Analysing the Cadastral Template Using a Grounded Theory Approach

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Abstract

The Cadastral Template contains a wealth of qualitative and quantitative data gathered from 47 nations over the past decade, but there has been little analysis of the qualitative data component to date. What has been done focuses on the Oceania region and groups countries according to their level of development. Also there have been several additions and updates to the data since the last published analysis in 2010. A more thorough qualitative analysis needs to be undertaken, and for this a grounded theory approach is advocated. The analysis to date focuses on the purpose of cadastral systems, with the aim of extending this analysis to include the state of development of cadastral systems around the world, including the challenges faced and how these challenges are being addressed. The results of this analysis should assist policy-makers and land administrators in developing the cadastre in Africa. This is a work in progress and initial results only are reported here.

1 Introduction

> *"Ideally, all countries would like to have their cadastral and registration systems operating under 'best practice', [but] there is … a lack of knowledge on what is in fact best practice. The concept of the cadastral template has aimed to address this through the creation of a tool to compare and contrast cadastral systems throughout the world." (Rajabifard et al., 2006, p. 10)*

A decade ago the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) set out to develop a cadastral template. The objective of the project was to uncover the basic social, conceptual and institutional context of a country's cadastral system as a whole (Rajabifard et al., 2007). The aims of the project were (Rajabifard et al., 2007; Steudler et al, 2003): 1) to learn what role the cadastre plays in a state's or nation's Spatial Data Infrastructure (SDI) ; 2) to compare best practice as a basis from which to improve cadastres, especially in terms of their role as providing a foundation for SDIs; and 3) to identify key cultural contexts hindering effective land administration. It was proposed that the information collected using the template could be used for comparison and assessment of land administration and cadastral systems as a means of helping countries to re-engineer and implement their own systems to address their future cadastral needs (Rajabifard et al., 2006). "Most importantly, the project facilitates analyses that contribute to international understanding of how each nation approaches land administration design" (Williamson et al., 2010, p. 272). Four key issues were addressed by the template (Steudler et al., 2003): 1) the order of magnitude of the basic tasks in a cadastral system; 2) the informal occupation of land; 3)

the role of the cadastre in SDI; and 4) the current capacity and the capacity that needs to be established in order to support the cadastral system.

The project experienced difficulties due to the cultural, technical, and social differences between each country, as well as in the different terminologies used and different understandings associated with like terms (Rajabifard et al., 2007; Steudler et al., 2003). Notwithstanding these difficulties, just four years after its inception 36 countries had completed and returned the template (Rajabifard et al., 2007). To date that number has extended to 47 countries (Steudler, 2013), see Figure 1 and Table 1.

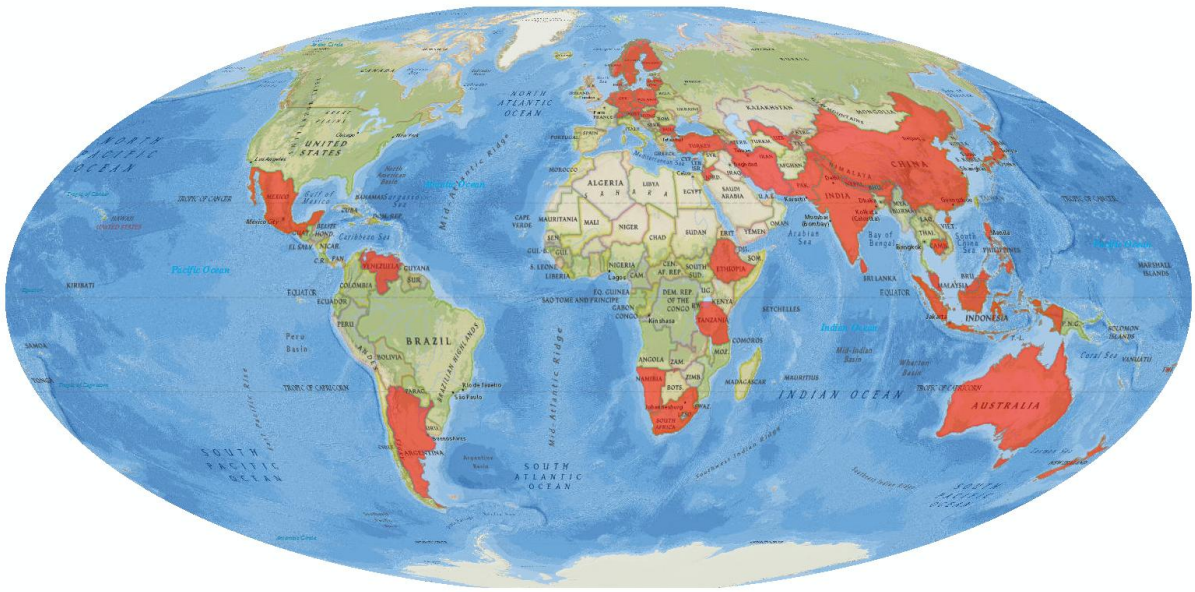


Figure 1 Countries that have completed the cadastral template to date

Table 1 Cadastral templates analysed to date including the date of submission of the latest template.

Analysed				Not analysed			
Country name	**Year**	**Country name**	**Year**	**Country name**	**Year**	**Country name**	**Year**
Argentina	2003	**Fiji**	2007	**South Korea**	2003	**Pakistan**	2012
Australia	2010	**Finland**	2009	**Latvia**	2013	**Philippines**	2003
Austria	2006	**Germany**	2003	**Lithuania**	2010	**Poland**	2012
Belgium	2003	**Hong Kong**	2010	**Macao**	2003	**Slovenia**	2010
Brunei	2003	**Hungary**	2010	**Malaysia**	2010	**Sri Lanka**	2003
Bulgaria	2010	**India**	2003	**Mexico**	2012	**Sweden**	2011
Cambodia	2003	**Indonesia**	2003	**Namibia**	2004	**Switzerland**	2003
China	2003	**Iran**	2003	**Nepal**	2003	**Tanzania**	2005
Cyprus	2010	**Israel**	2006	**Netherlands**	2010	**Turkey**	2003
Czech Republic	2010	**Japan**	2012	**New Zealand**	2003	**Uzbekistan**	2003
Denmark	2010	**Jordan**	2003	**Norway**	2007	**Venezuela**	2004
Ethiopia	2011	**Kiribati**	2003				
South Africa	2010						

Figure Figure 2 illustrates the relative distribution of responding countries per region. Asia and Europe make up the largest contributing regions with 15 and 17 respondents respectively, while the contribution of Africa, the Americas, the Middle East and Oceania combined is also 15. It is clear that there is a dearth of respondents from Africa, the Americas and Oceania, while nearly one quarter of countries in the Middle East, one third of European countries and over two fifths of Asian countries have responded.

