-making, which has an impact on the improvement of the overall democratic scene (Michels & De Graaf, 2010; Sæbø, Rose, & Flak, 2008). Public engagement in decision-making would evidently increase public awareness and policy acceptance, resulting in a smoother policy implementation and in further efficient results (UNDESA, 2010). Public engagement can be achieved either off-line, through the traditional way, or on-line, through e-democracy, which is classified into e-Participation and e-Voting (Macintosh, 2004). In contrast with e-Voting that is triggered by pre-scheduled periodical events, e-Participation is a continuous process that can be strengthened through continuous development of citizen-centric and innovative approaches. E-Participation is primarily concerning the utilization of information and communication technologies (ICT) to promote and reinforce political participation, facilitating a constructive dialogue among citizens and between them and their elected representatives to engage citizens in policy planning (Panagiotopoulos, 2011).

Having highly invested in e-Participation projects, governments' attempts to promote e-Participation were beyond expectations and yet were unable to build a critical mass to be engaged in the PPM that could lead to public policy formation (Komito, 2005). An initiative can be considered as successful if it attracts thousands of users and positively influences their lives. Thus, e-Participation efforts should be merely directed towards the public rather than those users with online existence (Osimo, 2010). This indicates a need to deliver e-Participation services to citizens through alternative but most commonly used channels like mobile phones and tablet devices.

Usually, people embrace technology that is relevant to their needs and easy to use. Thus, technology should be offered to them in an easy and convenient means, totally in fit with their context and daily routine (Charalabidis, Gionis, Ferro, & Loukis, 2010). Acquiring the required information for context-aware computing is through four main types of primary data: location, identity, time, and activity. Whenever context information is tied to location, context-aware computing is usually in conjunction with location-based services (LBS; Barbos, Pop, Lee, & Campos, 2011). Through benefiting from the location feature that exists in mobile devices, LBS are gaining a special interest primarily due to the exponential rate of cellular phones subscription (Dahlberg, Mallat, Ondrus, & Zmijewska, 2008, Virrantaus, Markkula, Garmash, & Terziyan, 2001; Wiechert, Schaller, Thiesse, & Fleisch, 2009). Surveys predict that by 2020, mobile phones will be the first communication means for

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most people worldwide. Today, the number of mobile connections is almost the same as human beings population (Molinari & Ferro, 2010). Also, mobile connections are three times more than personal computers, which again show the importance of using smart mobile phones.

The use of LBS for e-Participation in PPM is still an unexplored area in both academic and practical fields. Further research in such direction would evidently enrich the body of knowledge in the research areas of context-aware computing, LBS, and e-Participation, among others. Therefore, there is a need to combine all facets related to the use of LBS by the public sector and to provide a roadmap regarding several dimensions to be considered in this respect. As such, the purpose of this article is to investigate this research field and it is structured as follows: in the next section, the theoretical foundations on e-Participation and PPM are presented, and thereafter, the conceptualization is presented, followed by research methodology, empirical data, challenges, and considerations. The article closes with the conclusions and contribution.

THEORETICAL FOUNDATION

E-Participation

The extant literature exemplifies that e-Participation tools and technologies are increasing, due to increased governments' efforts in actively engaging citizens in democratic processes. All such applications are primarily reliant on physical and conceptual infrastructure (e.g., internet and software protocols; Tambouris, Liotas, Kaliviotis, & Tarabanis, 2007). The rationale for this reliance is that e-Participation cannot extend beyond the boundaries of infrastructure. Thus, e-Voting cannot take place in the absence of internet access or protocols for voting. Thus, infrastructure development goes hand in hand with the development of new technologies and applications.

A number of other software applications, ranging from weblogs and alert mechanisms to the more sophisticated consultation platforms have been used in e-Participation (Loukis, Charalabidis, & Diamantopoulou, 2012; Macintosh, Coleman, & Lalljee, 2005). Ferro, Osella, Charalabidis, Loukis, and Boero (2011) argue that a particular problem in the management of e-Participation initiatives is the diffusion and acceptance of the new applications—with many e-Participation tools remaining unnoticed and unused on the web. Other development problems are related to: (a) user involvement (where users are diverse and geographically dispersed), (b) strategy and design of e-Participation systems, and (c) a range of more technological problems, concerning, for instance, security, multiplatform access, and mobility.

Tambouris et al. (2007) accentuate that building agreement for democratic processes and finding the e-Participation tools to do so is vital for citizen participation in PPM. By implementing the appropriate tools, participatory decision-making can lead to empowering citizens and democracy itself. It is evident that e-Participation solutions mainly focus on how to provide citizens with ICT tools for the access to the central debating forums within the government systems. Nevertheless, advocates highlight the need for effectiveness of e-Participation tools/technologies and this can only be maximized when citizens are committed and have proactive attitude towards the PPM. Thus, the problem of developing ICTs to make citizens motivated to be involved in the PPM, apart from enabling them to access the PPM, illustrates a literature void and needs to be overcome (Irani, Lee, Weerakkody, Kamal, & Topham, 2010). For this reason, we argue that the development of LBS that enhance citizens' engagement in e-Participation and PPM may overcome this void.

