Analysis of governance interviews in Lusaka, Windhoek and Maputo: Visualising the structure of the data

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1. Introduction

As explained in Governance Brief 1, interviews with multiple city stakeholders were undertaken for the city-regions of Lusaka, Windhoek and Maputo in 2017. A preliminary analysis based on the understanding of governance and decision-making structures was compiled and governance configuration maps have been produced based on these findings. This was the first step of a more detailed thematic analysis (see Renaud, et al, 2018, Governance Brief 1).

The aim of Governance Brief 2 is to provide the next step of the governance analysis for the cities of Windhoek and Lusaka which is to organise the interview data and to provide an initial representation of the interview content. The software programmes of Nvivo[1] and Kumu[2] were used for the visualisation of the structure of the data. The analysis is not possible for Maputo as the transcription of the interviews into Portuguese was not completed at the time of writing.

The brief will:

- Present visualisations of interview data in the form of word clouds
- Describe the process of coding the interviews in NVivo
- Present visualisations of dominant nodes and sub-nodes of the interview data in NVivo and Kumu.

2. Interview data

2.1 Transcription and translation

Interviews for each city were recorded using a standard recording device. Lusaka and Windhoek interviews have been transcribed, as well the interviews for Maputo that were completed in English. Notes were taken during interviews where respondents preferred not to be recorded. The rest of the Maputo interviews require translation and transcription, which is currently underway. This governance brief will focus on the thematic analysis of the Windhoek and Lusaka data, but the same process will be applied to the Maputo interview data as soon as the translations have been completed to produce a separate brief.

2.2 Visualisation of dominant words used in the interviews[3] as word clouds

Word clouds are visual representations of the frequency of words occurring in text data. This is a novel way of representing the keywords of a set of text data, in our case the governance interviews in the two cities. Complete interview transcripts and notes recorded/taken at the interviews in Lusaka and Windhoek, have been uploaded into NVivo Pro. The word frequency tool was used in NVivo to list the most frequently occurring words in the interview sources for Lusaka and Windhoek and displayed in the form of a word cloud (see Figure 1). The word cloud assists in visualising possible themes or dominant patterns in governance during the early stages of the project.

1 Nvivo 12 is a software qualitative analysis tool which is used to query and identify meaning in texts by undertaking thematic analysis. It has a comprehensive range of visualisation tools (http://www.qsrinternational.com/nvivo/).

2 Kumu is a powerful visualization platform for mapping systems and better understanding relationships. It is "a blend of systems thinking, stakeholder mapping, and social network analysis" (https://docs.kumu.io/about/what-iskumu.htm).

3 This includes words used by the interviewee only.

Figure 1 | Word clouds for Lusaka (left) and Windhoek (right) generated in NVivo based on governance interview data.

Issues around water were evidently a dominant topic during the interviews in both city-regions and this was to be expected. The words 'climate' and 'change' were more frequently used in the Windhoek interviews, whilst the issue of 'government' featured much more prominently in Lusaka.

3. NVivo coding process

3.1 Overview of methodology for structuring and visualising the interview data

Qualitative data analysis software programmes are not designed for analysing data on behalf of the researcher, however, they provide tools to assist the analysis (Kaefer et al, 2015). In this study, NVivo Pro assists through a multi-level coding process to provide the first step of the analysis of interview data from Lusaka and Windhoek. The next part of this brief unpacks the method of coding the interview data and visualising major themes (see Figure 2).

A node is a term used by NVivo to represent a common theme, idea or topic in the data. The initial analysis of the interviews in this study is through coding, where coding is the act of "assigning segments of text or other content to nodes, which are best understood as containers or storage areas" (Bazeley, 2007, cited in Kaefer et al, 2015). Each node holds references to a particular topic or theme across interview texts. These nodes are usually structured hierarchically, moving from more general topics (parent nodes) to more specific topics (child-/sub-nodes).

This study employs a multi-level coding process which involves a mixture of deductive and inductive coding. Deductive coding is a top-down approach that involves formulating a pre-set coding framework of themes and exploring how and where these appear in the data (Kaefer et al, 2015). In this study the node framework is based on elements of the governance configuration (see Scott, 2017 and Renaud, 2018) and will be explained in more detail below. Inductive coding is a bottom-up approach to coding whereby concepts, ideas and topics are generated as themes emerge during a detailed analysis of sources. Sources are read line-by-line as the data itself constitutes the starting point for analysis (Kuş Saillard, 2011). The objectives of the textual analysis of this study are to determine the quantity (the amount and frequency) and valence (tone of the content) of the participants' responses to relating to governance in their city (see Kaefer et al, 2015). This brief aims to fulfil the first objective. NVivo and Kumu both

offer visualisation tools for qualitative data. Both tools were employed to produce visualisations of node hierarchies. These visualisations provide insight into which topics, themes and ideas were more dominant during the interview process.

