Conceptual and thematic analysis of policies and guidelines on engineering asset management of different states in Australia

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ABSTRACT

The role of government in developing policies and guidelines for asset management is becoming increasingly important especially in view of ageing infrastructure and increasing financial risks for building infrastructure. This paper reviews policies and guidelines developed by Australian state authorities against industry developed principles. It utilizes the software program Leximancer to; a) produce conceptual visualisations of the key themes and concepts embedded within state-wide policies and guidelines, and b) systematically compare the differing asset management foci between states. The analyses reveal mixed results in terms of policy priorities and guidelines for managing assets at a strategic level across states. This paper outlines a rigorous analytical methodology to inform specific policy changes.

Keywords: Policy development, asset management, Leximancer, content analysis, change management, risk

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Australia's built assets exceed $600b value. These assets are essential for the nation to function. The replacement costs of these built assets are expensive and involve a funding regime, time horizon and process that is not often widely considered, planned or budgeted. In the current business context, strategic asset management is becoming a critical task. With an array of pressures – ageing infrastructure, increasing public expectations, decreasing budgets, and changing climate conditions, asset management has become more complex. To adequately respond to these issues, and continue to deliver the range and quality of services expected, there needs to be an understanding of the strategy for governments to set the timeframe, direction for overall management of assets and the type and content of policies and guidelines for asset management.

Engineering asset can be defined as an object which has legal entity and value (OED 2007). The engineering assets, such as inventories, equipment, land, infrastructures and buildings, are part of a relationship between an object and an entity and a value is attached to the object by the entity. For the purpose of this paper, asset management is limited to engineering assets and not financial assets of firms. According to the Australian Asset Management Collaborative Group (AAMCoG) (2011), Engineering Asset Management [EAM] can be defined *as the process of organising, planning and controlling the acquisition, care, refurbishment, and disposal of infrastructure and engineering assets. It is a systematic, structured process covering the whole life of physical assets* (p.2). EAM is multi-disciplinary in its focus and includes general management, operations and production arenas and, social and human capital aspects (Amadi-Echendu et al. 2010). It is argued that asset-intensive organisations best achieve their objectives through systematic and coordinated activities and practices that optimally and sustainably manage its physical assets over their life cycles (British Standards Institution 2010). Engineering Asset management (EAM) is a relatively new emerging discipline in

terms of development of theories and practices, therefore government policies and guidelines are often not sufficiently mature to provide the basis for best practices.

Focused on achieving the efficient and sustainable use of its many resources, the Australian national government, and more specifically its states, have developed an array of guidelines and policies to help public and private organisations manage the life cycle of assets. Given the complexity of the current operating environment, a shift away from managing assets in the short term and by individual agencies/organisations towards a more integrated or collective approach involving the whole-of-life-cycle approach across multi-agencies/organisations is required. In view of this change, there is a growing imperative to develop policies and guidelines in relation to the multi-agencies environment. It is in this context, this paper argues that asset management needs to look beyond procuring and maintaining individual assets, and more focus on a service delivery approach across all assets of all governmental departments and agencies. This service delivery approach may be achieved through a whole-of-government model, comprised of policies, plans, service delivery strategies and standards, capital and recurrent budgets and, government institutions; and partnerships including business, working groups, community based organisations and private providers. The research question is: how do governments conceptualise and apply the approach to EAM policy and service delivery.

In this paper, we undertake a comparative exploration of asset management policies and/or guidelines of different states of Australia. Based on this, the paper identifies gaps in the existing policies, and makes policy recommendations for improving state-wide asset management. A systematic analysis of policy is important for examining state-wide polices and guidelines on asset management. The following section describes different frameworks for policy analysis and their suitability, and more importantly, how the content analysis fits into the policy analysis.