Public Administration and Governance Models

Theories of governance in public administration have relied on a model that decision makers act independently and define their activities through rules and confined prudence (Considine & Lewis, 2003). On the contrary, reformers support innovative models and concepts that increase citizens' participation to contribute to PPM (Ghose, 2005). Lauber and Knuth (1999) strongly advocate participation and argue that involving citizens in making decisions about issues (e.g. roads construction, new highways, etc.) that affect them is fundamental to democratic governance (Rowe & Frewer, 2005). Others contend that incorporating citizens into policy-designing processes will make those processes more acceptable to citizens, leading to a variety of benefits (e.g., helping to ensure the implementation of management plans, improving the relation between management agencies and the public administration; Irvin & Stansbury, 2004). Thus far, several governance models exist, such as: (a) governance by market, (b) governance by hierarchy, and (c) governance by community (Lamour, 1997). Navarra and Cornford (2004) studied governance models in Brazil and Ireland and suggest the participation of citizens in PPM as highly significant. However, the lack of an overall policy framework and the limited scale of these initiatives meant that a strategic approach to citizen engagement remained underdeveloped (Loukis et al., 2012; Reddel, 2003).

Existing and proposed governance models mainly focus on top-down, one-way communication between public administration and citizens. Nevertheless, these models do not provide any practical solution of a two-way communication flow between governments and citizens (Bingham, Nabatchi, & O-Leary, 2005). Only recently, we observed a few two-way communication e-Participation activities, but, again, these are limited (Barbos et al., 2011). Governments increasingly perpetrate to enable wider citizen participation in PPM with public administration, but the top-down approach alone is inadequate for strengthening democracy. From the bottom-up perspective, citizens are emerging as producers rather than just consumers of policy. During the last decade, this has successfully been done in the private sector, where companies collect customers' views

to improve their products–services (Jarvis, 2009). In recent years, more and more companies have stopped controlling the markets and passed the control to their customers who collaborate with them to achieve mutually-better results.

As aforesaid, public administration needs to adopt new governance processes and models to help the development and use of informed best practices. In addition, there is a need for new governance frameworks that recognize the:

- collaborative nature of modern efforts to meet citizens' needs,
- widespread use of technologies that engage networks of actors, and
- resulting need for a different style of public management, emphasizing on collaboration and enablement between governments and citizens rather than hierarchy and control.

PPM Models and Lifecycle

The manner in which government policies are developed and implemented, and their effects, requires an understanding of the behavior of government institutions and citizens (Teisman, 2000). This indicates the need for policy models that combine technical expertise and rational policy making with citizens' values and preferences. Researchers have highlighted citizens' roles in determining policy regarding issues of science and technology (Macintosh et al., 2005). There appears to be increasing realization in government bodies that they need to give additional attention to the citizens, become more liable and responsive to them, and get them involved in PPM, wherever and whenever feasible (Macintosh & Whyte, 2008). Proponents of greater citizen participation in the government PPM have ranged from government agencies and organizational departments to academic institutions to the citizens themselves (Rowe and Frewer, 2000). The PPM is thus perceived as a highly mechanistic system which necessitates improvements in systemic communications and coordination (Parsons, 2002). Macintosh (2004) illustrates the need to describe the PPM by looking at the following five stages involved on the policy life-cycle:

1. *Agenda setting:* setting up the need for a new policy or a change in policy and defining what the problem to be addressed is,
2. *Analysis:* defining the challenges and opportunities associated with an agenda item more clearly to produce a draft policy document,
3. *Creating the policy:* ensuring a practical policy document that involves several mechanisms,
4. *Implementing the policy:* this can involve the development of legislation, regulation, guidance, and a delivery plan, and
5. *Monitoring the policy:* this involves evaluation and review of the policy in action, research evidence and views of users.

The normative literature indicates that ICT provides the potential to allow policy makers to go directly to users of services and those at whom the policy is aimed to seek their input (Tambouris et al., 2007). Macintosh (2004) argued that citizens will be able to have greater influence on policy content through consultation earlier in PPM rather than later. It can also be argued that consultation at the stage of a draft policy document (stage 3, *Creating the policy*) requires citizens to have the communication skills necessary in order to interpret the typical legalistic terminology of the document before commenting appropriately. Whereas, if the wider audience of citizens are given the opportunity to comment before this stage in policy-making, they will still need to be well-informed on issues but the information could be made more readable and understandable. Barbos et al. (2011) underline the need for solutions that motivate citizens to be involved in PPM and introduce Ubiquitous Participation Platform for Policy Making as a concept based on linking PPM to citizens' everyday lives at all participation levels. They claim that this will increase the level of motivation and commitment of citizens leading to wider audience and increased participation (Barbos et al., 2011).

LBS

LBS are defined as "mobile computing applications that provide information and functionality to users based on their geographical location" (Shek, 2010, p. 1). Barnes (2003) describes LBS as network-based services that integrate a derived estimate of a mobile device's location with other information to provide value-added to users. This indicates that by bringing together localization, personalization, and immediacy to users, emerging LBS applications can be developed that may have enormous potential for enhancing safety, utility, and mobility of lives. LBS have a wide field of applications in various environments and include services to identify the location of a person or an object (Roebuck, 2011). Due to the range of its application, the LBS market has rapidly expanded, and the world LBS revenues are expected to increase from US $500 million in 2004 to US $12.7 billion by 2014 (Holden, 2010).