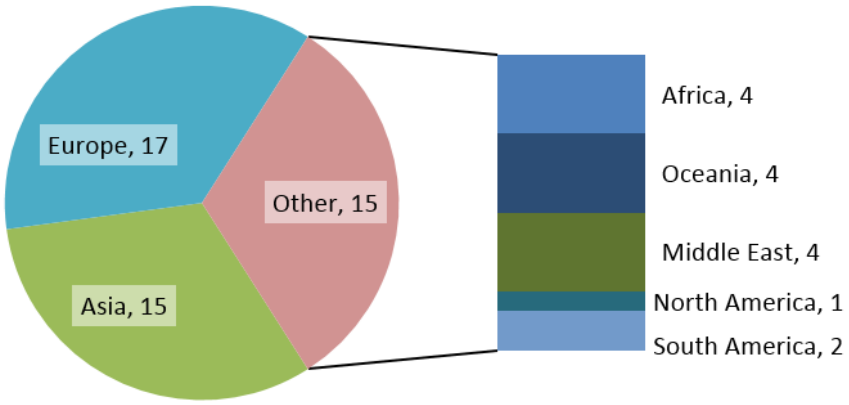


Figure 2 Distribution and numbers of countries represented in the Cadastral Template

The cadastral template was distributed by means of a questionnaire that was split into two parts (Steudler et al., 2003). The first part was designed as a qualitative, descriptive report of the national cadastral system, and it is this part that forms the basis for analysis in this paper. The second part was designed to quantitatively identify the basic principles and main statistics of the cadastre. In

Table 2 Results of analysis of indicator eight (Rajabifard et al., 2007)

Development level	Reform issues	Examples of countries
Low / previous communist rule	Digital cadastral mapping Lack of coordination in cadastral issues Need for capacity building: • more educational facilities, • funding / financial support, • training and qualification of surveyors, • better coordination of cadastral projects and initiatives	Namibia Czech Republic Hungary Uzbekistan
Newly industrialised	Lack of cadastral infrastructure Development of educational facilities and professional bodies	Indonesia India
Well developed	Creating maintenance systems for cadastral infrastructure Needing comprehensive systems to support transparent and fair land market Needing international compatibility within European nations	Australia Japan Switzerland Sweden

order to analyse the acquired data, performance indicators were used that take into account the different needs of the various respondents at their different stages of development (Rajabifard et al., 2006, 2007; Williamson et al., 2010). The first six indicators (registration systems, parcels vs. population, strata units, percentage of parcels registered, surveyors and lawyers, surveyors vs. lawyers) were used to assess the mostly quantitative data captured in the second part of the questionnaire. Indicators seven (education and professional bodies) and eight (cadastral reform issues and current initiatives) dealt with the descriptive part of the questionnaire (Ibid.). However the analysis of indicator seven focuses exclusively on the Oceania region (Rajabifard et al., 2007; Williamson et al., 2010) and needs to be extended to include other regions. Analysis of indicator eight revealed that cadastral reform issues could be grouped according to a country's level of development and that developing countries are facing issues that have already been dealt with by more developed nations (Ibid.). These results are summarised in **Error! Reference source not found.**.

2 Problem Statement and Research Questions

There is a diversity of cadastral systems in use around the world making comparison of systems and standardisation of practices difficult. The cadastral template contains a wealth of descriptive data gathered from 47 nations over the past decade, but there has been little qualitative analysis of this data to date. What has been done focuses on the Oceania region and groups countries according to their level of development, as per **Error! Reference source not found.**. Insufficient attention is given in the literature to the methodology upon which these results are based. Also there have been several additions and updates to the data since it was last analysed (Williamson et al., 2010). A more thorough, qualitative analysis needs to be undertaken, and for this a grounded theory approach is advocated. The following research questions will be addressed:

1. What is the purpose of the cadastral system?
2. What are the challenges facing cadastral development and land governance?
3. How are these challenges being addressed?

(Note that only a preliminary assessment of question one is presented in this paper, which is itself a work in progress.)

3 The Grounded Theory Approach

3.1 A Brief Summary

The grounded theory approach (GTA), as described by Corbin & Strauss (1990) and Charmaz (2006) among others, employs a cyclical to-and-fro between data collection, coding, categorising, memo-ing, sorting, validating, and writing, from which theory emerges (conceptually illustrated in Figure 3). Analysis begins with collection of the data and coding of the data using ideas derived from the data, not *a priori* (Barry & Roux, 2013). Coding is the process of identifying important issues that emerge from the data and describing these issues with short phrases (Allan, 2003). It begins the process of abstraction as data are conceptualised and labelled in order to filter out noise

and reveal the important issues contained within the data (Hatch, 2006). Similar codes are grouped together to form concepts, and similar concepts are grouped into categories. Data collection, coding, categorising, and analysis continue until categories are theoretically saturated, i.e. no new properties emerge from sampling (Charmaz, 2006; Corbin & Strauss, 2008). Hence the choice of data sources is not driven by the need for representativeness, but rather by gaps in the emerging theory. Theories are built up from an analysis of the linkages between concepts and categories to explain the phenomenon of interest. This is a cyclical process during which further data may be gathered in order to enhance the theory being generated and to fill in gaps as they emerge (Barry & Roux, 2013).