FRAMEWORKS FOR POLICY ANALYSIS

Policy analysis is a standard approach for a variety of techniques and tools to examine the characteristics of existing policies, how the policies were formulated and what their impacts are (Collins 2005). Walt et al. (2008) argue that there has been less attention on how to conduct a policy

analysis, and more importantly, what research designs, theories or methods best inform policy analysis (p. 308). The agenda-setting theory (Kingdon 1984) sheds some light in this regard as the theory proposes a model with three independent streams of policy-making activities of agents: the problem stream, the politics stream and the policies stream. These three streams can be understood as how different power structures operate and the way they are interconnected and exercised by a network of actors influence policy formulation (Giddens 1984). The theory of interconnectedness (Bourdieu 1983) complements the agenda-setting theory in a sense that both theories highlight the role of 'communities of practice' with policy influence e.g. policy networks (Walt et al. 2003), policy communities (Buse et al. 2005) and the role of social capital between different influential actors with common stake.

The primary purpose of this paper is to conduct thematic and conceptual content analysis of asset management policies and practices of the six states in Australia as disclosed in different documents. The actual policy-making process is beyond the scope of this paper. In this regard, Walt and Gilson (1994) proposed a policy analysis triangle to systematically guide policy analysis process. The triangular framework takes into account the interactions between various actors and context, content, and course of action of a particular policy. According to Walt et al. (2008), analysis of policies can be useful both retrospectively and prospectively to comprehend current policy underpinnings and to recommend future policy directions. A content analysis of policies and guidelines of an organisation can be used as a systematic tool for identifying the stated priorities (recurrent instances) of the organisation (Julien 2008). Accordingly, it is necessary to explore the policy clusters element in order to a) identify disconnected elements, and b) explore degrees of attributes, such as direction and intensity or qualities. Content analysis in this regard is flexible technique well suited for synthesising large data sets (Given and Olson 2003) from a multi-disciplinary approach to describe the frequency of concepts and connectivity between themes.

Bardach (2000) considers policy analysis as being more of an art than science because the process draws on researcher's instinct as much as the techniques involved. Based on the eight-fold framework for public policy analysis of Bardach (2000), Collins (2004) propose eight steps to conduct policy

analysis studies: (1) define the context; (2) state the problem; (3) search for evidence; (4) consider different policy options; (5) project the outcomes; (6) apply evaluative criteria; (7) weigh the outcomes; and (8) make the decision.

Step 1. Define the context: Australian States vary enormously in terms of geography, politics, economics, culture and the organization of managing assets.

Step 2. State the problem: The desktop research indicates that there is a discrepancy between existing asset management policies guidelines and the best practice asset management. Because of limited resources, organisations managing assets have to consider and bring together economics, engineering, information technology, sustainability, and human elements to form a holistic approach to the effective delivery of services. It is in this regard, state-wide policies and guidelines should include all these elements to assist effective and accountable service delivery across all levels of government as well as within the private and community sectors.

Step 3. Search for evidence: Once the discrepancy was detected, the evidence is assembled through content analysis using Leximancer software. The concepts and themes can help identify significant features of the policy problem of asset management and how it might be solved or mitigated.

Step 4. Consider different policy options: Once the key concepts and themes from content analysis have been compiled as evidence, we need to consider options to make existing policies better.

Step 5. Project the outcomes: The options to make policies better must be based on the projected outcomes of the proposed policy alternatives.

Step 6. Apply evaluative criteria: In order to evaluate alternative policies, we need to build standards or criteria against which we measure the projected outcomes.

Step 7. Weigh the outcomes: We need to avoid a common error of inexperienced analysts by not focusing to choose between the alternatives rather than between the projected outcomes.

Step 8. Make the decision: Once the outcomes are carefully weighed, based on the evidence, the decision-makers should be made regarding which policy option to pursue. This decision is very context specific and depends on the asset management priorities and values of a given state and the availability or the lack of financial, human, natural, social capital for enhancing asset (physical capital) management policies.