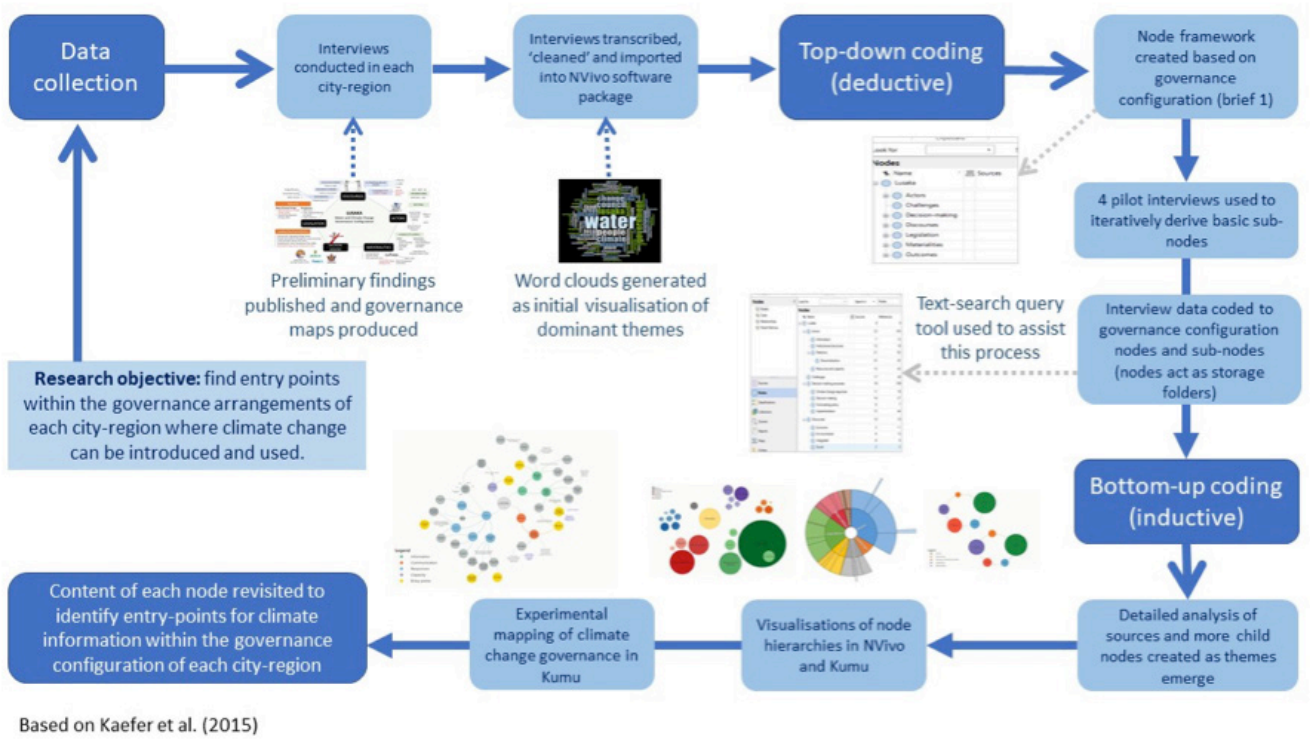
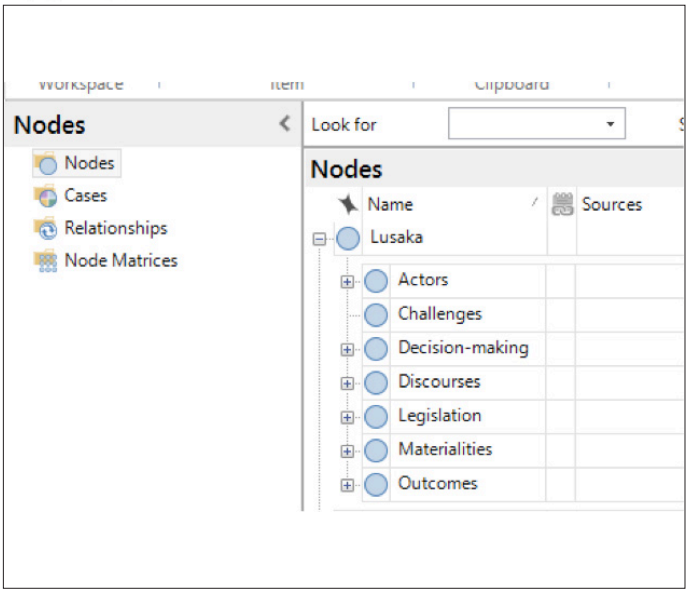


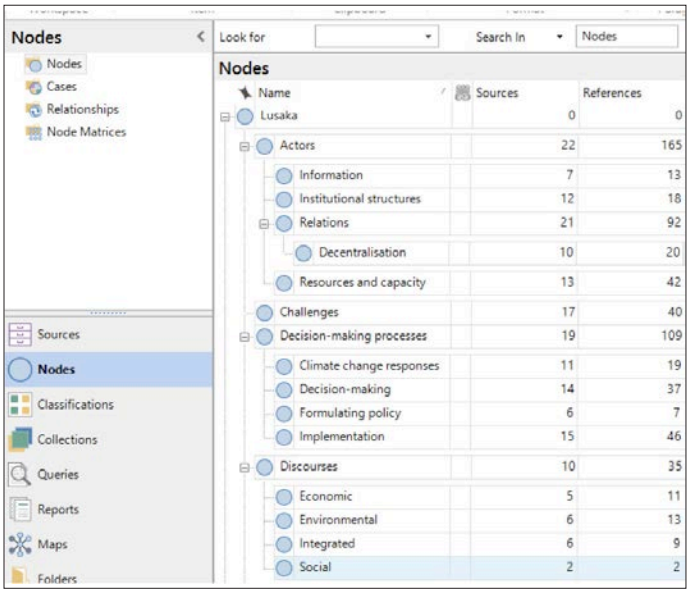
Figure 2 | Coding and visualisation process using NVivo and Kumu, figure is adapted from Kaefer et al (2015).

3.2 Organisational framework of nodes/deductive coding

NVivo Pro is being used as a tool to assist in the qualitative analysis of the interview transcripts. A framework of nodes was created in NVivo which served as an organisational structure for coding the interview data. Each node represents a theme, in this case each node was based on a theme/element of the governance configuration (Screen capture 1). The framework of nodes therefore includes actors, discourses, legislation, materialities, decision-making processes, the five elements of the governance configuration, and additionally challenges and outcomes (see Figure 1 in Governance Brief 1).

Interviews were analysed and coded according to this overarching framework of major themes, however, sub-themes emerged from the data throughout the coding process. These sub- and sub-sub-themes are represented as sub- and sub-sub-nodes in the organisational node framework in Nvivo (Screen capture 2). The first four interviews for each city-region were used as a pilot to derive some basic sub-nodes (see Roberts et al., 2005), however, more were derived iteratively during the coding process if a sub-node was seen to be prevalent in the data. Though these sub-nodes were derived iteratively, they still form part of the deductive coding process as the rest of the interviews were then investigated for texts relating to these particular nodes/sub-nodes. The full list of nodes and sub-nodes can be found in Table 1. Note that as the analysis proceeds, further nodes and sub-nodes are likely to be added in an iterative process.





Screen Capture 1 (left) | Organisational framework of nodes for Lusaka in NVivo.
Screen Capture 2 (right) |Organisational framework of nodes for Lusaka in NVivo.

NODE	SUB-NODE	EXPLANATION
Actors	• Structures • Resources and capacity • Information • Relations	Multi-scalar actors, both state and non-state, with varying levels of capacity, and their relations.
Discourses	• Environmental • Social • Economic • Integrated	The language used by actors to frame their interests in any policy arena, i.e. "Integrated Water Management".
Legislation	• Legal frameworks • Policy documents • Strategies • Guidelines • Plans • Standards • Mandates	Policies and mandates that give power to actors to implement policies.
Materialities	• Infrastructure • Topography/geology/climate • Climate change impacts • Technologies • Platforms • Programmes	Material attributes of the city including the physical environment and infrastructure, various technologies such as GIS, as well as platforms of engagement that exist for collaboration between actors, and the roll-out of programmes designed to address city-issues.
Decision-making processes	• Decision-making • Climate change responses • Policy decisions • Implementation	The actual work done by actors in deliberating and debating issues and formulating policies through their discourses. These can be in terms of climate change, in terms of formulating policies, or in terms of implementing.

Table 1 | Nodes and sub-nodes used for coding the interview data. Node structure was based on the governance configuration elements before deductive coding, and sub-nodes were added as the coding progressed. A sixth (challenges) and seventh node (outcomes) were added, namely, challenges and outcomes as part of a second iteration. Challenges impact on each element and their contribution to an outcome in various ways.