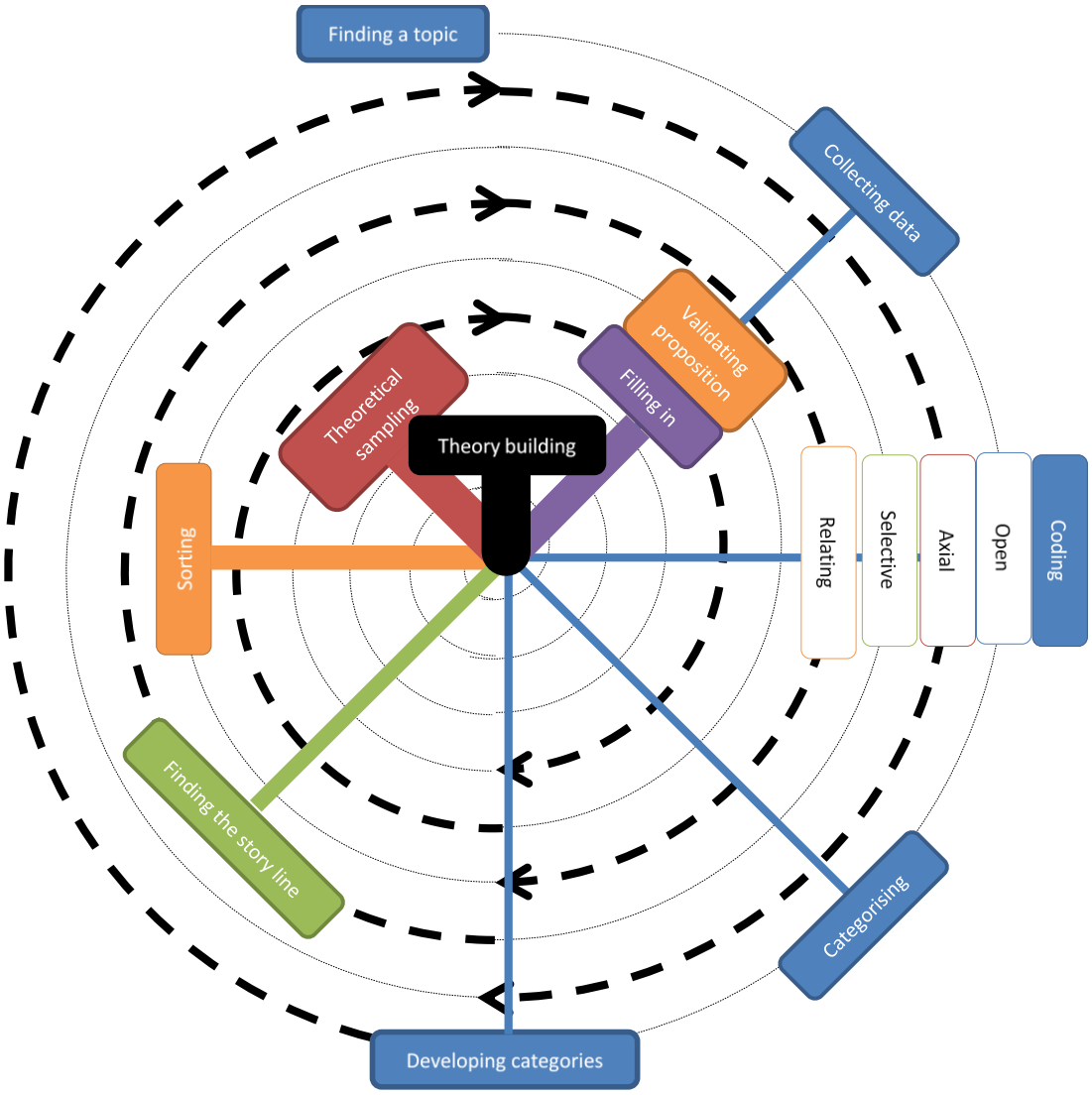


Figure 3 The cyclical nature of the Grounded Theory Approach

3.2 What is Theory?

Theories are organised bodies of concepts and principles designed to rationally and clearly explain a phenomenon (Leedy & Ormrod, 2010; McMahon, 2013). Their structure is typically general / summative such that knowledge is organised through the proposal of a general relationship

between events. Theories help us to describe and understand what has happened, and are useful in predicting what might happen under similar or different conditions (McAuley et al., 2007). They group phenomena in terms of their perceived similarities and differences in order to help us make sense of the world. At the heart of 'making sense' is simplification, or abstraction, of our observations into concepts or categories that help us to understand a phenomenon. Theories link these abstractions together in order to explain something (Ibid.).

Barry & Roux (2012) have developed a taxonomy of theory related to land tenure. They identify a hierarchy of concepts upon which theories are built and within which theories find their place. Of particular importance to the GTA are the following: *Constructs* are abstractions of *concepts* that are defined in association with relationships to other constructs and observable entities in the material world. "Clear definitions and descriptions of constructs and the relationships between them form the essence of good theory" (Barry & Roux, 2012, p. 306). This describes the GTA (Allan, 2003). A *proposition* is a formal statement of a concept, and a *hypothesis* is a testable proposition. *Theories* are based on a set of related hypotheses and condition statements. *Substantive* theory comprises a set of hypotheses that provide an explanation for a particular phenomenon or area of study. Most grounded theories are developed at this level (Glaser, 2007). *Formal* theories are generalised from substantive theories that have been validated in a range of diverse situations (Barry & Roux, 2012). A formal grounded theory is a conceptual extension of a substantive grounded theory's core category through constant comparison and theoretical sampling (Glaser, 2007).

4 Analysis

4.1 Coding and Categorising

Coding is the central process by which grounded theories are derived: coding enables the analyst to break through inherent biases brought to (or derived during) the research process. Codes provide the grounding, build the density, and help to develop the sensitivity and integration that are required to generate rich, explanatory theory that closely approximates reality. Codes are not labels under which similar instances of the same phenomenon are counted. They are the basic elements of an emerging theory derived from an interpretation of data; they are concepts that depict a part of reality, arise from the data, and hence are grounded in reality. Open coding can produce hundreds of codes, leaving the analyst no wiser and hardly closer to theory formulation than when they started. In order to recognise patterns in the data, similar codes have to be grouped into categories (Strauss & Corbin, 1990). A category is a code on a more abstract level.

4.2 To date 25 out of 47 countries' templates have been analysed (see Coding and Categorising

). A total of 350 codes have been generated focusing on the *purpose* of the cadastre (115), the cadastral *challenges* (110) and *strategies* (79), the different *types* of cadastral systems (54), the state of cadastral *development* (43), and good *governance* indicators (28). (Some codes feature in more than one of these themes.) The analysis presented here focuses on the *purpose* of the cadastre.

Table 3 lists the highest ranking codes in terms of their 'groundedness'. 'Groundedness' refers to the number of occurrences of a particular code. Taking the top code for example, there are 27 occurrences of 'fiscal (valuation / taxation)' in the data. Note that this does not imply that each of the 25 countries assessed thus far refers to this cadastral purpose: Brunei, Cambodia, Japan and Kiribati do not mention the fiscal cadastre, while other countries make reference to this more than once. Yet it is plain to see from this first inspection of the data that the 'traditional' fiscal and legal roles of the cadastre still feature prominently, while the more 'modern' multi-purpose role and the role of providing a foundation for SDI and Land Administration are just as prominent.