At this stage, this paper is concerned with the first three steps as mentioned above to conduct thematic and conceptual content analysis of asset management policies and practices of the six states in Australia as disclosed in different documents.

CURRENT ASSET MANAGEMENT POLICIES AND GUIDELINES IN AUSTRALIA

In New South Wales (NSW), the NSW Treasury published guidelines for the Total Asset Management (TAM). The Total Asset Management (TAM) guidelines assist government and other agencies to align their asset planning and management with service delivery priorities and strategies, so that all assets support services in the most appropriate, effective and efficient way (NSW Treasury 2006). This includes, demand management, whole of life asset management, risk management, value management and cross-agency coordination in service planning and delivery.

In Victoria, the Local Government of Victoria has developed guidelines for developing asset management policy, strategy, plan and details of the stages of asset management life cycle. These guidelines provide high-level guidance to assist councils to develop asset management policy for ensuring service delivery needs, incorporating life-cycle approach to asset management and promoting sustainability (Victoria Local Government 2006). Victoria Department of Treasury and Finance (2000) also published a number of series on asset management. These asset management series describe the purpose and fundamental principles of effective asset management and provides a strategic framework through which agencies can achieve its benefits, develops operational policies and practices for asset management for all government departments and agencies, and provides related strategic policies of asset management.

In Queensland, along with Strategic Asset Management Guidelines, the Department of Public Works published a number of policies and guidelines on asset management. It also draws upon an array of supplementary policies including the Building Asset Performance Framework, the Capital Works Management Framework and the Maintenance Management Framework (Queensland Department of Public Works 2010). These guidelines assist government agencies to develop management strategies to maximise/optimise the utilisation of assets in the delivery of services to the community in line with strategic plans, operational plans and service delivery strategies.

The South Australian Government (1999) developed Strategic Asset Management Framework (1999). In line with this, the South Australia Department of Transport, Energy and Infrastructure published (2006) Strategic Asset Management Policy Process Map to assist government agencies to achieve effective and efficient management of assets that supports the delivery of government service outputs.

In Western Australia, the Western Australia Department of Treasury and Finance (2010) published a Strategic Asset Management Framework. The purpose of this framework is to provide a sound basis for decisions on the investment in, and the management and disposal of, assets required to meet government service delivery objectives that include government policy and direction, and agency corporate planning, action and review.

Tasmania Department of Treasury and Finance (2000) has developed Strategic Asset Management Plans. This document has been prepared to assist agencies to develop strategic asset management plans as part of their overall strategy to improve the management of resources and guiding the process of the acquisition, use and disposal of assets to make the most of their service delivery potential and manage the related risks and costs over their entire life.

METHODOLOGY

Three authors individually used desktop literature reviews of publically available state-wide asset management guidelines and policies. The three literature sets were subsequently cross checked, using a manual screen technique determine the relevancy of the documents. Based on the criteria of EAM

adopted earlier, out of 110 documents only 2 documents were found irrelevant and were excluded from the database. The authors identified a large and varied body of literature on asset management policies and guidelines.

Once the list of documents was finalised, a comparative study was conducted. The comparative study is based on the thematic mapping technique using Leximancer software. Leximancer differs from the standard content analysis, which identifies themes and concepts based on the word frequency and co-occurrence of families of terms (Smith & Humphreys 2006; Smith 2003). In Leximancer each theme is named based on the most prominent concepts in the cluster of concepts. According to Dann (2008), Leximancer text mining software is useful for examining the interconnectedness of central themes and also uncovers contextualized content through the system's automated processes. Several studies have validated Leximancer by comparing stability, reproducibility and correlative and functional tests (Grech, Horberry, & Smith 2002; Smith & Humphreys 2006).

For this study, the data set on the EAM guidelines and policies of six Australian states: New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania were analysed separately. Table 1 presents the numeric results of this search. Thematic and concept maps were created for each state in the study. These maps provided additional details on the conceptual nature of policies and guidelines on asset management of each individual state.