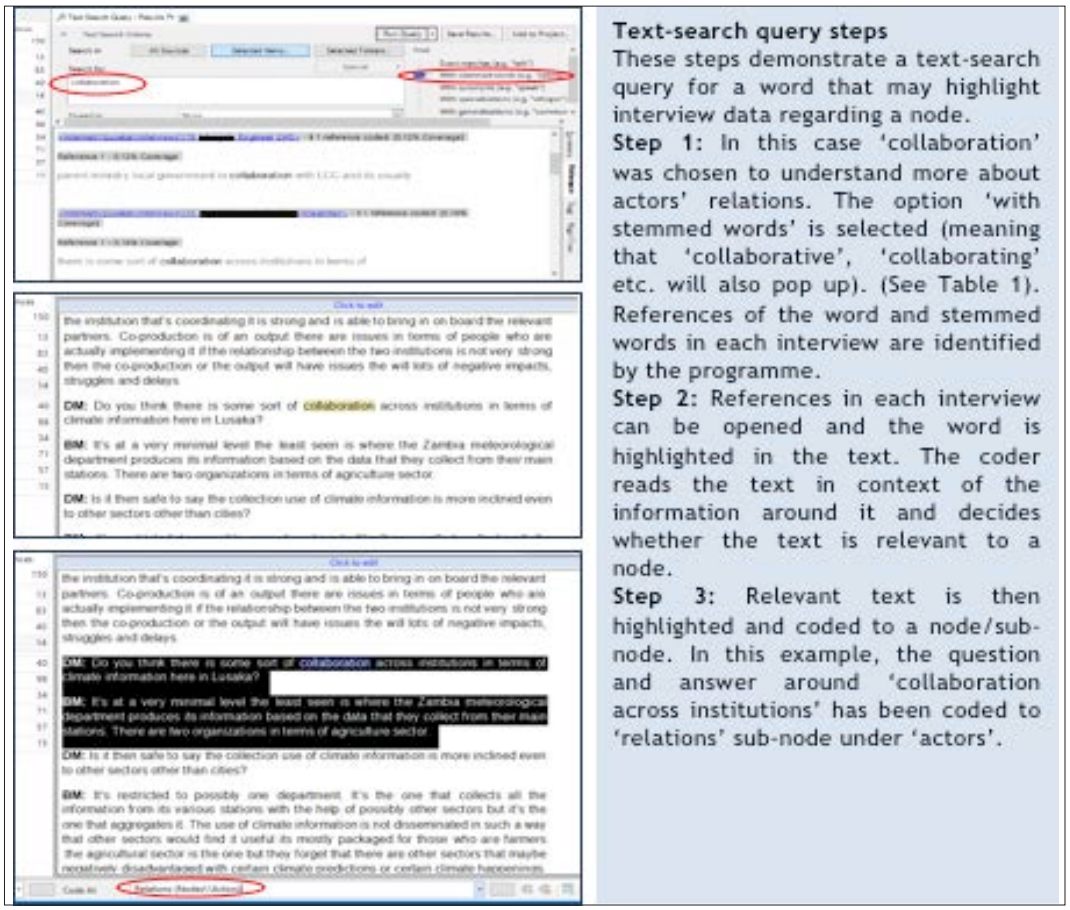
NODE	SUB-NODE	EXPLANATION
Outcomes	Burning issues, risk, vulnerability, water insecurity, water reclamation – things that exist and are measurable.	
Challenges	Challenges posed towards various elements of the governance configuration, influencing each element in contributing to an outcome.	

Table 1 | (Continued).

3.3 NVivo: text search query

The text-search query tool in Nvivo Pro assists the coding process by highlighting texts across all interviews in relation to each node/sub-node. The text-search highlights each specific piece of text in the interview data, and thereafter it is the role of the coder to determine which paragraphs/sentences provide important contextual information, such a perspectives, opinions, or general information regarding that node or sub-node (See more detailed depiction of this procedure in screen capture 3). Each key word is in a 'context unit' which is the piece of text surrounding the key word that is necessary to understand the meaning of the term in that context.

Table 3 indicates the list of words used to identify textual evidence to store in each node, or each sub-node if they were very distinct (e.g. in actors, there are four sub-nodes, a) of relations (relations between actors), b) information (the information/knowledge held by actors), c) resources and capacity and d) institutional structures, separate text-searches were done for each sub-node).



Screen Capture 3 | Steps involved in a text-search query.

NODE	SUB-NODE	WORDS USED FOR TEXT-SEARCH
Actors	**Resources and capacity** Texts regarding financial and human resources available to various actors and resulting capacities to act, make decisions, fund projects, etc.	• "resource" • "funding" • "capacity" • "money"
	Information Texts regarding data/information that is available to actors to inform their decisions, as well as the sources of this information.	• "information" • "inform" • "climate" • "data" • "awareness"
	Relations Texts regarding financial and human resources available to various actors and resulting capacities to act, make decisions, fund projects, etc.	• "partner" • "interact" • "engage" • "co-operation" • "collaboration" • "relation" • "relationship" • "tension" • "participate" • "silo" • "decentralisation" • "conflict"
	Institutional structures Texts regarding the internal structure of actors as well as the structure of the relations between actors. This node often overlapped with relations.	• "structure" • "arrangement" This information was often highlighted during the text-searches of the other sub-nodes
Discourses	The 'languages' used by various actors to frame their **environmental, economic or social** interests in a policy arena.	• "integrated" • "commercialisation" • "scarcity" • "security" • "language"
Legislation	Texts regarding **legal frameworks, acts, policy documents, guidelines, standards, plans and mandates**, and sub-nodes were divided into each of those categories.	• "legal" • "policy" • "mandate" • "standard" • "framework" • "act" • "guide"
Materialities	Texts regarding **climate change impacts, geology and topography** of the city-area, physical **infrastructure, programmes or projects** at work in the city, platforms of engagement, and **technology and information systems.**	• "infrastructure" • "geography" • "climate" • "tool" • "platform" • "programme" • "campaign" • "workshop" • "instrument" • "scheme"

Table 2 | Words used for text-search to highlight interview data relating to a node or sub-node.

NODE	SUB-NODE	WORDS USED FOR TEXT-SEARCH
Decision-making processes	Texts regarding processes of decision-making within governance structures, the formulation of policies, responses to various challenges and implementation of policies, plans and strategies. The sub-nodes overlapped often, and were divided into **decision-making, formulation of policy, climate change responses and implementation.**	• "decision" • "climate" • "implement" • "policy"
Challenges	Texts regarding obstacles faced by actors and society involving disaster events, various infrastructural damage, lack of capacity, lack of quality climate information etc. that influence each element of the governance configuration and therefore have influence on outcomes.	• "challenge" • "problem" • "issue" Challenges were often identified in searches for other sub-nodes.
Outcomes	Outcomes encompass the burning issues, risks, vulnerabilities and mechanisms implemented to reduce vulnerability, resulting from a variety of materialities and decisions by actors. Outcomes were coded throughout the coding process. The sub-nodes derived for outcomes include water, sanitation, policies and projects.	• "result" • "outcome" Outcomes were often identified in the searches for other sub-nodes.

Table 2 | (Continued).

