Land Administration for Macroeconomic Management

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For my family

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DECLARATION

This is to certify that:

(i) the thesis comprises only my original work towards the degree of Doctor of Philosophy;

(ii) due acknowledgement has been made in the text to all other material used,

(iii) parts of this work have been published in refereed journals or refereed conference proceedings (under maiden name N. Tambuwala) as listed in Appendix 1;

(iv) the thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

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Nilofer Christensen

Melbourne, November 2012

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And to Rasmus, for making it all worth while.

ABSTRACT

Land markets contribute significantly to economic growth. Land administration provides the infrastructure for secure land market transactions. Government macroeconomic policies work to manage the economy as a whole. As new land markets develop, there is an increasing need for better, more reliable information for improved economic management of land and its resources.

The focus of land administration research has largely been on creating tenure information and registration for the security of land rights. Creating data products has also seen significant motivation. However, not much attention has been given to the potential of this authoritative land information to be used for other economic activities, and the user needs from this perspective. This is of growing concern as new land markets in resources like carbon and water emerge.

The growing international focus on sustainable development, natural systems and 'green' economies has shown the utility of biomimicry. Biomimicry, a principle of natural capitalism, uses nature as a model, to study and design real-world systems that emulate the efficiency, sustainability and diversity of processes in nature. The ethos provides an innovative approach for studying land administration systems as information ecologies, and an opportunity for land administration to better service macroeconomic management.

This research initiates with a review of current literature within the disciples of land administration, macroeconomics, sustainable development and the impact of natural capitalism. Following this, a conceptual model that links the above disciplines is presented. The model proposes a land market information flow lifecycle as the ideal situation for achieving synthesis between land administration information and macroeconomic management, and forms the hypothesis of this research. A robust research design and methodology to test the hypothesis is developed and justified. This involves qualitative case studies of state-based real property, carbon and water markets in three Australian states: Victoria, New South Wales and Western Australia. The case studies help to evaluate the current situation and identify areas of the model that are currently not functional. The results also work to test the validity of the model and judge whether this representation of an ideal outcome is realistic or needs to be altered. A refined land market information flow lifecycle,

with 31 principles to achieve a functional link between land administration and macroeconomic management, is triangulated from the results.

The refined model is tested for its operation by showing its implementation on the case study states. The implementation shows the importance of each stage of the lifecycle. Achieving all recommended principles can establish synthesis between land administration information and macroeconomic policy making. However one dysfunctional stage can undermine the operation of the entire lifecycle. Additionally, a demonstrator 3D Property Market Tool is presented to show how spatial intelligence can be added to fiscal and monetary policy decisions. Such decision-aiding applications are possible if authoritative market information derived from a dynamic land market information flow lifecycle is achieved.

The final chapter of this thesis summaries the research and major contributions of this work. The land market information flow lifecycle establishes an operational link between government land administration and macroeconomic policy agencies. It is the first of its kind to link the disciplines of land administration and macroeconomic management though information supply and demand; based on the principles of natural capitalism and the need for sustainable development of land and resource markets. However, this thesis does not claim to fully solve the problem of holistic land information infrastructures. Suggested further research areas are presented to help build on this work. These include investigations into other drivers for authoritative land information and a dissemination framework to help make the land market information flow lifecycle a reality. Research into incorporating informal land rights and rights in other complex commodities into a holistic land information infrastructure are also suggested to follow from this work.

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LIST OF ACRONYMS

3D	Three dimensional
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AGIMO	Australia's National Government Information Sharing Strategy
ANZLIC	The Spatial Information Council (formerly the Australian and New Zealand Land Information Council)
APM	Australian Property Monitors
ATO	Australian Taxation Office
BAS	Business Activity Statements
CAG	Comptroller and Auditor General of India
CGT	Capital Gains Tax
DFD	Data Flow Diagrams
DSE	Department of Sustainability and Environment
EBP	Evidence-based Policy
ECM	Enterprise Content Management
ETS	Emissions Trading Scheme
EU	European Union
FAO	Food and Agriculture Organization
FIG	International Federation of Surveyors
GGAS	Greenhouse Gas Reduction Scheme
GRV	Gross Rental Value
GST	Goods and Services Tax
ILM	Information Lifecycle Management
INSPIRE	Infrastructure for Spatial Information in the European Community
IPART	the Independent Pricing and Regulatory Tribunal of NSW
IPW	Integrated Property Warehouse
ISO	International Organisation for Standardization
IT	Information Technology
ITS	Integrated Titling System
LA	Land Administration
LPI	Land and Property Information division
LPMA	Land and Property Information Authority
NAFTA	North American Free Trade Agreement
NECS	National Electronic Conveyancing System
NEM	National Electricity Market
NIRMP	National Land Records Modernisation Programme
NOA	Notice of Acquisition
NOS	Notice of Sale
NRC	National Research Council
NSW	New South Wales
OECD	Organization for Economic Cooperation and Development
OSR	Office of State Revenue
PSV	Property Sales and Valuation
RBA	Reserve Bank of Australia
RCIS	Revenue Collection Information System
SDI	Spatial Data Infrastructures
SINA	Storage Networking Industry Association

SIX	Spatial Information Exchange
SMR	Smart Register
SRO	State Revenue Office
UML	Unified Modelling Language
UN	United Nations
UNECE	United Nations Economic Commission for Europe
US	United States
UV	Unimproved Land Value
VG	Valuer General
VGV	Valuer-General Victoria
VIC	Victoria
VOTS	Victorian Online Titles System
VROM	Ministerie van Volkshuisvesting Ruimtelijke Ordening Milieubeheer (Ministry of Housing, Spatial Planning and Environment; Netherlands)
WA	Western Australia
WAL	Water Access Licence Register

GLOSSARY

The following definitions are adopted for the purpose of this research:

Authoritative information	Information sourced from government agencies or bodies, which is best of its kind and can be trusted as being accurate and reliable. In countries with well established formal land markets, the government land administration agencies can be considered the most legitimate and hence most authoritative source of land transaction information.
Biomimicry	Emulating nature and natural systems in the design of real world systems
Cadastre	According to the International Federation of Surveyors (FIG) Statement on the Cadastre, a cadastre is "normally a parcel based and up-to-date land information system containing a record of interests in land (eg. rights, restrictions and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, and ownership or control of those interests, and often the value of the parcel and its improvements."
Capital improved values	The value of the land plus any improvements made to the land such as house, fences, buildings etc.
Central government	The highest level of government in a country with a decentralised government structure.
Country	See: *Nation.* For the purpose of this research the terms 'country' and 'nation' follow the same definition.
Decentralised government structure	Countries that have a multi-tier government structure, i.e. a central or federal government and respective state, cantonal, territory or provincial governments. The government structure may further be broken down into local governments, councils, municipalities, or counties within each state, territory or province. Both central and sub-

central governments may have separate powers of government under the respective country's constitution.

Discipline   See: *Theory.* For the purpose of this research the terms 'discipline' and 'theory' follow the same definition.

Dynamic   Active or functional for effective action.

Fiscal policy   Government use of public spending and taxation to influence the economic performance of a country.

Information ecology   An information ecology views an information space as an ecosystem. According to Davenport (1997) an information ecology is characterised by an "integration of diverse types of information, recognition of evolutionary change, emphasis on observation and description and a focus on people and information behaviour."

Information lifecycle   A cyclical, cradle-to-grave approach to information management, which emulates closed-loop cycles in nature. It has a clear chronological structure with clearly defined phases.

Interest   A fee paid by a borrower of an asset, usually money, to the owner of the asset, as a form of compensation for the use of the asset (O'Sullivan, 2003).

Interest rate   The cost of borrowed money or the percentage of a borrowed sum of money charged for its use.

Land administration   According to Williamson et al (2010) land administration is "the processes run by government using public or private sector agencies related to land tenure, land value, land use and land development."

Land administration information   Information relating to tenure, value, use and development of land that is collected by authoritative, government land administration agencies. Tenure and value information needed for the efficient operation of land markets are the focus of this research.

Land market information flow lifecycle principles   Fundamental nested processes that help to achieve an activity with a clear purpose; and whose functionality is part of a

	larger process.
Land markets	Activities in exchange of interests in land for a price and their consequences. For the purposes of this research, only the buying and selling of freehold interests in real property and marketable land resources is considered.
Land resources	Natural resources such as water, carbon, biota, minerals etc that are derived from the land.
Land rights	The absolute ability of individuals and groups of individuals to obtain, possess and use land at their discretion, with the exception of activities that violate the absolute human rights of others (Adi, 2009).
Land tenure	A recognised relationship between people and land. According to Williamson et al (2010), tenure is also defined as "the manner of holding rights in and occupying land." For the purposes of this research, tenure information relates to ownership information for a land right being transacted in a market environment.
Land value	"The worth of a property, determined by one of a variety of ways, each of which can give rise to a specific estimate" (Williamson et al, 2010). For the purposes of this research value information relates to the consideration paid for the transfer of ownership or a land right in a market environment.
Land/property market information	Information about the tenure, value, use and development of land and its resources. The core land information components required for the efficient operation of a land market are land tenure and land value.
Layered property market	A land or property market where rights to different aspects of land, above and below the land surface exist and can be transacted (Wallace and Williamson, 2006).
Macroeconomic policies	Actions taken by governments to maintain national economic growth and tax revenues. This research focuses on interventions by central governments into the national economy, primarily fiscal and monetary policy.

Macroeconomics	Large-scale or general economic factors concerned with how the economy of a nation as a whole grows and changes over time (Agarwal, 2010).
Mixed capitalist economy	A capital economy where the government plays an important role either directly or indirectly in controlling the economy.
Monetary policy	Government use of money supply, particularly interest rates, to influence the economic performance of a country.
National government	See: *Central government*
Nation	According to Smith (1991) a nation is "a named human population sharing an historic territory, common myths and historical memories, a mass, public culture, a common economy and common legal rights and duties for all members."
Natural capitalism	A radical new way of thinking about the environment proposed by Hawkin et al (1999). It encourages a shift in business practices to biologically inspired models that value natural resources as an internal asset rather than an externality.
Natural resource economics	A disciple of economics that applies the economic concepts of supply and demand to natural resource allocation.
Property market tree	A conceptual model derived from theory, to show the idealised relationship between land administration and macroeconomic policy making for sustainable development.
Property markets	See: *Land markets*
Property rights	See: *Land rights*
Real property	Land and any physical structures attached to the land such as houses, buildings etc.
Spatial analysis	Analysis that take into account the geographical location of any object or event under study.
Spatial information	Spatial or location-based information describes the physical location of people, organisations or objects and the geographical relationship between them.
State government	A sub-central government in a federated country, usually

next in political hierarchy to the national, central or federal government.

Sustainable Development   Meeting the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987).

Tax   A compulsory contributions levied by the state on a taxpayer (individual or legal entity).

Taxes on land or property   Government charges on the transactions and holdings of property that form part of a land market. For the purposes of this research, local government charges for services or rates are treated as taxes on property.

Theory   A collection of ideas that form a field of study or domain of knowledge.

Transaction   An instance of buying or selling.

Unimproved land   The value of the land without physical improvements such as houses, fences, buildings etc.

Zoning   Division of an area for planning purposes. Different planning restrictions usually apply to different zones.

CHAPTER 1:
LETTER OF
INTRODUCTION

- *The following chapter introduces the problem targeted by this research. It also presents the research aims and objectives and argues for the significance of this work. A brief research structure is provided to outline the scientific approach to be used.*

1.1   Introduction

Over the last decade, many countries have felt the economic impacts of scarce natural resources and begun to develop a shared vision for sustainable development. New markets are emerging as a way to manage scarce resources as new land interests are recognised. Land administration provides the infrastructure for secure land market transactions and government macroeconomic policies work to manage the economy as a whole. As new land markets develop, there is an increasing need for better, more reliable information for improved economic management of land and its resources.

This need is most evident in many market economies where land administration is undertaken by state, provincial, or local governments; while macroeconomic policies to manage land markets occur at central government level. In these countries, the capacity of independent, decentralised land administration agencies to meet increasingly national drivers, particularly national economic policy, is challenging. This stems from an information asymmetry often caused by inadequate information flows between government collectors and users of land administration information. State, local or provincial based laws and processes make it difficult for central policy departments to access integrated land information needed to manage to the economy as a whole.

Past approaches to improve land information access include:

- Standard ontologies and conceptual schemas such as the Federated Data Model for land administration (Tuladhar and Radwan, 2005) and the Land Administration Domain Model (van Oosterom et al, 2006).
- Collaborative approaches (Warnest et al, 2005; McDougall, 2006).
- A systems approach to land registration by focusing on the "wholeness" of a system and the relations between entities (see Zevenbergen, 2001).

However new markets are threatened by information asymmetries in the land sector that still remain unchecked, and there is a need for a different approach. In particular, the growing focus on sustainable development, natural systems and 'green' economies has shown the utility of *biomimicry*. Biomimicry uses nature as a model, to study and design real-world systems that emulate the efficiency and sustainability of

processes in nature. It is often considered a part of the natural capitalism phenomenon that aims to increase recognition of the value of environmental resources. It allows for a new approach to unify land administration information and macroeconomic policy making for sustainable development.

This project draws on natural capitalism, to design principles that establish an operational link between land administration agencies and central macroeconomic policy departments based on information supply and demand. It advocates holistic management of land and its resources for better national economic policy and sustainable development.

1.2   Research Problem and Significance

The separation between land administration information and macroeconomic policy making hinders the economic management of a country as a whole.

Increasingly, market mechanisms are being adopted in many countries to meet the changing focus of economic growth on sustainable development. Mixed capital economies in particular, operate fundamentally through a market structure, where the price of goods and services is controlled largely by supply and demand in the private sector, and regulated by public sector economic policy. The role of fiscal policy, or broadly speaking spending and taxes, is to maintain a balanced yet growing national economy. Controlling the revenue and expenditure of the public sector via fiscal policy is used as a means of combating unemployment and balancing the demand in the private sector. Similarly monetary policy, generally controlled by a country's central bank, is used to regulate the supply of money and interest rates in the national economy. This serves as a means of achieving high employment, positive economic growth and low inflation.

In a land market, formal transactions are only possible through the existence of land administration infrastructures that allow for private land ownership to be registered, land values to be established, and rights in land to be exchanged in a market environment. As such, these administrative structures have a critical impact on the economy as a whole.

In many countries such as the United States, Australia and India, land administration functions fall into the constitutional authority of the state and territory governments. Essentially, the land registry that maintains ownership information is part of the state government. Information is sourced from various other departments, developers, surveyors or from local governments. Similarly, the land or property valuations department also forms part of the state governments in these countries. Often property valuation methods can be as varied as the property laws in various jurisdictions. Data relating to ownership and value of properties is generally stored in multiple jurisdictional databases.

In these countries, fiscal and monetary policies to manage the land markets are implemented at central level. The major vehicle or tool is increase or decrease to the bank rate of interest that feeds directly into the cost of borrowing for real estate transactions. Interventions in the property market by national agencies are best served by accurate and reliable information about the real state of the market.

For instance, the recent global financial crisis (2007 onwards) decreased real estate values in major market economies around the world. From a land administration perspective, part of this crisis was a result of poor decision making and ill-informed policy due to the lack of national property datasets, particularly in the United States (Buhler and Cowen, 2010). The financial crisis affected the central governments of many economies through lower tax revenues and duties from both income and capital gains tax, and increased spending in the form of economic stimuli. Essentially, fiscal and monetary policy decisions to combat the financial crisis left many market economies with large budget deficits and significant foreign debt. Following this there a need to better understanding the role played by land administration information in implementing central economic policies.

In many mixed capitalist countries, sustainable development objectives to better manage scarce natural resources have lead to new land rights that add to the complexity of administering land and economic management. Legal interests in land are increasingly complex and land management now involves environmental, heritage and use restrictions. New forms of property as tradable commodities are also emerging, for example water, biota, mining and carbon credits (Wallace and Williamson, 2006). These new markets involve new taxable commodities and

transactions, and changes to the availability and supply of money in the economy. New interests in land resources must be linked to a land parcel to become functional; and all marketable rights in land must be managed holistically to avoid new silo-like (cf. Garson, 2005) approaches emerging.

The heart of the problem lies in the need for increased information about transactions in land and resources, in order for economic policy decisions to meet a country's sustainable development objectives. Where market mechanisms are being adopted, information asymmetries are a significant cause of market failure (Cohen and Winn, 2007). Countries with decentralised land administration in particular, need to improve their administrative structures to enable a flow of information that minimises information asymmetries, between the government collectors and users of land information.

Past approaches to improve land information access have not adequately addressed the issue of information asymmetries between levels of government that can lead to market failure. Complexity in land administration and economic management increase as new market in land resources emerge. The research undertaken here makes use of new approach to address these issues. It is the first of its kind to apply the principles of natural capitalism to the discipline of land administration. Biomimicry in particular advocates for systems to be designed based on natural processes (Benyus, 2002). Natural processes are inherently sustainable and minimise waste (Hawkin et al, 1999). In the context of land administration systems, emulating natural processes will enable waste in the form of duplication, redundant and untimely process to be minimised. Additionally information systems can be looked at as an ecosystem, in which the different components are interdependent and co-evolving (Nardi and O'Day, 1999). Examining land administration systems as information ecologies allows for a better understanding of how land information is created, disseminated, used and recycled.

This research presents a public good system, with principles to assist national access to land transaction data held in diverse models and organisations. It aims to bring together the disciplines of land administration, macroeconomic policy and sustainable development.

1.3   Aims and Objectives

This research project aims to address the issues with current land administration processes in counties with decentralised land administration; and evaluate the need for land administration information and macroeconomic policy making to be linked, for sustainable development of current and emerging land markets. The project will present a new approach, based on natural capitalism, to achieve national integration of land administration information to better service macroeconomic decision making.

> *To develop a set of principles for enabling the synthesis of land administration information with macroeconomic policy making, in order to better support the economic management of a country as a whole.*

Research objectives

i   To understand the current theoretical link between land administration information, macroeconomic policy making, sustainable development and the impact of natural capitalism.

ii   To develop a conceptual model to show the idealised relationship between land administration information and macroeconomic policy making.

iii   To assess the model in real-world situations, to understand in-depth, the existing relationship between land administration information and macroeconomic policy making.

iv   To refine the model with functional principles derived to enable the synthesis of land administration information with macroeconomic policy making in practice.

1.4   Research Structure

The engineering discipline within which this research is to be conducted, calls for the use of a scientific method (cf. Kuhn, 1962). This requires identification of a problem followed by generation of a hypothesis to explain the problem or how it may be resolved. The research then involves testing the hypothesis for its validity. This

scientific method provides the structure for the overall project design which is illustrated in Figure 1.1.

PROBLEM
- Identification of issue and investigation of theories underpinning the research

→ Chapters 1, 2 and 3

HYPOTHESIS
- Generation of a theory/model to explain the issue or how it may be resolved

→ Chapter 4

METHOD
- Development of a scientific approach to test the hypothesis

→ Chapter 4

RESULTS
- Determination of the validity of the hypothesis in practice

→ Chapters 5 and 6

HYPOTHESIS REFINEMENT
- Refinement of the model based on the results

→ Chapters 7 and 8

CONCLUSION
- Check if original research aim and objectives were achieved

→ Chapter 9

Figure 1.1: Project design based on scientific method (adapted from Kuhn, 1962)

1.5   Chapter Summary

Effective macroeconomic policies to manage the economy need access to national, authoritative information about transactions in land and related commodities. However, with state, provincial or local-based land laws and processes, central policy departments in many countries struggle to gain access to this information. This creates an information asymmetry that can be increasingly problematic as new land markets emerge in response to economic growth and sustainable development.

Emerging interests create new marketable rights and consequently new taxable transactions and changes to the supply and flow of money in the economy. Transactions in new land resources need to be linked to the underlying land parcel and must be managed holistically with existing real property information.

A new approach, namely natural capitalism, can help to meet the information requirements of emerging market mechanisms that add further complexity to land administration and economic management. Natural capitalism advocates biomimicry or replication of natural processes in the design of real-world systems. The increasing international focus on sustainable development and the natural environment shows the utility of such an approach.

This research project aims to design a public good system, based on natural capitalism, with principles that enable the synthesis of land administration information with macroeconomic policy making; for improved economic management of a country as a whole.

CHAPTER 2:
LAND ADMINISTRATION AND SUSTAINABILITY
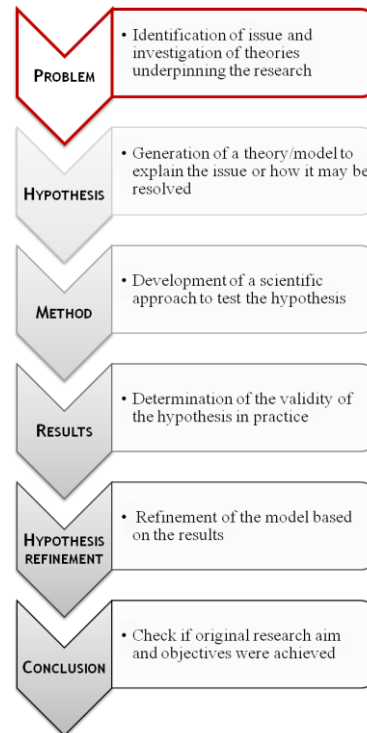
- *The following chapter introduces land administration and sustainable development; and explores the theoretical link between these disciplines.*

2.1   Introduction

Land administration and macroeconomic policies are key to the creation and management of national wealth, and sustainable development. Literature reflects this (Denman, 1978; Weale, 1989; Barro, 1990; Dale and McLaughlin, 1999 and Munasinghe, 2006). However in many countries these processes operate independently and their interdependence is not reflected in literature. In the United States for instance, the financial collapse of the late 2000s that resulted in the global financial crisis is suggested to have emanated in part, from a lack of integration between the information processes of land administration and macroeconomic policy making (Roberge and Kjellson, 2009 and Buhler and Cowen, 2010).

The link between the disciplines of land administration, macroeconomic management and sustainable development is particularly unclear in counties with decentralised land administration. For example in Australia, the United States and India, land administration functions are allocated by constitutional arrangements to the state, territory or provincial governments; while macroeconomic policies are administered at central government level. In these counties, the capacity of land administration to support sustainable macroeconomic policy making is in need of new evaluation. To achieve this, the role of land administration in sustainable development and macroeconomics is examined through existing theory and practices. Included is an evaluation of the need for new approaches that emulate sustainable natural processes. Figure 2.1 outlines the theories and disciplines that underpin this research, and that will be discussed in this chapter and the next. The focus is on the disciple of land administration and its theoretical relationship with the disciplines of sustainable development and macroeconomic.
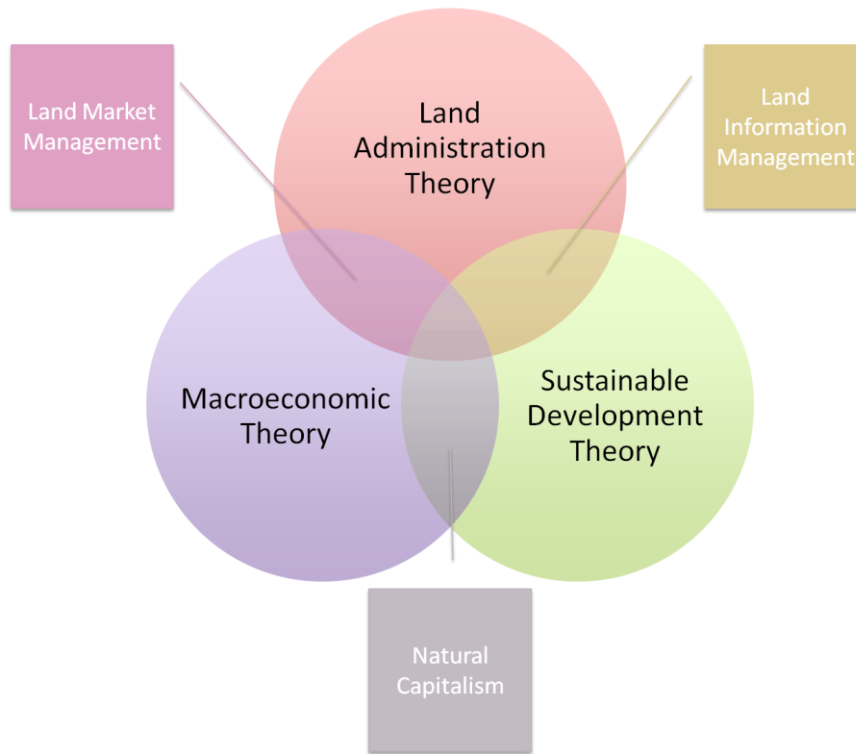
Figure 2.1: Theories that underpin this research

Figure 2.1 above guides the discussion to follow. Land administration argues it supports sustainable development, primarily though provision of information. Land administration also argues it supports macroeconomic, by providing market-supporting structures and transaction information for managing the economy. Meanwhile, sustainable development theorists argue that environmental externalities in current global economic systems need to be included in the design of real world systems. This is crystallized in the theory of natural capitalism. Where these three discourses overlap, is the theoretical setting for this research.

Each component of Figure 2.1 will be examined through literature. This chapter introduces land administration and sustainable development and examines the theoretical link between these disciplines. Chapter 3 introduces macroeconomic management and its theoretical links with the disciplines of land administration and sustainable development. The short comings of theories and the missing link between the above disciplines is further demonstrated by presenting two examples from the Australian context in Chapter 3.

2.2 Land Administration
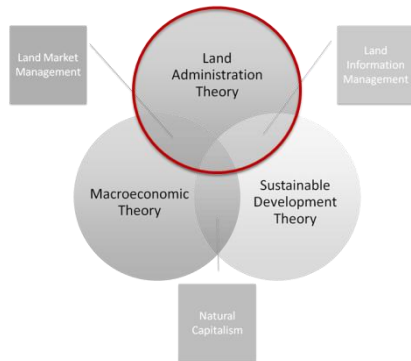
Land administration systems provide the mechanisms that support the management of property (Dale and McLaughlin, 1999, Wallace and Williamson, 2004). The UNECE Land Administration Guidelines state that land administration systems should create security not only for landowners, but also for national and international investors, moneylenders, traders, dealers and governments. Through this they can provide order and stability in society. The guidelines also state that systems of land registration are instruments of national land policy and mechanisms to support economic development.