Table 3 The highest ranking codes based on 'groundedness'

'Groundedness'	**Code**
27	Fiscal (valuation / taxation)
23	Foundation for SDI and Land Administration
20	Multi-purpose (planning, government)
	Legal (land transfer / market)
14	Identifying ownership
11	Delineating parcel boundaries
9	Providing security of ownership
	Identifying RRRs
	Providing access to land information
8	Linking multiple data sources to the cadastre
	Identifying mortgages
7	Identifying easements
	Linking registry and cadastre
	Identifying land parcels
5	Defining ownership rights
	Supporting legal land ownership
	Land registration
	Recognising different forms of tenure
4	Supports land administration
	Providing cadastral information to the public
	Land development
	Soil information system

The 115 codes related to the *purpose* of the cadastre were grouped into three general themes that

emerged from the data: Administration (54%), Governance (24%), and Multi-Purpose (22%). These themes provided a theoretical basis for further categorising. Here Land Administration is understood to mean the "processes of recording and disseminating information about the ownership, value and use of land and its associated resources" (UNECE, 1996, p. 14) and it "comprises an extensive range of systems and processes" (Enemark, 2005, p. 7) designed to manage the four components of the Land Management Paradigm (LMP): land *tenure*, land *value*, land *use*, and land *development*. Out of the 115 codes, 63 (55%) were categorised in terms of these four components. These are illustrated in

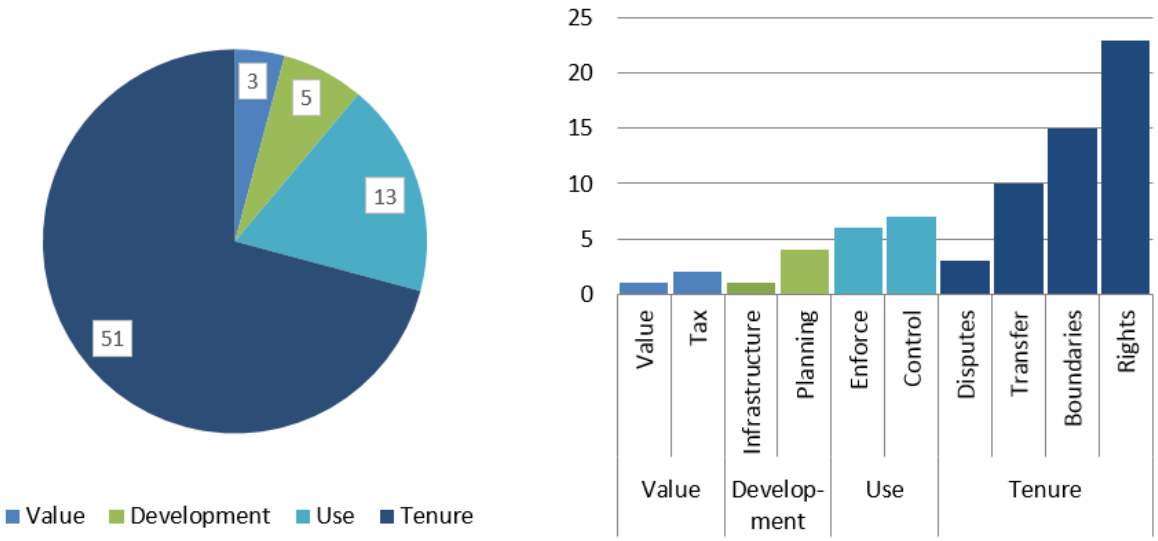


Figure 4 The components of the Land Management Paradigm.

Good governance indicators relevant to cadastral systems have been synthesized by Hull & Whittal (2013) into four categories. Out of the 115 codes, 58 (50%) related to these categories (see

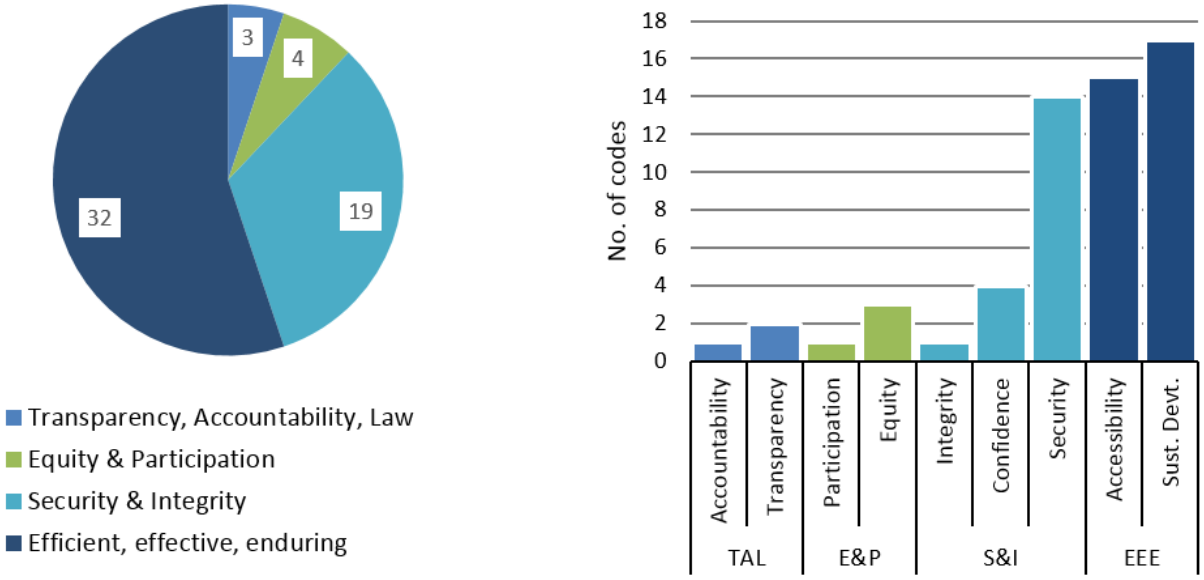


Figure 5). A focus on efficiency, effectiveness and endurance is evident from the data, this focus

being split almost equally between providing equitable and efficient access and providing the means for sustainable development. Issues of security also featured prominently.