3.4 Inductive coding

Once the coding process was completed for Lusaka and Windhoek, the interviews were revisited individually. Each interview was re-read line-by-line, specifically the text that had not been highlighted/coded, with the aim of picking up whether any important themes had been missed. Any data of significance, or that which strongly correlated to a node/sub-node was coded. Since the interviews were based on gaining an understanding of governance arrangements according to the governance configuration theory, it was understandable that these concepts would be most prevalent in the coding process and appear in the word clouds. However, several sub-nodes were added through the inductive coding, such as "challenges", "climate change awareness", "decentralisation" and various sub-nodes relating to materialities.

4. Visualisation of nodes and sub-nodes by number of coding reference

This section presents the visualisation of nodes and sub-nodes using NVivo and the data visualisation platform of Kumu.

4.1 NVivo visualisations

Hierarchy charts were generated in NVivo which are a visual representation of nodes compared by the number of coding references. The *sunburst hierarchy charts* (see Figure 3 and 5) indicate the proportional number of coding references for each node (inner ring), sub-node (middle ring) and sub-sub-node (outer-ring). The *treemap hierarchy charts* (see Figure 4 and 6) depict the same thing but have the additional benefit of having the sub-nodes labelled.

Figure 3 | Sunburst hierarchy chart of governance configuration nodes for Lusaka. (NVivo) (Note that the labels of the sub-nodes do not appear).

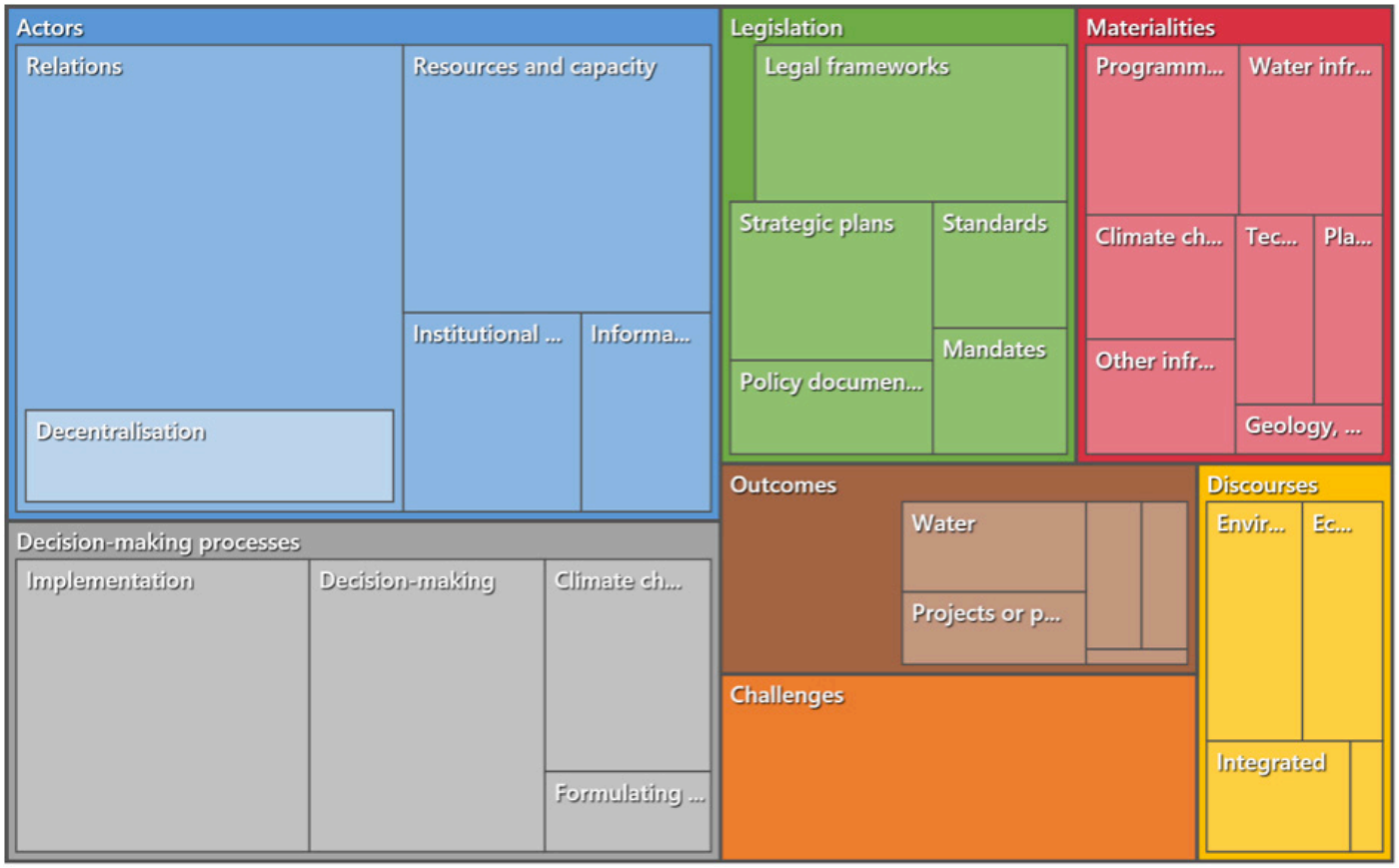


Figure 4 | Treemap hierarchy chart for Lusaka showing sub-nodes and proportions in terms of number of coding references relative to the total number of coding references for the city. (NVivo) (Note that the same data is used here as in Figure 3, but the names of the sub-nodes appear, unfortunately the text cannot be wrapped).

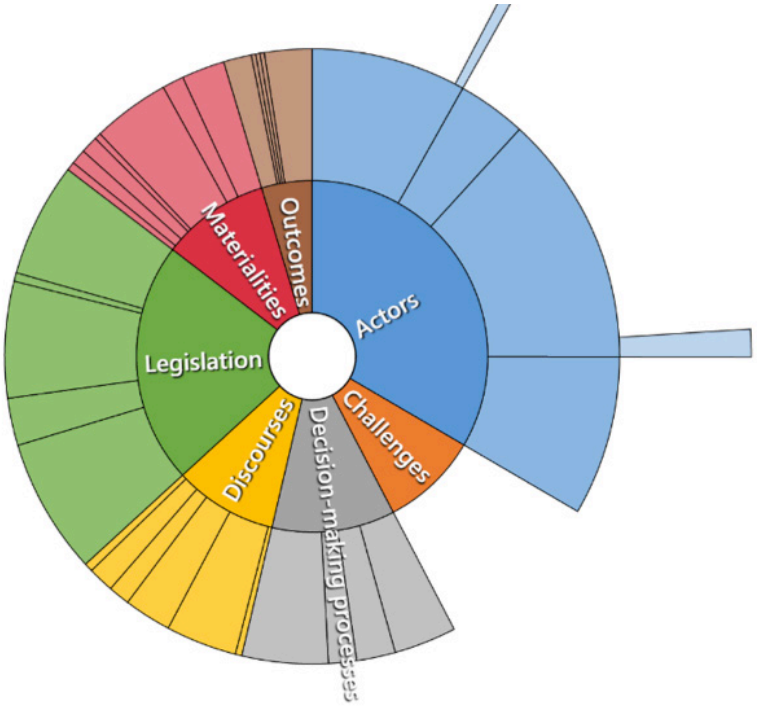


Figure 5 | Sunburst hierarchy chart of nodes for Windhoek. (NVivo).

