

# How VGI Intersects with Land Administration

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## SUMMARY

There is an increasing trend in creating Rights, Restrictions and Responsibilities (RRRs) related to land and property through the different legislative systems responding to the human-land relationship. However, current land administration systems tend to accommodate those RRRs in direct relation to ownership rights with a high level of accuracy, assurance and authority. Information about other RRRs (e.g. residential noise levels, native vegetation) is neither collected nor spatially represented because of insufficient financial resources and professionals. VGI could be a complementary approach to facilitate the data collection process of other RRRs. However, many different factors affect the possibility of using VGI. Due to the immature role of VGI in land administration, this paper sets out to identify the factors that could impact the use of VGI in land administration using a Delphi study. This paper reports the results of the first round of the Delphi study. These results suggest eight important categories of factors that could impact on the applicability of VGI in land administration and provide new insights into the role of VGI in land administration more broadly.

Keywords: VGI, Land administration, Delphi study

## INTRODUCTION

Currently, many existing land administration systems collect a limited number of land rights, restrictions and responsibilities (RRRs) such as ownership boundary, easement and mortgage. They are based on a narrow land administration paradigm focused on cadastral surveying and land registration for titling purposes. Many other land and property RRRs created through non-titling legislation are either not captured or are not easily accessible or discoverable (e.g. native vegetation, national parks boundary or residential noise levels). The volume of legislation which defines a range of RRRs related to land and property is enormous. For example, in Victoria (state of Australia), over 60 percent of legislations create RRRs; in New South Wales, this figure stands at over 50 percent [3]. Recently, having recognised these problems, Australia and New Zealand's governments are taking action. They describe a vision in future-oriented national cadastre strategies that support the identification of all RRRs related to land and property [15,19].

The value of collecting and managing RRRs is highlighted in much of the literature, statements and reports and is a growing focus for organisations such as the World Bank and the International Federation of Surveyors [10,17,25]. However, there are a number of impediments for collecting and managing RRRs including limited resources, insufficient professionals and the high costs of current spatial data capture methods (e.g. cadastral surveying). Therefore, locating and spatially defining RRRs remains a challenge. In short, the collection of other RRRs requires a quick and low-cost methodology.

This need, and recent enhancements in volunteered geographic information (VGI), have sparked an interest in applying this approach to land administration. VGI is a phenomenon by which people voluntarily collect, organise and disseminate geographic information and data in such a manner that the information can be used by others [26]. VGI is an emerging topic in land administration, with

limited literature. Over past years, most research has emphasised the value of VGI as a timely and low-cost approach to fill the knowledge gap about land rights in current land administration systems, particularly in developing countries [2,18,21]. However, VGI could present opportunities for developed countries to enhance their current land administration systems by determining the spatial extent of other land and property RRRs (e.g. native vegetation) which are not captured in current systems.

Prior studies do not provide insight as to when and where VGI can be used particularly regarding RRRs data collection. Therefore, this paper aims to identify factors that could impact on the use of VGI in land administration through an ongoing international Delphi study. This paper makes two main contributions: firstly, it makes an argument for the Delphi research method as a valuable approach in land administration research particularly in investigating new approaches and practices; secondly, it introduces new insights for advancing the use of VGI in contemporary land administration practices. The remaining part of the paper will introduce the Delphi methodology then it will present the finding of round one of Delphi study. The implications of these findings are discussed before the paper concludes with some future directions.

## THE DELPHI METHOD

This research adopts the Delphi research methodology, which is a powerful technique to facilitate the process of data collection from a carefully selected panel of experts [23]. The aim of a Delphi study is to form a consensus concerning ideas, opinions and arguments about a specific field of research to unlock hidden knowledge and forecasting the future direction [11]. This method is highly recommended, accepted and adopted when exact knowledge is not available in a particular field or in domains where complex issues exist [7]. It has been successfully employed in many published studies in a variety of different applications and domains including healthcare, ICT-based problem-solving, technology, education, sociology, government, economic, environmental, social, and community development [13,20,23]. This study presents one of the few applications of this methodology in the domain of land administration.