Literature indicates that there are numerous classifications of LBS. Virrantaus et al., (2001) distinguish LBS into pull and push services. Push services are activated by a network event and sent to the user without his/her request (e.g., a user passing outside a theatre receives information about forthcoming events; Levijoki, 2000). Pull services deliver information on the user's request. Schiller and Voisard (2004) classify LBS into person-oriented (where the user controls the service) and device-oriented (where the user or the object [e.g. a stolen tablet–PC] is not controlling a service). According to Spiekermann (2004), some applications may incorporate both pull and push functionality. Reichenbacher (2004) classifies LBS into five categories: (a) orientation and localization, (b) navigation, (c) search, (d) identification, and (e) event check. Similarly, Shek (2010) proposes LBS types and introduces two

new categories: (a) safety and emergency, and (b) information service applications. Gartner (2011) reports a list with ten consumer mobile applications to watch in 2012, including LBS, among others. Despite that these ten applications are classified as mobile applications, we suggest that a few of them can be categorized as LBS, too. These include: (a) mobile payments, (b) object recognition, and (c) mobile instant messaging. The abovementioned LBS categories that derived from the literature review are summarized in Table 1 and examples are given for each category.

CONCEPTUALIZATION

Proposed Classification for LBS Categories

A more critical analysis of the LBS categories presented in Table 1 indicates that some of these categories can be merged or combined together. For instance the categories "Event Check," "Object Recognition," and "Mobile Instant Messaging" can form subcategories of the broader category "Information Services." LBS of these three subcategories can be used to send or receive information about an insistent (e.g., running late) event or a place (e.g., a sensor can be attached on a monument and can provide the user with relevant information [i.e., historical details about the monument]).

Likewise, "Navigation" and "Search" LBS categories can be merged, as they have similar functionality and logic. An analysis of the functionality of these two categories points out that the current location of the user is required to perform the navigation or search services. This means that some categories of LBS are fundamental and can be used to produce other LBS categories. Thus, based on the analysis of the normative literature we propose that there are at least three fundamental categories that characterize LBS: (a) identification, (b) location, and (c) information, as presented in Table 2. These fundamental categories are in line with the context-aware computing characteristics, namely, identity, location, time, and activity (Abowd et al., 1999). In our proposition, we replace time and activity with information, as the latter incorporates both of them and allows us to refer to other data/information that is also transmitted through LBSs. In addition, "Information" is also reported by Shek (2010) and Barnes (2003) as an attribute of LBS.

TABLE 1
Summary and examples of LBS categories as derived from the literature review

Category	Example
Event check	What is happening here today?
Identification	What is here/there?
Information services	Receive or send information.
Mobile instant messaging	Send instant message to tell that you are running late.
Mobile payments	Pay the congestion zone charges.
Navigation	How do I get to the park from here?
Object recognition	Which is this statue?
Orientation and localization	Where am I? Where is my stolen laptop?
Safety and emergency	Help—bushfire!
Search	Where is the nearest petrol station?

In order to propose a more updated and accurate classification for LBS categories, we combine the categories of Table 1 and enhance them with emerging LBS categories such as: (a) monitor services, (b) access control, and (c) management services. The demand for LBS that provide access control, management, and monitor services has increased, and early adopters have already developed LBS of these categories. The proposed classification is illustrated in Table 3, in which the first column refers to the LBS categories, the second, third, and fourth columns show the combination of the fundamental categories for each row (IDE = identification, INF = Information, and LOC = location), and the last column presents an example for each LBS category.

Proposed Roadmap for LBS in e-Participation

The investigation of LBS adoption by the public sector in e-Participation reveals that governments are still lacking in this regard (Irani et al., 2010). In order to support the discussion and the efforts that are currently undertaken in this area, we review LBS and introduce a list of applications that can be implemented and used in e-Participation. The proposed list can be used as a roadmap, and we suggest that the development of such services can also improve PPM and therefore address the literature void reported in previous sections. The proposed roadmap will help the development of those applications that fall in the intersection of e-Participation, LBS, and PPM as it is illustrated in Figure 1. Currently the penetration of applications within this intersection is limited, and thus, it is of high importance to speed up the implementation of such solutions. This will result in many benefits both for citizens and public authorities.

To this end, we propose a roadmap of LBS in e-Participation that is grounded on literature review. The proposed roadmap is also based on the categories of Table 3, and it is presented

TABLE 2
LBS fundamental categories

Fundamental categories	Description
Identification	Reveal the identity of a user or an object
Location	Report the location of a user or an object
Information	Send or receive information to/from a user or an object

TABLE 3
Proposed classification for LBS categories

LBS categories	IDE	INF	LOC	Example
Identification	√			Who is this user? What is here/there?
Information		√		Receive or send information.
Location			√	Where am I? Where is my stolen laptop?
Navigation and search		√	√	How do I get to the park from here? Where is the bus stop?
Safety and emergency		√	√	Help—car accident!
Access control	√	√	√	Is this user allowed to enter this area or use this machine?
Management	√	√	√	Which is the closest ambulance? Switch off lights remotely.
Monitor	√	√	√	How is my patient today? Does he need help?
Payments	√	√	√	Pay the congestion zone charges.