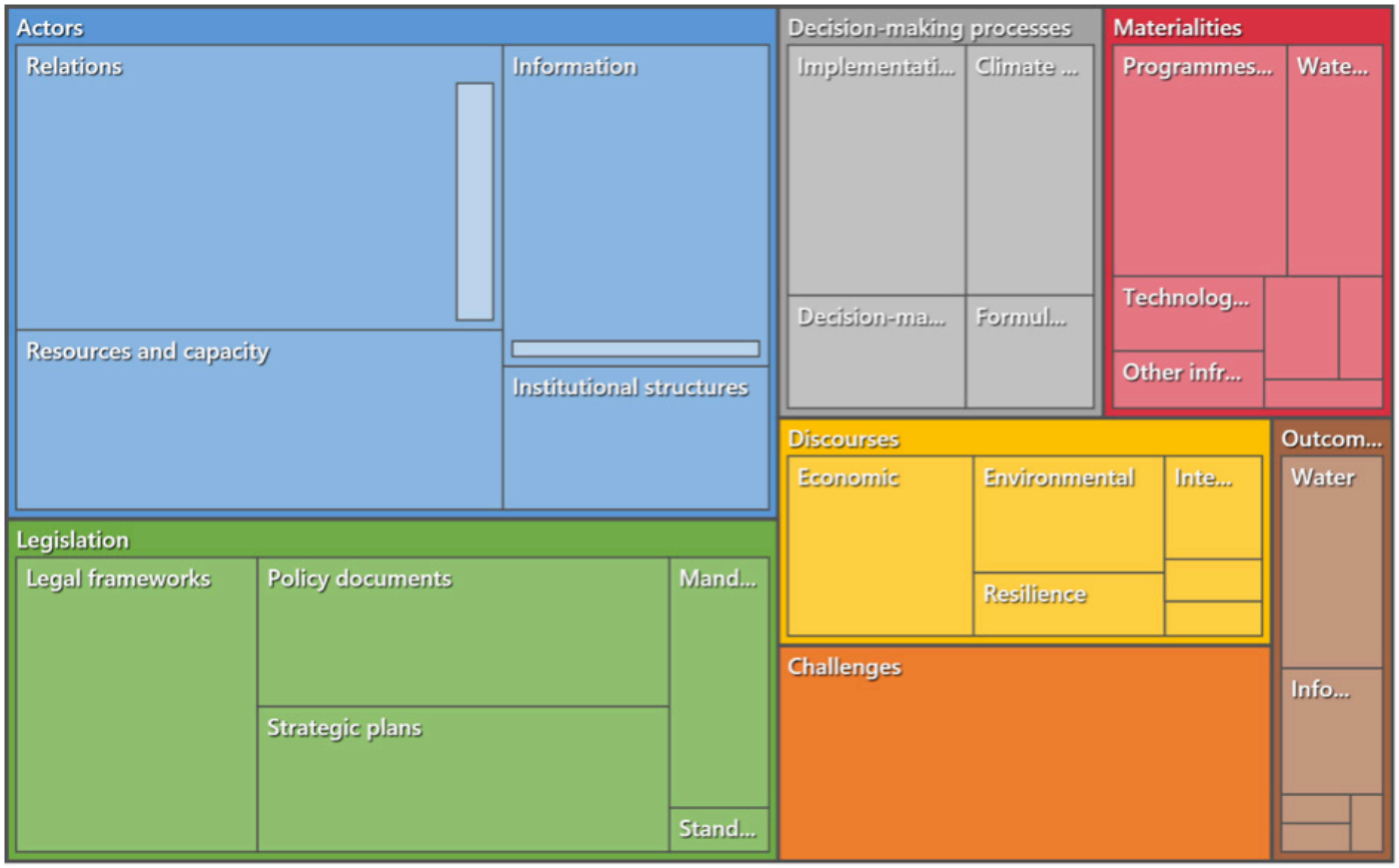


Figure 6 | Treemap hierarchy chart with sub-nodes and proportions for Windhoek. (NVivo).

4.2 Visualising sub-nodes in Kumu

The node data was exported from Nvivo as a spreadsheet and imported into Kumu. Kumu software was used as another mechanism/ programme to visualise nodes and sub-nodes. Each group of sub-nodes was coloured according to the governance configuration element it related to (see key in Figure 7 and 8). Shading and scale indicate the density of coding references. In Figure 7, the size of sub-nodes is scaled relative to the number of coding references of each sub-node compared to the total number of coding references in the city of Lusaka. Figure 8 presents the same thing except coding references are scaled compared to the total number of coding references in the city of Windhoek. Therefore, the Windhoek map is not scaled to Lusaka map.