Delphi studies do not require face-to-face communication; therefore it can facilitate communication between geographically distanced experts [9]. They should remain anonymous until the completion of the Delphi study to help prevent the opinion of any one member having an undue influence on the responses of the others [9]. Anonymity incorporates to minimise dominance bias from any panellists. The panel of a Delphi study should be recognised as representative sources of expertise within a particular field [11,23]. The number of panellists in the Delphi study is commonly quite small. The literature recommends eight to 18 experts on the Delphi panel [4,6,8,23]; a panel larger comprising more than 30 experts rarely provides additional value in terms of difference in perspectives [5]. A Delphi study is an iterative process of structured questionnaires completed by the panellists. Using three rounds of questionnaires aims to clarify the panellists' responses to achieve consensus [14].

This Delphi study commenced in 2015 and is ongoing as part of a doctoral study. This research targeted four different types of experts to form the Delphi study panel: (1) academics that are highly qualified and well respected in VGI and/or land administration field; (2) government practitioners and (3) industrial practitioners who usually collect data related to land administration in their daily job; (4) individuals with expertise in collecting data in VGI projects, such as OpenStreetMap and WikiMapia. This structure ensured a sufficient number of perspectives for the study. Potential panellists were identified based on the guidelines developed by [23]. In total, 21 experts formed the Delphi study panel. In comparison to the majority of Delphi studies found in the literature a panel of 21 is considered to be a healthy size.

The overall Delphi study will consist of three rounds. The first round consisted of five sections and this paper utilised data from one section. The first round is exploratory; therefore, an open-ended and semi-structured questionnaire was employed to encourage freethinking and generating new ideas. Furthermore, this keeps panellists focused on the topic and aims of the research. The first round was conducted via email through online questionnaires. The aim of this round was to obtain as broad range of factors as possible that could impact on the use of VGI in land administration. Therefore, the panellists were asked to respond to the following questions:

- *What are the factors that could affect the use of VGI as an approach for collecting land and property RRRs?*

- In what circumstances would VGI be an alternative solution regarding data collection in the context of land administration context?

## VGI IN LAND ADMINISTRATION: FACTORS

Responses were gathered and analysed based on qualitative content analysis. This included coding, generating categories and abstraction. Generating categories is a conceptual challenge as well as empirical one [9]. Categories should simplify the data as well as reflect the subject of study in a reliable manner. In this step, factors are being classified as ‘belonging’ to a particular category. This implies a comparison between these factors and other factors that do not belong to the same categories. As a result of this step, 34 factors and eight categories were generated. To label categories, a general description for each category was formulated by content-characteristic words in the abstraction phase. Each of these categories illustrated in Figure 1 is discussed in the subsequent section.