TABLE 1 HERE

FINDINGS

In the process of analysis, the authors removed general terms (such as provides, advice, including, results, use, support, required, possible, needs, following, existing, example, appropriate) that did not provide meaning to the concept maps. Furthermore, most singular and plural words were merged. For example, the words *asset* and *assets* were merged because they were closely connected and located in

the semantic space. The analysis output (Theme 50%, Concept 100%) was used to visualize all the thematic maps for consistency.

In this paper, four different categories of theme are addressed. The categories of the theme are based on the connectivity value (%). The categories are: most important theme (75%-100%), important theme (50%-74%), moderately important theme (25%-49%) and the less important theme (1%- 24%).

New South Wales

Figure 1 presents the themes and concepts for New South Wales. The most important theme is *asset management (100%)*, with its important concept (asset management) well connected to 'service delivery', 'planning', 'maintenance', 'level', 'performance', 'systems', 'data' and 'design'. Another important theme is *projects* (74%), with its important concepts connected to 'economic', 'appraisal', 'value', 'public', and 'sector'. The next important themes are *costs* (61%), *agencies* (58%), as well as the less important themes of *risk* (23%) *and review* (17%). The risk, agencies and review focus of asset management is supported through the proximity and overlap of the four themes of *asset management, risk, agencies* and *review*.

FIGURE 1 HERE

Victoria

The analysis of the Victoria literature data set identifies a number of themes, as shown in Figure 2. The most important recurring theme is that of *asset management* (100%), which is closely related to concepts such as 'service delivery', 'planning', 'performance', 'sector', 'community', and 'infrastructure'. Other themes in this data set include important theme such as *investment* (69%) as well as moderately important themes are *costs* (40%), *value* (25%) and less important theme is *information* (15%). The analysis also indicates that the policies and guidelines related to asset management for Victoria is focused on information, projects, and costs as four themes (*asset management, information, projects, and costs*) are closer as compared to other themes.

FIGURE 2 HERE

Queensland

Figure 3 presents the themes and concepts for Queensland. From the summary generated by Leximancer, the most important theme in the selected literature of asset management is *asset management* (100%), the next theme is moderately important which is *projects* (37%) and the remaining themes are categorised as less important themes which are *development* (23%), *procurement* (22%), and *maintenance* (20%). The theme *asset management*, with its most important concept (asset management) is closely connected to 'building', 'process', 'performance', 'costs', and 'level'. These concepts also indicate that the relevant guidelines and policies of asset management developed by the Queensland state authorities are mostly focused on the building sector. The map indicates that the approach to asset management policies and guidelines are more to procurement, and maintenance focused and this statement is supported through the proximity and overlap of the three themes (*asset management*, *procurement, and maintenance*).

FIGURE 3 HERE

South Australia

Figure 4 presents the themes and concepts for South Australia. The most important theme is *asset management* (100%), with its important concept (asset management) connected to 'planning', 'process', and 'disposal'. The second most important theme is *agencies* (78%). The remaining themes are less important and they are *costs* (18%), *information* (12%) *and property* (10%). The analysis also indicates that the policies and guidelines related to asset management for South Australia is focused on agencies as two themes (*asset management* and *agencies*) are in close proximity as compared to other themes.

FIGURE 4 HERE

Western Australia

The analysis of the literature data set for Western Australia identifies a number of themes, as shown in Figure 5. The most important recurring theme is that of asset management (100%), which is closely related to the concepts such as 'plan, 'agency', 'non-asset', 'information', and 'land'. The other most important theme in this data set includes *investment* (85%), and further, an important theme includes *costs* (59%). The remaining themes are found as less important which include *demand* (18%) and evaluation (3%). The map suggests that the approach to asset management policies and guidelines is focused more on demand and investment, and this suggestion is supported through the proximity and overlap of the three themes (*asset management, demand,* and *investment*).