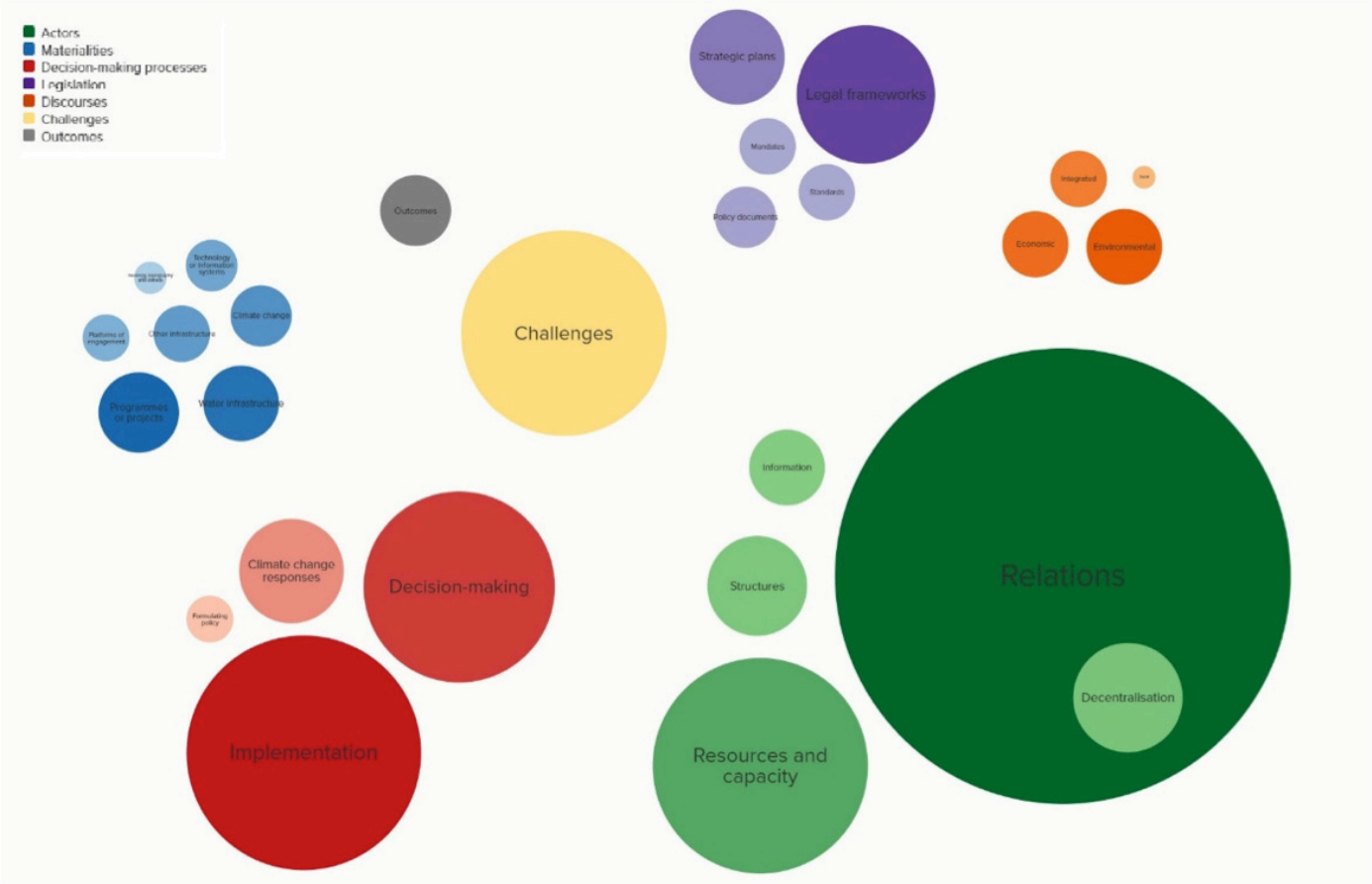


Figure 7 | Visualisation of proportional coding of sub-nodes for each node for Lusaka. (Kumu). (Produced by Celeste Renaud, June 2018).

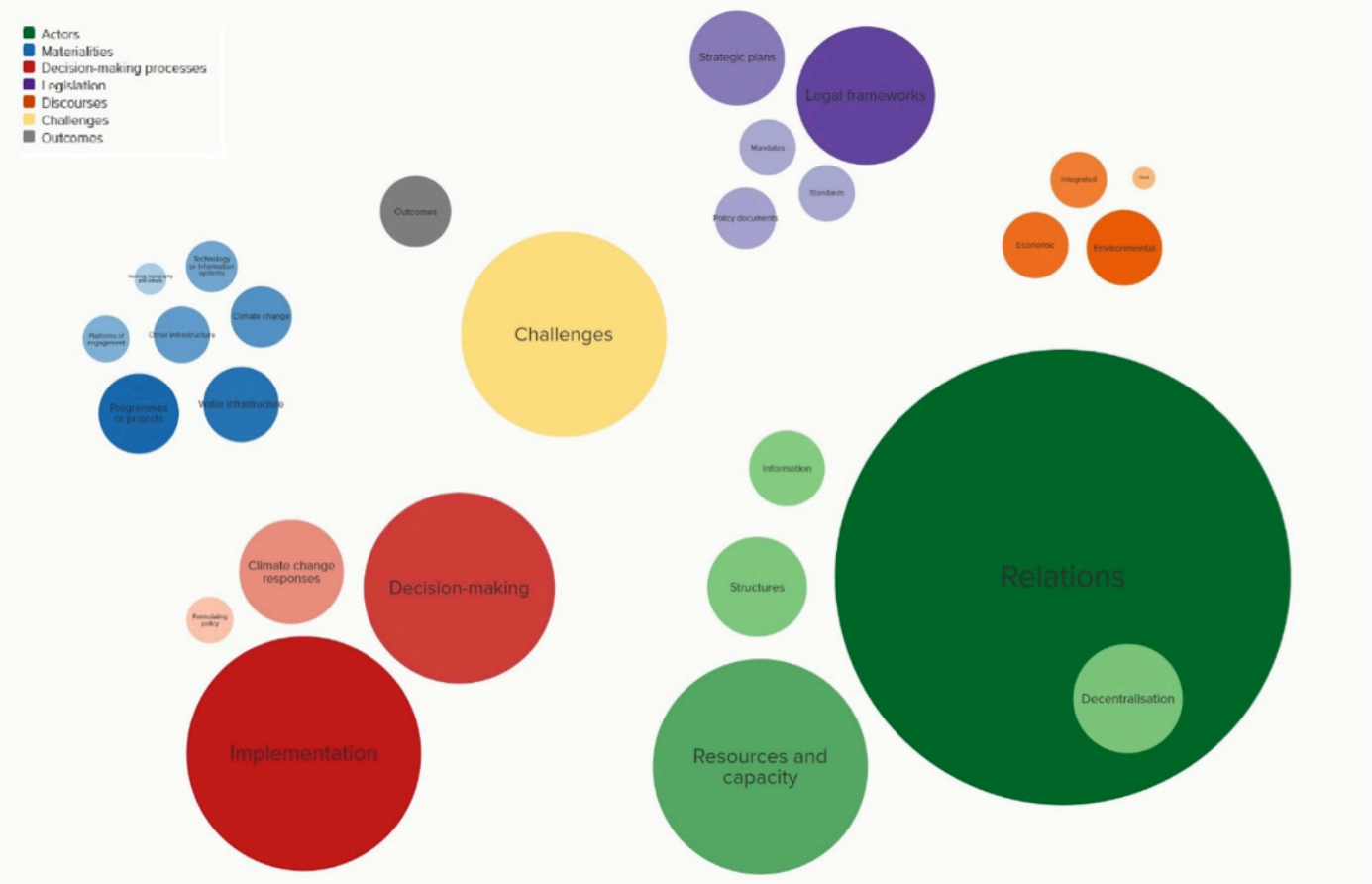


Figure 8 | Visualisation of proportional coding of sub-nodes for each node for Windhoek. (Kumu). (Produced by Celeste Renaud, June 2018).

4.3 Visualising governance configuration

The Kumu visualisation (Figure 9) represents the proportion of the interview data relating to each element of the governance configuration. Each element is scaled by percentage of total coding references for both city-regions, hence the size of elements is comparable between cities.

This visualisation technique revealed that the actors element – which includes sub-nodes relating to their institutional structure, the information they hold/receive/generate, relations between them, their resources and capacity – constitutes a large proportion of the interview conversations in both cities. In addition, it is visible that there is relatively more mention of legislation in the Windhoek interviews compared to Lusaka. Conversation topics would revolve around the sub- nodes of this element including legal frameworks, policies, mandates, standards and strategic plans. In Lusaka, there is relatively more mention of issues surrounding the decision-making processes element compared with Windhoek. Sub-nodes of this element which would constitute as conversation topics include general decision-making, the implementation of projects, legislation and plans as well as policy formulation. The next step in the governance analysis is a detailed analysis of the content coded to each node i.e. what are the major issues illuminated in the node regarding relations between actors – whether actors are collaborating, whether they are working in silos, what the major conflicts are and so on.