Land administration has four core functions, namely tenure, value, use and development (Williamson et al, 2010). These functions are essential for the purpose of recording and producing land information, implementing national policy and delivering a country's sustainable development objectives: Figure 2.2. Of these functions, tenure and value underpin the efficient operation of land markets. Land development and land use, though interrelated with tenure and value, are indirect participants in efficient land markets. Use and development can both affect the capital value of land, and in the context of land markets, are reflected in the land administration function of land value.
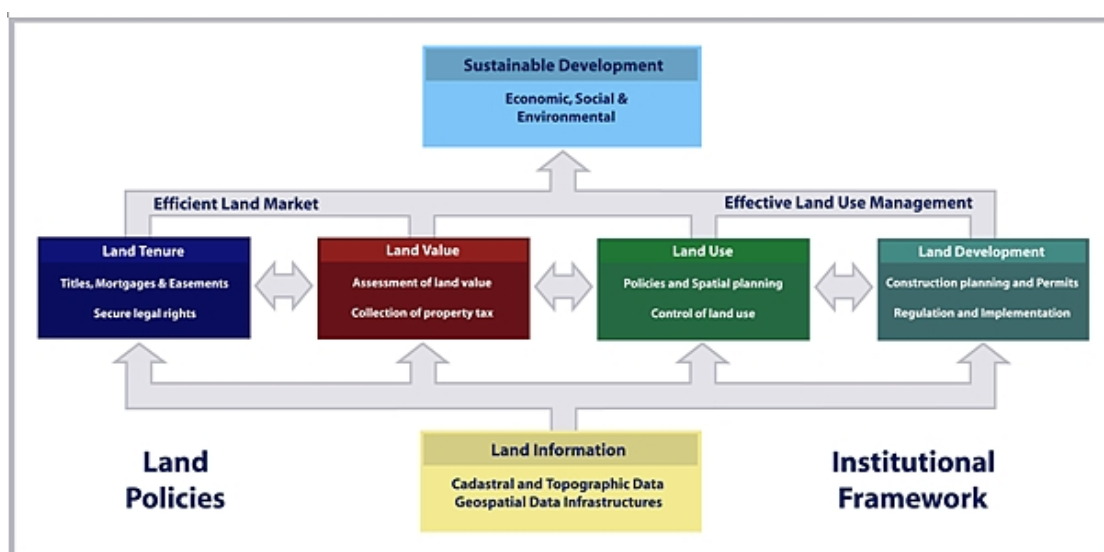
Figure 2.2: The functions of land administration (Enemark, 2004)

Land tenure is essentially a recognised relationship between people and land. As Figure 2.2 shows, mature land tenure systems incorporate titles, mortgages and easements. To make a right in the land a tradable commodity, security is needed. Security is achieved through registration. Land value is also essential to the operation of an efficient land market. Value comprises an assessment of the price of land and the collection of property tax.

In many countries with decentralised land administration, the functions of tenure and value are the constitutional authority of the state, local or provincial governments. Essentially, the land registry that maintains ownership information is part of these governments. Information is sourced from various other departments, developers, surveyors or from local governments. For instance, in India, generation and maintenance of property records was handed over to the state and territory governments in 1904. Since then different processes have evolved in different states (PCGIAP, 2003): Example 1. In a country that has twenty-eight states and seven territories, this can create significant disparity. Australia and the United States face similar issues as the federal government in each country has no constitutional authority over land administration.

Similarly, the land or property valuations department can also form part of the state, local or provincial governments in countries with decentralised land administration. Often property valuation methods can be as varied as the property laws in various jurisdictions. In Australia for instance, Queensland and New South Wales are the only two states that value and tax unimproved land. Valuations data is collected either by in-house or private valuers hired by the state or local governments. As such, data relating to ownership and value of properties are generally stored in multiple jurisdiction based databases.

Example: Land administration in India

In India, generation and maintenance of the property records was handed over to the state and territory governments in 1904. Since then different processes evolved in different states (Deininger, 2008). Land transaction records are maintained by both the revenue department and the registration department. The overlap increases transaction costs and inconsistencies in land records, resulting in a greater potential for fraud. For instance, the Comptroller and Auditor General of India (CAG) conducted a sample audit of 169 property tax declarations in one jurisdiction and found 40 percent to be false, amounting to an approximate loss of US$38 million in 2008-10 (Geospatial TODAY, 2012). In a country that has twenty-eight states and seven territories, independent land administration and revenue collection process can create

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significant disparity. Due to this, India proposed the development of the National Land Records Modernisation Programme (NIRMP) in 2008, under the Union Rural Development Minister. Activities to be undertaken under this new national scheme included computerisation of registration, including entry of valuation details, and establishing inter-connectivity among revenue offices and other agencies involved in land records such as Survey and Settlement Offices, Registration Offices and the like (Sinha, 2009). This ambitious scheme will take many years to realise, but the underlying sentiment provides clear recognition of the importance of well organised land information.

Land administration literature, in particular best practice documents (Williamson (2001) discuss the ideal role of land administration information. Those concerned with tenure and value information for the efficient operation of land markets are discussed below.

The UNECE land administration guidelines state:

> *"Good land records will improve efficiency and effectiveness in collecting land and property taxes by identifying landowners and providing better information on the performance of the land market, for example by identifying the current prices being paid for property and the volume of sales"* (UNECE, 1996).

Though the needs of land information users will differ, ownership and value are part of the common theme (UNECE, 1996). As such, to achieve good national land records, there is a need to standardise the basic ownership and value information that is collected by land administration agencies, during a change of ownership. Integral to this is the confirmed identities of the parties involved (buyer/s and seller/s) and the value of the transaction. The date of contract is also needed to judge the performance of the market accurately within a given time period. However, information collected must be timely so that economic decision making can be based on data that best reflects the status of the economy within the same time period. Timeliness is recognised as important criteria by the World Bank for successful land administration of legal rights in property (Burns, 2007).

The UNECE guidelines and World Bank indicators (Burns, 2007) and the Bathurst Declaration (UN-FIG, 1999) all advocate land information systems that are customer-focused, that is, for the benefit of the user rather than the information producer.

The UNECE guidelines, Cadastre 2014 (Kaufmann and Steudler, 1998) and World Bank indicators also recognise the benefits of computerisation within land administration. Greater efficiencies and increased standardisation can be achieved by computerising the collection of land transaction information. In Australia, The National Electronic Conveyancing System (NECS) aims to digitise the processes of land registration within the states. Common functionality across jurisdictions, easier cross-border transactions and increased transparency are some of the benefits identified for such a system (NECS Steering Committee, 2011). The system is in various stages of implementation within the Australian states.

In a questionnaire conducted for Cadastre 2014, state guarantee of title was one of the most frequently named strengths of existing cadastral systems (Kaufmann and Steudler, 1998). This requires land registries to be accountable for the integrity of data in the registry. Furthermore, the UNECE land administration guidelines state that the usefulness of a land information system depends on the system being up to date, accurate, complete and accessible. Data should be registered only once and kept up to date in one place (UNECE, 1996).

The World Bank land administration guiding principles recommend a *"coordinate policy between existing government agencies, with concrete mechanisms to support and encourage coordination"* (Burns, 2007). Established lines of communication are encouraged as part of this coordination. Public access to land information is encouraged by all best practice guidelines mentioned above, particularly for informed public decision making. The UNECE guidelines recognise the importance of public access to land registries to assure certainly and maintain confidence in land market transactions; however they recognise the need to maintain the privacy of individuals (UNECE 1996). All the above mentioned best practice literature support easy and cost-effective access to land information, and the benefits of technology and online delivery in land administration reform are acknowledged. Cadastre 2014, UNECE and World Bank guidelines recommend cost-recovery procedures (UNECE, 1996; Kaufmann and Steudler, 1998; Burns, 2007).

Land administration systems have been proven to be critical, public good infrastructures (Bennett et al, 2013). The derived land information is also public good and as such should exhibit low excludability and rivalry of use. The exception is

information about the privacy of individuals, such as owner identities, which should in contrast have a higher excludability from public use.

In additional to the above best practice literature, Bennett et al (2010) present six design elements for future cadastres. These build on the concepts of multipurpose cadastres that originated in the 1980s (NRC 1980) and Cadastre 2014 (Kaufmann and Steudler, 1998). The design elements include survey accuracy, property objects instead of parcels, the inclusion of height and time information, real time maintenance and information access, regional and global access for cross-border trading, and the modelling of organic land resource information (Bennett et al, 2010). Three dimensional (3D) information in particular, is supported by Kalantari et al (2008) and Bennett et al (2008), who argue that two dimensional information is often not sufficient for modelling all interests related to land. Stoter and Salzmann (2003) and Aien et all (2011) both discuss the needs and technological capabilities of developing a 3D cadastre.

Added to the above discussions on land administration information, is the addition of the Land Administration Domain model to the 57 published standards relating to geographic information by the International Organisation for Standardization (1SO, 2012). The ISO standards for geographic information address a range of issues from data models and metadata to classification systems and quality assurance. ISO 19152 for geographic information is the Land Administration Domain Model, which provides a standardised way to model cadastral systems. The model aims to provide a basis for studying and improving land administration systems by providing a shared vocabulary and enabling easier cross-border sharing of land administration information (ISO, 2008). This and other land administration modelling techniques are discussed in Chapter 4.

Land administration is one of the core disciplines that underpins this research. The following section briefly introduces the next building block of this research, namely the discipline of sustainable development.

2.3   Sustainable Development
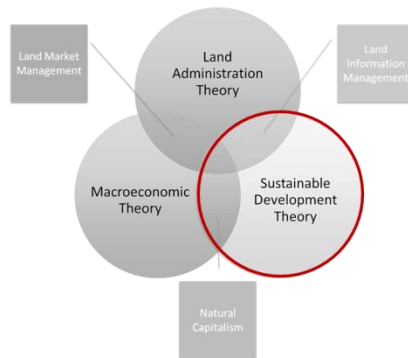
Sustainable development has many different, often competing meanings (Fowke and Prasad, 1996; Williams and Millington, 2004; Hopwood et al, 2005). In a broad sense the concept has stemmed from growing concerns for the environment and better management of scarce natural resources, combined with other socio-economic issues. It is underpinned by the understanding that whilst humans should continually seek to improve their quality of life and further their development, this cannot be encouraged at the expense of the environment. The classic definition, as presented in the Brundtland report, states sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987). Yet, as Willaims and Millington (2004) point out, this definition is associated with a particular developmental world view and is challenged by many.

Sustainable development concepts have evolved from work in the early twentieth century surrounding the relationship between human development and the environment (Beatley, 2004). As Beatley (2004) further points out, this was followed by an evaluation of unsustainable development practices and the social and environmental impacts of global development, some decades later. Since then the concept and meaning of sustainable development has been much debated.

Redcliff (1987) argues for environmental change as a social process, linked to activities in the world economy. This has expanded to accommodate the ideas of fairness and interdependence, not only between generations, but between countries and human beings (Bourdages, 1997). To many sustainable development commentators, such as Goodin (1992) and Fitzpatrick and Cahill (2002), there is an inherent mismatch between the supply and demand of Earth's resources. Williams and Millington (2004) consider the constant negotiations of natural resource supply and demand as the process of sustainable development.

As new information and innovations are discovered, sustainable development definitions evolve to reflect these advancements and are integrated into the

Constitutions of some countries (UN, 2012). Though there is much debate on the meaning, the concept of sustainable development has also been widely adopted by international political initiatives, particularly as climate change concerns gain momentum. 178 governments adopted Agenda 21, the Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests, at the United Nations Conference on Environment and Development (UNCED) in 1992 (UN, 2009).

However, international advancement on the road to sustainable development has not progressed as far as hoped for in 1992, as "*many of the global problems we are facing today are more acute or larger in scale than they were in 1992*" (UN, 2012). Sustainable development requires a long-term perspective with proactive planning and management (Bourdages, 1997). Clear principles at all decision-making levels must form part of a long-term approach to sustainable development. Unfortunately international initiatives and institutional structures have often failed to evolve to better adapt to growing global challenges (UN, 2012).

The challenge for sustainable development policy is the need to factor multiple social and economic variables across multiple environments and time. In recent years, environmental innovation and compliance through regulation has gained relevance in policy making (Bernauer et al., 2007). However there is no single solution or policy for sustainable development. Giddings et al (2002) acknowledge sustainable development as "*the intersection between environment, society and economy*." The finite nature of resources dictates the need for a greater understanding of the interdependencies between these three disciplines. Furthermore, the balance underpinning sustainable development requires a seismic shift in people's perception of the world. Such revolutionary change is advocated by Hawken et al, 1999 and Kovel, 2007. Kovel (2007) sees the problem as inherent in capitalism while Hawken et al (1999) on the other hand, present a new approach, namely natural capitalism. This approach, discussed further in Chapter 3, aims to increase the perception and economic value of a fourth factor of production, which is natural capital or the environment.

This growing international focus on protecting the environment or natural capital, calls for innovative approaches to achieving sustainable development (Robinson,

1992). Land administration has a significant role to play in achieving natural, economic and social sustainability (Enemark et al, 2004). Past approaches to improving land information access and dissemination need to give way to new approaches that can help to achieve wider sustainable development goals. The following section looks at land administration's role in sustainable development through a theoretical examination of the interactions between the two disciplines.

2.4   Land Administration and Sustainable Development
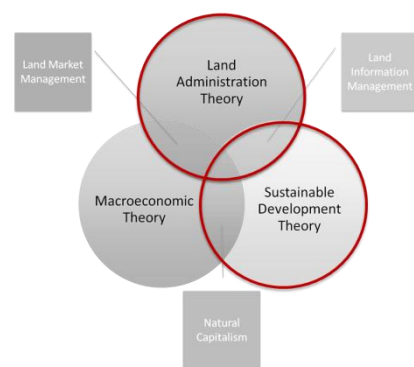
In a land or property market the product is formalised by a land administration system that determines the type of title and land right through the tenure system, and other functions of land value, land use and land development (Enemark, 2007). The land administration system identifies the complex land right that is the foundation of formal land markets. Therefore, appropriate and effective land administration is integral to sustainable development of land markets (Williamson et al, 1999; 2010).

Excessive population growth has created many competing and overlapping concerns over land, making it a scarce resource that needs to be better managed and preserved for future generations (Henssen, 1991). Many countries are adopting market mechanisms to better manage scarce land resources, particularly carbon and water. Consequently, new rights in land have emerged over the last fifty years as the concept of applying property rights to environmental issues is seeing much progress (Watson, 2006; Bennett et al, 2008). Formal transactions in these new commodities need a definition of property rights and security of tenure. These, together with access to land and land information management have significant implications for sustainable development (FAO, 2007).

Much of the literature surrounding emerging land rights is in agreement that land administration systems should extend to markets in land resources; and holistic management frameworks must be developed for all land interests (Kaufmann and Steudler, 1998; Bennett et al, 2008; Enemark et al, 2004; Williamson and Wallace, 2007). As Williamson and Wallace (2007) observe, "*seamless and integrated*

management of all land and associate resources" allows for the most successful management of land markets. Essential trading processes in new land resource markets must be managed together with traditional land parcels, if these markets are to be sustainable and reach the same levels of success.

The joint United Nations (UN) and International Federation of Surveyors (FIG) Bathurst Workshop on Land Tenure and Cadastral Infrastructures for Sustainable Development acknowledged that land administration institutions and infrastructures need to evolve, and change their often limited focus to meet a wide range of new sustainable development needs. To achieve this, the Bathurst Workshop set out recommendations for global commitment. These included:

- Investing in the necessary <u>land administration infrastructure</u> and in the <u>dissemination of land information</u> required to achieve these reforms
- Encourage <u>the flow of information relating to land and property between different government agencies</u> and between these agencies and the public. Whilst access to data, its collection, custody and updating should be facilitated at a local level, <u>the overall land information infrastructure should be recognised as belonging to a national uniform service</u> to promote sharing within and between nations.
   (Williamson et al, 1999)

Both recommendations advocate land information flows between government agencies, towards achieving national uniformity in land and property information, as integral to sustainable development. Disseminating information about the ownership, value and use of land is one of the defining functions of land administration (UNECE, 1996).

The following section looks at information management, particularly lifecycle concepts that draw their roots from sustainable development ideas; and their application to land administration information.

Land Information management
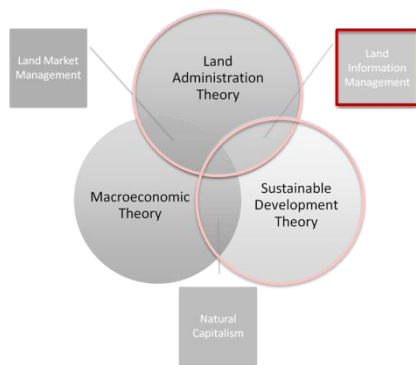
Land market information has a temporal aspect. The date on which a land transaction takes place is an indicator of the market environment at that point in time. Bennett et al (2010) indicate that property market management requires cadastral information to be maintained and made available in real-time. Land markets are dynamic and as the market evolves, the transactions within the market reflect this. Organisations using land market information for decision-making need information that is timely and that accurately reflects the market environment. This makes it important for land market information to be appropriately sourced, managed and disseminated. In the digital age, information management often follows a lifecycle approach. A historical review of this approach is provided below to give a better understanding of its application to land administration information.

The concept of information management predates computers. So does the concept of lifecycles. The former can be traced back to the days of record keeping and data management of paper-based files and other hard-copy media. Lifecycle modelling originates from the natural science discipline. It involves tracing the processes that form the life history of organisms or cradle-to-grave processes in nature. In the 1940s the United States (US) National Archives combined the two disciplines to formalise a lifecycle approach to the management of records, to conceptualise their creation, maintenance and disposal processes (McKemmish, 1997).

In the late 1970s, data maintenance and information management to aid decision making emerged. Simon (1977) looked as data and information as an input to decision making and broke down the process of decision making into intelligence, design, choice, and review. This perspective evolved out of work in behavioural sciences being applied to organisational theory (March and Simon, 1958; Cyert and March 1963). It promoted the view that organisations are information processing and decision-making systems. Additionally, Wilensky (1967) presented organisational intelligence in the form of gathering, processing, interpreting and communicating information needed in decision making processes.

This concept remained through the 1990s as information processing and dissemination via computer networks was widely adopted. 'Capture and share' continued to be linked to organisational intelligence (Haeckel and Nolan, 1993). Choo (1998) further acknowledged a cyclical approach to organisational intelligence; namely the 'learning cycle' or information management cycle, which included creation, acquisition, storage, analysis and use. This evolved into the business concept Information Lifecycle Management (ILM), linked to overall Enterprise Content Management (ECM) in the early 2000s. Information technology systems in support of ECM emerged to *"create, store, manage, secure, distribute and publish any digital content for enterprise use"* (Jenkins, 2005).

In 2003, the Storage Networking Industry Association (SINA) assigned a new broader definition to ILM:

> *"Information Lifecycle Management comprises the policies, processes, practices, and tools used to align the business value of information with the most appropriate and cost effective IT infrastructure from the time information is conceived through its final disposition."* (SINA, 2009)

Since then, many information lifecycle models have emerged, with the original cradle-to-grave concept that mimics natural systems being adapted for individual business requirements. Modern web based access services and cloud computing have adopted the approach to better understand how these services are offered to users, for identity management and to optimise the migration of businesses from traditional data storage to cloud-based services (Breiter and Behrendt, 2009; Conway and Curry, 2012). These technological advancements may eliminate the need to dispose data, allowing it to be viewed and used under the stewardship of the information owner.

In the land administration domain, information collection and dissemination are key aspects of information management. Lifecycle principles in information management discussed above support the view that information collected and disseminated by land administration systems should follow a lifecycle approach for improved sustainability. A lifecycle approach will allow for better management of land administration information, greater transparency in decision making and better alignment of the needs of information providers and users.

2.5   Chapter Summary

Land administration is a critical, public good infrastructure which has the key role of collecting and disseminating information about the ownership, value, use and development of land. Land administration literature argues it supports sustainable development, primarily though provision of information. Sustainable development literature adds to this discourse by advocating a lifecycle approach to information management.

In the context of land administration, the application of sustainability principles support the view that information collected and disseminated by land administration systems should follow a lifecycle approach. A lifecycle approach will improve efficiency and effectiveness in collecting and disseminating land administration information, enabling improved decision making.

CHAPTER 3:
LAND ADMINISTRATION AND ECONOMIC MANAGEMENT
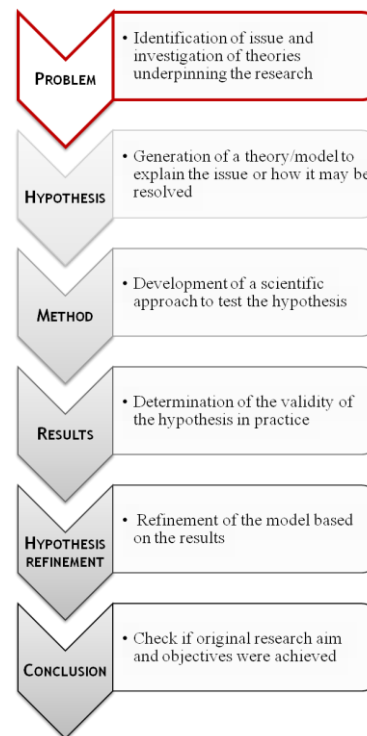
- *The following chapter introduces the discipline of macroeconomic policies. Furthermore it explores the theoretical links, and lack thereof, between macroeconomic management, land administration and sustainable development.*

3.1   Macroeconomic policies
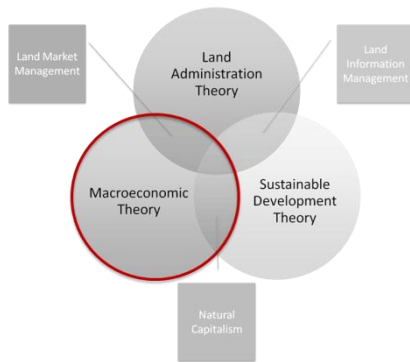
Literature explored in Chapter 2 shows a clear link between the disciplines of land administration and sustainable development. This chapter introduces the third discipline underpinning this research, namely macroeconomic policies. It further explores the theoretical links between macroeconomic policies, land administration and sustainable development. Two examples from the Australian context are presented to better illustrate the shortcomings of theory in linking these disciplines.

A brief discussion on contemporary economies is presented below to help better understand the concepts that underlie macroeconomic management.

The evolution of economic thought over the last three decades has led to the development of contemporary economies. Dividing contemporary economies into capitalist nations and socialist nations makes it easier to see how the nature of a country's economic system drives the extent of government regulation of economic activity. Figure 3.1 illustrates the types of economies that operate in contemporary times.
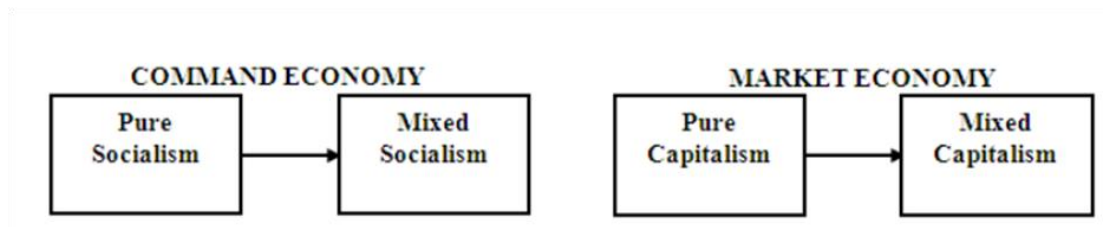
Figure 3.1: Span of economic systems (McKenzie and Betts, 2006)

Socialism is generally understood as an economic system where national priorities are of paramount importance and the allocation of resources is primarily the responsibility of the government (Jalan, 2005). Within this spectrum of socialism, communist countries such China are characterised by state capitalism, where the government maintains ownership and control of production patterns and the allocation of investment. Based mainly around the ideas of Karl Marx and Vladimir Lenin, communism favours a command economy, in which the government controls production, distribution and exchange (Busky, 2000). This is in contrast to a market economy, where the forces of supply and demand determine most aspects of production, distribution and trade. As Jalan (2005) points out, in communist and

state capitalist nations there are generally no private enterprises, and no private ownership of property. However, a command economy does not always operate. For instance, Yugoslavia practised market socialism before its breakup, and China and Vietnam have also developed market economies within their socialist constraints (Busky, 2000).

Democratic or mixed socialist nations strive to create a compromise between private capitalism and communism. They support a socially owned economy and a political democracy. In terms of market economics, democratic socialism supports private enterprises regulated by the state (Jalan, 2005). While a free market economy may operate, the state still endeavours to create social and economic conditions that provide for reasonable equality of opportunity, through the redistribution of wealth and income (Calhoun, 2002).

> *"The capitalist system is one characterised by the private ownership of the means of production, individual decision-making, and the use of the market mechanism to carry out the decision of individual participants and facilitate the flow of goods of services in markets"* - Jalan, 2005.

According to McKenzie and Betts (2006), capitalist systems apply the following principles:

- The right of individuals to own, control and dispose of private property
- The right of individuals to control private enterprises and the freedom of choice to use the resources and businesses they own
- The existence of competitive markets in which supply and demand are the major forces that control the price of goods and services in the market
- The existence of personal motives, that drive individuals to take risks and form businesses that supply the goods and services that society demands
- Success and failure in the market are met by personal gains and losses respectively
- The existence of no or minimal government controls on the basic economic decisions of individuals.

Most capital economies today are not pure capitalist. In Australia, for instance, the majority of goods and service are produced by private enterprises. However, the government plays an important role either directly or indirectly in controlling the economy. This is considered to be a mixed capitalist economy. The governments in mixed capitalist economies attempt to maintain high levels of employment, economic stability and promote economic growth. They

also regulate business activity, run welfare programs and often take measures to redistribute income. Macroeconomic policies are the tools of central governments to manage the economy as a whole. These include monetary and fiscal policies that can greatly impact a country's land market.

Fiscal policy deals with government expenditure and taxation, while monetary policy deals with the availability and supply of money in the economy, and the cost of money or interest rates. The availability of money in the economy, especially unrestricted mortgage financing, managed by monetary policy tools, has a significant impact on land or property markets. Throughout modern history many property market bubbles came from explosions in lending. The more recent global financial crisis saw global credit dry up and money for loans being much harder to source. The central reserve banks of many mixed capitalist nations reduced interest rates to record lows in order to prevent market collapse and stimulate growth. At times the interest rates were close to zero but property markets still fell because of fear and uncertainty in the market place, and a resultant lack of money lenders (International Monetary Fund, 2009). Fluctuations in interest rates play an important part in the property market, but money must also be available for lending. Operations in the secondary mortgage market also influence purchasing power (Carper et al, 2007).

Many capitalist nations today employ principles from institutional, free market and Keynesian economics (cf. Coddington, 1983) to support government management of aggregate demand in the economy. Government macroeconomic policies are intended to combat the instabilities that a pure market structure may cause. However, the property market is unique in terms of its economic structure and the principles and practices that govern the supply and demand of property. A discussion on this follows. Understanding the distinctive economics of the property market and the role of land administration is essential to better policy making in support of land markets and the economy as a whole.