IDE = identification, INF = information, and LOC = location.

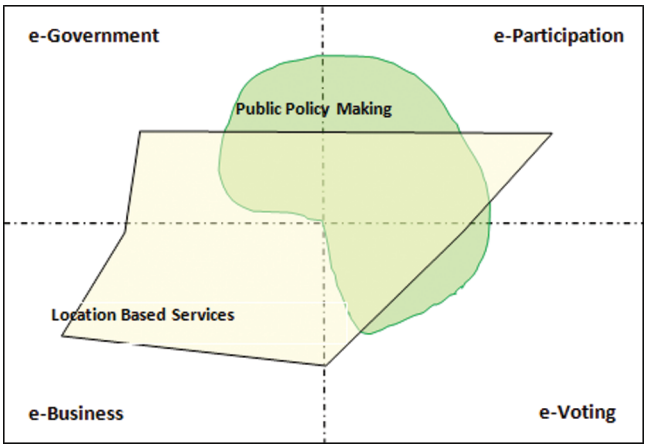

FIG. 1. e-Participation LBS for PPM (color figure available online).

in Table 4. The first column of Table 4 shows specific service areas of LBS in e-Participation, columns two to ten map each service area to relevant LBS categories, and the last column reports examples for each service area. From Table 4, we can observe that LBS of a specific area may be based on different LBS categories, depending on the nature of the application of the LBS. For instance, the three examples of the service area "traffic, road-works, and improvements" of Table 4 are based on three common LBS categories (information, location, management), but they differ in others (identification, navigation and search, safety and emergency).

Based on Table 4, it can be argued that the application of LBS in various areas of e-Participation will improve PPM and will possibly result in improvements in other aspects like handling emergencies and better preparing the actions, equipment, and synthesis of rescue teams, to name a few. For example, according to Schiller and Voisard (2004), around 57,000 emergency calls are made every day in the United States from mobile phones, and in most cases, people do not know their precise location. The same happens in the case that someone observes a fire in a forest, or a trapped climber, or a wounded hunter, or a car accident somewhere along a highway. These cases, among many others, demand immediate response, sufficient decision making, and careful preparation, in order to achieve good results. This means that it is of high importance to receive timely and accurate information regarding the location and the nature of an incident. With LBS, there is no need to lose time on reporting the location, as the system automatically reveals the caller's location and thus saves time for scheduling the right actions. In addition, in the cases of a forest fire, the authorities will be able to identify the exact place of the incident, retrieve information about the type and the characteristics of the trees, the landscape, and the nearby lakes and rivers that can support the actions of the firemen to better prepare and execute the operation. In this example, citizens usually initiate the process for PPM by sending all relevant details, where the authorities receive the information and take decisions accordingly.

The LBS in the area of the "immediate response to environmental disaster" requires quick and accurate decision-making that has an impact on citizens. For example, people who enjoy the sun on a beach may not be aware that a tsunami is approaching the sea-shore. In this case, the authorities can notify all people on the beach about the tsunami and ask them to abandon the area. This can be done immediately and successfully through LBS. Also, the authorities can make a policy regarding the groups of people they inform and the timing (e.g., first notify those citizens on the beach and later the rest). Another example refers to the people who are trapped in a collapsed building after an earthquake. In this instance, the people can use specialized LBS that can function even with a weak signal to report that they are trapped. Citizens can trigger the LBS and can also report their situation and whether or not there are other trapped people in the same building. Again, such an example

TABLE 4
Roadmap of LBS in e-Participation

Service area	Is based on LBSs categories: Identification	Information	Location	Navigation and search	Safety and emergency	Access control	Management	Monitor	Payments	Example of LBS in e-Participation
Immediateresponse to environmental disaster	√	√	√		√		√			Forest fire (difficult to explain where the fire exactly is)
	√	√	√		√		√	√		Tsunami (inform people)
	√	√	√		√		√	√		Earthquake, volcano, flooding (people may be trapped)
Traffic, road-works, and improvements		√	√	√			√			Congestion ahead. Take the next exit
	√	√	√		√		√	√		Driver informs police and ambulance about nature and exact place of a car accident.
		√	√				√			Questionnaires to drivers using this road asking for their views on building a new highway in the area
Emergency	√	√	√		√		√	√		Help—climber is trapped, hunter is wounded, lost in the forest
	√	√	√		√					Help—someone is following my car
	√	√	√		√					Help—robbery next door
Transportation		√	√				√			Metro is suspended
		√	√	√						Where is the nearest X26 bus stop?
Parking		√	√	√			√			Where can I find an available parking spot?
Tolls and congestion	√	√	√			√			√	e-Toll collection
		√	√							Information about tolls and congestion zones charges.
Indoor navigation		√	√	√			√	√		Where is the VAT department?
		√	√	√						In a library where is the music section?
Outdoor tour		√	√	√						What are the main places of interest in this area?
		√	√	√		√	√			Take a picture and tag it with location and time. Retrieve or tell information about this monument.
Reminders		√	√				√			Land department will be closed next Friday.
		√	√				√			Road works in Rhodes avenue tomorrow from 7:00–11:30 AM