** Idea: once the content relating to each node has been analysed, we incorporate the main ideas into the governance configuration below in a visual way i.e. key quote relating to each element or element sub-node etc.

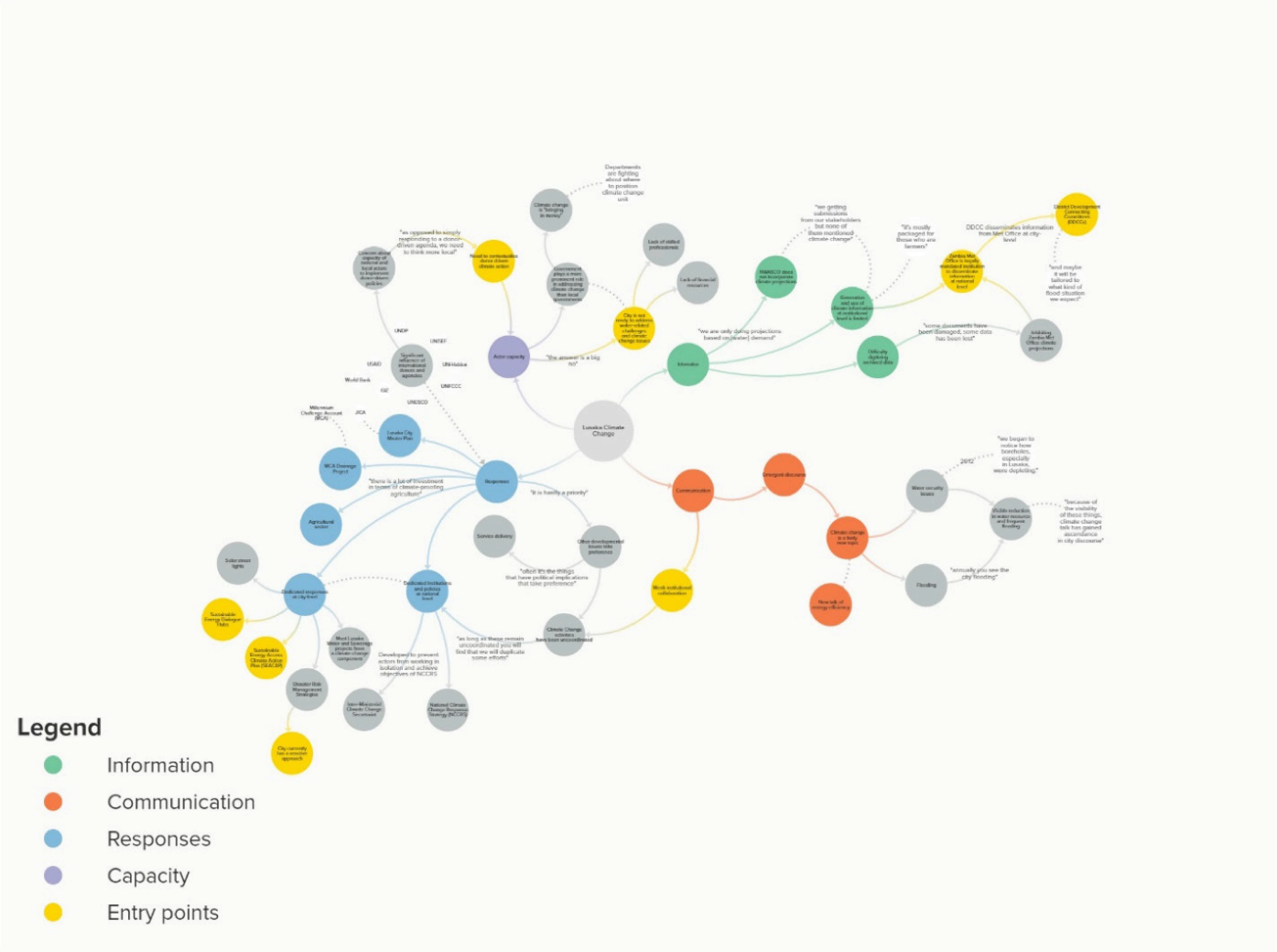


Figure 9 | Governance configurations for Lusaka and Windhoek with elements sized according to proportion of coding references.

5. Experimental mapping of climate change governance in Lusaka and Windhoek

Kumu is a tool for organising complex data into relationship maps. Climate change is a central concept of this study and one of the main objectives of the governance research is to understand climate change governance in each city-region. Figure 10 and 11 represent attempts to visualise the interview responses relating to ”climate change’ by mapping some key themes, ideas and quotes emerging from the coded interview data (see Figure 10 and 11). These responses were generally coded under the three sub-nodes relating to climate change, namely, a) climate change responses (under decision-making processes); b) the materiality of climate change (under materialities), and c) information relating to climate change (under actors). This analysis bridges across to the second objective for textual analysis in this study which is to determine the valence (tone of the content) of governance interviews. However, this is an experimental mapping procedure, a more detailed thematic analysis is underway and will be presented in the brief that follows.