3.2   Land Administration and Macroeconomics
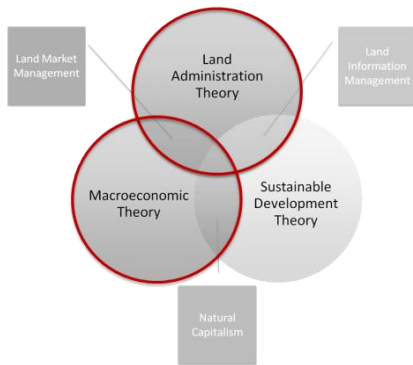
For land administration to help achieve better economic sustainability, its importance to macroeconomic policy tools needs to be better understood. Property rights in particular have a significant impact on the economy (Denman, 1978). As Feder and Nishio (1998) argue, the registration of land rights can lead to improved access to formal credit, higher land values and increased investment and income. The management of land rights and associated markets using macroeconomic tools can also impact on economic activity. For instance higher interest rates can make mortgage repayments less affordable and thus affect demand for property. This can slow the growth of the property market as a whole. Similarly lowering interest rates can reduce the cost of holding mortgaged property and consequently increase demand in the market place.

Property markets come from a nation's capacity to create 'property rights institutions' (North and Thomas, 1973), and these are often within the domain of land administration The formal and informal economic and political constraints are the market institutions needed for markets to run efficiently. As McMillan (2008) points out, market institutions work to limit transaction costs, that is the time and money spent locating others to transact with, comparing prices, evaluating the quality of the commodity for sale, negotiating agreements, monitoring performance and settling disputes.

Contemporary economics has evolved to better understand the role of institutions, such as individuals, agencies etc, in influencing economic behaviour. Within institutional economics, markets result from the complex interaction of various institutions. Commons (1931) introduced the idea that individual behaviour or the exchange of goods is a transaction. This was the preface for the idea of the 'cost of market transactions' in Coase's (1960) The Problem of Social Cost, and Transaction Cost Economics by Williamson (1979). Coase used the concept to predict when certain economic tasks would be undertaken by agencies and when they would be carried out by the market. Birner and Wittmer (2004) apply Williamson (1985)'s work on transaction costs in the public sector to study the efficiency of government structures within the context of natural resource management. Collection of information here is regarded as a transaction cost of decision making. In land or property markets, government services lower transaction costs. On a macro level, central governments in most market

economies employ economic principles to combat the instabilities that a pure market structure may cause. However, the land or property market is formalised by land administration systems whose importance in macroeconomic policy is not yet clearly understood.

Some economic theory does recognise the role of land administration systems in national economic development. For instance North and Thomas (1973) identified the existence of property rights as the main cause for some societies to be much better off than others. Deininger and Binswanger (1999) and De Soto (2000) too, argued for the importance of the capacity of a nation to build land rights. De Soto (2000) established the link between the formalisation of property rights and the creation of wealth using the settlement of the American West as an example. Van der Molen (2012) reviewed the ideas of De Soto, concluding that governments need to show political will and good governance principles towards recognising ownership and value of property rights vested in the poor, to bring about social and economic equality in society. Deininger and Binswanger (1999) argued for secure, transparent and enforceable property rights as a vital requirement for investment, economic growth and poverty alleviation.

However, economic literature does not adequately recognise land administration as an authoritative repository about the land market, with the defining functions of information collection and dissemination; vital to sustainable macroeconomic policy decisions. In many countries land information collection is decentralised, and the link between authoritative state, local or provincial land information repositories and central government users is not well established. As new markets in land resources emerge, the importance of increasing land information to macroeconomic management needs to be better understood.

The following section looks at the economic management of land markets and the functions of land administration within this context.

Land market management
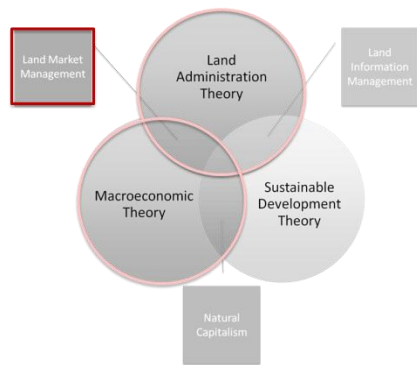
In general, the price of goods and services being traded in a market environment is determined by the forces of supply and demand. Though these general economic assumptions apply to property markets, and to the credit markets that underpin them, a number of factors often not quantifiable affect the market price of a property. These include land quality, legal constraints, intended use of the land, the general state of the local economy and other intangible factors such as people's perception of what the land is worth (FAO, 2003). Hence, while some of these factors such as land quality can be measured by physical qualities such as soil, aspect, rainfall expectancy and location, the actual price paid in a property market transaction is what a buyer is willing to pay and a seller is willing to accept (Dale and McLaughlin, 1999). This selling price may or may not reflect the market equilibrium at the time, since for example a buyer may be willing to offer more due to their preconceptions or desires, and a seller may be willing to settle for less due to their urgent need to sell. Additionally, the supply of property and its use can be seen as fixed in the short term (Carmona, 2003). Development of property takes time and once a building is built its use remains fixed for a long time, regardless of short term fluctuations in the property market.

Property or real-estate economics endeavours to account for the unique characteristics of property markets, by linking the actions of people to their effect on the value of property. This discipline tries to apply general economic theory to the realities of real estate practices. However, property markets come from a nation's capacity to create 'property rights institutions' (North and Thomas, 1973), and these are often within the domain of land administration.

Dale (2000) used the Land Market Model to show that a country's land markets need to be supported by the pillars of land registration, valuation, capital and credit, and must stand on the firm foundations of national land policy. Wallace and Williamson (2006) suggested that in a property system the rights are the commodities, not just the land itself, and successful land markets derive strength from creating and marketing land rights and complex commodities. Building an appropriate belief system is also deemed to be important, as property markets are driven by the perception that land is a valuable commodity and that wealth is derived from land holdings.

Williamson et al (2010) convey the importance of land administration processes that are influenced by national land policy and economic systems. They emphasize that infrastructures that manage land data, particularly valuations data, should allow access, interoperability and multipurpose use of that data. They also acknowledge that free land markets are subject to many indirect controls including taxation of transactions and macroeconomic controls over money supply. Land administration systems underpin the performance of these controls by providing information and facilitating transparent processes (Williamson et al, 2010).

However much of this literature deals mainly with developing nations, with a focus on establishing land administration systems and recording land parcels, for the purposes of basic taxation and the construction of formal land markets. In many countries the land administration systems and consequently the land markets are already well established, relying on a complex set of interrelated institutions, formal and informal, to promote information flow. Often they fall into the constitutional authority of the state, provincial or local governments. As Roy (2010) commented, "*Data accessibility has long been as issue concerning the geospatial industry, a legacy of a colonial data policy that did not encourage data sharing outside the government or even within certain sections of the government.*"

New markets in land resources add further complexity to property economics and current land management systems. For instance, time is an additional variable to be considered in administering land resources, and the management of renewable and non-renewable resources can differ on different economic time scales (Conrad, 2010). Additionally, assigning property rights to previously non-marketable land resources creates the potential for significant economic activity and wealth creation. However, the interdependence of resources (Cronin and Pandya, 2009) and their relationship with the underlying land parcel cannot be ignored. As such, new land-related markets that aim to sustainably allocate scarce natural resources need to be holistically administered with the tenure, value, use and development of the land itself.

The discipline of natural resource economics helps to better understand the economic mechanisms behind markets in land resources. Natural resource economics aims to apply the economic concepts of supply and demand to natural resource allocation for sustainable development. Contemporary resource analysis looks at the issues of resource exploitation versus conservation and the capacity of ordinary market mechanisms to regulate resource use

(Neher, 1990). The importance of property rights is acknowledged, particularly as the lack or poor definition of property rights in natural resources can lead to market failure (Tietenberg and Lewis, 2009). However, the management and dissemination of additional information about transactions in new marketable land interests is not adequately acknowledged within macroeconomic theory.

Initiatives to solve some land market management issues for the purpose of sustainable development have brought the ideas of natural capitalism to a forefront. The following section explores the theoretical link between the disciplines of macroeconomic management and sustainable development, with a focus on new approaches for the design of sustainable real world infrastructures.

3.3 Sustainable development and Macroeconomic: Natural capitalism
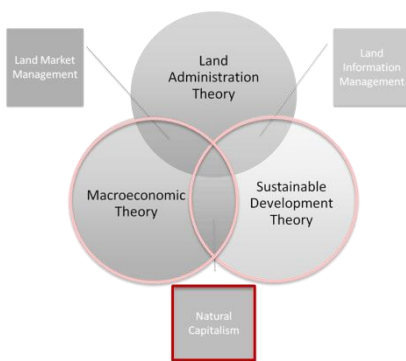
The UN Conference on Environment and Development, RIO 1992, can be considered the first global innovation summit (RIO+20, 2012). Twenty years on, innovation, particularly 'green growth' is still a key feature of RIO+20, the UN Conference on Sustainable Development (World Bank, 2012). Green growth encourages, among other principles, innovative business models for sustainable growth that minimise waste. Minimising waste in systems design is a key principle of natural capitalism (Hawkin et al, 1999).

Closed-loop cycles in nature work to eliminate waste. In the context of land administration systems, waste occurs in the form of duplication, redundant processes and issues of timeliness, relevance and authority that bring the reliability of information into question. Emulating natural processes, or biomimicry, to improve current land administration processes can help to minimise or eliminate wasteful processes and resources, resulting in increased sustainability of current systems.

Biomimicry forms part of a radical new way of thinking, namely, natural capitalism that values natural resources as an internal asset rather than an externality. It encourages a shift in business practices to biologically inspired models that place higher value on solution-based systems and the flow of services (Lovins et al, 1999). This innovative approach is ideal for

the evaluation and improvement of current land administration systems for future economic sustainability. As Albert Einstein said, "We can't solve problems by using the same kind of thinking we used when we created them" (Hardcastle et al, 2011).

Nature can deliver the best architecture having evolved over 3.8 billion years of what can effectively be called trial-and-error or *research*. The potential benefits of using nature as a design tool, or biomimicry, are increasingly recognised in many scientific endeavours that choose to base innovations on principles that are learned from nature (Benyus, 2002; Bonser, 2006; Nakrani, and Tovey, 2007).

Benyus (2002) argues that "*doing it nature's way*" has the potential to change many of our current societal processes, including how we store information. In this context, Davenport (1997) discusses the concept of information ecologies. He argues that better technology does not always lead to a better information environment. Instead, an information ecology views an information space as an ecosystem, putting "*how people create, distribute, understand and use information at its centre*". Additionally Nardi and O'Day (1999) state that in an information ecology the different parts of the system exhibit strong interrelationships and dependencies. These co-evolve and diversity is encouraged, however local differences must be understood. Lueg (2007) looked at the concept of information ecologies for information dissemination and sharing activities; and found that communication plays a central role in geographically distributed information ecologies.

Land administration systems in many countries exhibit the features of geographically distributed information ecologies. Improving these systems is best achieved through studying the various interactions and interdependencies within the system, to understand how land information is created, distributed and used. Additionally, national initiatives in any country with decentralised land administration systems must accommodate local differences.

Braungart and McDonough (2009) advocate a shift of view on how we design and make real work systems. They propose a shift from environmental ethics to the basic question of quality, in order to optimise the right materials and resources that go into the design of a product or system. Within the context of this research, public land administration agencies can be considered the most authoritative source of land information in many countries with established, formal land markets. As such, they are high quality components of a countries land administration infrastructure. Improving this infrastructure, to allow for better access to

authoritative land information for economic management at a central level, requires improved communication in the form of inter-governmental information flows.

Past approaches to improving land administration systems have often adopted a mechanistic method, focusing on definitions, hierarchies and internal controls. Studying land administration systems as information ecologies allows the shift in view to an organic infrastructure, which relies on self-regulation and a network of communication (Burns and Stalker, 1994). Forms and patterns can be identified within the organic infrastructure with a focus on tailoring information processes, rather than instructions and ontologies to enable the infrastructure to better adapt to changing needs.

Literature shows economists initiating ideas within the sustainable development space and land administration being acknowledged as integral to sustainable development. Literature also shows that a large part of macroeconomics is about land. However these theories fall short of adequately understanding the overlap between the three disciplines that underpin this research. There is clearly a missing link. The following section discusses the consequences of this missing link with examples from a country that has decentralised land administration.

3.4   The Missing Link Between the Disciplines
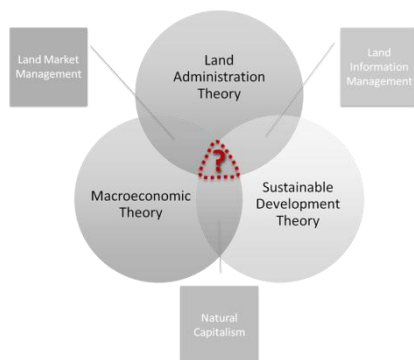
Rodríguez-Pose and Gill (2003) state that decentralisation of responsibilities and resources can undermine a central governments' traditional role of maintaining a balanced economy. However, in China, a centralised system has proved ineffective as private ownership of land-use rights has begun to emerge (Zhang and Pearlman, 2009). For effective management of a national economy in any country with a tiered government structure, the relationship between governments needs to be understood, particularly in the context of land rights, their management and administration.

Literature shows that land administration information, particularly market transaction information, supports sustainable development and macroeconomic management. Additionally, the overlap between economic and sustainable development literature supports an increased focus on the environment; and a change in priorities in the design of real world

system to better value natural capital. The focus of this research is on the overlap between these three debates, which is currently missing in literature.

A consequence of this missing link is that the land or property markets in many countries with decentralised land administration functions are impeded by information asymmetries (Garmaise and Moskowitz, 2004). The example from India presented in the previous chapter shows the problems that can arise with decentralised land administration systems. Both Australia and the United States also face issues resulting from the central government in each country having no constitutional authority over land administration.

Market-supporting institutions are required to ensure that property rights are respected, that people can be trusted to live up to their agreements, that externalities are held in check, that competition is promoted, and that information flows smoothly (McMillan, 2003). Of this, information flowing up to the central government is essential in the management of national wealth. However, there is often a lack of understanding at higher levels of government about the role that authoritative state, provincial or local-based land administration information should play in macroeconomic policy making for sustainable development of a county's land markets. This is further illustrated by two examples in the following section.

Examples of the missing link

The short comings of economic, land administration and sustainability theory in supporting the link between these disciplines is clear. The following examples, conceptualised from existing literature, further illustrate this missing link, by looking at two macroeconomic process, taxation and interest rates, in the context of property markets in Australia. Of the four functions of land administration, the examples focus on tenure and value that directly underpin the efficient and sustainable operation of land markets. Additionally, the property object approach, introduced by Bennett et al (2008), is used to distinguish each tax or complex commodity derived from a land parcel as a separate attribute of the land.

Example: Monetary policy – interest rates in Australia

Monetary policy decisions by the Reserve Bank of Australia (RBA) are expressed in terms of a target for the cash rate, which is the benchmark overnight rate for bank lending. Kohler and Rossiter (2005) found that an important consideration for property ownership is the ability to make financial commitments towards purchasing property and to meet any repayment obligations if a loan is taken out to purchase the property. Since the interest rates set by banks generally follow the official RBA cash rate (RBA, 2010), changes to the cash rate affect affordability and hence investment in the

property market. This consequently impacts on supply and demand within the market economy. Official interest rates, set by the RBA, depend upon how the economy is functioning at a certain time. This requires timely and accurate information about transaction in the land market. The situation in Australia with regard to the access to authoritative land market information by the RBA is illustrated by Figure 3.2.
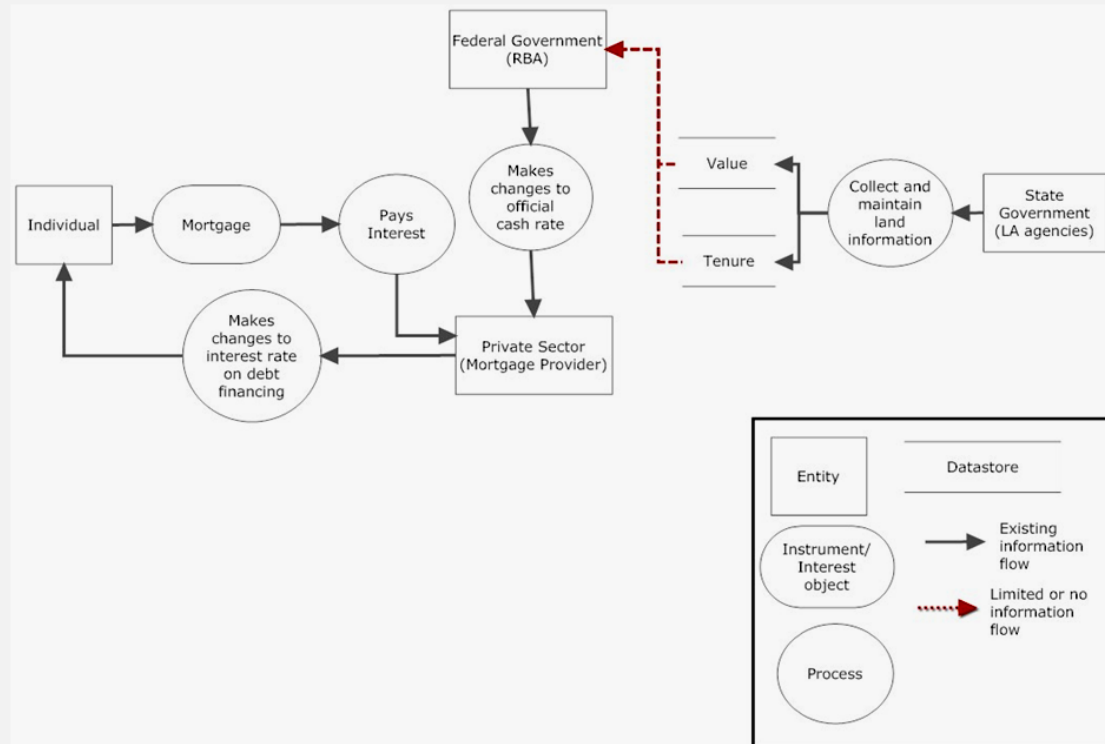
Figure 3.2: The relationship between tenure, value and interest in Australia, conceptualised from existing literature. Land administration is abbreviated to LA.

Currently in Australia, though market information is eventually available at central government level, it is held in separate state databases, with lack of a central database of property and prices (West, 2010). As the RBA points out, "*data timeliness' is a major problem with access to housing price data*" (RBA, 2004; 2005). The flow of authoritative land information from state governments to macroeconomic policy decision makers is impeded. The key issue is the time it takes for collected information to reach federal level. Due to insufficient and untimely information flows and poor data integration at a national level, the RBA collects sale and transaction data from the private sector. This alternative private sector solution provides more timely data, however, the information is not assured and collection techniques limit the overarching accuracy. The result is macroeconomic policy decisions are made using less than optimal datasets, and ultimately result in monetary policies being potentially out of kilter with the economic reality.

Example: Fiscal policy – land taxation in Australia

The setting of tax rates form part of a country's fiscal policy that manage national wealth. Higher transaction taxes may cause otherwise affordable transactions to become unaffordable. Similarly, higher taxing on the holding of property increases the cost of ownership and consequently increases the incentive to sell. These taxes in turn affect supply and demand in the market place.

In Australia, property is taxed at different levels of government (For the purposes of this example, local government charges for services or rates are treated as taxes on property). Figure 3.3 shows five tax objects levied by the various governments in Australia.
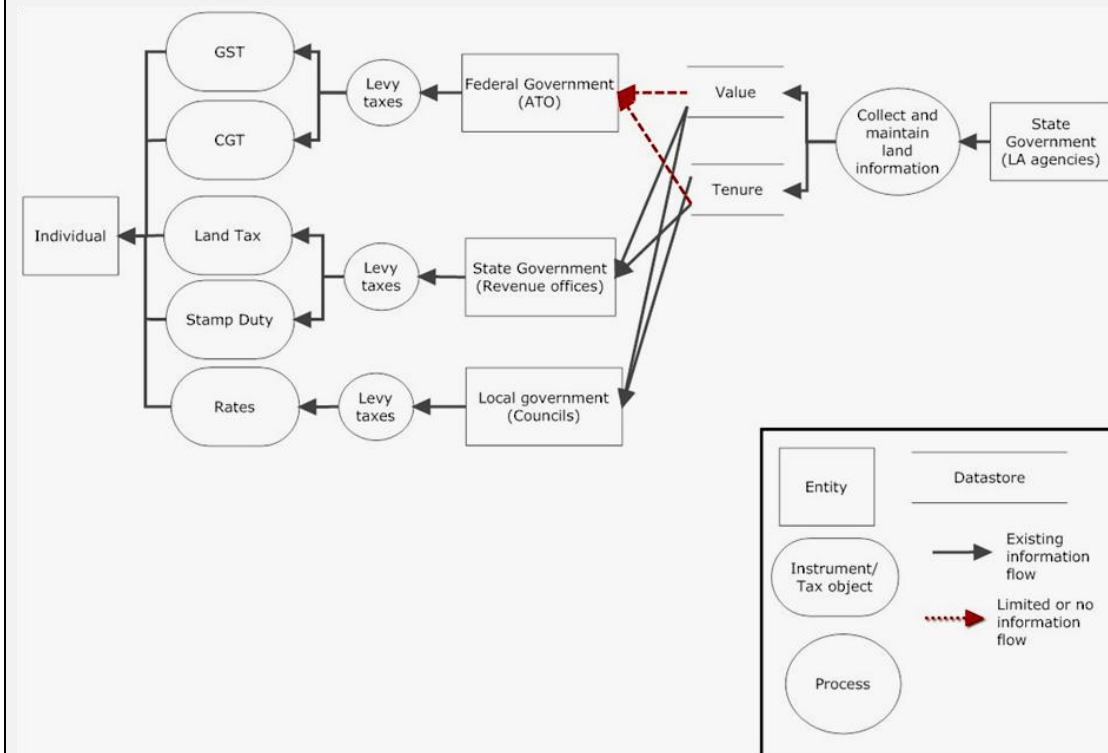
Figure 3.3: The relationship between tenure, value and taxation in Australia's land market, conceptualised from existing literature. Land administration is abbreviated to LA.

In Australia, though publically sourced information about property ownership and value is available to the state taxation offices and local councils, it is generally maintained in separate databases by independent levying authorities. Duplication is evident. Additionally, as the dotted line in Figure 3.3 shows, the Australian Taxation Office (ATO) has limited or, in some cases, no access to the authoritative data stores of tenure and value information. It relies on information declared in tax returns and on data purchased from the private sector in order to collect Capital Gains Tax (CGT) and Goods and Services Tax (GST) on real property. This brings the reliability and accuracy of this information into question.

Both examples clearly show the presence of an information asymmetry. This relates to the gap between information available within land administration agencies and what is actually shared with central macroeconomic policy makers. Milgrom and Stokey (1982), Clapp et al (1995), Dolde and Tirtiroglu (1997), and Garmaise and Moskowitz (2004) all studied different problems associated with information asymmetries within property markets. However, much of this literature deals with horizontal information asymmetries between agents, brokers, buyers and sellers, or between neighbourhoods or over time. Clarkson et al (2007) also looked at vertical information asymmetry and the benefits of information sharing between tribal and other forms of government, in the context of underdevelopment and

inequality in capital markets and law enforcement. However literature does not adequately account for the problems associated with information asymmetries between different levels of government in the context of sustainable macroeconomic management and development of land and resource markets.

What policy makers need is national information about market transactions and taxable objects related to land in order to meet broad policy needs. These include assessing tax revenue capacities and meeting economic productivity challenges. Information on transactions in new land resource markets is also needed to meet sustainable development priorities. This includes land tenure information, particularly ownership of properties and land-related commodities being transacted, and the value of the interest or taxable transaction.

3.5   Chapter Summary

Economic literature recognises the importance of property rights to wealth creation. Defining property rights and the collection and dissemination of authoritative land market information are core functions of land administration. However the importance of land administration information to macroeconomic management is not adequately exemplified in current literature. This is particularly problematic in countries where land administration functions are decentralised. In these countries land market information is generally collected and maintained by state, provincial or local governments while macroeconomic policies are made at central government level. The large central policy departments and agencies need access to national land market information in order to meet broad policy objectives such as assessing tax revenue capacities and meeting economic productivity challenges.

New transactions in land resource like carbon and water create new taxable transactions and changes to the availability and supply of money in the economy. Sustainable development initiatives need tenure and value information for transactions in these new markets. This information is often held in separate jurisdictional databases in many countries.

Some economists advocate new approaches for studying and designing real world systems for improved sustainability. These approaches include studying real world systems as information ecologies and designing new systems that mimic sustainable natural processes. This research will apply these concepts to help achieve synthesis between the land administration information and macroeconomic management for the sustainable development of land and resource markets.

CHAPTER 4:
METHODOLOGY
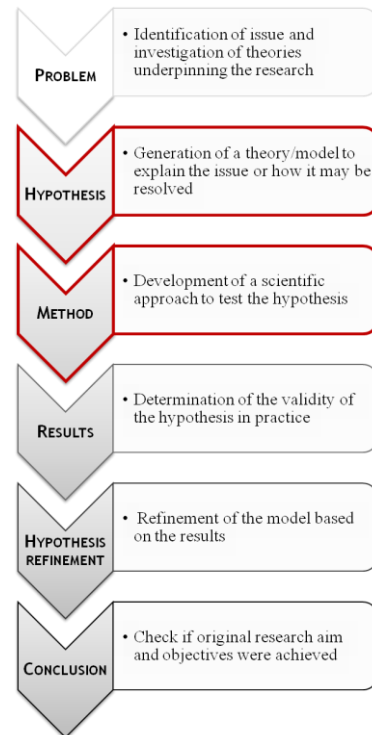
- *The following chapter presents the research hypothesis, the overall research approach and the methodology that will be used to test the hypothesis. The methodology selected is justified and its limitations are acknowledged.*

4.1   Research Questions

Literature shows the importance of land administration to sustainable development and wealth creation; and the importance of managing land and its resources holistically. However it does not adequately demonstrate the value of a synthesis between macroeconomic policy making and land administration information. This is particularly the case in countries where land administration is decentralised and constitutional responsibilities over land information and macroeconomic policy making are divided.

The following research questions have been articulated to help formulate a hypothesis and guide the research to follow:

1.   (i) What are the current theoretical linkages between land administration information, macroeconomic policies and sustainable development?

(ii) What is the ideal relationship between land administration information and macroeconomic management?