Police/security	√	√	√		√			Send the picture of a bank robber to police
		√	√		√			Police department sends photos of a suspect to nearby policemen to speed up the investigation.
Improving PPM	√	√	√	√		√		Citizens visiting a place can receive questionnaires about it and respond to help authorities taking robust decisions.
Monitor people in need	√	√	√			√	√	Elderly people with health problems.
	√	√	√			√	√	Drug or alcohol users under rehabilitation.
	√	√	√				√	People who attempted to commit suicide in the past and need support.
Tourist information		√	√					Tourists visiting a place receive information e.g. museums, events, travel and emergency information etc.
Access control to resources	√	√	√			√	√	Distributed Smartphone-based access control systems
	√	√	√			√	√	Physical resources—photocopy machines, office doors
Advertisement		√	√	√				You are 250 meters away from the archeological museum. Visit it and get a 10% off.

demonstrates how the citizens contribute in the decision-making process using LBS and how they can save their lives or the lives of their peers. Even in the worst scenario, where a trapped citizen in a building is unconscious, the authorities can more easily and quickly locate him or her through LBS. The authorities can search through the network for mobile phones. Usually people have their phones with them or close to them. Thus, it is easier to identify the victims in this way, rather than searching the whole building without having a clue.

Typical examples of the use of LBS in e-Participation for PPM are the cases where the local authorities require citizens' feedback or opinions about an issue. For instance, an old hospital or stadium will be demolished, and the authorities would like to collect citizens' views on how to use this space. Citizens who live in this area and drivers and pedestrians who pass by can receive questionnaires on their mobile phones and can respond. The questionnaires can be short, and citizens can respond using instant messaging. In this typical scenario, the local authorities provide the service, and citizens participate. The former collect the views of the latter, analyze them, and make robust decisions.

Citizens can also participate in LBS for PPM in other service areas, such as safety and emergency. In the event of a robbery in a store, a customer can take a picture with his or her mobile phone and send it to the police. The police authorities can send the picture of the suspects to the nearby police officers to speed up the investigation.

In Figure 2, there is another example of LBS in e-Participation. When a citizen approaches a metro station, he or she can check for the availability, and in the case that he or she finds out that the subway service is suspended, the LBS suggests to the citizen to search for alternative transportation means or to find out instructions on how to reach his or her destination on foot. In case he or she selects the latter, the citizen adds information about his or her destination, and a map with walking directions pops-up on the screen. If the citizen chooses the former, he or she can add the name of the metro station for his or her destination, and the system reports alternative options for bus, tram, or other metro lines followed by maps and instructions on how to get there. In this example, the local authorities inform citizens about the problems at the metro. In doing so, authorities take measurements to scale down the confusion and citizens' reactions as appropriate; e-Participation LBS can suggest customized alternative ways for each individual citizen.

FIG. 2. e-Participation LBS (color figure available online).

LBS for Direct and Indirect PPM in e-Participation

PPM in e-Participation refers to the decisions that are taken based on the interaction of public authorities with citizens. In this article, we suggest that this interaction can result to PPM in two ways: (a) direct and (b) indirect. Despite that the research community has not distinguished the LBS for PPM in e-Participation into direct and indirect, it has paid attention only to those LBS that have a direct impact, as they are more obvious. Although, in both cases higher levels of citizens' engagement in e-Participation are achieved, we suggest that the former is controlled and managed by the public authorities. Citizens who use e-Participation LBS can take decisions that have an impact on themselves or both themselves and public (indirect effect on PPM). To better explain these two ways, we differentiate the decisions that are taken by the public authorities from those made by citizens.

- **LBS for direct PPM in e-Participation:** Public authorities use LBS to interact with citizens and come up with a new action, policy, measurement, or regulation after analyzing citizens' views or reactions. An example of this is the service area "Improving PPM" in Table 4 (e.g., there is an empty piece of land in a neighborhood, and the authorities ask the preferences of the locals and people passing on what to build there [a kindergarten, a school, a parking area, or a theater]).
- **LBSs for indirect PPM in e-Participation:** In this case, public authorities or citizens initiate a LBS, and citizens' actions result in overcoming a problem or a situation. This is achieved without taking any

formal decision. For instance, drivers receive information about a car accident through LBS and take the decision to use alternative roads to get to their destination. Indirectly, this decision has a positive effect on PPM for public authorities, as drivers' reactions help to overcome the problem (congestion), since not all drivers are heading towards the same direction or take the same decision on which new route to follow. In other words, public authorities can use LBS to interact with citizens and influence their decisions in a way that may help in better PPM. This is also illustrated in the case of the service area "Parking" of Table 4. Drivers looking for a parking spot may use a LBS to locate one. In doing so, they spend less time in the roads and thus reduce congestion. This LBS is indirect, as the drivers are not obliged to follow the suggestions of the LBS.