**(pdfs may be requested if we want a higher resolution for the maps)

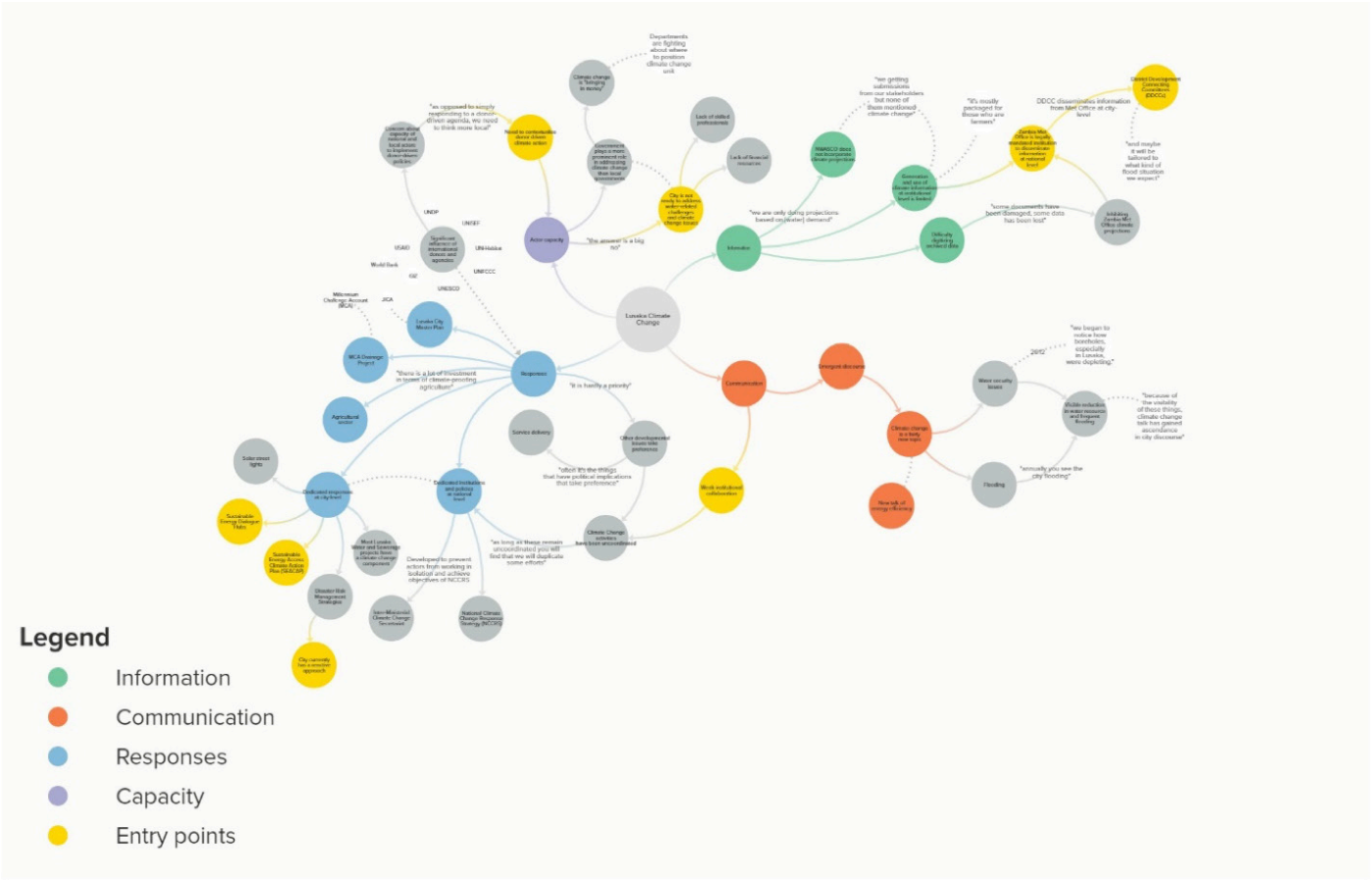


Figure 10 | Experimental mapping of climate change governance in Lusaka using Kumu.

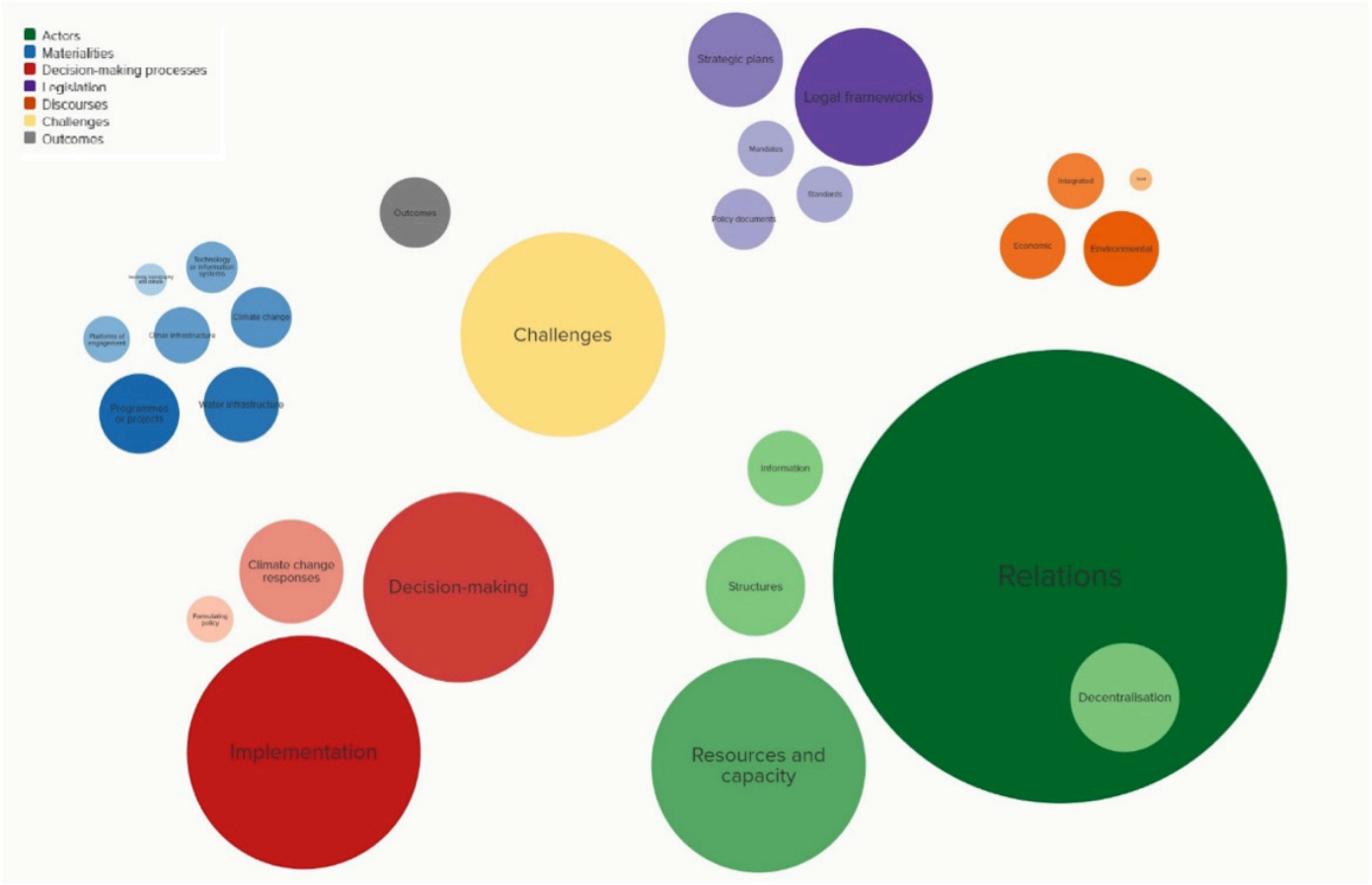


Figure 11 | Governance configurations, each element is sized by percentage of total coding references for its respective city-region.

6. Conclusion

The software programmes of Nvivo and Kumu are used to provide visualisations of the most frequent words, and the hierarchical structure of the nodes used in the analysis of the governance interviews.

The brief provides, as an initial form of analysis, a visualisation of the data contained in the governance interviews that took place in Windhoek and Lusaka in 2017. The word clouds provide an indication of the frequency of words in the interviews providing a broad pattern of the dominant words in the interviews, and the likely themes (see Figure 1).

The nodes for the thematic coding of the interviews were derived both deductively and inductively. Whiles the nodes and sub-nodes were derived from the concepts that make up the governance configuration theory, additional nodes and sub-nodes were added iteratively after a detailed reading of the text of interviews. It is likely these will change and be added to as the analysis proceeds. The process of coding using these deductively derived nodes is described (see Figure 2 and Screen Capture 3).

Visualisations of the nodes, sub-nodes and sub-sub nodes (parent and children nodes) for Lusaka and Windhoek are presented using Kumu. The visualisations provide a very useful summary and initial representation of the content of the governance interviews and suggest gaps where additional interviews might be necessary.

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