2.   (i) What is a valid design methodology for building integrated land administration information and macroeconomic processes?

(ii) How can existing real-world relationships between land administration information and macroeconomic management be examined?

3.   What tools or principles can be designed to change the existing situation into the ideal situation with respect to a functional synthesis between land administration information and macroeconomic management?

Chapters 2 and 3 examine Questions 1(i) and 2(i) listed above. This chapter used the outcomes of the literature review conducted in these previous two chapters, to help answer Questions 1(ii) and 2(ii) of this research. It articulates a simplified, idealised model that links sustainable development, macroeconomics and land administration processes, using the principles of natural capitalism. The model forms part of the hypothesis underpinning this research. A scientific methodology to test the hypothesis by modelling real-world relationships is then outlined. Chapters 5, 6, 7 and 8 aim to test and refine the hypothesis by mapping real-world information flows and answering Question 3.

4.2   Generating a hypothesis

Williamson et al (2005) state that in a country like Australia, a national infrastructure must be a hierarchy of layers, providing inter-jurisdictional and intra-jurisdictional links between people and data. They emphasize the importance of land administration to such an infrastructure, particularly in its role in administering secure property rights in support of efficient land markets. The land registries are central to this function. Bennett et al (2011) advocate the importance of land registries to land markets and the economy, stating that "*land registries will be essential multipurpose infrastructures for the decades ahead*."

The examples in the previous chapter show the missing link between authoritative land registry information and elements of monetary and fiscal policies in Australia. The situation in many other market economies such as the United States and India is similar and potentially worse given the size and complexity of their respective government structures. Where fiscal and monetary policies are used to manage a county's wealth, policy makers need authoritative market information to judge the state of the nation's economy and make evidence-based policy decisions.

The need for Evidence-based Policy (EBP) is gaining a strong hold in many countries around the world. "*The primary goal is to improve the reliability of advice concerning the efficiency and effectiveness of policy settings and possible alternatives*" (Head, 2009). Good data or 'high-quality information bases' is one key component of this (Head, 2009). To achieve this within a land market context requires links between the institutions that manage national wealth and those that support land market transactions to be established. A new model is required to show the land information needs of macroeconomic policy makers, and initiate a paradigm shift regarding the organic nature of decentralised land administration systems. These systems operate like geographically distributed information ecologies, where a network of communication processes that share information can optimise their role in national economic policy and sustainable development.

The Property Market Tree

The Property Market Tree is a conceptual model derived from theory, to show the idealised relationship between land administration and macroeconomic policy making for sustainable development. Land administration, macroeconomic and sustainable development theories underpin this ideal model: Figure 4.1. It uses the principles of natural capitalism, particularly biomimicry.
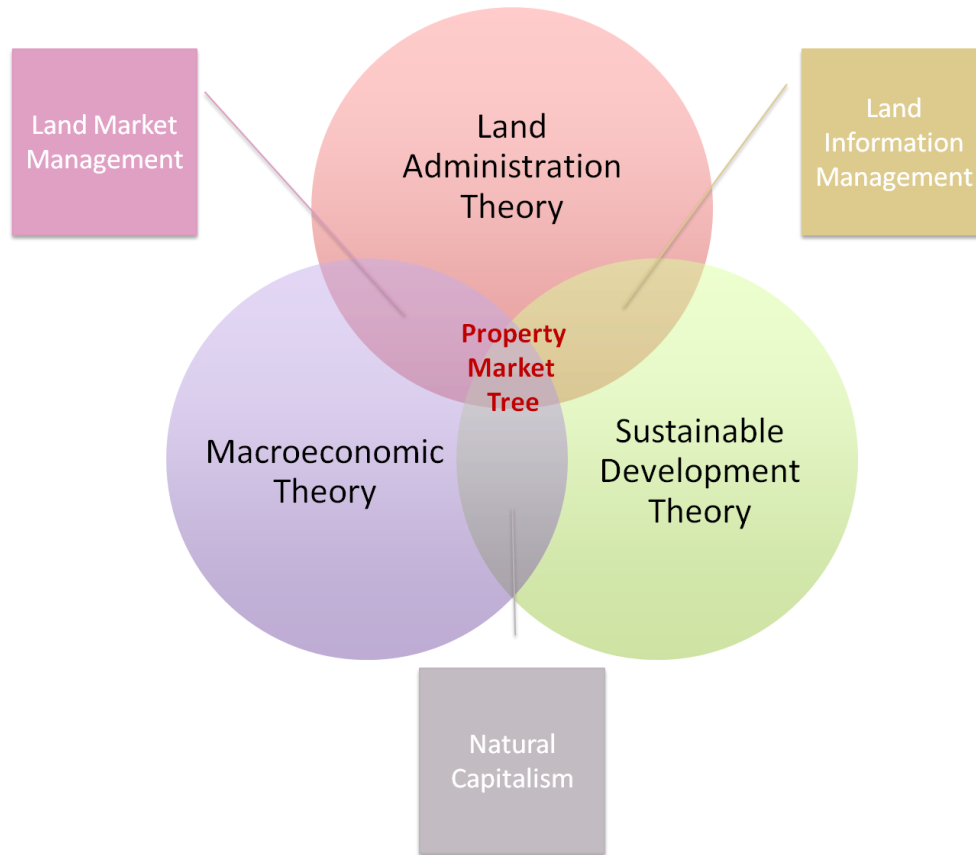
Figure 4.1: Theories underpinning the Property Market Tree

Illustrated in Figure 4.2, the property market tree proposes better links between macroeconomic functions and land administration processes, for better informed government and sustainable management of land markets. It uses nature as a model and emulates cycles that occur naturally. In this case, the property market tree advocates a flow of information or information cycle from the creators to the users of land market information, just as the principles of natural capitalism encourage alignment of the interests of providers and customers (Lovins et al, 1999). A feedback loop is encouraged imitating closed-loop natural systems. Sustainability is inherent in the model. It illustrates the need for adequate information flows between the government land administration and policy institutions in order to sustain a healthy land market. This encompasses both real property and emerging land resource markets, termed *layered property market* for the purposes of this research.
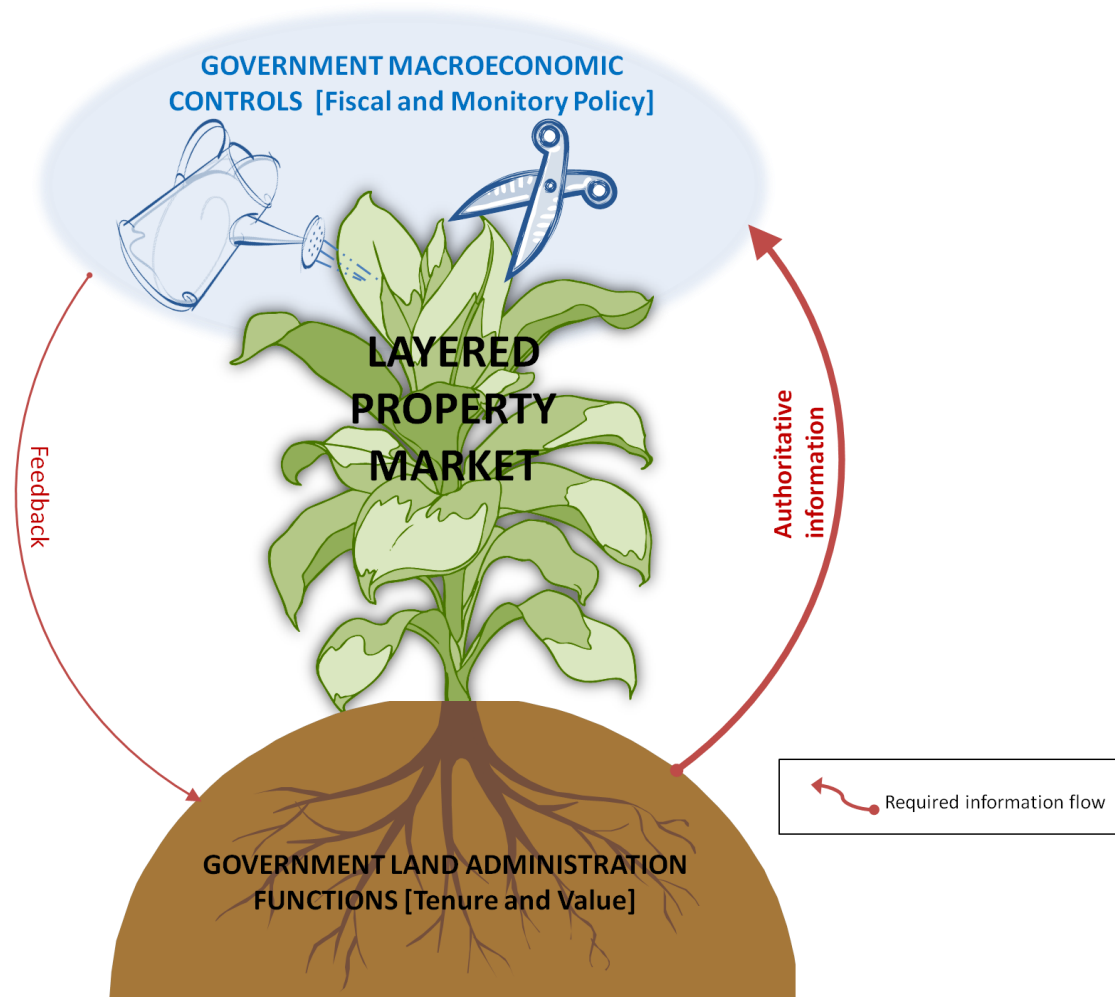
Figure 4.2: The Property Market Tree

A tree is used to emphasise the idea of sustainability and land administration infrastructures as ecologies. A sustainable, healthy market can be growing or retracting, as circumstances suit. Traditionally strategies have favoured local, regional and national authorities administering data development, acquisition and storage independently (Morgan, 1985). These silo approaches resulted in unsustainable, redundant, inflexible and occasionally counterproductive processes that were deemed myopic (Morgan, 1985). Government land administration agencies tend to work more or less independently within their fields of responsibility, and information production is often specific for limited sectors. Coordination and integration require continuous, constructive action.

Emerging practical approaches support the concept proposed by the Property Market Tree. In Europe the Infrastructure for Spatial Information in the European Community (INSPIRE) Directive has led to the development of legally established 'key registers' of addresses and

buildings in Netherlands (VROM, 2007). The registers contain authoritative information from municipal registries and are made available centrally through a national system managed by the Dutch Land Registry Office. The use of these is mandatory for all public agencies in the Netherlands. The concept of key registers stemmed from the goal that government must have access to reliable, high quality digital information (VROM, 2007). Regarding geo-information, the planned basic registers include buildings, addresses, parcels and maps (Besemer et al, 2006).

Sedunary (1984), in his nodal approach to land database configuration, showed the need for high levels of communication between the primary nodes of legal/fiscal and geographic or land information. He stated that the legal or fiscal node should integrate databases with functions relating primarily to property description, title registration, valuation and land tax. Additionally the popular and well-known concept of the multi-purpose cadastre to integrate land related data from individual land administration sectors was explained in the early 1980's (NRC 1980; Kaufmann and Steudler, 1998).

Cox (1983) showed how ill-informed policy decisions to manage the property market in Britain in the early 70's lead to adverse consequences for the country's economy. More recently, Roberge and Kjellson (2009) showed how the absence of a reliable property rights infrastructure in the United States contributed to the collapse of its land market. Buhler and Cowen (2010) also supported the view that following the mortgage crisis, the federal government in the United States should take a more active role in supporting a national cadastre.

Like the United States, in Australia too land administration datasets cater primarily for internal information needs within individual agencies, and co-ordination at a national level is very limited. Here the proposed property market tree aligns well with Australia's National Government Information Sharing Strategy (AGIMO, 2009) which promotes information sharing between government agencies in Australia. The strategy envisions that "*timely, reliable, and appropriate information sharing is the foundation for good government and has the capacity to deliver a better way of life for all Australians*". Benefits to government agencies such as improved capacity for evidence-based policy and decision making and greater confidence in data quality and accessibility, are expected to ensue from agencies sharing information with each other (AGIMO, 2009).

Information sharing, propagation or dissemination can be better illustrated by adding an information lifecycle approach to the property market tree. This further emulates the theories of natural capitalism and is discussed in the following section.

A lifecycle approach

Land is an integral component of national wealth. Government policies formulated to manage national wealth should be based on authoritative information, a key component of which is information about transactions in land and its resources. A better recognition of the role of land administration information in macroeconomic policy making is needed, in order to maintain a sustainable land and resource market. This includes a nation-wide approach to land information access and delivery at higher levels of government. A land market information flow *lifecycle* can help to achieve this goal.

Figure 4.3 shows the proposed land market information flow lifecycle model, based on the property market tree, which will be used as the overall conceptual model for this research. It represents the ideal situation or outcome. The information flow lifecycle has been adapted from Sharma (2011)'s five phases of the lifecycle continuum of business records. This model was adopted for a number of reasons. Firstly, it originated from the management of business records, which translates well to property market information and the management of land records. Secondly it presents a clear chronological structure with clearly defined phases. Information technology and business management jargon is minimised.

Figure 4.3 continues to build on the principles of biomimicry that motivate this research. Cycles of flow evident in nature are mimicked here and further broken down in this context into five stages of the life of land market information:

1. *Collect* refers to the entities and processes involved in registering a transfer of ownership.
2. *Store and Maintain* includes the entities, databases and processes currently involved in the storage and maintenance of land transaction and historic sales information.
3. *Share* refers to the entities and inter-governmental process and services that dissimilate information.
4. Land information requirements of central government policy makers relate to the *Use* stage of the information flow lifecycle.
5. The *Dispose or Archive* stage of the information flow lifecycle may be not be needed in the face of technological advancements in web based access systems and cloud

computing. This however, requires further evaluation and is beyond the scope of this research.
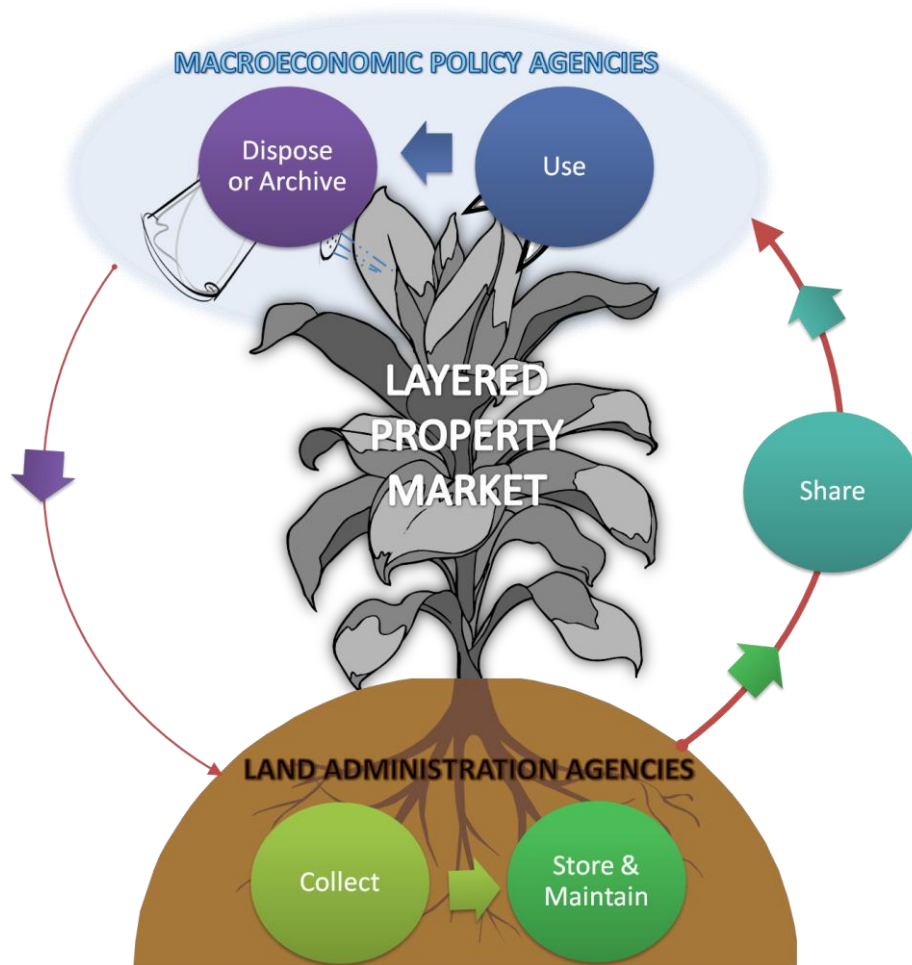
Figure 4.3: A land market information flow lifecycle: the overall conceptual model for this research.

The conceptual model above is proposed as the ideal situation for achieving synthesis between land administration information and macroeconomic policies to sustainably manage property and land resource markets. The research that follows aims to test this model in practice by application to a number of case studies. The case studies help to understand, in detail, the current situation and identify areas or stages within the lifecycle where refinement is needed. The case studies also work to test the validity of the model and judge whether this representation of an ideal outcome is realistic or needs to be altered.

4.3   Research Hypothesis

The property market tree is a theoretical model that links the disciplines of land administration, macroeconomic policy and sustainable development. Together with the information flow lifecycle, it proposes dynamic flows of high quality tenure and value information between the government collectors and users of this information. Based on this, the following research hypothesis was developed.

A dynamic land market information flow lifecycle, based on the property market tree, is required for appropriate macroeconomic policy making.

Where:

- *Dynamic* implies active or functional for effective action.
- *Land markets* represent activities in exchange of interests in land for a price and their consequences. For the purposes of this research, only the buying and selling of freehold interests in real property and marketable land resources (carbon and water) is considered.
- *Information lifecycle* is introduced in Chapter 2 and defined earlier in this chapter.
- *Property market tree* is defined in earlier in this chapter.
- *Land or property market information* is information about the tenure, value, use and development of land and its resources. The core land information components required for the efficient operation of a land market are land tenure and land value.

4.4   Research Approach, Methodology and Outcome

Approach: engineering design

This project follows the overall approach of *design* research, according to Simon (1996)'s definition of design as developing "courses of action aimed at changing existing situations into preferred ones." Hevner and Chatterjee (2010) further explain design as *"instructions based on knowledge"*, a central element of the engineering discipline. Çağdaş and Stubkjær (2009) demonstrated the use of design research within the land administration discipline, particularly research which addresses information systems. Within the engineering discipline, research *for* design or research-based design, has a long tradition (Simonsen et al, 2010) and e*ngineering design* in particular involves generating knowledge systematically (Dym and

Little, 2000). As Figure 4.4 shows, systematic knowledge generation requires the design process to follow a valid methodology to achieve the design aims of not only producing understanding, but also improving the design. The design aims are (Blessing and Chakrabarti, 2009):

(1) A model or theory of the existing situation

(2) A vision (model or theory) of the desired situation

(3) A vision of the support that is likely to change the existing situation into the desired situation, and maintain the changes.
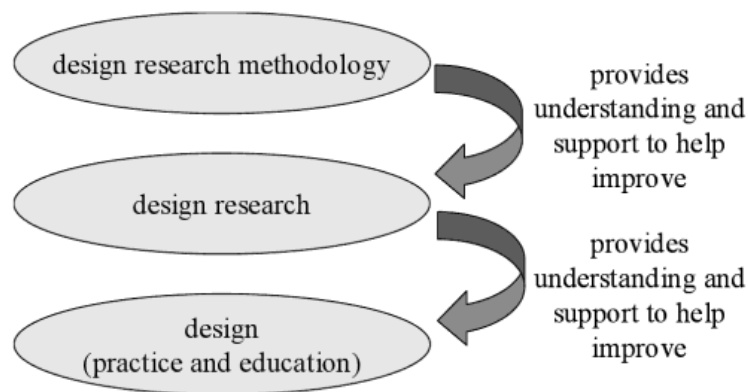
Figure 4.4: The relationship between design, design research and design research methodology (Blessing and Chakrabarti, 2009)

Methodology: triangulation using qualitative case studies

- Design aim (1) represents the data collection or requirements gathering phase of the research.

- The desired situation, design aim (2), is represented by the land market information flow lifecycle, which forms part of the hypothesis of this research.

- To test the hypothesis and arrive at a new 'vision of support', design aim (3), the project uses a *triangulation* (c.f. Golafshani, 2003) methodology to ensure reliability and validity in the research process.

Triangulation involves arriving at a new model or theory based on two independent starting points, or separate perceptions about a single reality (Healy and Perry, 2000). It assists in validating results through cross verification from two or more sources. By combining multiple theories and perspectives the research can overcome the weakness, intrinsic biases or problems that may otherwise arise (Bogdan and Biklen, 2007).

This research uses qualitative methods, achieving reliability and validity through triangulation from two different perspectives within the layered property market: existing real property markets and new land resource markets. Barbour (1998) advocates the use of triangulation in qualitative research stating, "*...in using triangulation of several data sources in quantitative research, any exception may lead to a disconfirmation of the hypothesis where exceptions in qualitative research are dealt to modify the theories and are fruitful.*" Hence, via this approach, the project hypothesis can not only be tested, but can also be refined to produce a better theory or model allowing the overall design aim to be achieved.

Unlike quantitative methods, qualitative research uses a non-statistical approach to understand phenomena in "real world setting [where] the researcher does not attempt to manipulate the phenomenon of interest" (Patton, 2002). No means of quantification are used. Instead qualitative methods seek explanations, understanding, and extrapolation to similar situations (Hoepfl, 1997). Reliability in qualitative methods comes from the quality of the research, which is its ability to generate understanding (Stenbacka, 2001). Validity in the qualitative methods adopted will derive from research thoroughness, rigor and trustworthiness (Davies and Dodd, 2002; Lincoln and Guba, 1985; Seale, 1999; Stenbacka, 2001).

Within the framework of qualitative approaches, this research uses case studies to better understand relationships, information flows and data sharing between organisations. A study by Çağdaş and Stubkjær (2009) looked at the research methodologies employed by ten doctoral dissertations within the land administration discipline; and found case study research to be one of the most common qualitative research methods used. The case study approach is advocated by Yin (1993) as the method of choice when the phenomenon under study is not readily distinguishable from its context. This can be the case with advanced technologies and inter-organisational partnerships. Additionally, Benbasat et al (1987) and Maxwell (1996) support the use of case studies to examine data sharing partnerships in their natural settings, enabling opportunities to learn from current approaches and practices.

In this research, land administration systems are examined as geographically distributed information ecologies. Inter-dependencies and data sharing partnerships within these systems are examined in their natural settings, so that relationship and local differences can be better understood. This is done by mapping the flow of land market information between the fundamental entities in the system, that is, government land administration and

macroeconomic policy agencies. The following section explores the concept of mapping information flows and identifies the most appropriate documentation technique for land information flows within a land information ecology.

Mapping information flows

Davenpont (1997) stated the behaviour of information as a key attribute of information ecologies. Other attributes defined were the integration of diverse types of information, recognition of evolutionary change, emphasis on observation; and a focus on people. To study land administration systems as information ecologies in the context of the land market information flow lifecycle, requires an observation of the existing behaviour of land information, to enable evolutionary change towards better integration with macroeconomic processes.

Other research projects have attempted to achieve similar understanding of information systems. In 1992, the European public administration and informatization comparative research project (Frissen et al, 1992) looked at national government policies and the success and failure of large scale information systems in the context of public administration in nine European countries. The focus was not only on information technology, but also on the procedures for processing, storage and transfer of information; and the information and communication infrastructure for inter-governmental information exchange. In most cases the actual information infrastructure was described in a policy sector, within the administration of water pollution and water quality. Additionally, the studies looked at how the existing information flows between agencies need to be improved for better government performances and decision making.

Zevenbergen (1992) modelled the processes for changes of ownership and property formation within the real property markets of a number of European countries, using the Unified Modelling Language (UML). UML is often used in the analysis and design of information systems, particularly to show behaviour or activities within a system. Tuladhar (2002) advocated the benefits of using UML for visualising cadastral systems. The Land Administration Domain Model (LADM) uses UML (Lemmen, 2012) and many land administration project have used this modelling technique (Tuladhar et al, 2005; Augustinus et al, 2006; Hespanha et al, 2008; Inan et al, 2010). Other modelling techniques have also been used to understand relationships and document information systems. Chen (1976) proposed the ER model for database design, based on relation and set theory, to represent the

semantics of data. Other documentation approaches include entity relationship diagrams, system flowcharts, program flowcharts and record layout diagrams (Hall, 2012).

While all the above are beneficial for documenting internal databases, semantics, use cases, activities or logic within a system, an information ecology is characterised by complexity, ambiguity and nonlinearity (Baker and Bowker, 2007). Additionally, as Choo (1998) points out, *"an ecology is marked by the presence of a certain keystone species whose presence is crucial to the survival of the ecology itself."* Within the land administration context, the authoritative government land administration agencies are crucial to the operation of the system and the formal land markets they support. Understanding the behaviour of information within these systems requires an in-depth observation of the flow of information into and out of these fundamental entities. Data Flow Diagrams (DFD)s provide the most appropriate documentation solution here.

DFD, introduced in by Gane and Sarson (1979), allow for interrelated information flows and broad functional processes to be mapped using a simple, non-technical visual representation (Pendse, 2008). They focus on the process aspects of information systems and can be used to show the direction of information flow (Bruza and van der Weide, 1989). DFDs commonly use only three symbols to show entities, processes and data stores in a system. Arrows between these symbols or nodes signify a flow of information. As Austin and Baldwin (1996) describe, DFDs examine systems from a data or information view point and allow analysis of information flows without the need to model individual design tasks. This makes DFDs an appropriate tool to model land administration ecologies in the context of the land market information flow lifecycle. Additionally, Turetken and Schuff (2007) advocate DFDs as a classic tool for analysing processes, particularly for 'fisheye views' of systems. Their hierarchical structure allows system details to be modelled with different degrees of interest.

In this research, DFDs are used to map the cross-governmental flow of market transaction information within geographically distributed land administration ecologies and macroeconomic processes. This research is the first of its kind to apply these principles of natural capitalism and systems analysis to the design of sustainable land administration systems for macroeconomic management.

Key entities within the information ecologies examined in this research include government land administration agencies, government macroeconomic policy makers and the non-governmental entities involved in market transactions (buyers, sellers, financial institutions,

tax payers). Market information flowing between these entities for the purposes of taxation and setting interest rates, and interrelated land administration processes, are mapped within existing land markets in a country with decentralised land administration. The case studies assess the current situation and test the validity of the proposed hypothesis to evaluate whether this representation of an ideal outcome is realistic or requires improvement. Additionally, results of the case studies enable the proposed land market information flow lifecycle to be refined into an operational or functional outcome.