METHODOLOGY

The purpose of this article is to explore an area that is still in its infancy (LBS in e-Participation for PPM). An empirical research methodology has been used to study the phenomenon under investigation. This methodology has the following three development stages: (a) research design, (b) data collection, and (c) data analysis. Research design focuses on literature review, in order to better understand the research area under investigation. From the literature review, issues related to LBS, e-Participation, and PPM were highlighted for a more focused study. In doing so, the research need was identified. Thereafter, a conceptualization that represents the intended empirical research was developed. Aspects of the conceptualization were investigated through empirical study. Due to the nature of this research and the fact that the area under investigation is still in its infancy, we decided to use focus groups to explore this area. The participants of the focus groups were experts from the field (municipality staff or consultants) from two large European countries. The use of focus groups with experts is well described, analyzed, and justified in the literature (Miles and Hubermann, 1994).

Overall, 11 experts participated in the focus groups. The majority of them work for local government organizations. Three of the participants are experts who work as consultants in the area of e-Participation and work closely with local governments in Italy. We attempted to clarify issues that derived from discussions we had with the focus groups, and we collected some important data regarding the area under investigation. The discussions we had with the participants were tape recorded and transcripts prepared soon afterwards. Tape recording allowed us to collect accurate data. It is worth noting that, during the focus groups discussions, many emerging issues and concerns came to the surface. Since the goal was to explore this area, we decided to include them in this research, as we believe they are also important.

EMPIRICAL DATA

Initially, we discussed the classification for the LBS categories with the experts. In terms of the proposed fundamental categories of Table 2, all participants agreed that these are the basic categories of LBS that can be used to build the functionality of other LBS applications. When we asked them whether they consider "time" and "activity" as separate categories, they mentioned that "time" and "activity" can be subcategories of the category "Information." Regarding the proposed classification for LBS categories of Table 3, there were few disagreements. In particular, there were two disagreements in the first focus group where two participants suggested that "Search' should form a separate category and the other four participants reporting that "Search" and "Navigation" refer to the same function. Since the second group shared the same view with the four participants of the first group, we decided not to change the classification. Another proposed LBS category that led to a discussion in both groups is the "Access Control." Initially, only one participant of the second group supported this category. The remaining did not understand why this should form a category. After discussing the issue, the supporter of this category managed to better explain and persuade the rest about her views. The situation was similar in first group, and thus, we did no changes. One participant suggested that "Tariff Applications" should form a separate category, but he did not manage to convince the rest.

When the participants asked to comment about and discuss the proposed roadmap and the issues of direct and indirect LBS, interesting findings were revealed. In terms of PPM, the participants supported our proposition that LBS in e-Participation can be divided into direct and indirect. Regarding the proposed Roadmap of Table 4, the experts reported that some areas like "Advertisement," "Tolls and Congestion," "Access Control to Resources" and "Tourist Information" should not be considered as service areas for e-Participation LBS. From the discussions, it was disclosed that the proposed services areas will possibly result in improvements in: (a) security, health, and safety; (b) the quality of service, life, and information; (c) handling emergencies and better preparation for the actions, the equipment, and the synthesis of the rescue teams; and (d) reducing the time and cost of specific actions. For this reason, participants revised our proposed Roadmap to report the views of the focus groups. In addition, the participants suggested to use the values "C" and "P" in the third column of Table 5 to indicate that a LBS is related to decisions that citizens (C) or public authorities (P) make. This allows them to better differentiate the direct and indirect LBS in e-Participation for PPM. For instance, in those cases where the result is "P" or "P,C," we refer to LBS with direct PPM, where the values "C,P" refer to indirect PPM.

CHALLENGES AND CONSIDERATIONS

From the discussions we had with the focus groups, emerging issues were revealed. In terms of the service areas of Table 5,

TABLE 5
Revised roadmap of LBS in e-Participation, and expected benefits (C = Citizen, P = Public)

Service area	Example of LBS in e-Participation		Expected improvements in									
			Decision making	Quality of service	Quality of life	Emergency	Rescue teams actions	Time	Cost	Health and safety	Security	Information
Immediate response to environmental disaster	Forest fire (difficult to explain where the fire exactly is)	P,C		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Tsunami (inform people)	C,P		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Earthquake, volcano, flooding (people may be trapped)	P,C		✓	✓	✓	✓	✓	✓	✓	✓	✓
Traffic, road-works and improvements	Congestion ahead. Take the next exit	C,P		✓	✓			✓	✓			✓
	Driver informs police and ambulance about nature and exact place of a car accident.	P,C		✓	✓	✓	✓	✓	✓	✓		✓
	Questionnaires to drivers using this road asking for their views on building a new highway in the area	P,C		✓								✓
Emergency	Help—climber is trapped, hunter is wounded, lost in the forest	P		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Help—someone is following my car	P		✓	✓	✓	✓	✓			✓	✓
	Help—robbery next door	P		✓		✓	✓	✓	✓		✓	✓
Transportation	Metro is suspended	C,P			✓			✓	✓			✓
	Where is the nearest X26 bus stop?	C,P		✓	✓			✓	✓			✓
Parking	Where can I find an available parking spot?	C,P		✓	✓			✓	✓			✓
Indoor navigation	Where is the VAT department?	C,P		✓				✓				✓
	In a library, where is the music section?	C,P		✓				✓				✓
Outdoor tour	What are the main places of interest in this area?	C,P		✓				✓				✓
	Take a picture and tag it with location and time. Retrieve or tell information about this monument.	C,P		✓	✓							✓
Reminders	Land department will be closed next Friday	C,P		✓	✓			✓	✓			✓
	Road works in Rhodes avenue tomorrow from 7:00–11:30 AM	C,P		✓	✓			✓	✓			✓
Police/security	Send the picture of a bank robber to police	P,C		✓	✓	✓	✓	✓			✓	✓
	Police department sends photos of a suspect to nearby policemen to speed up the investigation	P		✓	✓	✓	✓	✓	✓		✓	✓
Improving PMP	Citizens visiting a place can receive questionnaires about it and respond to help authorities taking robust decisions.	P,C		✓					✓			✓
Monitor people in need	Elderly people with health problems	P,C		✓	✓					✓		✓
	People who attempted to commit suicide in the past and need support	P,C		✓	✓		✓	✓		✓		✓
	Drug or alcohol users under rehabilitation	P,C		✓	✓					✓		✓