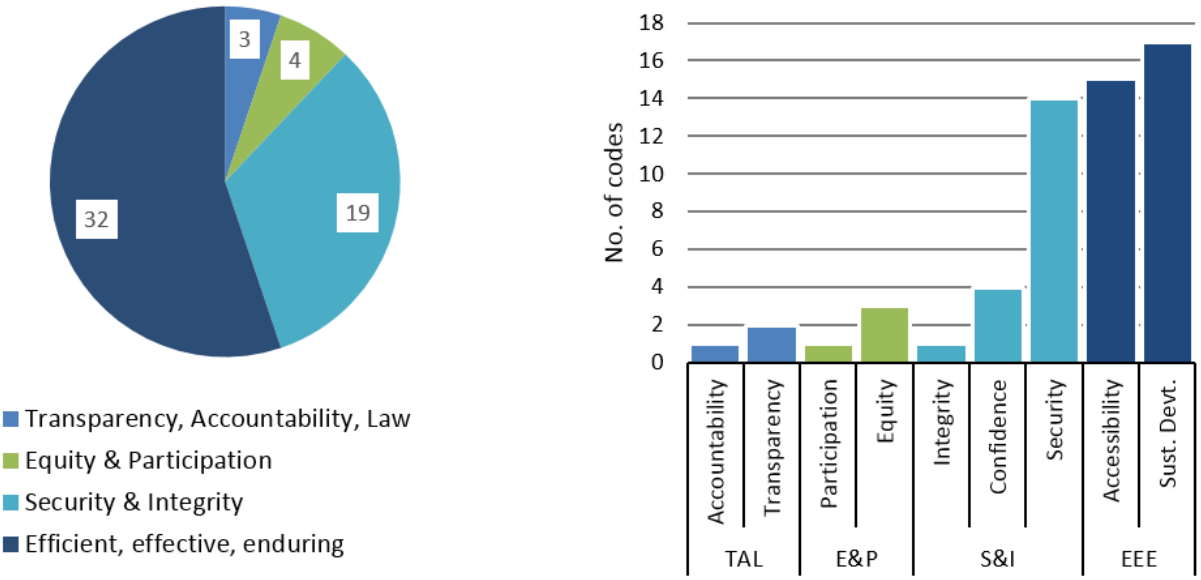


Figure 5 Good governance indicators

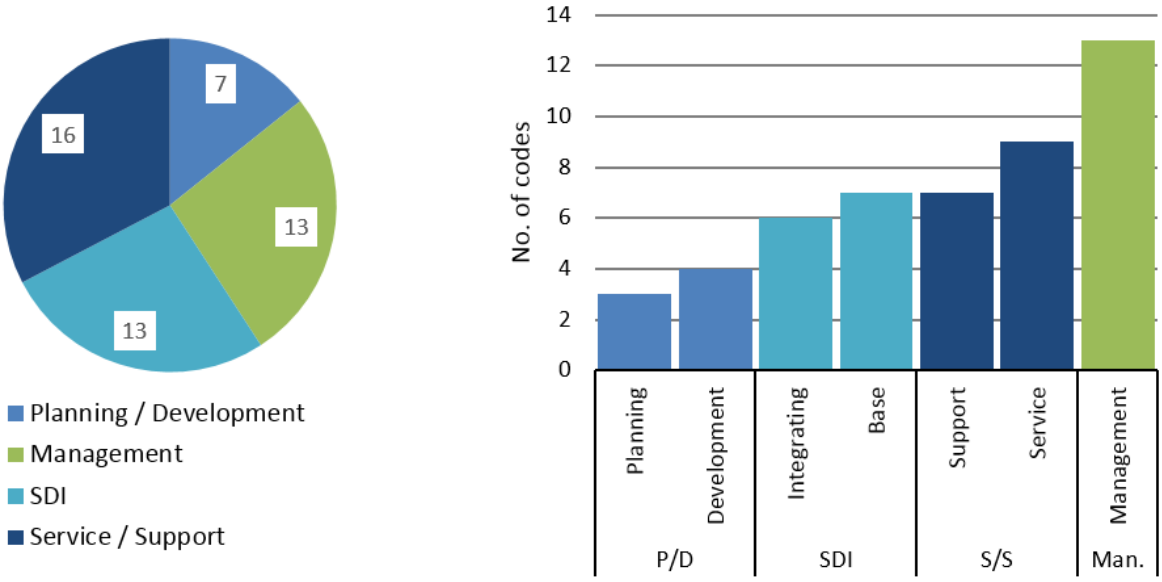


Figure 6 Multi-purpose role

A multi-purpose cadastre is one that is able to meet a "range of needs beyond simply recording land ownership or defining parcels for taxation" (Jones & Land, 2012, p. 2). These needs include "the global concerns of environmental degradation, urbanisation, natural disasters, climate change, poverty, sustainable development, and social equity" (Hull & Whittal, 2013, p. 351). 49 out of 115 codes (43%) revealed a multi-purpose role for the cadastre. These codes were categorized as follows: relating to SDI and the management of land information (SDI), providing a service or supporting multiple uses of cadastral information (Service / Support), management of land and

land-related activities (Management), and Planning / Development (

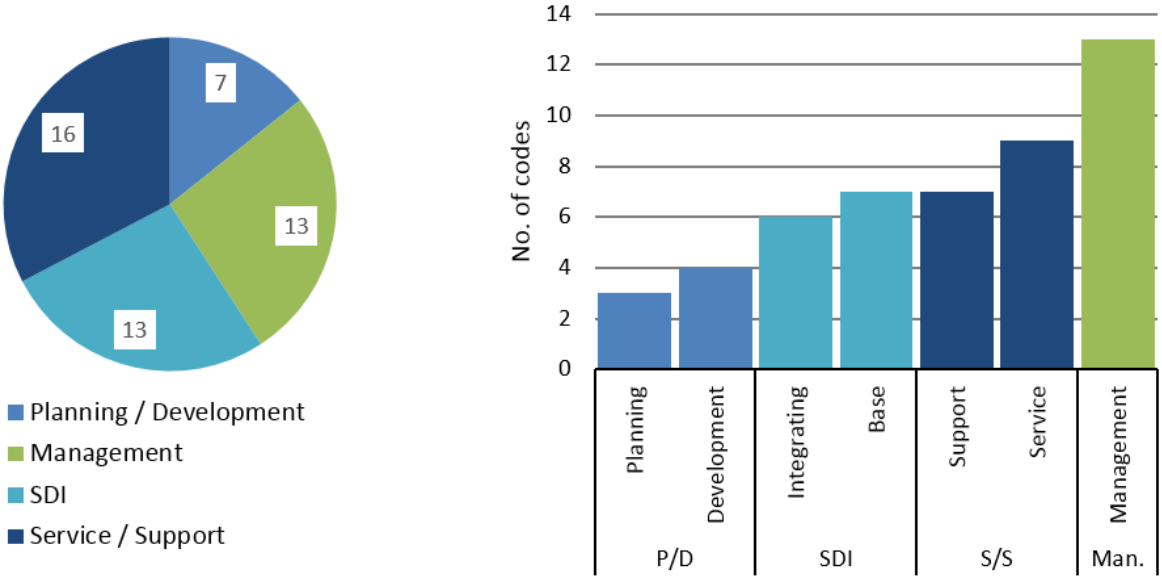
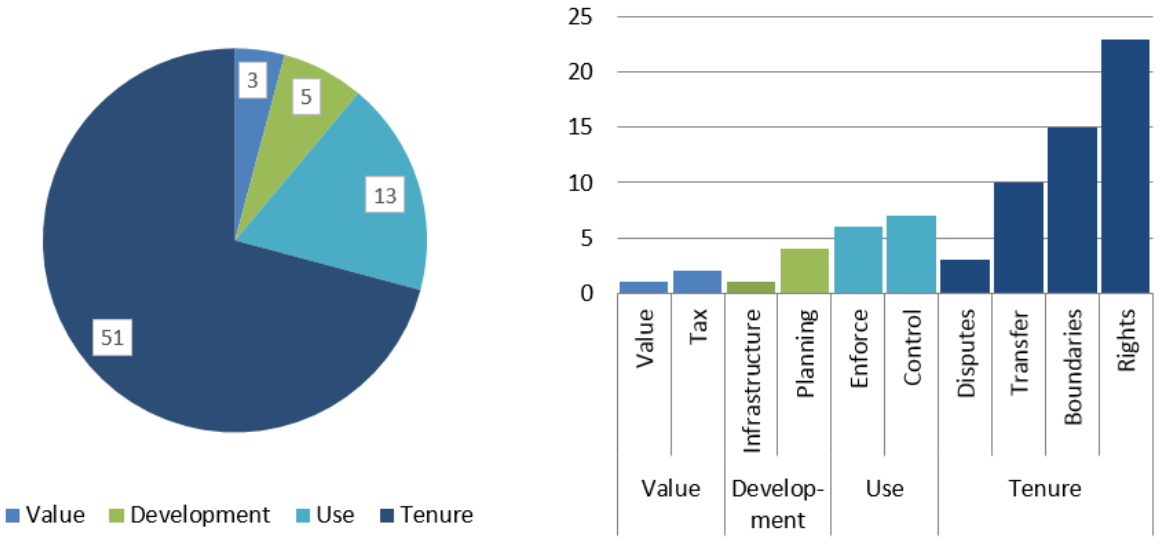