FIGURE 5 HERE

Tasmania

Figure 6 presents the themes and concepts for Tasmania. From the summary generated by Leximancer, the most important theme in the selected literature of asset management is *asset management* (100%), and there are two themes in the category of 'important' include *planning* (51%), *agencies* (50%). The remaining themes in the selected literature are less important and they are *maintenance* (13%) and *policy* (7%). The most prominent theme is asset management, with its most important concept (asset management) closely connected to 'service delivery', 'life', 'acquisition', and 'costs'. The analysis indicates that the authorities are more focussed on the maintenance as the *asset management* and *maintenance* themes overlap to some extents to each other.

FIGURE 6 HERE

The Leximancer manual indicates that the more the overlap of the themes, the more there is interconnectedness. In this regard, there are less interconnections for Tasmania with its major themes whereas, New South Wales and Victoria are more interconnected in terms of themes. In the case of New South Wales, the relevant guidelines emphasize more on the themes of risk based, agency and

review focused asset management whereas, Victoria provides more emphasis on the projects and assessment (development), costs (operations and maintenance) and information aspects.

Table 2 provides some useful insights in relation to the different key concepts of whole-of-government framework for an asset management. These concepts are drawn from the strategic asset management framework developed by Australian Asset Management Collaborative Group in association with CRC for Infrastructure and Engineering Asset Management (CIEAM).

TABLE 2 HERE

This table provides comparative assessment of some of the key concepts across six Australian states. Some of the highlights are: a) among all the key concepts, only two concepts (asset management and costs) are addressed across all the states, b) except Queensland all other states have concepts in relation to the service delivery, c) only NSW has all the concepts in relation to the whole-of-life cycle management of assets, d) Victoria and Queensland have not the concept in relation to the agencies in their asset management guidelines and policies, e) the concept related to the community is addressed only in three states (New South Wales, Victoria and Tasmania), f) with exceptions of South Australia and Tasmania, risk concept is addressed in the other four states (New South Wales, Victoria, Queensland and Western Australia) and, g) information concept is addressed across all the states except Tasmania.

Overall, the authors observed that there is a missing concept in relation to climate change in all the six thematic maps. This indicates that the incorporation of climate change into the asset management policies and guidelines of state governments have so far been overlooked.

DISCUSSION AND CONCLUSION

This paper began with highlighting the importance of the role of government in developing policies and guidelines in relation to asset management. Based on the framework (Collins 2005), the paper

undertook content analysis of state-wide asset management policies and guidelines documents using Leximancer software. The analysis revealed the major themes for different states on asset-related policies and guidelines. Asset management policies and guidelines of New South Wales and Victoria have provided more interconnected themes as compared to other states in Australia. Moreover, based on the findings, New South Wales has covered all the key concepts in relation to asset management. The remaining five states are yet to develop a comprehensive and integrated approach to policies and guidelines on asset management.

There is also a need for incorporating climate change into asset management guidelines and policies at the state level. This action will particularly help public and private organizations to incorporate specific environmental design code into the development of engineering assets. According to Rayner (2010), new engineering assets need to be designed against design codes or history-based asset-specific environmental criteria and management of existing assets also need to be incorporated established techniques for the estimation of environmental criteria.

This paper provides a basis for further research about analysing the context and processes of asset management guidelines and policies. In-depth analysis of state-wide asset management policies and guidelines has uncovered that strategic, integrated asset management is not yet incorporated into whole-of-government approaches to asset management across all states. Evaluation is an important management tool for understanding the performance of assets but it has not been widely linked to asset management across Australian states. The inclusion of community-based input to asset management is a new feature for government policy-making and the start of this approach can be evidenced in three states. Community involvement in asset management has expanded the range of stakeholders involved in asset management and future research could explore the ways in which meaningful exchange could be achieved and the appropriate methods of evaluation of this contribution developed.