Overall research outcome

Designing and establishing land administration systems is a complex endeavour (Williamson et al 2010). According to Wallace et al (2010), a workable national system requires the development of eight design elements:

1. a shared vision
2. a common language or ontology
3. a governance framework
4. a business case for change
5. selection of a data model
6. an accompanying technical infrastructure
7. an implementation or maintenance model
8. an international compatibility framework

Building a fully functional system to test is a substantial undertaking. This research endeavours to promote a shared vision via the property market tree and aims to design one aspect of this infrastructure: an implementation model. This will take the form of an empirical and functional land market information flow lifecycle that supports synthesis of land administration information and macroeconomic management.

4.5   Research Stages

The hypothesis will be tested, and the research objectives (see Chapter 1) of the project will be achieved through four major stages within the methodology: Figure 4.5.

Stages 1 and 2 test the hypothesis in the following areas:

- To evaluate if a land market information flow lifecycle is needed for macroeconomic policy making.
- To evaluate if each stage of the cycle is currently dynamic, that is, active or functional to effectively serve the needs of macroeconomic policy making.

Stage 3 refines the hypothesis based on the results of Stages 1 and 2.

Stage 4 shows an implementation of the refined hypothesis to test it as a functional outcome.
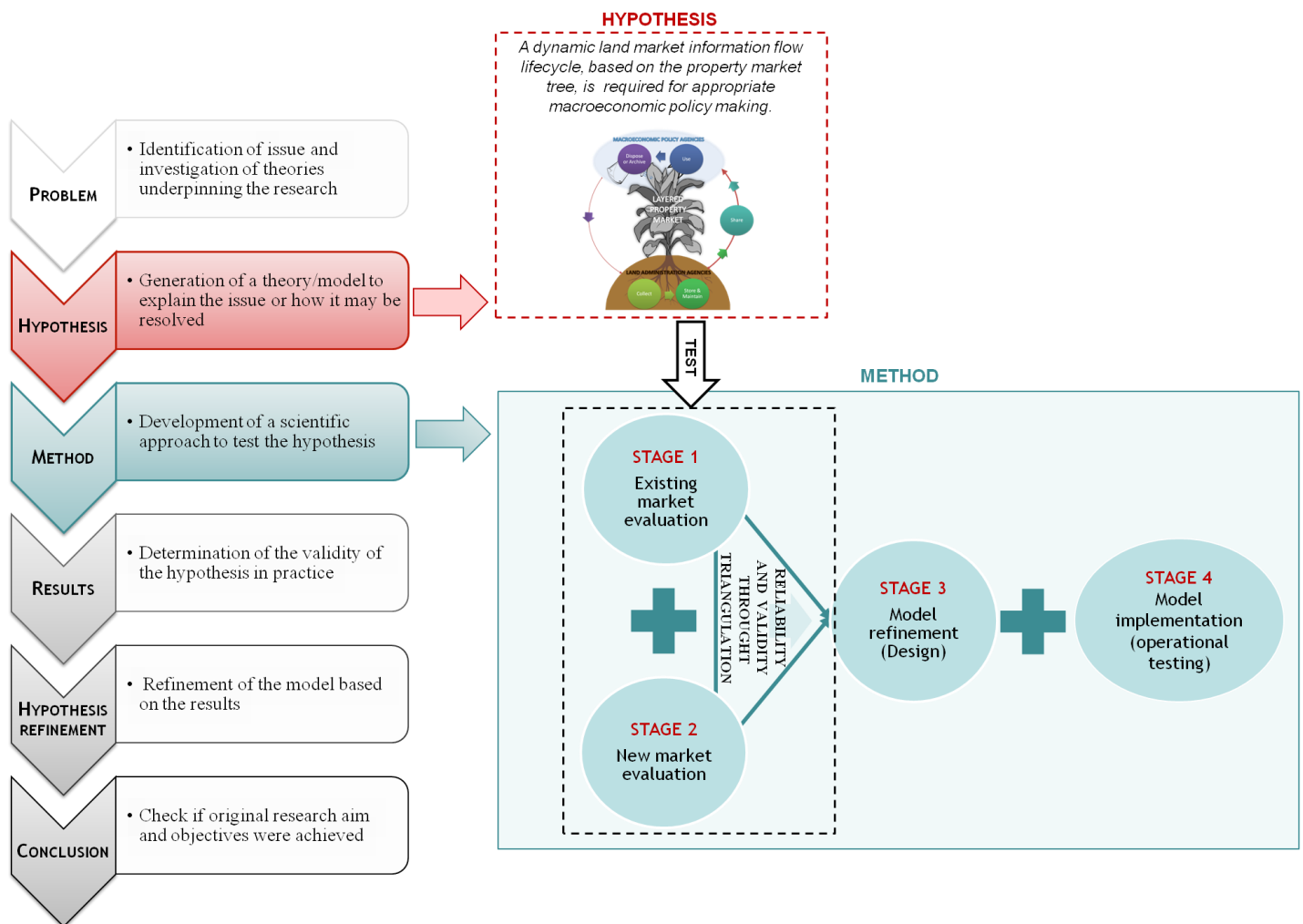
Figure 4.5: Outline of research stages

Details of each stage of the research are discussed below and illustrated in Figures 4.6 – 4.9.

Stage 1 (Figure 4.6): Existing market evaluation

Evaluating the land market information flow lifecycle model in this stage involves studying existing land administration systems as geographically distributed information ecologies, by examining the existing relationships and inter-dependencies within the systems. This includes an in-depth analysis of the current information flows between macroeconomic policy making and land administration practices, within state-based real property markets in a country with decentralised land administration. Three qualitative case studies are undertaken in Australia to examine the information flows between state land registries, valuation departments, state revenue offices and federal policy departments (Australian Taxation Office (ATO) and Reserve Bank of Australia (RBA)) in Victoria, New South Wales (NSW) and Western Australia (WA). These case studies are based on discussions during case study visits to state land agencies, personal correspondence, information gathering from published research, ATO and RBA white papers, annual reports and press releases; added to discussions with senior personnel from fiscal and monetary policy departments of ATO and RBA (see Appendix 2 for details of case study visits and discussions).

Australia was the chosen country for these case studies due to its tiered government structure, with all governments having distinct constitutional responsibilities. While other countries such as India and the United States also fit this requirement, Australia was local to the researcher and offered the easiest means of data collection, given time and resource constraints. The states of Victoria, New South Wales and Western Australia were selected due to their well established land markets, availability of published information for qualitative data collection and accessibility of their land administration agencies to the researcher. Further information about these states is provided in their respective case study sections.

This stage also involves consolidating a list of the different types of taxes on land in Australia, from current legislation and taxation manuals. This will clarify the central government taxes on land that require national market transaction information.
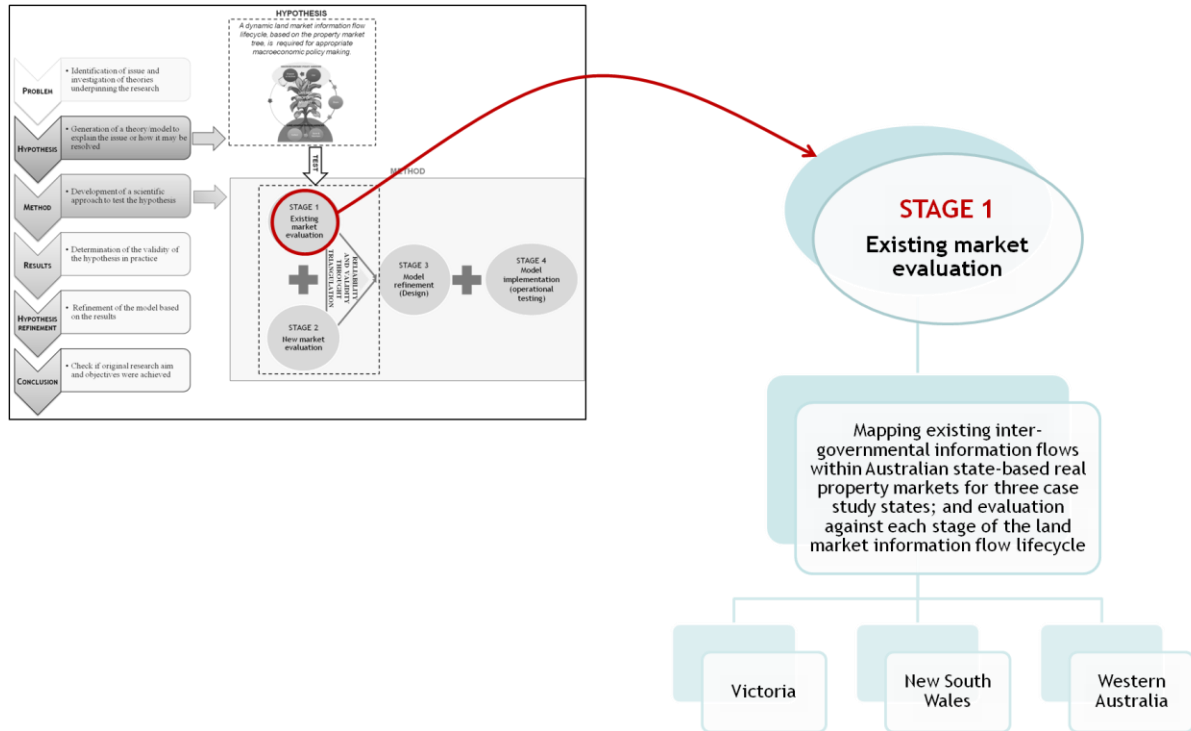
Figure 4.6: Stage 1 of research methodology

Stage 2 (Figure 4.7): New market evaluation

Evaluating the land market information flow lifecycle model against the existing situation within new land resource markets involves mapping the cross-governmental flow of market transaction information in two case studies – carbon and water trading. This is done for the same case study states as Stage 1: Victoria, NSW and WA. Data collection is based on personal correspondence, published research and government documents. Information asymmetries are identified and contribute to the development of a refined model in Stage 3. Carbon and water markets were selected for this stage as they are two emerging formal land resource markets in Australia. However NSW is the only state in Australia that has a formal carbon trading scheme.
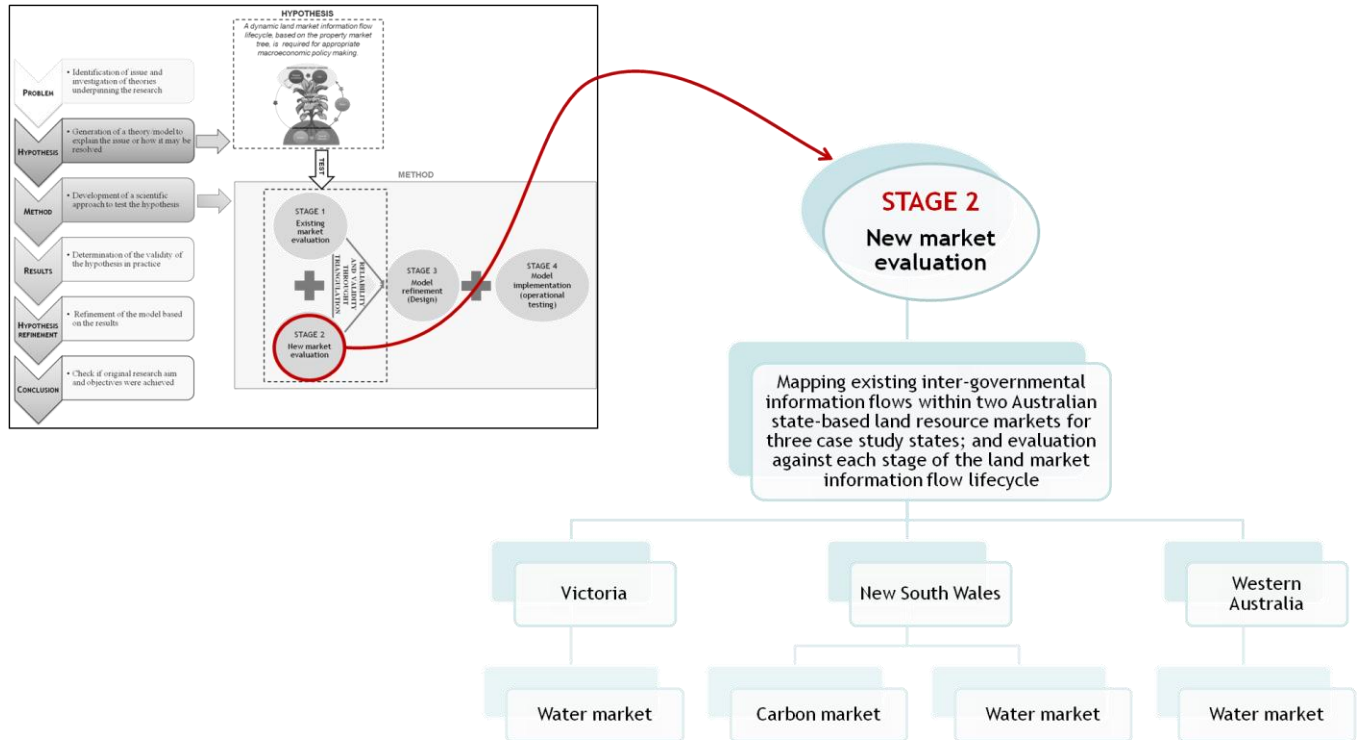
Figure 4.7: Stage 2 of research methodology

Stage 3 (Figure 4.8): Model refinement (design)

The results of the first two stages test the hypothesis to see (i) if each stage is currently dynamic; and (ii) to clarify the information requirements of macroeconomic policy decisions. This will be used to design a refined land market information flow lifecycle, with principles for each stage that will enable cross-governmental sharing of key land market tenure and value information. The principles are derived from the results of the case studies, and aim to make each stage of the lifecycle dynamic or functional, in order to effectively meet the needs of macroeconomic policy making. The principles will also draw on best practice in land administration recommended by

- The United Nations Economic Commission for Europe (UNECE)'s *Land Administration Guidelines* (UNECE, 1996)
- International Federation of Surveyors (FIG)'s *Cadastre 2014* (Kaufmann and Steudler, 1998)
- UN-FIG *Bathurst Declaration on Land Administration for Sustainable Development* (UN-FIG, 1999)

- The World Bank's *Land Administration Reform: Indicators of Success and Future Challenges* (Burns, 2007).

Various parts of these documents are used to support the recommendations in this stage. These documents were selected as they are well respected and widely accepted as best practice in establishing land administration systems. As Williamson et al (2010) describe, these documents represent key milestones in the evolution of the concept and disciple of land administration; and its influence on land policy and development aid projects. Williamson (2001) lists the UN-FIG Bathurst Declaration and World Bank's land policy documents as contributors "*to the evolving concept of land administration best practice.*" Additionally he acknowledges the UNECE's key role in broadening the focus of best practice from cadastral systems to land administration with their Land Administration Guidelines. FIG's Cadastre 2014 is also recognised as an important publication in land administration best practice that takes into account emerging digital technology (Williamson, 2000; 2001; 2010).

However no individual document examines the land information trail in the context of land administration for macroeconomic management and sustainable development of a country's land and resource markets. Together, the above documents add further rigour to the recommendations drawn from the case study results. Comparisons are also drawn to the European systems of key registers that aim to improve the cross-governmental availability and quality of spatial and administrative data (Ellenkamp and Maessen, 2011).
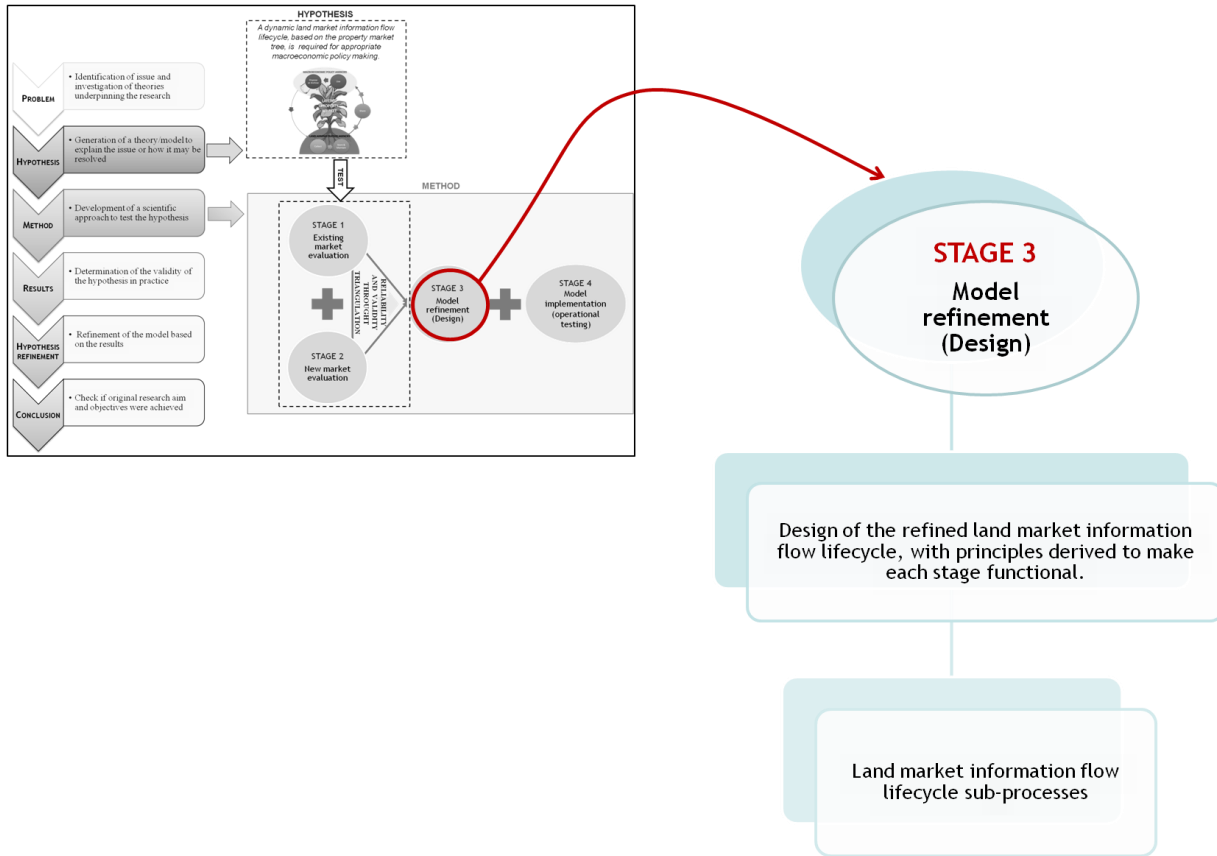
Figure 4.8: Stage 3 of research methodology

Stage 4 (Figure 4.9): Model implementation (operational testing)

The hypothesis refinement process includes testing the refined model as a functional outcome. This is done by:

a) Implementing the refined design on the case study states to show its operation.

b) Demonstrating how authoritative market transaction information, resulting from a dynamic or functional land market information flow lifecycle, can be used by organisations like the ATO and RBA to add spatial intelligence to macroeconomic decisions. An example of such spatial visualisation of transactions in land and resource markets is presented, as an added tool to aid fiscal and monetary decisions.
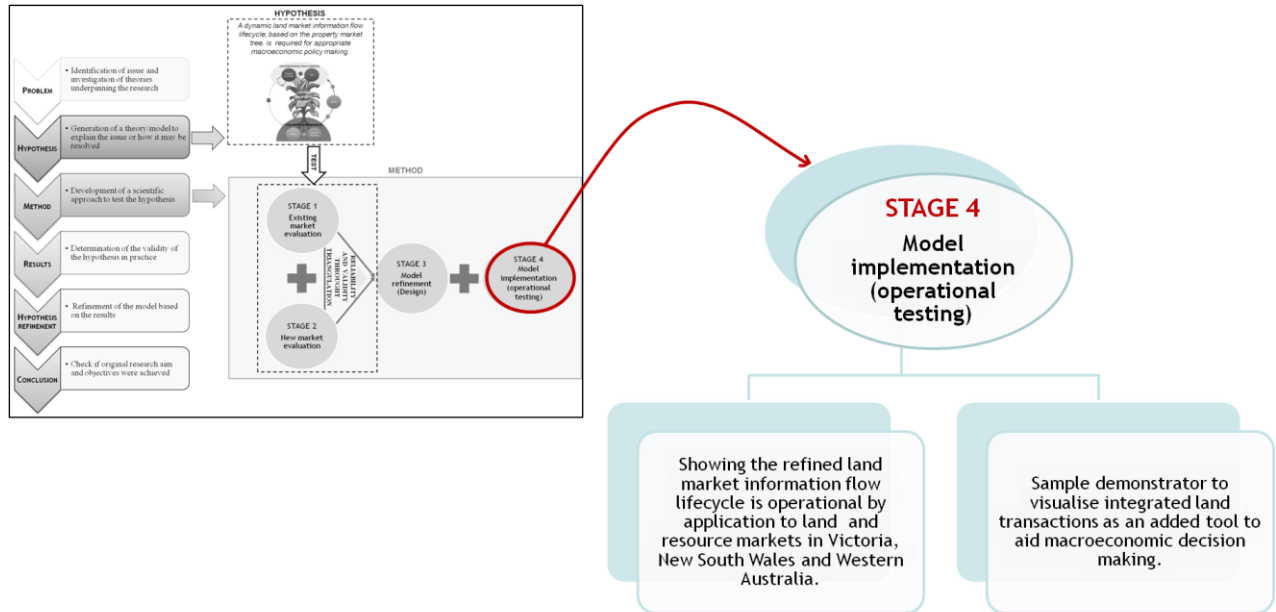
Figure 4.9: Stage 4 of research methodology

4.6 Limitations

Design research has its limitations. The aim of design is refinement. Much of this research takes place in a learning environment with multiple variables. To optimise the outcome the design requires detailed observations from multiple perspectives and significant data gathering. In this research, all case studies were conducted within Australia. This was primarily due to resource and time constraints. Though comparisons are drawn with other countries, such as the United States and India, a more thorough examination of their administrative systems would have enabled additional validation of the Australian case study results. Comparisons with other market economies where land administration functions are decentralised within different government structures would also have helped to support the outcome. For instance, a more detailed examination of cross-border initiatives within the European Union (EU) would have provided for a good comparison for results, since the EU shows many characterises similar to a federation of states but is not classified as a federation (Bednar et al, 1996; Fillippov et al, 2004; Keleman, 2007).

The case studies in stages 1 and 2 involve mapping inter-governmental information flows. These represent 'current' processes as of April 2011 and are often a simple representation of complex relationships. Simplification here does not imply incompleteness. The mapped

information flows are indicative of the fundamental patterns as connections between entities and hierarchal dependencies are maintained, with no influence on the precision and reliability of the outcomes.

4.7   Chapter Summary

The property market tree, developed from literature, conceptualises the ideal situation where macroeconomic policy making and land administration process are linked via information flows. This forms the basis of a proposed land market information flow lifecycle.

The design research that follows, will test the hypothesis that a dynamic land market information flow lifecycle, based on the property market tree, is required for appropriate macroeconomic policy making. The hypothesis will be tested and refined in four stages using a case study approach. Each case study involves examining decentralised land administration systems as geographically distributed information ecologies. Inter-governmental information flows are mapped using qualitative data. This helps to identify which stages of the lifecycle are currently not dynamic or fully functional in the real-world. A functional model in the form of a refined land market information flow lifecycle will be triangulated from the results to achieve the overall aim of the design. The refined model will includes principles, derived from the case study results and backed by best practice in land administration, to help achieve a functional synthesis between land administration information and macroeconomic management.

The refined land market information flow lifecycle will be tested as an operational output by implementing it on the case study states and demonstrating one way in which integrated market transaction information can add spatial intelligence to macroeconomic decision making.

CHAPTER 5:
RESULTS FROM REAL PROPERTY MARKET STUDY
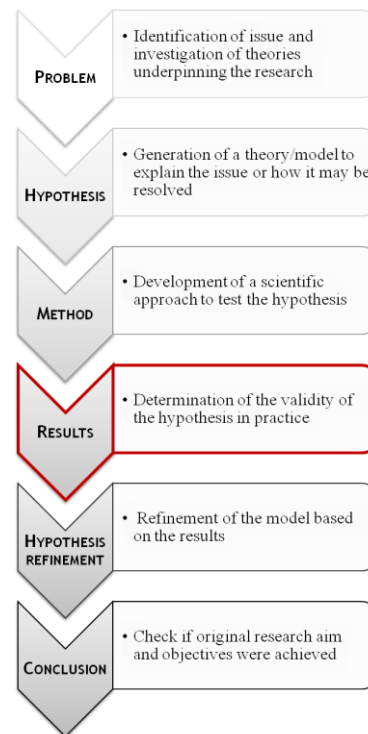
- *The following chapter explores the inter-governmental flow of land market information within three geographically distributed information ecologies; that is three state-based land administration systems in Australia. Results show that integration is occurring within some state land agencies; however communication with central government agencies is limited, leading to information asymmetries.*

5.1   Introduction

Authoritative information about the land and resource markets is vital to management of the economy and sustainable development. Authoritative implies information that is best of its kind and can be trusted as being accurate and reliable. In countries with well established formal land markets, the public land administration agencies can be considered the most legitimate and hence most authoritative source of land transaction information.

In many countries, land administration is decentralised. The collection and maintenance of information about land transactions occurs within the state, provincial or local land agencies, however decisions on taxation of transactions and macroeconomic controls over money supply, are made by the central government agencies.

The land market information flow lifecycle is a simple conceptual model that demonstrates the ideal relationship between land administration and macroeconomic policy making in countries where constitutional responsibilities are divided. It illustrates the need for adequate information flows between the government land administration and policy institutions, in order to sustain a healthy land market.

This chapter evaluates the conceptual land market information flow lifecycle against geographically distributed information ecologies in a country with decentralised land administration functions. Three case studies: Victoria, Western Australia and New South Wales in Australia. Each case study investigates the flow of land market information between the tiers of government within the state and up to the central government. Comparisons are drawn within the discussion that follows, and common information asymmetries are identified.

Taxes on land in Australia

In a market economy anything that is tradable or disposable is potentially taxable. Taxation involves taking processes that have value and extracting part of that value for government. The ownership and sale of property make up the main processes

within a land market. In the context of this study, we can define taxes on land to be *government charges on the transactions and holdings of property that form part of a land market*. As with any other form of tax, taxes on land are *compulsory contributions levied by the state on a taxpayer* (individual or legal entity).

Land taxes defined above can be divided into two categories: ad-hoc and periodic. The concept of ad-hoc duration or time limited property interest was explored by Bennett et al (2008). In the context of this study, ad-hoc taxes are only charged when the asset is sold or otherwise disposed of. They are levied on one or other party involved in the market transaction, depending on the type of tax. Periodic land taxes are generally charged annually, and are typically borne by the owner of the property.