there is a plethora of challenges, difficulties, and issues of concern that need to be addressed. For instance, indoor navigation is an attractive type of application that is useful for people who are not familiar with a place (e.g., an airport). Soon, people can navigate inside a building to find the office/department/section they are looking for. In the example of Figure 3, a citizen is looking for the music section of a public library. Instead of spending time trying to locate this section, he or she can search for it using specific LBS. In order to achieve this result, we have to improve the accuracy of the locationing methods and the computational algorithms, among other issues. Today, it is not enough to locate the geographical location (horizontal axis) of a user. The altitude of his or her geographical location (vertical axis) needs to be identified as well. Currently, many locationing systems display wrong results in this regard. For instance, two tenants of the same building are in their beds. Both of them live in studio-flat number five, but the first one is on second floor and the other on the 34th. Although they are 100 meters away (the one on the top of the other), the system shows them at the same place (same bed). By improving indoor navigation techniques, the layout of all floors of a building will be able to be defined and can help users easily find their way. This may also have a positive effect, as citizens may have fewer questions to ask, and thus employees can perform their tasks without disturbances and achieve better results.

A big challenge that we should deal with refers to the data volume, storage, management, mining, retention period, and cost. Numerous issues are still unexplored, such as: (a) how often do we refresh/update the data? (b) what is the data volume? (c) where do we store the data? (d) is cloud storage more efficient? (e) who owns and who controls the data? (f) are there any legal and regulatory issues? (g) what about security? (h) is privacy a problem? (i) are their technical issues (integration, interoperability, network overload, etc.)? (j) is spam an issue? (k) how much do LBS cost? (l) who is paying for this? (m) what is the cost model?, and so on.

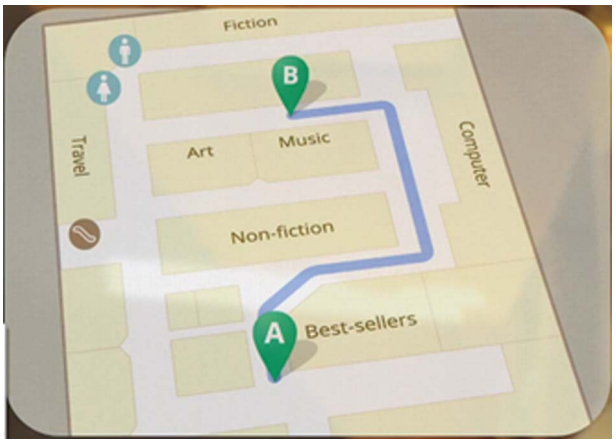

FIG. 3. Indoor LBS (color figure available online).

In an attempt to enhance and facilitate the discussion on these challenges and considerations, we collected the views of the experts on these issues and summarized and classify them (in Table 6) into: (a) technical, (b) human/culture/social, (c) managerial, (d) strategic, (e) financial, and (f) computational. For example, and as it is depicted in Table 6, data storage is considered as a technical, managerial, and financial concern. At the technical level, decisions need to be made for data storage (e.g., security, storage media, etc.), where from a managerial perspective, decisions can focus on the development of an in-house IT infrastructure for data-storage, or on the use of a cloud storage, or select the type of cloud (private, public, hybrid, etc.), or the backup strategy, and so on. In terms of finance, a suitable and attractive cost-strategy should be defined (e.g., pay per use, Google model, advertisements, tax, etc.). The cost model is extremely important, as it has an impact on the use of the LBS and thus on the engagement of citizens in PPM. Each country has places of attraction. Local authorities can place sensors (or tags) on monuments and statues and can charge a small amount of money (e.g., 10 cents) or collect money from advertisements when somebody takes a photo or requests information about the statue. At the same time, they can give citizens the option to get a photo or information for free when they fill in questionnaires. Since millions of people visit places of interest (e.g., 30 million per annum for Big Ben, 6.5 million for Eiffel Tower), authorities can collect the views of visitors and citizens to improve their services and at the same time find the resources for running and maintaining their LBS. Certainly, all these raise many issues of concern, like mobile-payments, security, and ethical issues.

Currently, only a small part of these issues is partially discussed in the literature, as it is reported in Table 7. This indicates that there is a plethora of issues that need to be investigated to speed up the deployment of LBS in e-Participation for PPM.