Figure 6). The SDI, Service and Support related roles featured prominently while the role of the cadastre in land Management was most prominent.

along with the constituent parts of each component. (These constituent parts were derived from Enemark's definition of each component – see Table 4.) Land tenure, and the administration of rights to land, formed the largest category and component.

Table 4 Definitions of land tenure, value, use and development (Enemark, 2005, p. 7)

Land Tenure	**Land Value**	**Land Use**	**Land Development**
the allocation and security of **rights** in lands	the assessment of the **value** of land and properties	the **control** of land use through adoption of planning policies and land use regulations	the building of new physical **infrastructure**
the legal surveys to determine parcel **boundaries**	the gathering of revenues through **taxation**	the **enforcement** of land use regulations	the implementation of construction **planning**
the **transfer** of property or use through sale or lease			**change** of land use through planning permission and granting of permits
the management and adjudication of doubts and **disputes** regarding rights and parcel boundaries.	the management and adjudication of land valuation and taxation **disputes**.	and the management and adjudication of land use **conflicts**.	



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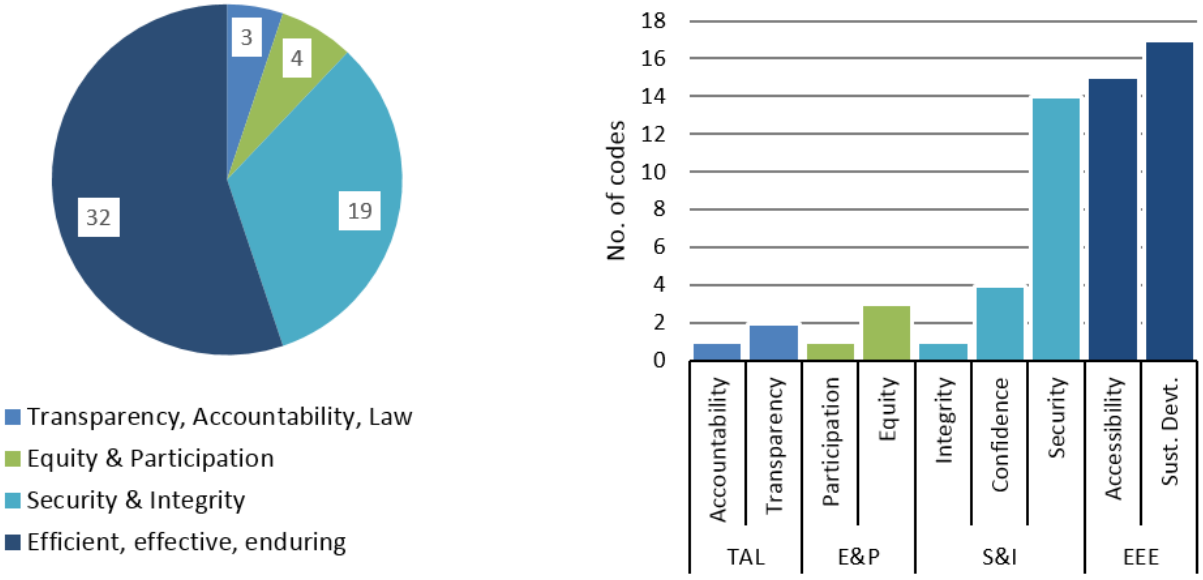

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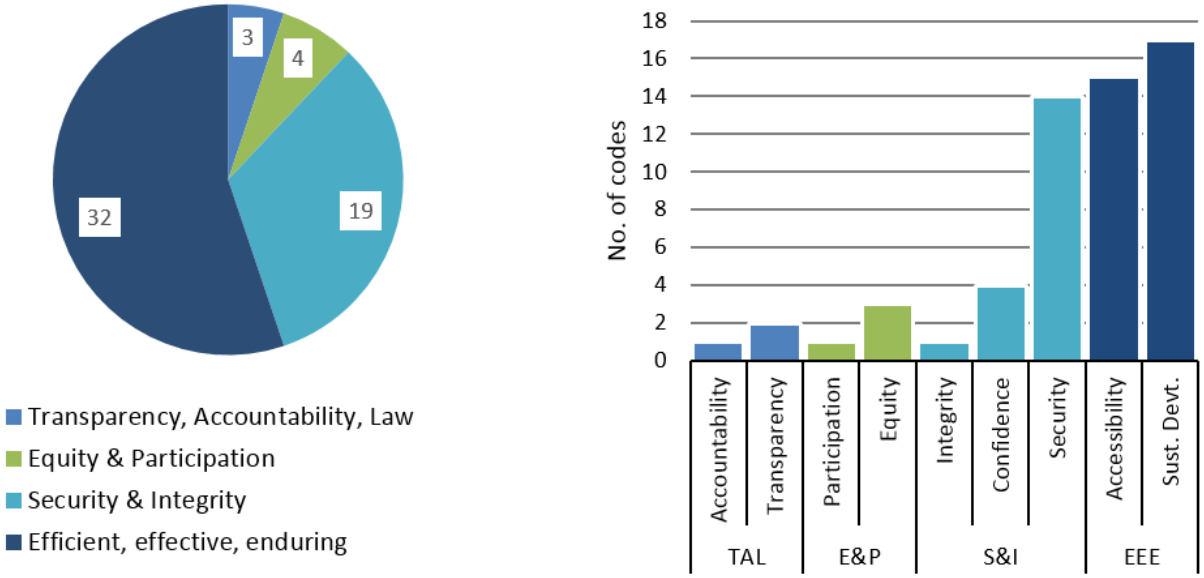