In Australia, property is taxed at different levels of government. Table 5.1 outlines the five different taxes on land levied by the various governments in Australia. For the purposes of this research, local government charges for services or rates are also treated as taxes on property.

2009-10 values from the Australian Bureau of Statistics indicate that of the country's total tax revenue, the federal government holds about 80%, the state governments about 16% and the local governments about 4% (ABS, 2011). GST accounts for about 27% of total tax revenue for all levels of government. Taxes on property make up about 10% of total tax revenue. Of this, taxes on immovable property account for 6% and taxes on financials and capital transactions about 4%. Taxes on property were the largest source of taxation revenue (37%) for state governments in 2009-10 and were also the sole source of income for local governments (ABS, 2011).

Table 5.2: Classification of different taxes on land in Australia

Tax	Description (CCH Editors, 2010)	Levying authority	Process taxed	Type	When	Generally Paid by
Federal Capital gains tax (CGT)	Net gains are treated as taxable income in the tax year an asset is sold or otherwise disposed of.	Central government	Transaction	Ad-hoc	On disposition	Seller
State Stamp duty	Levied on various land transactions either at a fixed rate or on the value of the transaction. In all states and territories stamp duty is levied on transfer of 'dutiable' property, primarily the transfer of land.	State government	Transaction	Ad-hoc	On disposition	Buyer or Seller depending on the jurisdiction
State Land tax	Based on the ownership or use of land, except in the Australian Capital Territory (ACT) where land tax is also payable on land leases. It is largely levied on the unimproved value of taxable land.	State government	Holding	Periodic	Annual	Owner
Federal Goods and service tax (GST)	GST is essentially a value-added tax. The sale of all newly constructed residential property and the sale of all commercial property by a registered business is generally taxable. Though administered and collected federally, the revenue from GST is distributed to the states and territories.	Central government	Transaction	Ad-hoc	On disposition	Buyer or Seller depending on the jurisdiction
Municipal Rates	Depend on land value assessments. Rates differ depending on the level of revenue the local government wishes to raise based on their proposed budget. The frequency of payment is determined by local councils, but assessment is annual.	Local government	Holding	Periodic	Annual/ Quarterly	Owner

5.2 Case Study Results

The results of the three case studies that follow focus on the first three stages of the information flow lifecycle, namely: *Collect*, *Store and Maintain* and *Share*. In the context of this research, *Collect* refers to the entities and processes involved in registering a transfer of ownership. *Store and Maintain* includes the entities, databases and processes currently involved in the storage and maintenance of land transaction and historic sales information. *Share* refers to the entities and inter-governmental process and services that dissimilate information. Land data requirements of the ATO and RBA relate to the *Use* stage of the information flow lifecycle and will be discussed in the section following the case studies. The *Dispose or Archive* stage of the information flow lifecycle requires further evaluation and is beyond the scope of this research.

A summary of results is presented at the end of each case study using the conceptual land market information flow lifecycle. These conclusions are drawn based on the mapped information flows in each respective case study.

The case study results presented below are based on the data flow symbology shown in Figure 5.1.

This symbology is derived from the standard symbols used in Data Flow Diagrams (DFDs) (Agarwal et al 2009), and is based on a set of four simple symbols to represent a function or process, external entity, data store and data flow. The context of the case studies requires the addition of an extra symbol for 'Service', to represent a web service or portal for data access provided by a state land agency.
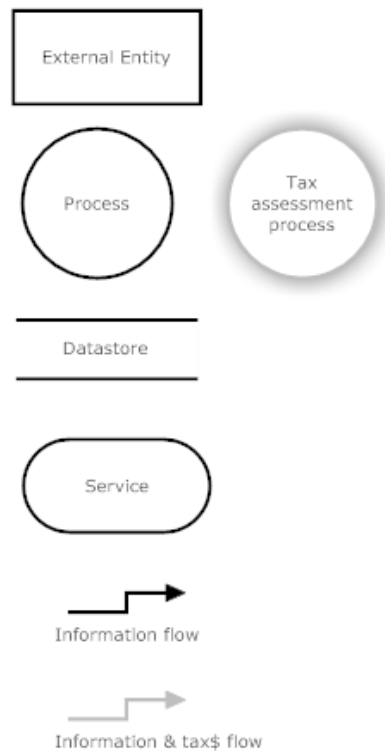
Figure 5.1: Data flow symbology used in case studies

VICTORIA

Victoria is the smallest mainland state by area and the second largest by population size in Australia. It is located in the south-eastern corner of the country, bordered by New South Wales and South Australia. This densely populated state is also highly urbanised, with almost three-quarters of the population residing in the capital city, Melbourne.

Victoria's land administration agencies consist of the land registry and Valuer-General Victoria (VGV) which reside within Land Victoria in the Department of Sustainability and Environment (DSE), the State Revenue Office (SRO) and the local government authorities. The land registry is the land titles office in Victoria, responsible for registering all land transactions in the state. VGV maintains the official record of valuations for all rateable properties in the state. It also sets the valuation guidelines for independent valuations conducted by the local government authorities. General valuations of all properties in Victoria are conducted every two years with supplementary valuations undertaken as required to maintain the valuations record. Local government authorities can hire independent valuers or nominate VGV

to complete valuations. As of April 2011, 5 of the 79 local government authorities in Victoria have opted for the latter option. The SRO collects stamp duty and land tax on behalf of the state government. The information flows within the first three stages of the information flow lifecycle are presented in Figure 5.2 and discussed below (refer numbers [1-5] to respective annotated sections of Figure 5.2).

Inter-governmental information flows for stamp duty, land tax and rates

[1] A Notice of Acquisition (NOA), a copy of the contract of sale, other documents evidencing intention to transfer and the transfer of land are supplied by the buyer (usually an agent or financial institution on behalf of the buyer) to the SRO when paying stamp duty. A valuation declaration also accompanies the stamp duty documents. The valuation is checked in the SRO office against VGV values and if it is lower, the VGV value is used as the base for calculation of stamp duty. In Victoria stamp duty is paid at settlement by the buyer. The stamp duty payment is receipted on the transfer of land. When documents are lodged for registration at the titles office, the stamp duty must already be paid. The land registry will not register the transfer unless the stamp duty receipt is on the document.

The time limit for submission of stamp duty documents to the land registry is thirty days after settlement. Financial institutions lodge documents for stamp duty and registration in bulk. Once stamp duty is paid, it is not unusual for documents to be lodged at the land registry up to three months after settlement.

A copy of the NOA is also supplied by the buyer's agent or financial institution to the relevant local government authority. VGV usually finds out about change of ownership from the local government authority's copy of the NOA.

[2] The Victorian Online Titles System (VOTS) services the register of all land titles in Victoria. It is updated on a transaction by transaction basis. Access is restricted to authorised staff and certain local government authorities who have signed a memorandum of understanding. The registry is public and is accessible via LANDATA, an online land records and information service. Information is provided on a cost-recovery basis.

[3] Land Victoria also maintains a historic property sales database, Property Sales and Valuation (PSV). The database stores sales history as far back as 1975 and is updated at least weekly. However it is often about six months after transaction that the data in PSV is complete and reliable. The PSV stores mainly NOA information. The land valuation databases, maintained by the VG, provide some valuations to PSV. The VG, licensed valuers, brokers and real estate agents who hold a PSV account have access to this database; however no public access is available. The SRO maintains its own property sales database and has no access to PSV.

[4] For land taxation purposes, the SRO receives general valuations data ever two years. They can also request a property value from VGV if the information is not supplied. The SRO calculates land tax and sends notices to property owners. Similarly local government authorities calculate and send rates notices to all owners of rateable property in their respective municipal districts.

Inter-governmental land information flows for CGT, GST and interest rates

[5] Though Land Victoria does have one-off information exchanges with the ATO, there are currently no formal data exchange arrangements in place between the state land administration agencies in Victoria and the central macroeconomic policy institutions. Property owners lodge their CGT liability as part of their quarterly or annual tax return. Similarly GST on land transactions is lodged with the ATO as part of financial institutions' quarterly Business Activity Statements (BAS) return.

Figure 5.3 highlights the main issues within the Victorian real property market with regards to the land market information flow lifecycle.

Figure 5.2: Information flows between state land administration agencies in Victoria and central policy agencies for the purposes of taxes on land and setting of interest rates

Figure 5.3: Overview of main issues within the Victorian real property market with regards to the land market information flow lifecycle

As Figure 5.3 shows, information flows within the Victorian real property market are not sufficiently effective within the Collect, Store and Maintain, and Share stages of the land market information flow lifecycle. The major issues are:

- *Collect stage:* The time limit for submission of stamp duty documents to the land registry is thirty days after settlement. This affects the timeliness of this data and its ability to accurately reflect the state of the market at time of contract.

- *Store and Maintain stage:* Multiple databases exist for land tenure and value information. These databases are not well integrated. This can result in duplication, redundant efforts and inaccuracies caused by mismatched data.

- *Share stage:* The Victorian state land agencies only support one-off information exchanges with the ATO and have no existing data sharing agreements with the RBA.

NEW SOUTH WALES

New South Wales (NSW) is the state with the largest population in Australia. Located to the north of Victoria, it also shares a boundary with Queensland, South Australia and surrounds the whole of the Australian Capital Territory. A large percentage of the population in NSW reside in the state's capital city, Sydney. Sydney is also the most populous city in the country.

The land registry and Valuer General's office (VG) in NSW, prior to April 2011, resided within the Land and Property Information division (LPI) of the Land and Property Information Authority (LPMA). The LPMA was abolished under the NSW Government restructure in April 2011. The LPI now resides within the Department of Finances and Services. However key land administration registration and valuations processes were not impacted by this change. Other agencies in NSW with land administration functions include the Office of State Revenue (OSR) and local government authorities. The information flows within the first three stages of the information flow lifecycle are shown in Figure 5.4 and discussed below (refer numbers [1-6] to respective annotated sections of Figure 5.4).

Inter-governmental information flows for stamp duty, land tax and rates

[1] Stamp Duty in NSW is paid at time of contract. After stamp duty payment, a Notice of Sale (NOS) is submitted to the LPI by a financial institution or agent on behalf of the buyer, along with other documents that support the transfer of ownership.

[2] LPI registers ownership in the Integrated Titling System (ITS). A copy of the NOS is sent by LPI to the relevant local government authority. LPI supplies OSR with a daily update of data via the Integrated Property Warehouse (IPW). The IPW is a whole-of-government approach to data sharing. It centralises land information across the different land administration agencies. The data supplied to the OSR covers information changes to owner names and leases, sales data from NOS and valuation

data regarding new lots created by subdivision activity. OSR can also access copies of any related documents through LPI's online service, Spatial Information Exchange (SIX).

[3] The VG conducts general valuations to provide new land values for all properties in a local government area. Valuations are done by grouping similar properties together. Within each group, at least one representative property is valued annually and the change in value from the previous year is applied to all properties in the group to determine their new value. Supplementary valuations are also conducted to obtain new land values outside the general valuation process. This may occur due to new subdivisions, changes in zoning or a change in land area.

[4] VALNET is the valuations database in NSW, maintained by the VG. It captures and stores information relating to the land value of a property, the dates land tax assessments are forwarded to tax payers, and unconfirmed sales information from details of sales price submitted to OSR for payment of stamp duties. Unconfirmed sales are sent electronically to valuation contractors. VALNET supplies information to IPW and also receives daily updates from the IPW. For the purposes of rates, general valuations data is sent to local government authorities every three to four years, and supplementary valuations are sent monthly. Local government authorities use these to calculate and send out rates notices to all owners of rateable property in their municipal districts. Batched up registration and valuation changes are also sent to local government authorities from IPW via an internet delivery service. VALNET also stores sales history, electronically back to 1990, microfiche and film back to 1980. Access to transaction history is publically available via SIX, on a cost-recovery basis.

Inter-governmental land information flows for CGT, GST and interest rates

[5] LPI supplies ATO with a complete history of ownership changes and subdivision changes for all lots on a six monthly basis. The data supply is for all lots and all transaction since 2002. The LPI-ATO data supply is changing to an incremental update with the complete history of any lot being affected by an ownership change or subdivision action over a six month period. ATO holds the complete data file and the incremental update will be absorbed into that file. Additionally property owners lodge

their CGT liability as part of their quarterly or annual tax return. Similarly GST on land transactions is lodged with the ATO as part of financial institutions' quarterly BAS return.

[6] No information is regularly supplied to the RBA, although the bank does make one-off enquiries for specific extracts. The last request was for mortgage value information, which LPI could not supply as the information is not collected in their system. LPI does provide property sales information to the Australian Property Monitors (APM) under a licence agreement. The APM is a regular supplier of data on dwelling prices to the RBA.

Figure 5.5 highlights the main issues within the NSW real property market with regards to the land market information flow lifecycle.
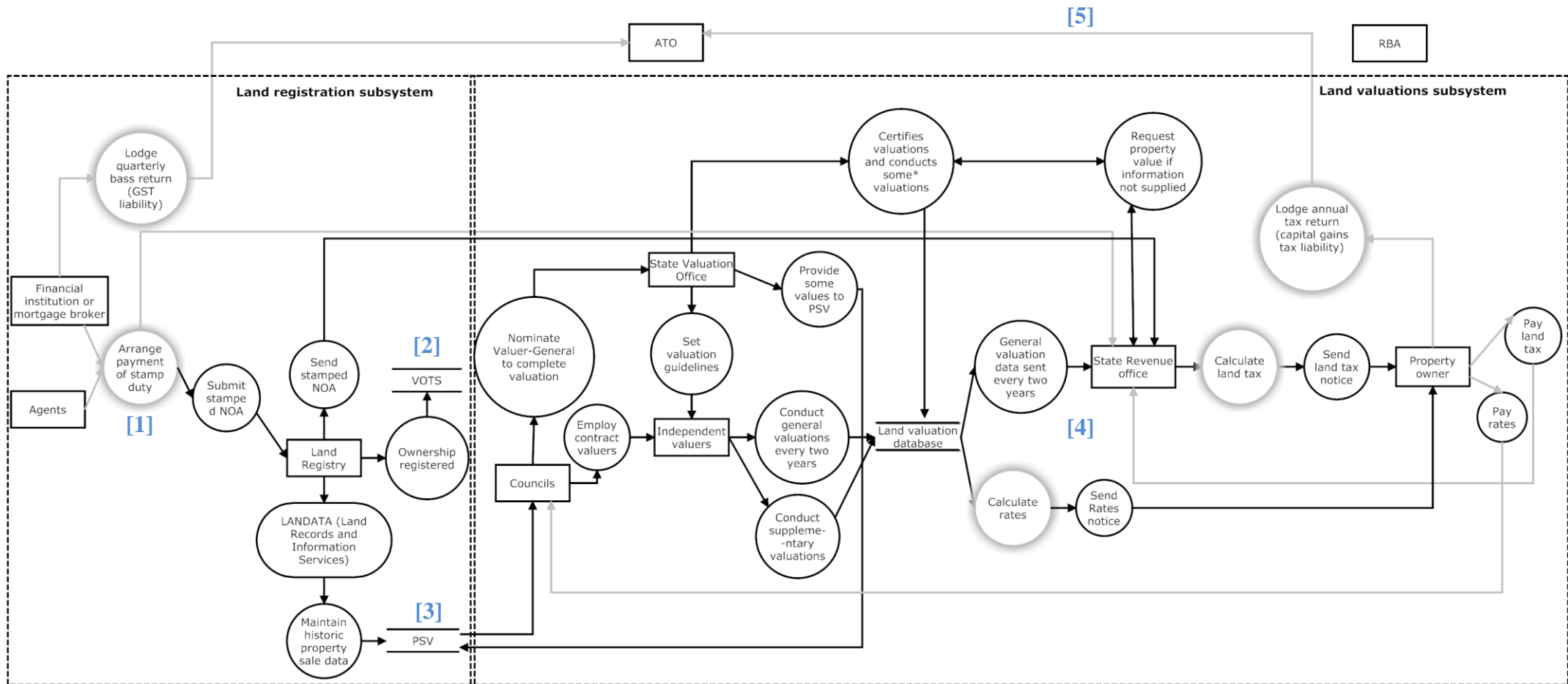
Figure 5.4: Information flows between state land administration agencies in NSW and central policy agencies for the purposes of taxes on land and setting of interest rates
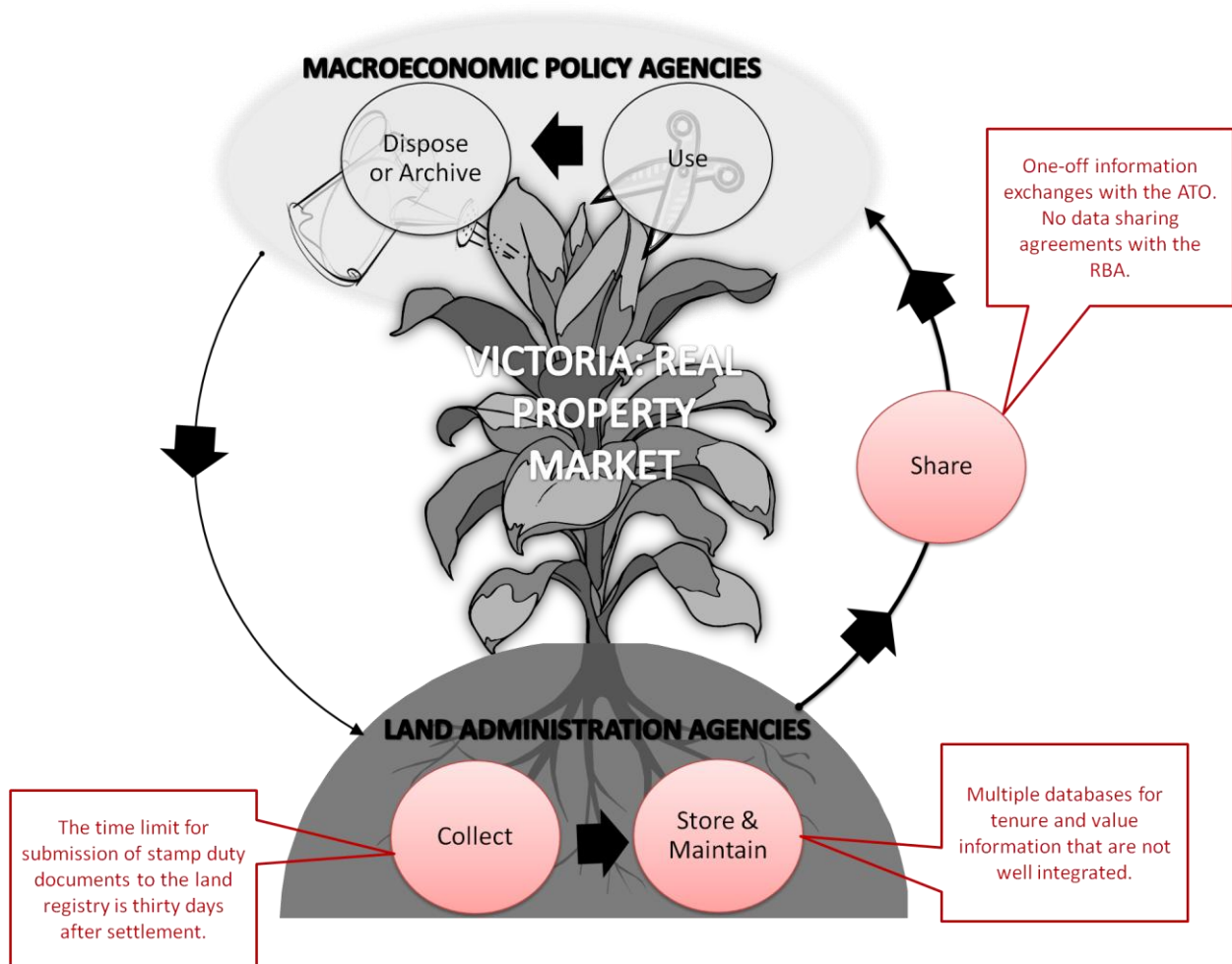
Figure 5.5: Overview of main issues within the NSW real property market with regards to the land market information flow lifecycle

As Figure 5.5 shows, information flows within the NSW real property market are not sufficiently effective within the Collect and Share stages of the land market information flow lifecycle. The major issues are:

- *Collect stage:* There is no requirement to report transactions to the land registry at the time of contract. This affects the timeliness of market transaction information and its ability to accurately reflect the state of the market when the actual agreement to buy and sell takes place.
- *Share stage:* Though the NSW state land registry does supply data to the ATO on a six monthly bases, they have no existing data sharing agreements with the RBA.

WESTERN AUSTRALIA

Western Australia (WA) is, geographically, the largest state in Australia. It shares borders with the Northern Territory and South Australia. The majority of the population resides in the south-west corner of the state, in and around the capital city, Perth.

Land administration agencies in WA consist of the land registry and Valuer General's office (VG) under Landgate, the Office of State Revenues (OSR) under the Department of Treasury and Finance, and local government authorities. The information flows within the first three stages of the information flow lifecycle are shown in Figure 5.6 and discussed below (refer numbers [1-8] to respective annotated sections of Figure 5.6).

Inter-governmental information flows for stamp duty, land tax and rates

[1] Stamp duty in WA is paid at time of contract. After payment of stamp duty, a financial institution or agent submits the transfer of land and other supporting documents to the land registry on behalf of a buyer.

[2] The land registry maintains a Smart Register (SMR) of all land dealings including new titles, general title examinations, complex dealings (such as joint venture arrangements) and registration of crown land. SMR stores ex-proprietors and all new transactions.

The VG is responsible for all property valuations in the state. Valuation System (Valsys) is the land and property information system, maintained by the VG. Valuations are heavily reliant on SMR. Data is provided either periodically as a batch update (for example monthly data extract from SMR) or transaction based from the registry. New plans come to valuations in paper format from the registry. Landgate is looking at making this process electronic in the near future.

Internet access to Valsys is provided to rating and taxing clients. About 60% of local government authorities also have access to Valsys via the web. Similar restricted access applies for the OSR, but only for the rateable properties in the respective local government authority areas. If the OSR has any discrepancy in their data they inform

valuations. Local government authorities also send information about changes in subdivision to the VG.

[3] Sales information is provided to valuations via Electronic Advice of Sale 2 (EAS2). EAS2 is an online service that assists the conveyancing process in WA. The sales data is confirmed when it comes through after registration. Sales history is maintained back to 1988. Sales information is publically available via the Landgate website on a cost recovery basis. Information is provided via property reports that are created on the fly through tables in Valsys. A consolidated list of properties and values is provided to some other government agencies.

[4] For taxation purposes, the VG conducts Gross Rental Value (GRV) valuations every three to five years, and unimproved Land Value (UV) valuations annually. According to the Valuation of Land Act 1978 (WA) GRV is "*the gross annual rental that the land might reasonably be expected to realize if let on a tenancy from year to year upon condition that the landlord were liable for all rates, taxes and other charges thereon and the insurance and other outgoings necessary to maintain the value of the land.*" Essentially, gross valuations are conducted on potential rental earnings of a property. UV is, in general terms, the value of the land as itself, as if it were vacant, without buildings or other improvements. GRV data is sent to local government authorities every three to five years via valuation rolls. Local government authorities receive UV data annually in a similar manner. Local government authorities use this data to calculate and send rates notices to all owners of rateable property within their jurisdiction.

[5] The land registry periodically sends official land and ownership records to the OSR.

[6] The OSR maintains its own data base for purposes of stamp duty and land tax collection, namely the Revenue Collection Information System (RCIS).

Inter-governmental land information flows for CGT, GST and interest rates

[7] ATO gets regular updates about new transactions registered in SMR. ATO also requests information periodically. However on occasion acquired data cannot be loaded into the ATO's system due to data incompatibilities. Property owners lodge their CGT liability as part of their quarterly or annual tax return. GST on land

transactions is lodged with the ATO as part of financial institutions' quarterly BAS return.

[8] Landgate has no direct data sharing agreements with the RBA. It provides information to the APM, who are supplies of dwelling price data to the RBA.