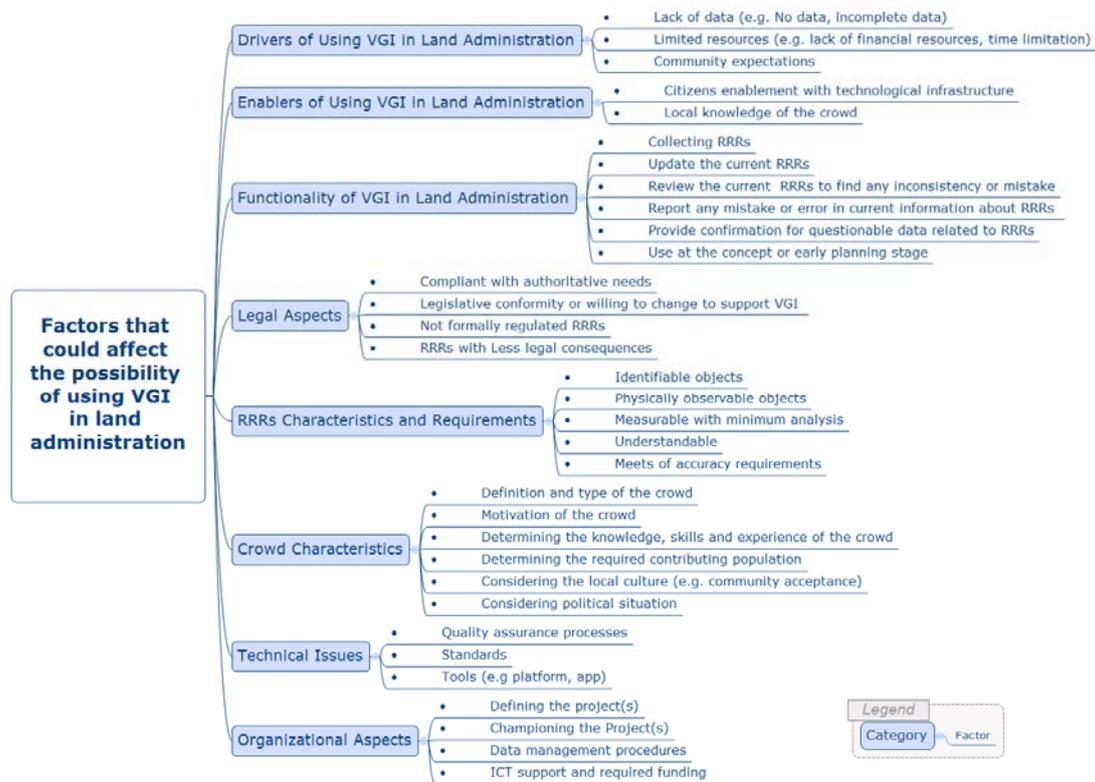


Figure 1: The result of qualitative content analysis of the Round 1 of Delphi study

### Drivers and enablers of using VGI in land administration

The most commonly proposed drivers for using VGI in land administration were the lack of data related to land and property RRRs and limited resources. For example, one of the panellists said that “VGI is an alternative where we have no current data or incomplete data”. These results endorse the value of VGI as a quick and low-cost data collection approach.

The most commonly proposed enabler by the panellists was technology advancements. Some suggested that access to appropriate technological infrastructure for contribution has an important role in enablement of VGI (e.g. access to the Internet, Smartphone, GPS and social media).

### Functionalities of VGI in land administration

The panellists suggested different functionalities for VGI. For example, some panellists argued that citizens might be able to collect a type of land and property RRRs (e.g. residential noise levels) that do not exist in a specific jurisdiction, or they could update existing ones (e.g. native vegetation).

Furthermore, they felt that VGI could be used effectively to detect and report mistakes or to provide confirmation of questionable data in land administration.

These findings expand on current studies, which have to date emphasised the role of VGI as a data collection mechanism in land administration, especially in those countries where limited land rights records exist. Although data collection is undoubtedly an important functionality – and hence, rationale – for adopting VGI, preliminary results from this study suggests that volunteers could also contribute to the processes of updating, reviewing and confirming existing RRRs.

### **Legal Aspects**

The legal implications of using VGI in land administration were one of the main concerns of the panellists. This is unsurprising given that the prevailing function of land administration systems is to provide and manage authoritative land records as the basis for property transactions. Although some panellists stated that legal implications of incorrect data could limit the use of VGI in land administration, others suggested that a more productive path forward might be to distinguish between mandatory or legislative data, and other types of useful (not legislatively prescribed) data. For example, one of them said, *“I would see VGI being more at the 'indicative' level rather than at the more hard-edged legislative or definitive end”*. They also said that in situations where legislation or regulations have been changed or lawmakers are willing to change current legislation to support VGI, there would likely be more chance for VGI to be used in land administration.

This suggests that there is room to adopt VGI in terms of collecting those RRRs with none or fewer legal consequences, or in a situation where RRRs were never formalised in the first place. Different types of RRRs are created through legislation; however, it is important to note that not all of them require the high level of governmental guarantees as explained in [3]. Furthermore, RRRs typically exist as a continuum ranging from informal to formal as discussed in [27] and VGI could represent a kind of data that supports less formal RRRs.

### **Land and property RRRs characteristics and requirements**

The characteristics and requirements of land and property RRRs within jurisdictions formed another category of factors. The panellists set out some characteristics to determine what sort of land and property RRR could be collected by crowds such as *“Easily identifiable objects”*, *“Easily measurable variables”*, *“Require observation but no or minimal analysis or interpretation”*. These results suggest that a range of factors related to land and property RRRs characteristics could have an influence on the possibility of using VGI. For example, the characteristics of the data itself (e.g. definition, complexity, required quality) and the crowd knowledge requirements to contribute to the process of collecting data. Volunteers could potentially collect data that they understand and can observe such as roads, buildings, and walls. These results are in line with those discussed in previous studies [1,22] but also reveal more factors related to land and property characteristics that could affect the use of VGI in land administration.