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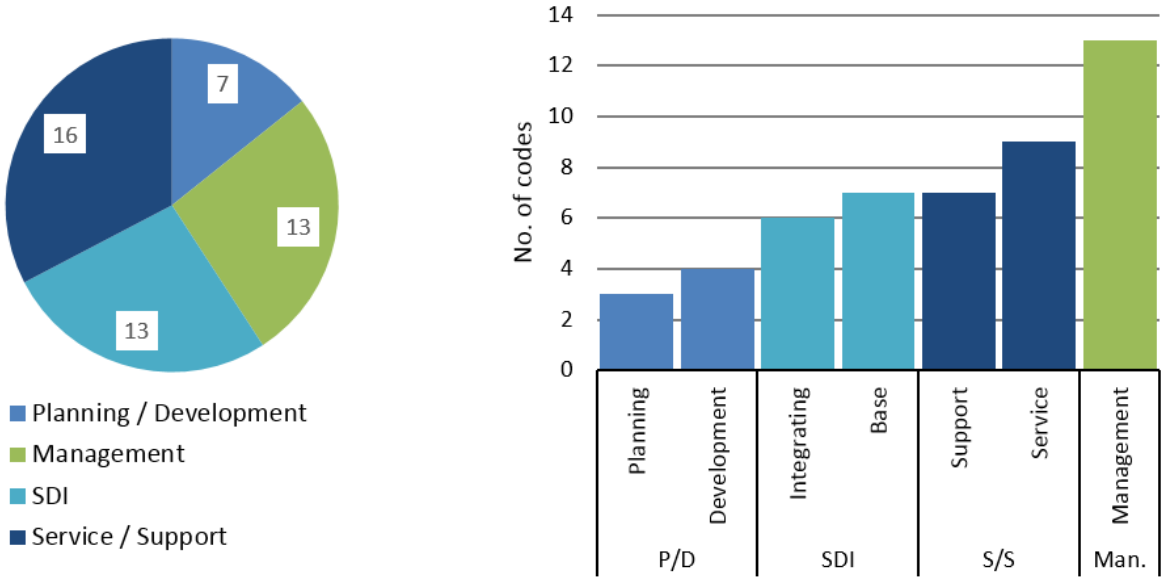

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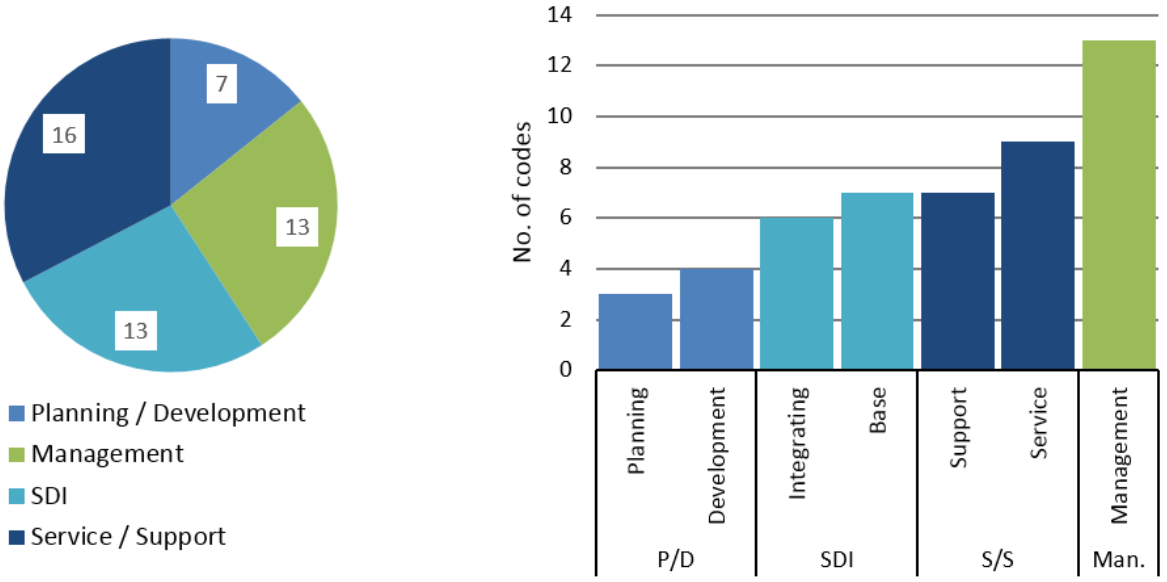

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4.3 Theoretical sensitivity

The analysis described thus far, while being grounded in the data, has been influenced by extant, technical literature. Glaser & Holton (2007) caution that the use of literature in a GTA may influence the researcher into applying pre-conceived codes onto the data, rather than allowing the codes to emerge from the data. Corbin & Strauss (2008) make the case that existing literature is useful for comparison with the data, for enhancing the researcher's sensitivity to subtle nuances in the data, and for stimulating questioning during analysis.

While apparently contradictory, both stances are correct: codes, and the theories derived therefrom, should emerge from the data and should not follow any preconceived bias. Extensive engagement in extant literature prior to data collection and analysis can run the risk of clouding the researcher's ability to remain open to the emergence of new core categories (Holton, 2007). Yet 'emergence' is a problematic methodological concept: researchers always draw on their existing theoretical knowledge to help them to make sense of empirically observed phenomena (Kelle, 2007). Hence researchers need theoretical sensitivity: "the ability to 'see' with analytic depth what is there" (Strauss & Corbin, 1990, p. 76), especially at the beginning stages of a project. One way of enhancing theoretical sensitivity is to avoid simply summarising or grouping ideas into themes when coding. Rather, codes should be a conceptualisation of what the data is saying, using gerunds where appropriate (Strauss & Corbin, 1990).

4.4 Developing theory

Applying this principle, all of the codes were categorised afresh using gerunds. This yielded 43 categories. The most prominent gerunds were 'Identifying' (ownership, plots/parcels, rights, land use), 'Supporting' (administration, the environment, finance, ownership, rights, transfer, land use),

and ‘Providing’ (access, confidence, employment, information, security, service). ‘Identifying plots / parcels’ (10) and ‘Providing information’ (7) were the two most prominent categories, while ‘Defining land use’, ‘Providing access’, and ‘Providing security’ (5) also featured prominently. (The number in brackets refers to the density of each category, i.e. how many codes it contains.) These findings concur with the ‘groundedness’ reflected in Table 3, where the codes ‘Identifying ownership’, ‘Delineating parcel boundaries’, ‘Providing security of ownership’, ‘Identifying RRRs’, and ‘Providing access to land information’ all feature prominently.

Analysing the data through the lens of land administration revealed the prominence of the land tenure component in the LMP, especially in terms of rights, boundaries and transfers (Figure 4). This is partially supported by the categorisation described above. In terms of governance, issues of accessibility and security featured prominently (Figure 5), both of which are supported by the categories above. By definition the multi-purpose role of the cadastre is a support for a variety of purposes. This is confirmed in the analysis represented by Figure 6, where the Service / Support category features most prominently. The categorisation described above yielded a long tail of categories related to only one or two codes. This, too, is evidence of the multi-nature of the purpose of the cadastre.