Figure 5.7 highlights the main issues within the WA real property market with regards to the land market information flow lifecycle.
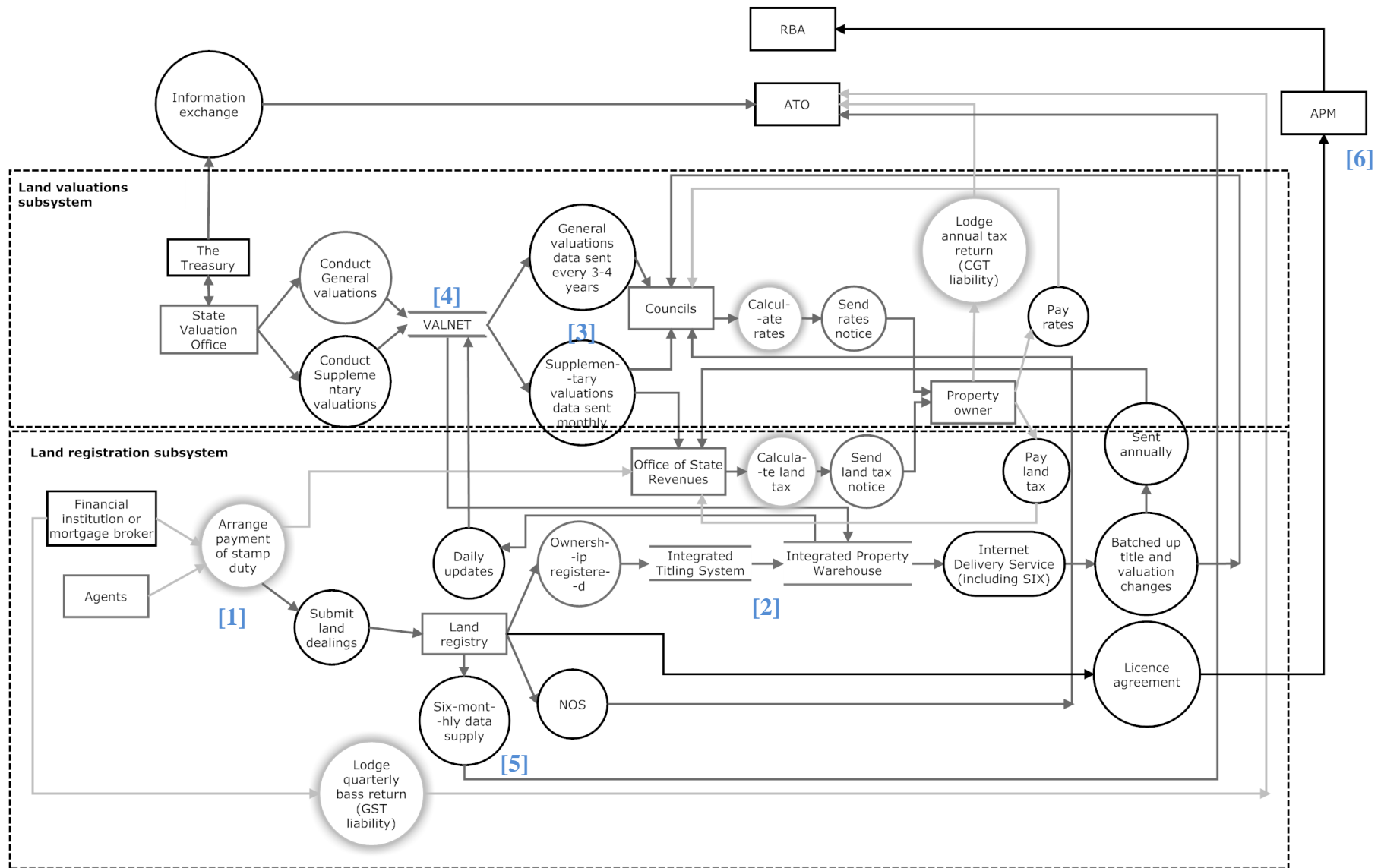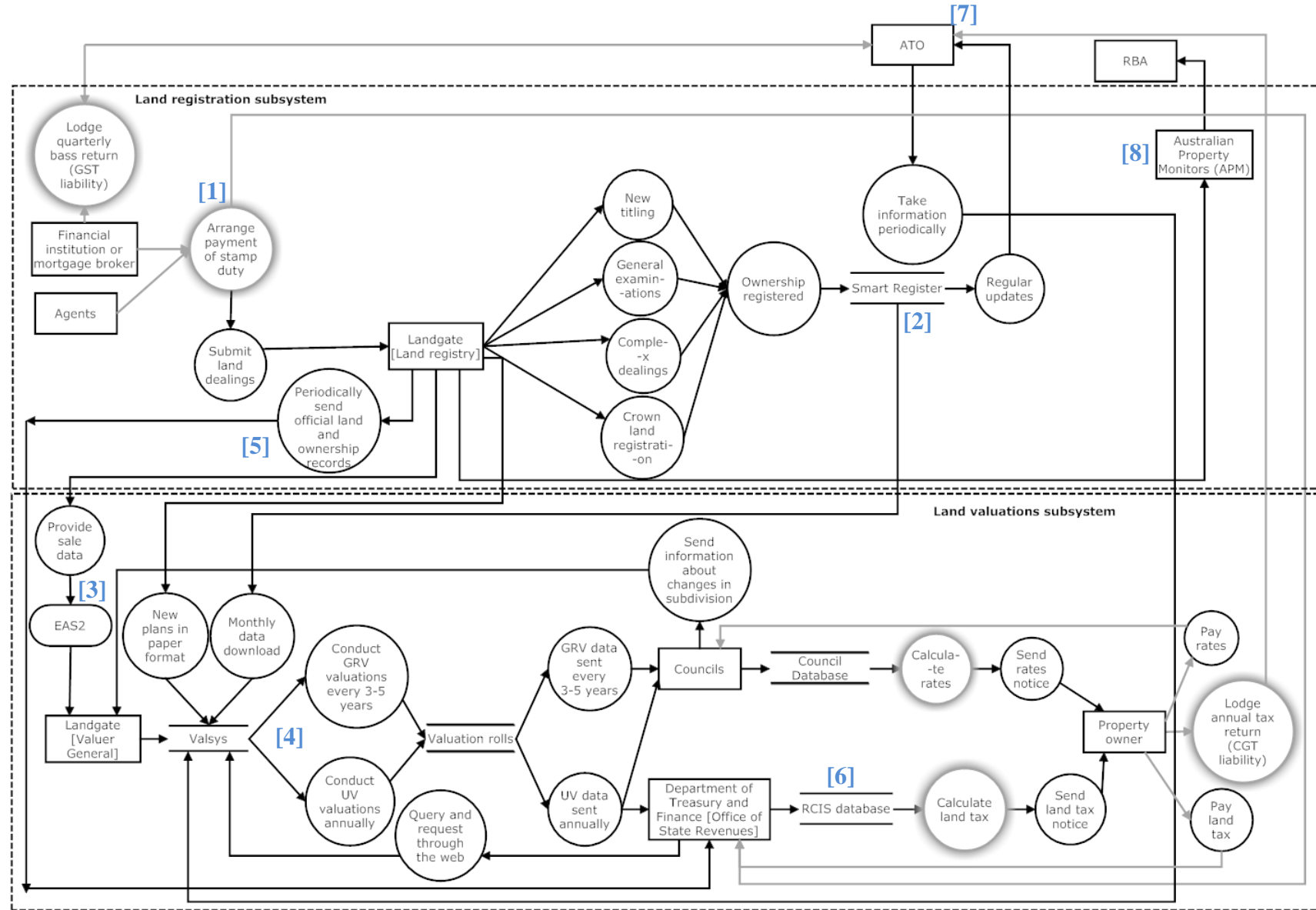
Figure 5.6: Information flows between state land administration agencies in WA and central policy agencies for the purposes of taxes on land and setting of interest rates
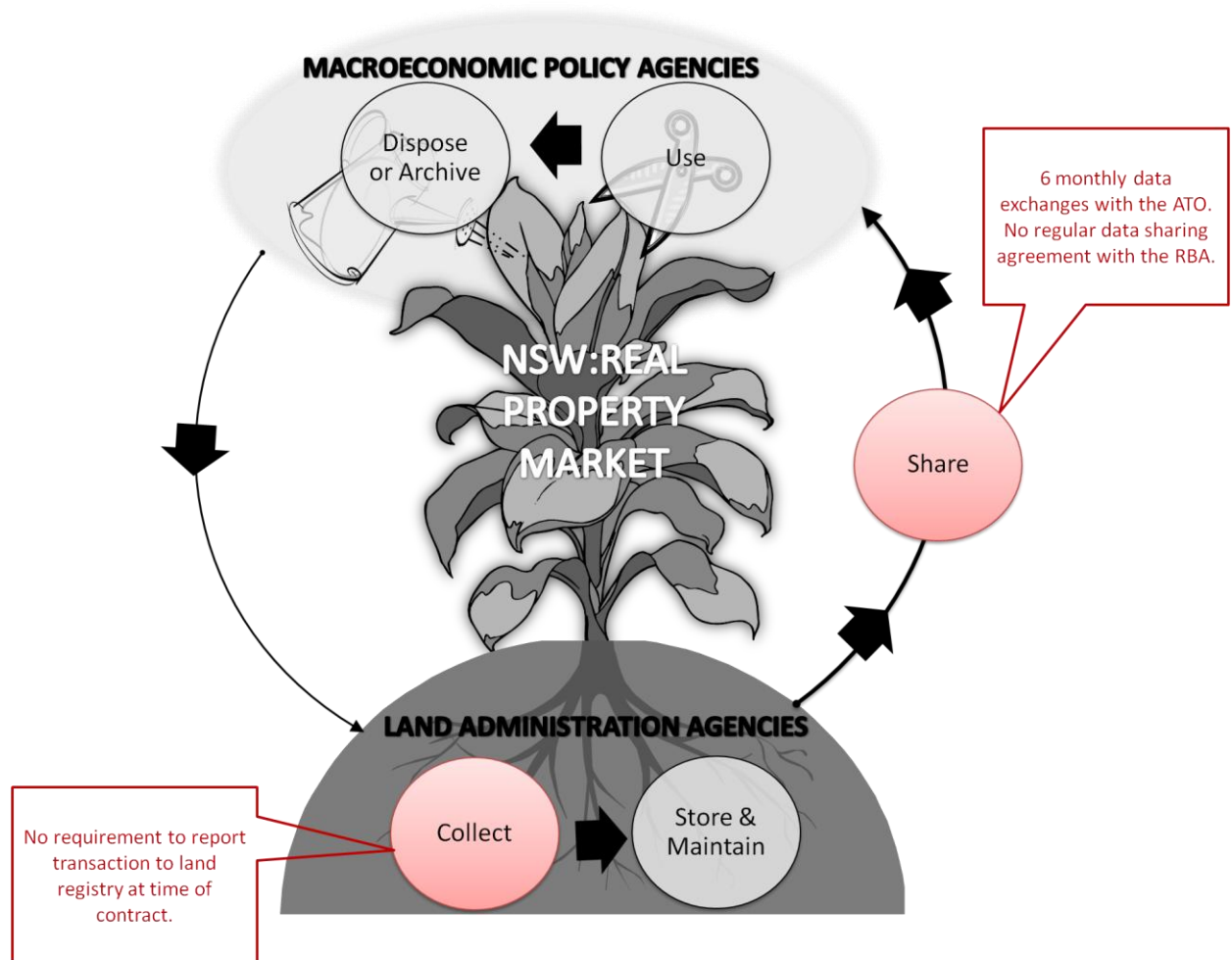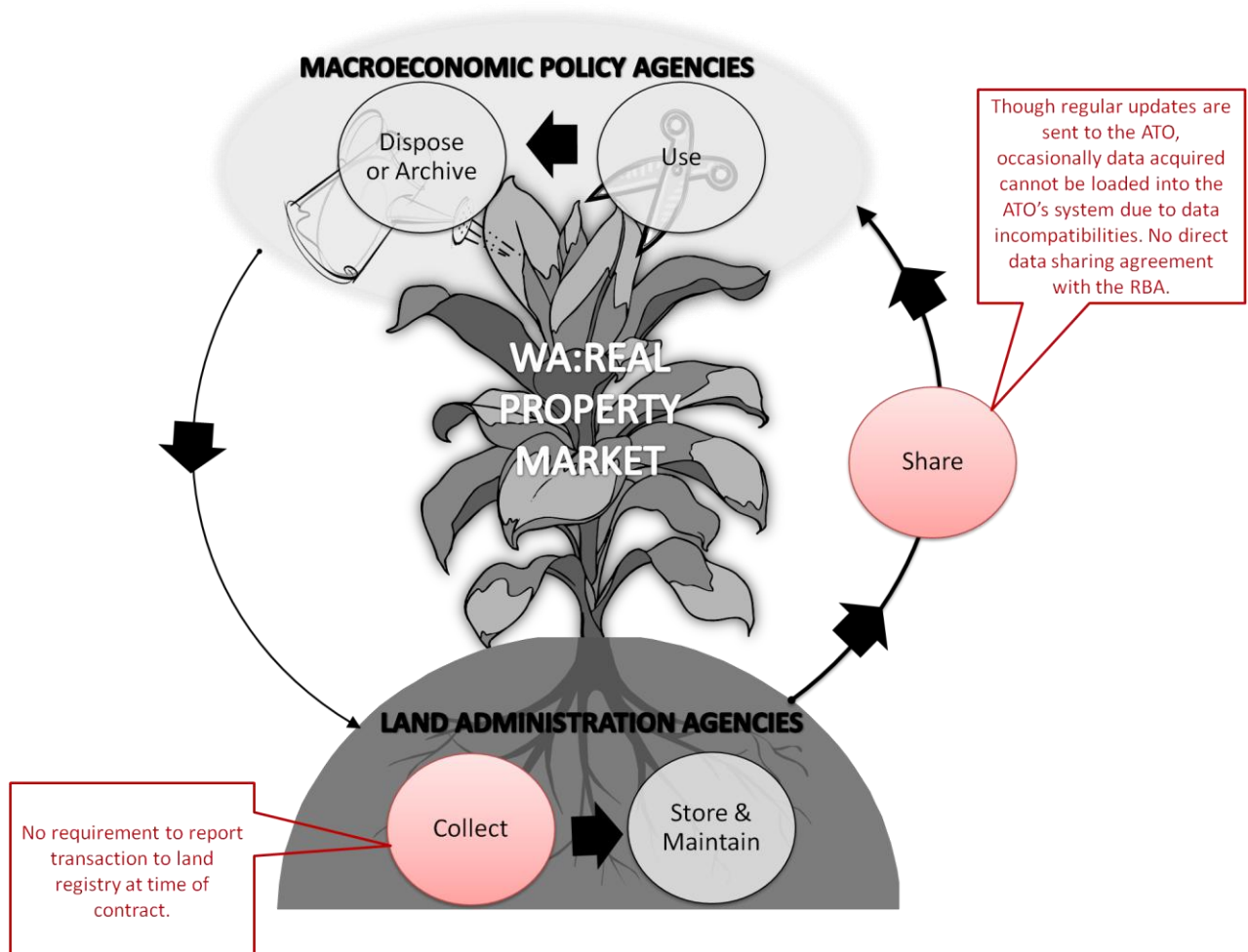
Figure 5.7: Overview of main issues within the WA real property market with regards to the land market information flow lifecycle

As Figure 5.7 shows, information flows within the WA real property market are not sufficiently effective within the Collect and Share stages of the land market information flow lifecycle. The major issues are:

- *Collect stage:* There is no requirement to report transactions to the land registry at the time of contract. This affects the timeliness of market transaction information and its ability to accurately reflect the state of the market when the actual agreement to buy and sell takes place.
- *Share stage:* Though the WA state land registry does supply data to the ATO on a regular bases, occasionally data acquired cannot be used due to data incompatibilities. Additionally, the WA state land agencies have no existing data sharing agreements directly with the RBA. Data is provided to the RBA via the private sector.

5.3　Key Comparisons

Land information being collected, stored and maintained is unique to each state. Databases are diverse, with data models tailored to meet individual agency needs. Processes are labyrinthine and again unique to each state. Of all the case study states, WA has the most highly streamlined processes for data collection, storage and maintenance. Here, integration of databases and data sharing is occurring at a higher degree than other states. Direct and regular information exchange with the ATO is already underway; however improvements in terms of data compatibility and timeless can be made. Since land market information has a temporal aspect, it is highly desirable for information sharing to be timely, ideally on a transaction-by-transaction basis, so that decisions are made based on information that best describes the status of the market at any point in time. Consistency in data collection needs to be achieved across the state land registries, so that information shared can actually be used.

NSW has also achieved significant data integration and inter-governmental sharing via its IPW. Here too, direct and regular information exchange with the ATO is occurring, with a complete history of ownership and subdivision changes since 2002 being provided on a six monthly basis. However, processes within the registration and valuation subsystems are still complex. Victoria is yet to achieve integration and sharing to the same extent as the other case study states. Legacy systems still dominate here, with databases being highly accurate but stale. Victoria is also distinct in terms of the public inaccessibility to property sales information and no established relationships for data exchange with the ATO. None of the three case study states currently have direct data exchange agreements with the RBA.

The time of data collection is notable in all states. In NSW and WA, stamp duty is paid at time of contract. So potentially tenure and value information is available when properties are transacted. However, in New South Wales the ITS is populated by information about transactions provided by the parties when lodging land dealings for registration. This is usually after settlement has occurred. The same is the case in WA. In Victoria, stamp duty is collected at settlement and stamp duty payments and submission of associated documents can occur up to 30 days after settlement. Moreover, the Victorian government maintains PSV using information collected

through Notices of Acquisition and Disposition, which are supplied after settlement of the transaction. This can be up to two months on average after the contract of sale.

As a result, though authoritative property market information is eventually available, it is held in separate state databases and information collection is untimely. Wallace and Williamson (2011) advocate the need for 'AAA' (Accurate, Authoritative, Assured) land information at national level for taxation and governance including monetary policy. Information used in policy making needs an audit trail. It must be assured by statutory functions, risk management systems, and, in case of Torrens and other successful systems, guaranteed. The Dutch 'key registers' are a good example of authoritative information sources. The registers are legally established and contain authoritative information from municipal registries and are made available centrally through a national system managed by the Dutch Land Registry Office. However, the national 'Geo-Portal' is only updated every 3 to 6 months (Bamps et al, 2012).

Current land information sharing process in Australia, fall short of 'AAA' requirements. Though land registry information is guaranteed by the states, as the RBA points out, 'data timeliness' is a major problem with access to housing price data (RBA, 2004; 2005). This is attributed to the lack of consistency in transaction reporting requirements between the states. The case studies show an absence of reporting requirements at the time of sale.

Additionally, from the perspective of efficient economic policy, it is desirable for market analysis on house price data to be based on the period in which the price was determined, rather than when the transaction was later settled (RBA, 2005). Due to insufficient and untimely information flows, and poor data integration at a national level, the RBA purchases sale and transaction data from the private sector. For instance the RBA collects information about the commercial property sector, including vacancy rates, property prices and rents from the Australian Bureau of Statistics and other organisations such as Jones Lang LaSalle, the Property Council of Australia and Savills Research (RBA 2009). Sales transactions are obtained from the Australian Property Monitors (APM) among others.

To better align land information collection and dissemination with central government policy needs, the legal mandate of land administration agencies could be expanded to incorporate the information requirements of the central policy makers. However, a

shared vision can be more effectively developed though the flexibility of self-regulation, as seen in natural ecologies. OECD (2009) advocates self regulation as a very efficient policy instrument that can be tailored to address a particular issue. Self regulation via codes of practice or the voluntary adoption of standards can lead to lower compliance; however it is also considerable more adaptable to suit specific jurisdictional-contexts in federated countries. To achieve the vision of synthesis between land administration and macroeconomic policy marking, the land information needs of central policy markets needs to be understood. This is represented by the *Use* stage of the land market information flow lifecycle and is discussed below.

The Use stage

At the time of writing, the federal government information policy plans were under re-construction, with the creation of the Office of Spatial Policy, and its emerging role as a policy initiator and coordinator, along with the focus of ANZLIC, the Spatial Council, on policy initiatives. The needs of the federal government were contextualized in the broad initiatives to spatially enable functions and processes, and information delivery. All these will inform the strategies in individual departments in their use of spatial information. Meanwhile the extent of engagement by departments and agents in information creation and collection is increasing as the various uses of spatial systems, and spatially enabling non-spatial information become apparent. The government departments playing a lead role include the Australian Bureau of Statics, Australian Electoral Commission and ATO.

The *Use* stage of the information flow lifecycle relates to the information needs of the central macroeconomic policy agencies. Both the RBA and ATO in Australia have private sources of data for essential analysis. Transition from volunteered information to verified information has already taken place with sophisticated data matching techniques. However both agencies require authoritative land information to achieve monetary and fiscal tax intelligence. Specific information needs are discussed below.

The ATO requires land information with accurate owner identities. The current state land registration systems do not conduct identity checks when registering land titles. For example Victorian standards require an adult witness for a signature on an approved form, without an identity check. Current legislation also does not permit the

ATO to acquire data compulsorily from the registries. Though most land registries in Australia cooperate with data requests from the ATO, refusals to provide information on privacy grounds are not uncommon.

Additionally, the ATO requires authoritative information about primary places of residence for CGT purposes. Land registries do not currently capture this information. The ATO also requires a cost base. However historic sales data maintained by state land agencies are prone to errors, with older data being highly problematic. Additionally, if registration and valuations databases are not integrated, as is the case in Victoria, errors tend to propagate.

The ATO currently gets 6 monthly data updates from some state land registries and revenue offices, as part of arrangements initiated in 1985. For income tax lodged annually, 6 monthly data is often sufficient. However for GST purposes the ATO requires data in much smaller time increments. Additionally, the data being collected in each state is different, making it difficult to integrate information at a national level. This stems from different Spatial Data Infrastructure (SDI) visions and organisational models, making cross-border coordination challenging. Reporting requirements are unique to each state. For instance, in WA, sales of multiple units per property are often reported as one sale price for the property, rather than one per buyer. This is problematic for CGT. Reporting sales made off-the-plan to land registries are also not compulsory, so no information can be passed on to the ATO about these.

The information needs of RBA are also sophisticated and sometimes beyond the capacity of existing systems to deliver. For instance, a recent RBA research project (Kulish et al. 2011) looked for information on land zoning in Australia's major cities, including the proportion of land zoned for high, medium and low density residential use. However, most land agencies, including the planning agencies, do not have this information. Those that do are disparate and operate in silos. The RBA authors noted that only WA was able to provide this information. Consequently, the RBA could only obtain data for one city of the five major cities in the country. "*Given the importance of housing in household budgets and in broader social outcomes, this suggests significant scope for further data collection and empirical work on the pricing, usage and zoning of land in our major cities*" (Kulish et.al, 2011, 32).

The RBA has made requests for mortgage information in the past, particularly land transactions with mortgages, the value of the mortgage and the date of discharge of the mortgage. Most state land agencies do not collect this information. As Barker (2004) and Bertaud and Malpezzi (2003) argue, data on housing affordability, land zoning and land usage should be important inputs into policies surrounding the planning process. Information collected should support this.

The RBA's recent research project (Kulish et al. 2011) also looked for data on unimproved land values in Australia's major cities. However, property valuation methods are as varied as the property laws in various jurisdictions. Data is stored in multiple databases with different levels of integration. Different object definitions within each land administration system can lead to further data incompatibility.

House price information needs of the RBA are currently met by two non-government providers who supply aggregated data on a monthly basis. Not being publically sourced, this land information is not authoritative or assured by the government. Often this information is obtained from real estate agencies which do not always have any statutory obligation to report transaction information. Consequently evidence-based policy decisions are undermined. Informal interviews during case study visits revealed that the RBA requires actual and authoritative transaction data that they can analyse in-house. Current land information collection processes are inept to meet these needs.

5.4   Conclusion

Figure 5.8 outlines the overall issues within the state-based real property markets studied in Australia, with regards to the land market information flow lifecycle.

MACROECONOMIC POLICY AGENCIES

Dispose or Archive

Use

KEY ISSUES:REAL PROPERTY MARKET

Share

LAND ADMINISTRATION AGENCIES

Collect

Store & Maintain

User needs, that is information needs of the central macroeconomic policy departments are generally beyond the current capabilities of land administration agencies to deliver.

There is limited or no sharing of key tenure and value information between the authoritative state land agencies and central macroeconomic policy departments.

Information being collected by land administration agencies differs between states depending on individual state legislation, procedures and requirements.

There is no requirement to collect information at time of contract. Reporting requirements differ from 30-60 days following contract.

Key tenure and value (including historic sales information) information is stored in multiple jurisdiction databases and levels of integration differ.

Figure 5.8: Summary of key issues within state-based real property markets in Australia with regards to the land market information flow lifecycle

The problem here is two-fold and issues exist within every key stage of the land market information flow lifecycle. The main issues are:

- *Collect stage:* Information being collected by land administration agencies differs between states depending on individual state legislation, procedures and requirements. This is also no requirement to collect information at time of contract. Reporting requirements differ from 30-60 days following contract.
- *Store and Maintain stage:* Key tenure and values information, including historic transaction data, is stored in multiple jurisdictional databases and levels of integration within the state land agencies differ.

- *Share stage:* There are currently limited or no data sharing agreements for key tenure and value information between the authoritative state land agencies and the central macroeconomic policy makers.

- *Use stage:* Information needs of the central government macroeconomic policy makers are generally beyond the current capabilities of the land administration agencies to deliver.

Fundamentally, there is a mismatch between the land information requirements of central policy makers and the land information processes at state level. The type, timeliness and quality of information being collected, stored and maintained does not align with user requirements at central government level. Additionally, the data available at state level is not being adequately shared with agencies at central level. There is an information asymmetry in operation.

Land administration information collected needs to be fit-for-purpose. It must meet the requirements of policy makers or risks being undervalued. Issues within each stage of the land market information flow lifecycle need to be addressed to achieve this outcome.

5.5   Chapter Summary

The land market information flow lifecycle was evaluated in practice, to confirm information asymmetries between government levels in the context of property markets in one country with decentralised land administration. Lack of consistency in land information collection, storage, maintenance and sharing was evident through case studies of three Australian states, Victoria, New South Wales and Western Australia. Historically these states have developed their own land administration processes based on different state legislation, organisational structures, economic drivers and land information infrastructure ambitions. Western Australia leads in terms of streamlined processes and integrated land administration datasets, with New South Wales showing similar achievements. Victoria is still to achieve comparable results. However, lack of adequate inter-governmental sharing between all three state land agencies and the central macroeconomic policy agencies is evident.

Problems identified include legacy systems and processes, silo approaches, lack of transaction reporting requirements at time of contact and mismatch between information requirements and information collected. Adequate land information sharing in alignment with the proposed land market information flow lifecycle is yet to be realised.

CHAPTER 6:
RESULTS FROM CARBON AND WATER MARKET STUDIES
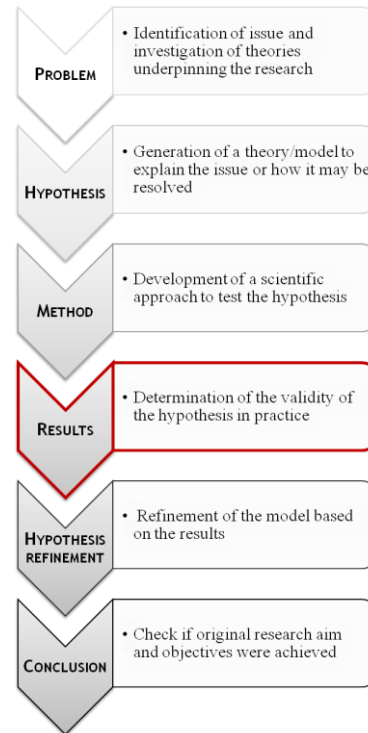
- *The following chapter explores the inter-governmental flow of land market information within two emerging state-based land resource markets in Australia: carbon and water. Results show new silo-like approaches emerging which are independent of established land administration process within the real property market. Communication with government macroeconomic policy agencies is limited, leading to information asymmetries.*

6.1   The Administration of Land Related Markets

New rights in land have emerged over the last twenty years as market-based mechanisms to manage environmental issues and scarce natural resources are becoming increasingly popular. This chapter looks at the current administrative structures of two new land resource markets: carbon and water in the context of the land market information flow lifecycle.