Some panellists also argued that the accuracy requirement of RRRs is another factor that needs to be considered. For example, a panellist said *“Accuracy requirements both spatially and content would also be factors in determining the suitability of RRRs being collected through VGI”*. The accuracy of VGI collected data for land administration purposes is evaluated in some studies [2,16,24], which tended towards an average spatial accuracy of around 5 meters. However, these studies found that this accuracy was not sufficient [24] while others found the converse to be true [2]. Findings from this study suggest that accuracy of VGI might be sufficient for some jurisdictions not all of them.

### **Crowd characteristics**

The panellists argued that the definition and type of the crowd would have a significant impact on the possibility of using VGI in land administration. For example, one of the panellists said, *“VGI can be operated by a range of participants. There is room to have Professional participants, Trusted participants and General participants”*. Furthermore, some said that local culture, community acceptance and also ethical and moral profile of community could affect the use of VGI. Also, some panellists discussed the role of knowledge, skills, experience and motivation of contributors as other factors that would impact on the possibility of VGI in land administration. This study identified six factors, illustrated in Figure 1, related to crowd characteristics that could affect the use of VGI in land administration. This indicates that understanding crowd characteristics is essential to the use of VGI.

## Technical issues

Quality assurance of VGI was a widely discussed issue by the panellists. The panellists felt that finding stable quality assurance methods for a specific type of RRRs is likely to have a significant impact on the possibility of using VGI in land administration. Some methods for validation of entered data were proposed by the panellists including a rating system to determine the level of trust, using trusted supplier or trusted intermediaries; evaluating entered data by independent review, checking entered data by third party information. Some panellists said that VGI could be used to qualify the source of data which lets the user decide whether to accept it or not. Furthermore, as some panellists mentioned, data can serve as complementary or alternative data sources. In addition, some suggested that standardisation of data collection, edit, review and update processes are also important in land administration domain. Useful and well-designed tools were also identified by the panellists as other technical factors that could affect the use of VGI.

Currently, there is a wide range of quality assurance methods for VGI with differing advantages and limitations [12]. For example, as [22] discussed, most of these methods rely on the number of verifications and in many cases in the land administration domain, only a few people can verify the correctness of entered data. Therefore, developing or adopting a suitable quality assurance method for specific RRRs relevant to the particular jurisdiction is important.

## Organisational aspects

The panellists raised some issues related to organisational aspects. This is illustrated in Figure 1. For example, one of the panellists said, *“The key here is coordination of data collection by someone. Then sharing it to whoever can usefully use it”*. Another panellist was concerned about the *“strategy of dealing with inconsistencies”* and *“the way of recording the quality of provided information”*. On the whole, the panellists determined data management issues, championing of the VGI project, defining the scope of project, and required funding for ICT support as factors that could affect the use of VGI in land administration.

The findings from this study endorse the value of having a specific entity to manage, structure and maintain the voluntary process of collecting RRRs related to land and property. This entity could be part of a government body or a non-profit organisation or even a private company. For instance, a non-profit organisation is supporting the OpenStreetMap project to maintain and grow while Wikimapia is a privately owned commercial site based on an open-content collaborative mapping project.

## CONCLUSIONS

VGI in land administration is an emerging topic with limited literature. Prior studies have noted the value of using VGI as a cost effective data collection approach in land administration domain, but there remains limited understanding of what specific factors could affect the use of VGI. The findings presented here is part of an ongoing study investigating this gap.

The findings demonstrate the multidimensional challenges of adopting VGI in land administration by identifying 34 factors across eight different categories. These factors are mainly related to drivers and enablers of VGI in land administration, RRRs characteristics and requirements in specific jurisdiction, crowd characteristics, legal aspects, technical issues, and organizational aspects. Furthermore, different functionalities were identified for VGI in land administration.

These findings contribute to current knowledge about utilising VGI in land administration. Going forward, the subsequent rounds of the Delphi study will explore these factors in greater detail and seek consensus about the most pertinent ones.

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