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LIST OF TABLES AND FIGURES

Table 1: State-wise Number of Articles on Asset Management Policies and Guidelines

Database Results	NSW	Victoria	QLD	WA	SA	Tasmania
Number of articles	24	11	40	6	25	2

Table 2: Comparison of Key Concepts of State-wide Asset Management Policies and Guidelines

Concepts	**NSW**	**Victoria**	**QLD**	**South Australia**	**Western Australia**	**Tasmania**
Asset Management	√	√	√	√	√	√
Projects	√	√	√			
Costs	√	√	√	√	√	√
Service Delivery	√	√		√	√	√
Planning	√	√		√	√	√
Design	√		√			
Maintenance	√	√	√		√	√
Disposal	√			√		
Performance	√	√		√		
Agencies	√			√	√	√
Community	√	√				√
Risk	√	√	√		√	
Information	√	√	√	√	√	

Figure 1: Thematic Map on Asset Management Guidelines and Policies of New South Wales

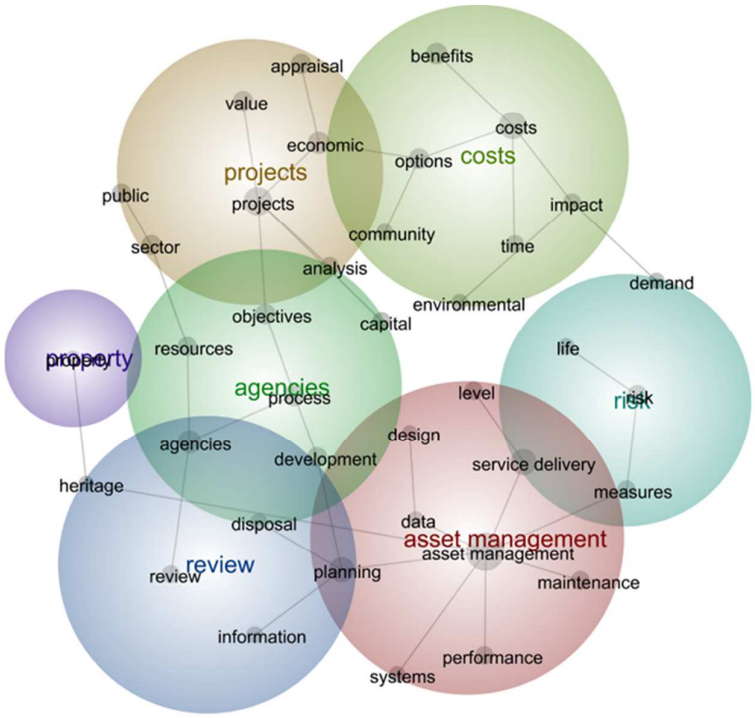

Figure 2: Thematic Map on Asset Management Guidelines and Policies of Victoria

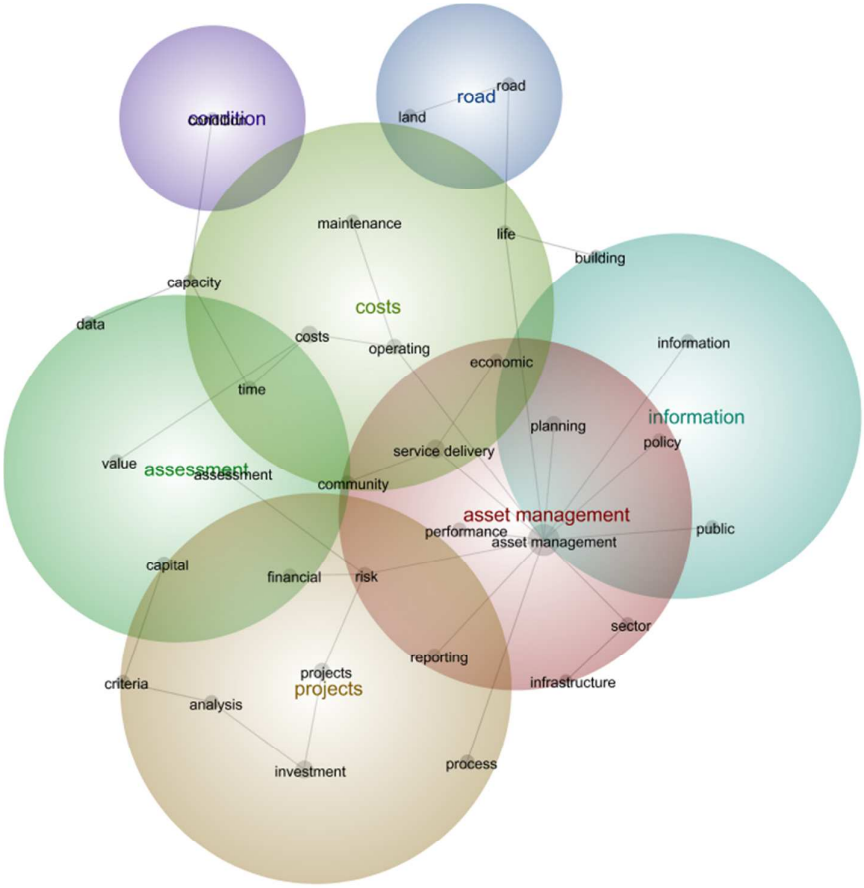

Figure 3: Thematic Map on Asset Management Guidelines and Policies of Queensland

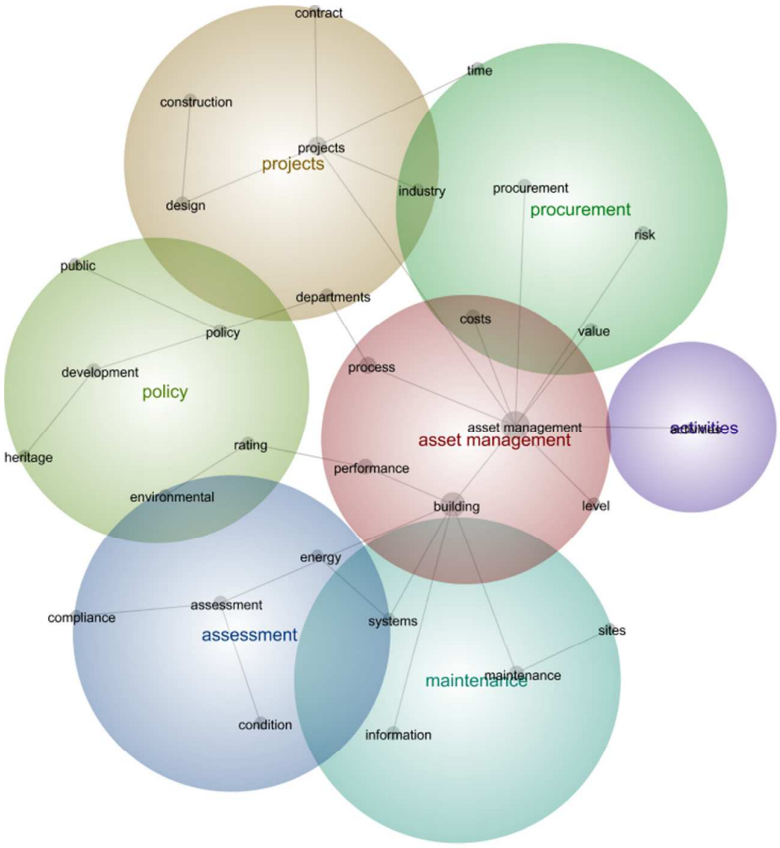

Figure 4: Thematic Map on Asset Management Guidelines and Policies of South Australia