Although it is too early to draw any solid conclusions, the theory that appears to be emerging is that the *purpose* of the cadastre is to *secure, identify and support rights to land and to provide a means of accessing land-related information to support multiple purposes.* The cadastre can be defined as follows (FIG, 1995, p. 1), with reference to the preceding discussion: “a parcel-based” corresponding with the focus on identifying and delineating plots / parcels “up-to-date land information system” corresponding with providing access to information “containing a record of interests in land” corresponding with the prominence of land tenure, especially rights, and the multi-nature of land use. Hence the identified purposes correspond with this formal definition of the cadastre.

4.5 What’s next?

As mentioned previously, this is a work in progress. With reference to Figure 3, this analysis has progressed one third of the way around the first cycle of the spiral! The next step is to further develop the categories which means identifying the properties and dimensions of each category (Strauss & Corbin, 1990). This is followed by gathering more data to fill in holes in the developing theory, and the cycle of coding and categorising repeats. As the theory becomes clearer, the coding process becomes more selective and data is gathered that validates (grounds) the theory. It is also noteworthy that the preceding analysis has focused exclusively on the most prominent codes and categories that have emerged from the data. But prominence does not imply importance. More attention needs to be given to developing the categories at the lower end as well.

5 Conclusion

Although the Cadastral Template was not designed with this type of analysis in mind, it appears

that an analysis of the data using the GTA will yield useful results that may validate and probably even extend existing theories about the purpose of the cadastre. The existing analyses of the Cadastral Template have not engaged with the question of the purpose of cadastral systems, even though this was explicitly asked in the questionnaire. Hence a grounded theory analysis of this data set should yield novel results. These could be useful for those engaged in the design and administration of land policies and associated datasets, especially in the context of developing countries such as are dominant in Africa. Already strong biases towards identifying parcels, securing rights, and providing access to land information, have emerged from the data. It remains to be seen from further analysis what other noteworthy roles the cadastre fulfils.

Acknowledgments

I am grateful to the University of Cape Town for supporting my work through funding assistance.

References

Allan, G. 2003, 'A critique of using grounded theory as a research method', *Journal of Business Research*, vol. 2, no. 1, pp. 1–10.

Barry, M., & Roux, L. 2012, 'A change based framework for theory building in land tenure information systems', *Survey Review*, vol. 44, no. 327, pp. 301–314.

Barry, M., & Roux, L. 2013, 'The Case Study Method in Examining Land Registration Usage' *GEOMATICA*, vol. 67, no. 1, pp. 9–20.

Charmaz, K. 2006, *Constructing grounded theory: a practical guide through qualitative analysis*, Sage Publications, Los Angeles.

Corbin, J., & Strauss, A. 1990, 'Grounded theory research: Procedures, canons, and evaluative criteria', *Qualitative Sociology*, vol. 13, no. 1, pp. 3–21.

Corbin, J., & Strauss, A. 2008, *Basics of Qualitative Research: Techniques and procedures for developing grounded theory*, 3rd edition, Sage Publications, Thousand Oaks.

Enemark, S. 2005, 'Understanding the Land Management Paradigm', In *FIG Commission 7 Symposium on Innovative Technologies for Land Administration*, International Federation of Surveyors, Madison, Wisconsin.

FIG 1995, *FIG Statement on the Cadastre*, FIG Commission 7: Cadastre & Land Management, viewed 26 March 2013, <http://www.fig.net/commission7/reports/cadastre/statement_on_cadastre.html>

Glaser, B. G. 2007, 'Doing Formal Theory' In A. Bryant & K. Charmaz (Eds.), *The SAGE Handbook of Grounded Theory*, pp. 96–114, SAGE Publications Ltd, Los Angeles.

Glaser, B. G., & Holton, J. 2007, 'Remodeling Grounded Theory', *Historical Social Research*, Supplement, no. 19, pp. 47–68.

Hatch, M. 2006, *Organization theory: modern, symbolic and postmodern perspectives*, 2nd edition, Oxford University Press, Oxford.

Holton, J. 2007, 'The Coding Process and its Challenges', In A. Bryant & K. Charmaz (Eds.), *The SAGE Handbook of Grounded Theory*, pp. 265–290, SAGE Publications Ltd, Los Angeles.

Hull, S., & Whittal, J. 2013, 'Good e-Governance and Cadastral Innovation: In Pursuit of a Definition of e-Cadastral Systems', *South African Journal of Geomatics*, vol. 2, no. 4, pp. 342–357.

Jones, B., & Land, N. 2012, 'Cadastre 2.0 – A technology vision for the cadastre of the future', In *FIG Working Week 2012*, International Federation of Surveyors, Rome.

Kelle, U. 2007, '"Emergence" vs. "Forcing" of Empirical Data? A crucial problem of "Grounded Theory" reconsidered', *Historical Social Research*, Supplement, no. 19, pp. 133–156.

Leedy, P., & Ormrod, J. 2010, *Practical Research: Planning and Design*, 9th edition, Pearson Education International.

McAuley, J., Duberley, J., & Johnson, P. 2007, *Organization theory: Challenges and perspectives*, Pearson Education Limited, Essex

McMahon, M. 2013, *What is a Theory?* Conjecture Corporation, viewed 12 December 2013, <http://www.wisegeek.org/what-is-a-theory.htm>

Rajabifard, A., Binns, A., Williamson, I., & Steudler, D. 2006, 'A Template for Assessing Worldwide Cadastral Systems as Part of National SDI Initiatives', In *GSDI-9 Conference Proceedings*. Santiago, Chile.

Rajabifard, A., Williamson, I., Steudler, D., Binns, A., & King, M. 2007, 'Assessing the worldwide comparison of cadastral systems', *Land Use Policy*, vol. 24 no. 1, pp. 275–288.

Steudler, D. 2013, *Cadastral Template,* viewed 21 March 2014, <http://www.cadastraltemplate.org/>

Steudler, D., Williamson, I., & Rajabifard, A. 2003, 'The Development of a Cadastral Template', *Hong Kong Journal of Geospatial Engineering*, vol. 5, no. 1, pp. 39–47.

Strauss, A., & Corbin, J. 1990, *Basics of qualitative research: Techniques and procedures for developing grounded theory,* Sage Publications, Newbury Park.

UNECE. (1996). *Land Administration Guidelines with Special Reference to Countries in Transition*, United Nations Economic Commission for Europe, Geneva, Switzerland:.

Williamson, I., Enemark, S., Wallace, J., & Rajabifard, A. 2010, *Land administration for sustainable development*, Esri Press, Redlands, California.