CONCLUSIONS AND CONTRIBUTION

Citizens' participation is a significant aspect in democratic decision-making, which has an impact on the improvement of the overall democratic scene. During the last fifteen years, many efforts have been made to increase citizens' participation in PPM and lead to e-Participation applications development. Despite that, the analysis of the literature reveals a void, as citizens are not motivated to be involved in PPM. Hence, we argue that the development of appropriate LBS in e-Participation may overcome this void, as LBS are technological interventions that may influence citizen behavior.

LBS have evolved over the last years from retroactive to proactive, single to multi-target, and from content- to application-oriented. In a proactive approach, services are pushed to the user and triggered by an event rather than being invoked by him or her. Another advanced feature is the ability to track different targets while specifying the relational locations among them. In the early times of LBS, applications merely provided information that depended on the user's location;

TABLE 6
Classification of issues of concern and challenges of LBS in e-Participation

Challenge/concern	Technical	Human/culture/ social	Managerial	Strategic	Financial	Computational
Accuracy (of locationing methods)	√		√	√		√
Availability of service	√		√	√		
Citizens' mobile skills		√		√		
Cloud computing use	√	√	√		√	
Contextual instant messaging	√					√
Cost model for LBS			√	√	√	
Data mining	√	√	√	√		
Data storage	√		√		√	
Data volume	√		√			
Design and implementation issues	√					√
electronic-ID (eID)	√	√	√	√		
Impact on human and living organizations health		√				
Impact on human lives		√				
Indoor navigation and route planning	√		√			√
Integration	√			√		
Interoperability	√			√		
LBS cost	√				√	
Legal and regulatory issues			√	√		
Minimize Spam	√	√	√	√		
Need for advanced algorithms	√			√		√
Need for improved locating methods	√			√		√
Network workload	√			√		
Over-regulation		√	√	√		
Platform independence	√					√
Portability	√			√		
Privacy		√	√	√		
Security issues	√			√	√	√
Storage-retention period	√		√		√	
Updates frequency			√	√		
User authentication	√					
Who controls data		√	√			
Who owns data		√	√			

TABLE 7
Limitations of LBSs derived from the literature

Limitations	Reference
Ability to create services that attract users	Carlsson (2006); Haaker, Kijl, Galli, Killström, Immonen, and De Reuver (2006)
Cost of services	Molinari and Ferro (2010)
Design user-effective interface	Steiniger, Neun, and Edwardes (2006); Haaker et al. (2006)
Limitations of bandwidth and mobile devices	Molinari and Ferro (2010)
Privacy	Roebuck (2011); Barkuus and Dey (2003)
Technical complexity	Bradley and Dunlop (2008); Hong and Landay (2001)
Users' trust and awareness	Haaker et al. (2006)

nowadays, they focus on dynamic and interactive applications that are customized to fit each user's demands. Despite the attention that LBS receive and the range of their applications in other sectors, their penetration rate is still limited in the public sector.

In this article, we study the area of LBS in e-Participation, and we suggest that LBS can improve citizens' engagement and can result in informed decisions and improved PPM. Our main contributions and implications to theory and practice derived from this study are listed below:

- *LBS Applications Classification:* We synthesized a generic LBS applications-categories classification by analyzing and incorporating existing taxonomies and enriching them with new. In doing so, we propose a taxonomy that consists of nine categories, and it extends the body of knowledge in this area. The proposed classification is not e-Participation specific, and thus, it can be used in any sector. We also suggest that three of these categories are fundamental and can be used to produce the remaining six categories.
- *A Roadmap for LBS Areas in e-Participation:* We use the proposed LBS applications classification and customize it in the area of e-Participation by giving examples of usage. Based on the empirical findings, the expected improvements in various parameters are reported. The proposed roadmap highlights eleven different service areas in which e-Participation LBS can be developed. The majority of these LBS engage citizens in PPM.
- *Direct and Indirect Effect on PPM:* In an attempt to better understand the effect of LBS on PPM through e-Participation, we distinguish their effects on decision-making. We suggest that LBS may have a direct impact on PPM through the decisions that public authorities take based on citizens' participation. In addition, we propose that there are many cases in which the interaction between LBS and citizens influences the citizens' decisions, and these decisions, in turn, may have a positive impact on the overall PPM (indirect effect). This classification may help decision makers and also support designers to propose new LBS that result in indirect PPM. Thus, other types of LBS applications may contribute to PPM.
- *Classification of Concerns and Challenges of LBS in e-Participation:* Considerations and challenges in this area are identified through a literature review, our experimentation, and empirical findings. These are classified into technical, human/culture/social, managerial, strategic, financial, and computational categories. We believe that the proposed taxonomy can help researchers to study this area in a more systematic way.

The intention of this article is not to explain and analyze all these service areas and the challenges and concerns reported in Tables 5 and 6. For this, we would need time and effort to produce articles with theories, models, patents, and empirical data. Instead, we seek to speed up this process by identifying new avenues of research and by sharing our views with others. Consequently, we highlight all these areas of applications, challenges, and concerns to empower the discussion and allow the scientific community to study, experiment, and test these and report its results.

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