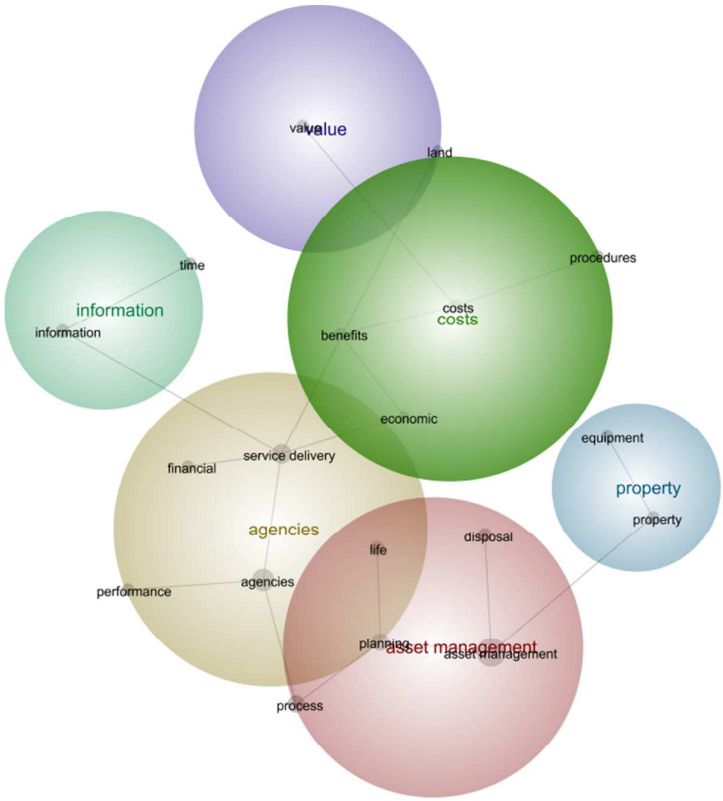

FIGURE 5: Thematic Map on Asset Management Guidelines and Policies of Western Australia

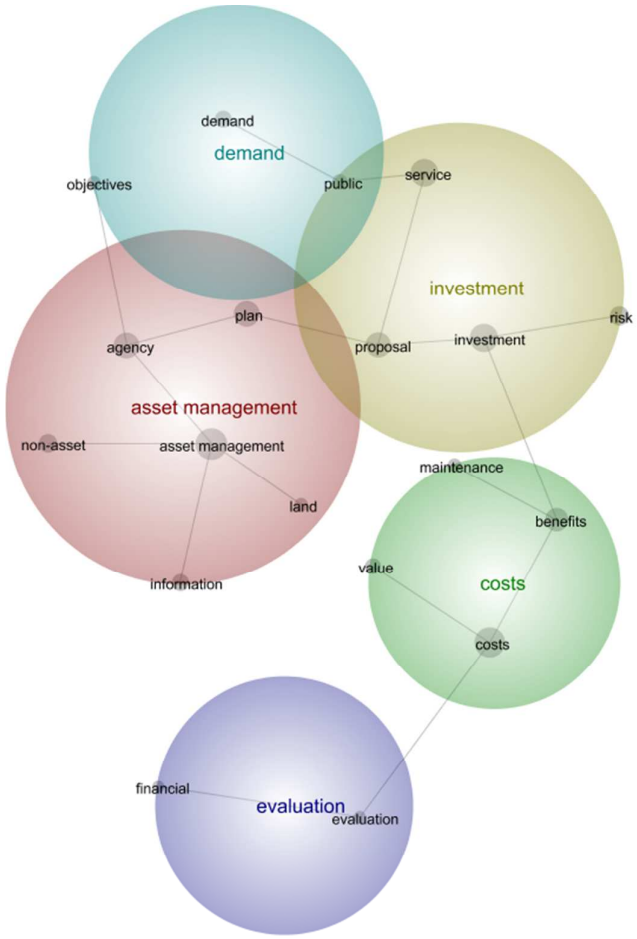

FIGURE 6: Thematic Map on Asset Management Guidelines and Policies of Tasmania