Within the land administration disciple, much discussion surrounds the understanding and definition of these new rights in land. The bundle of sticks (Maine, 1861), bundle of rights (Klein and Robinson, 2011), web of interests (Arnold, 2002; Zellmer and Harder, 2007) and constellation of property rights (Boydell et al, 2009; von Benda-Beckmann et al, 2006) have all been used to describe property, and understand the separation of rights in land such as carbon and water, from traditional rights in real property: Figure 6.1.
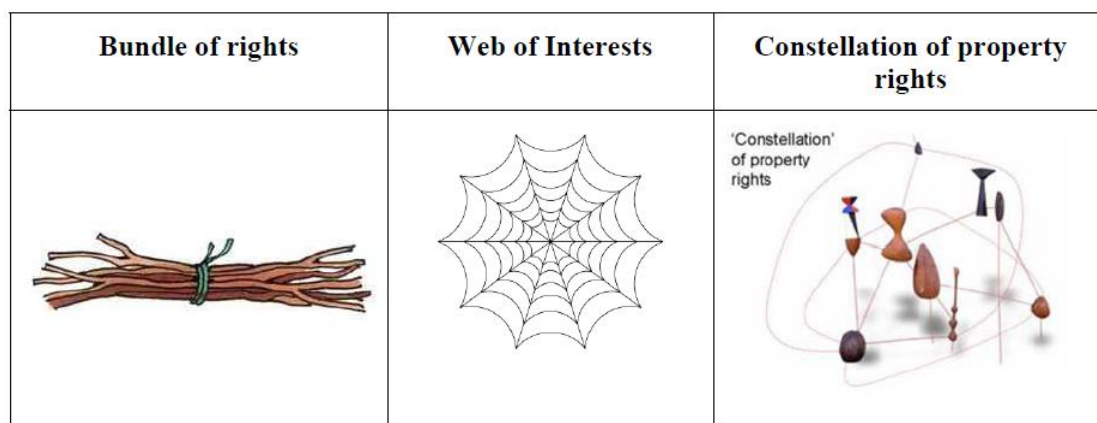
Figure 6.1: Different descriptions of property rights (Fairlie and Boydell, 2010)

Literature exists on how land interests should be administered (Bennett, 2009; Lyons et al, 2002, 2004, Dubreuil, 2006), however this research looks at what systems and processes have developed in practice over the last decade, and where information asymmetries may be leading to sub-optimal economic management at a national level. In particular, it promotes the view advocated by Wallace and Williamson (2007); that as formal land markets mature, land administrative systems need to evolve to support complex commodity markets. This includes inter-governmental sharing of information on transactions in new land markets, which can have a significant impact

on the economy through new taxable transactions and changes to the availability and supply of money in the economy. Lack of what Dale (2000) terms a 'joined-up' government approach, can lead to information asymmetries, sub-optimal decision making and resultant market failure.

The following sections map the current structure of information flows within decentralised carbon and water markets, by evaluating the theoretical concepts of the land market information flow lifecycle. Each market is examined though state-based case studies: Victoria, Western Australia and New South Wales in Australia. Each case study investigates the flow of market transaction information between the tiers of government within the state and up to the central macroeconomic policy makers, namely the RBA and ATO. Comparisons are drawn within the discussion that follows, and common information asymmetries are identified.

In Australia, the water and carbon markets are not as well developed, and comparatively small, when compared to the real property market. However their potential to impact on the economy is growing as these markets mature. Hence it is valuable to compare the current administration of these land interests, to see if they are holistically managed with real property rights and accounted for in macroeconomic management.

6.2 Case Study Results: Water Markets

In many countries where water management is decentralised, powers over water are segregated between the different states, provincial or local governments. In Australia all rights to water are granted and controlled by the state governments. These rights are not absolute, but have limits placed on their use by state-based laws and regulations (Watson, 2006). The regulatory framework governing water rights in Australia has evolved over centuries from English common law and the 'Riparian Doctrine' to the National Water Initiative by the Council of Australian Governments (CoAG) in 1994 (Alford, 2007). As Alford (2007) points out, while the National Water Initiative suggests water trading should occur across jurisdictional boundaries, in practice trading is currently occurring mostly within States, catchments and even zones within those catchments.

Three case studies follow to examine the land administration processes within current state-based water markets in three Australian states: Victoria, New South Wales and Western Australia. The case studies map how key tenure and value information is *collected*, *stored and maintained* within state-based systems and *shared* with central policy makers, using standard data flow symbology (see Chapter 5, Figure 5.1). Tenure information here relates to the ownership of a water product and the change of ownership from seller to buyer. Value relates to the consideration paid for the transfer of the water product.

The main terms used to describe the different tradable water products in the three case study states are shown in Table 6.1 below. Water allocations are also products in all three states and can include surface water, ground water or water from regulated or unregulated water sources (see Appendix 3 for details).

Table 6.1: Water product terms in case study states (Australian Government, 2011)

State	Unbundled water access right	Bundled water access right
Victoria	Water share	Approval for underground disposal
		Bulk entitlement
		Private right
		Registration licence
		Supply by agreement
		Take and Use licence
		Water allocation
New South Wales	Water access licence	Water licence
Western Australia	N/A	Water licence

Water transactions in Australia are subject to Duties and CGT, particularly on permanent trades of a water entitlement. Entitlements acquired prior to 20 September 1985 are not subject to CGT. Water property owners lodge their CGT liability with the ATO as part of their quarterly or annual tax return.

VICTORIA

The Water Act 1989 (Vic) provides the legislative framework for all water trades in Victoria. The main land administration agencies responsible for recording water rights and administering trades are the local water corporations and the Office of Water within the Department of Sustainability and Environment (DSE). The information flows within the first three stages of the information flow lifecycle are presented in Figure 6.2 and discussed below (refer numbers [1-4] to the respective annotated sections of Figure 6.2).

Inter-governmental information flows

[1] DSE maintains the Victorian Water Register which is a public, online register of all water entitlements in Victoria. Water products that can be traded include shares, allocations and take and use licences. In order to take effect, all trades of water products must be recorded in the water register. The water corporations are responsible for water supply and sewage collection services within their service areas. There are 16 water corporations and 3 state owned companies licensed with similar responsibilities in Victoria. These agencies must approve applications to trade water products based on their local trading rules.

[2] Transferring ownership of a water product requires the seller to first apply for approval to trade from their local water corporation. Once approval is received, the buyer can settle payment and other contractual details with the seller. A pre-filled registration form provided by the water corporation must be submitted to the Victorian Water Registrar within two months of the approval to trade. The transfer of ownership is then recorded in the water register.

[3] There are currently no processes in place that share information about trades in water products in Victoria with the ATO and RBA. This is potentially due to the relatively small size of water markets, in comparison to the real property markets in Australia. Consequently, adequate consideration is not yet being paid to these markets in central macroeconomic decision making. For CGT purposes, water property owners lodge their CGT liability with the ATO as part of their quarterly or annual tax return.

[4] For state-based taxes or duties on water entitlement trades, water entitlements transferred with the land are not considered to be dutiable. Unbundled water, that is, where water rights are separated from the land is one exception to this rule. Whether water is transferred with the land or unbundled, relevant documents including, but not

limited to, a copy of the contact must be provided by the parties to the State Revenue Office (SRO). The trade of unbundled water rights requires an additional application to transfer a water share or a copy of the water share record in the Victorian Water Register to be provided to the SRO. This is usually done after settlement of the water entitlement trade.

Figure 6.3 highlights the main issues within the Victorian water market with regards to the land market information flow lifecycle.

Figure 6.2: Information flows between state administration agencies within the Victorian water market and central macroeconomic policy agencies

Figure 6.3: Overview of main issues within the Victorian water market with regards to the land market information flow lifecycle

As Figure 6.3 shows, information flows within the Victorian water market are not sufficiently effective within the Collect, Store and Maintain and Share stages of the land market information flow lifecycle. The major issues are:

- *Collect stage:* There is no requirement to report transactions to the land registry at the time of contract. This affects the timeliness of market transaction information and its ability to accurately reflect the state of the market when the actual agreement to buy and sell takes place.

- *Store and Maintain stage:* The water register is currently maintained independently and is not integrated with the land titles register.

- *Share stage:* The state land agencies that administer water rights in Victoria have no existing data sharing agreements with the ATO and RBA.

NEW SOUTH WALES (NSW)

The *Water Management Act 2000 (NSW)* provides the legislative framework for water transactions in NSW. Land and Property Information (LPI), State Water and the NSW Office of Water are the land administration agencies responsible for recording and administering water rights in NSW. The information flows within the first three stages of the information flow lifecycle are presented in Figure 6.4 and discussed below (refer numbers [1-4] to the respective annotated sections of Figure 6.4).

Inter-governmental information flows

[1] In NSW, the administrative processes required for a water trade to take effect depend on the type of water product being traded. Different water products require different approval authorities. Water products that can be traded include water access licences (general water trades) and water allocations. All water access licences are registered on the Water Access Licence Register (WAL register) which is maintained by LPI. The WAL register is public and accessible online. All trades in water access licences must be recorded on the register in order to take effect. However, some water access licence trades, such as subdivisions and consolidations, require prior approval by the NSW Office of Water. Sellers or holders of WAL certificates must first apply for approval before the transfer can be settled and registered in the WAL register.

[2] To trade in water allocations on regulated rivers and major inland groundwater systems, approval and registration is undertaken by State Water. Other water allocations trades require approval and registration by the NSW Office of Water. Once the required approval has been granted, application for registration is generally undertaken by the buyer.

[3] There are currently no processes in place that share information about trades in water licences and allocation in NSW with the ATO and RBA. For CGT purposes, water property owners lodge their CGT liability with the ATO as part of their quarterly or annual tax return.

[4] All water licences in NSW are taxable or dutiable property except for those that can be permanently transferred between licence holders or sold to a new licence holder. Water rights are considered to affect the dutiable price of the property. Hence for transactions that include water rights, a contract or transfer along with relevant

documents under the *Duties Act 1997 (NSW),* need to be submitted by the parties to the Office of State Revenue (OSR).

Figure 6.5 highlights the main issues within the NSW water market with regards to the land market information flow lifecycle.
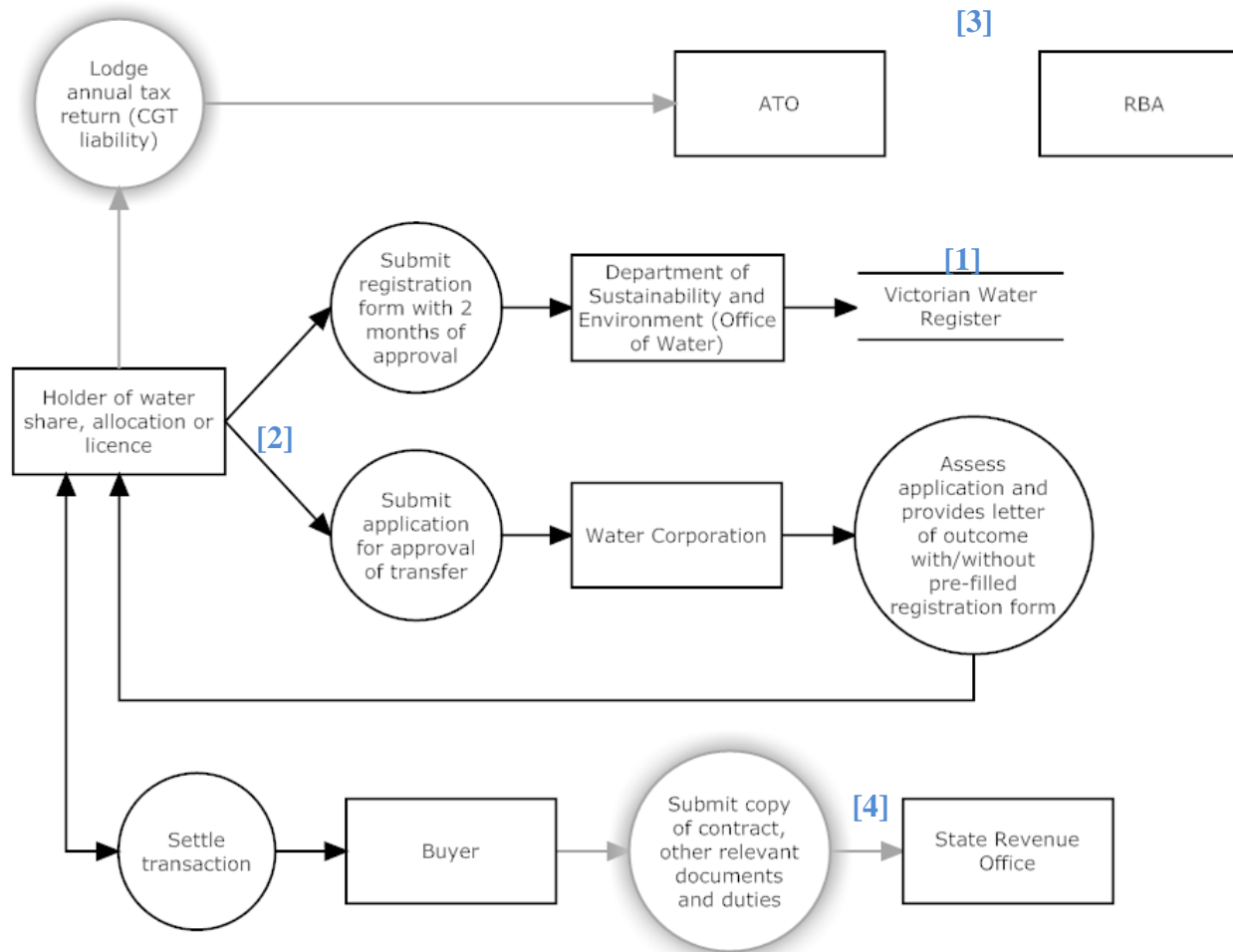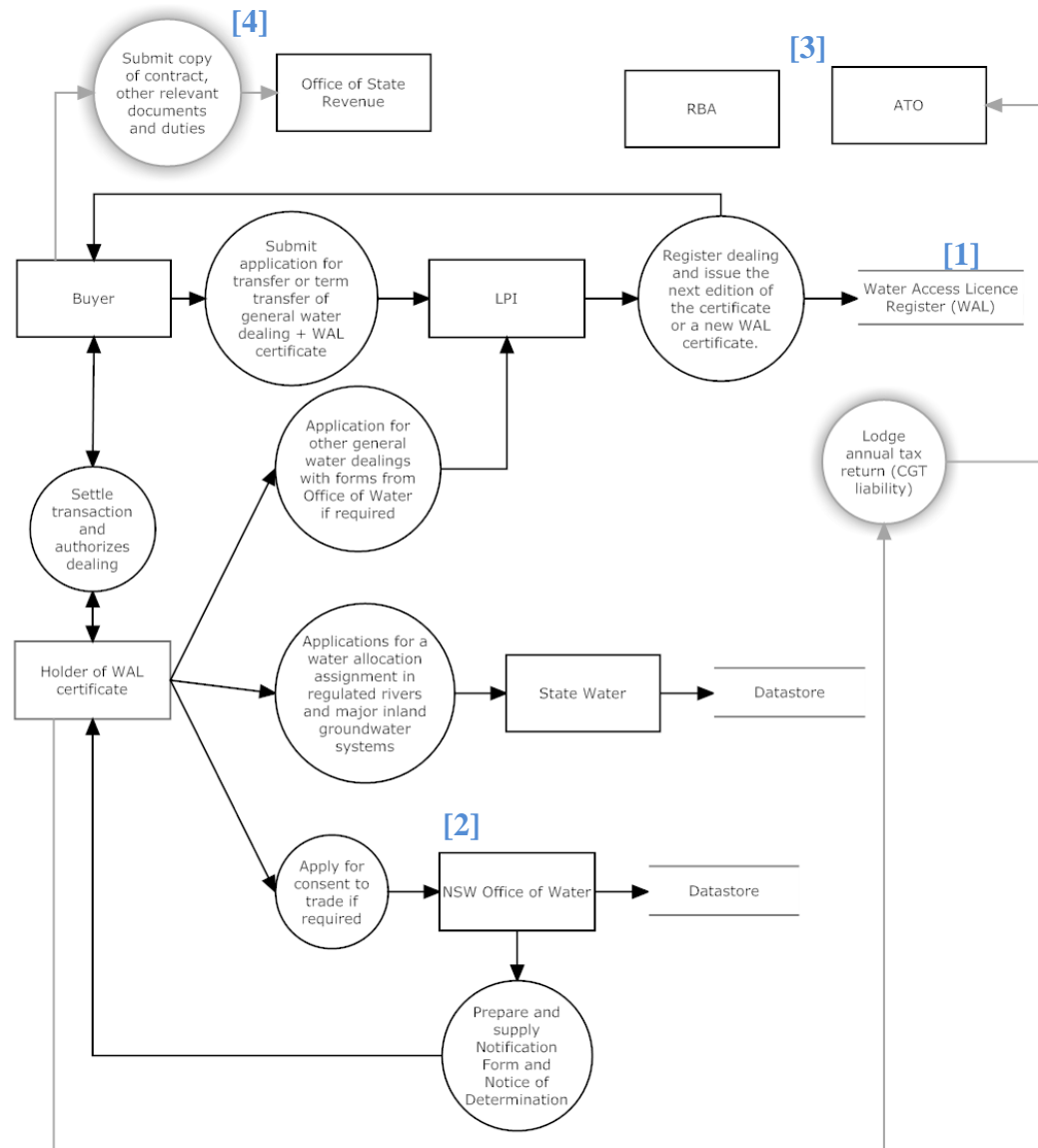
Figure 6.4: Information flows between state administration agencies within the NSW water market and central macroeconomic policy agencies
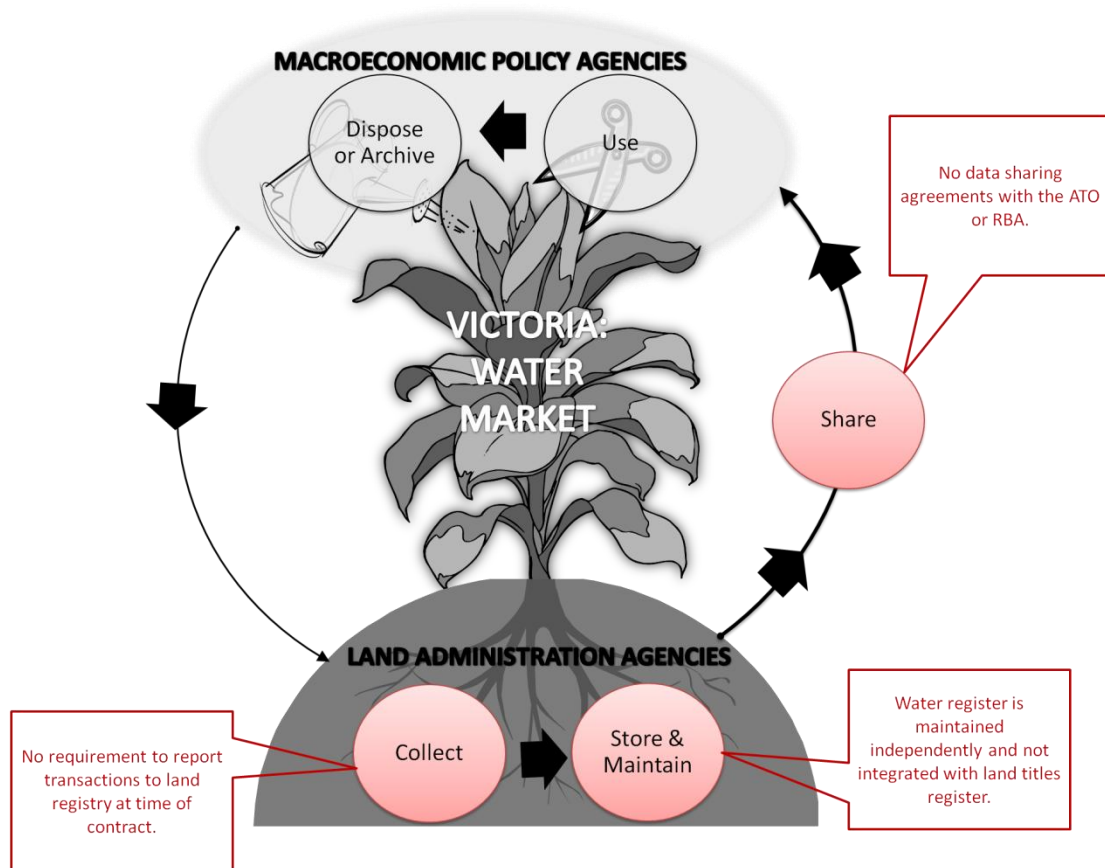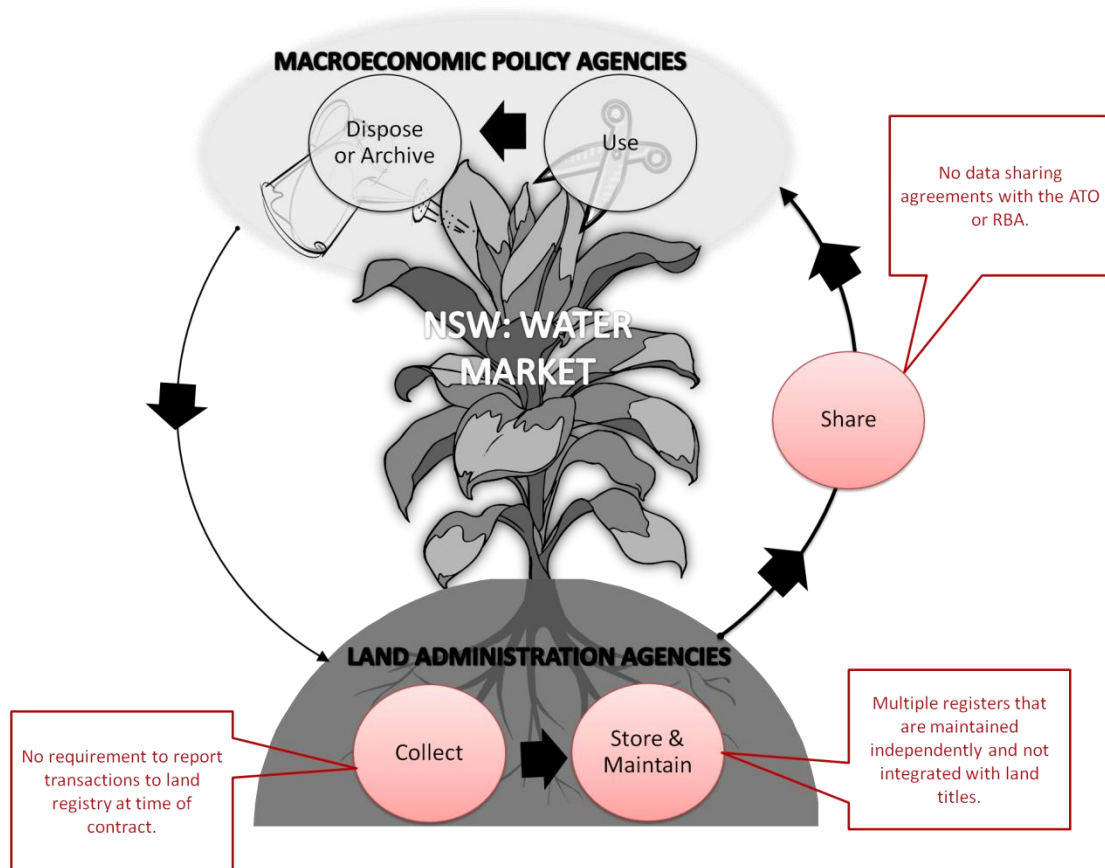
Figure 6.5: Overview of main issues within the NSW water market with regards to the land market information flow lifecycle

As Figure 6.5 shows, information flows within the NSW water market are not sufficiently effective within the Collect, Store and Maintain and Share stages of the land market information flow lifecycle. The major issues are similar to the ones identified for the Victorian water market and outlined below:

- *Collect stage:* There is no requirement to report transactions to the land registry at the time of contract. This affects the timeliness of market transaction information and its ability to accurately reflect the state of the market when the actual agreement to buy and sell takes place.
- *Store and Maintain stage:* Multiple registers exist for recording water rights in NSW. There are maintained independently and are not integrated with the land titles register.
- *Share stage:* The state land agencies that administer water rights in NSW have no existing data sharing agreements with the ATO and RBA.

WESTERN AUSTRALIA (WA)

The *Rights in Water and Irrigation Act 1914 (WA)* provides the legislative framework for water trades in WA. The primary water product in WA is licences to take water. Other licences are granted to construct or alter a well. Some permits are also issued, primarily a permit to interfere with beds and banks. The information flows within the first three stages of the information flow lifecycle are presented in Figure 6.6 and discussed below (refer numbers [1-4] to the respective annotated sections of Figure 6.6).

Inter-governmental information flows

[1] The primary land administration agency in charge of the process is the Department of Water, which issues licences and permits and resisters transactions in the Water Register. The Water Register is public and available online.

[2] A water entitlement holder wishing to trade their licence can settle payment and other contractual requirements with a potential buyer. Following this, a paper application is submitted to the Department of Water, outlining the trade for registration. If additional information is required for assessing the application, the Department of Water may issue a request for this information to the buyer or seller.

[3] There are currently no processes in place that share information about trades in water licences in WA with the ATO and RBA. For CGT purposes, water property owners lodge their CGT liability with the ATO as part of their quarterly or annual tax return

[4] A water entitlement under licence is considered dutiable property in WA by the Office of State Revenue (OSR). Duty is paid on transactions, usually by the buyer or purchaser of the water licence. The buyer must lodge the transaction with the OSR within two months of settlement.

Figure 6.7 highlights the main issues within the WA water market with regards to the land market information flow lifecycle.

Figure 6.6: Information flows between state administration agencies within the WA water market and central macroeconomic policy agencies

Figure 6.7: Overview of main issues within the WA water market with regards to the land market information flow lifecycle

Registering water dealings in WA is comparatively free of administrative complexities. However, as Figure 6.7 shows, information flows within the WA water market are not sufficiently effective within the Collect, Store and Maintain and Share stages of the land market information flow lifecycle. The major issues are:

- *Collect stage:* The agency administering water rights in WA is independent to the state's main land administration agency for real property rights. Similar to Victoria and NSW, there is also no requirement to report transactions to the land registry at the time of contract.

- *Store and Maintain stage:* The water register is currently maintained independently and is not integrated with the land titles register.

- *Share stage:* The state land agency that administers water rights in WA has no existing data sharing agreements with the ATO and RBA.

6.3   Case Study Results: Carbon Market

As Stern (2006) observed, "*climate change presents a unique challenge for economics*". Market-based solutions use property rights to provide the foundations for trade. The concept of carbon property rights in the context of climate change has been vastly debated, particularly since the Kyoto Protocol in 1997 (Allan and Baylis, 2005; Klass and Wilson, 2010; Sheehan and Kanas, 2008; Boydell et al, 2009). Since then, many carbon markets or emissions trading schemes have emerged, with the European Union Emissions Trading Scheme (ETS) being the world's largest.

Australia has only one formal carbon offset market, the Greenhouse Gas Reduction Scheme (GGAS). It has been in operation since 2003 and was the first mandatory ETS in the world. It remains the world's second largest carbon market in terms of volume and value of carbon credits (Kossoy and Ambrosi, 2010).

Even though GGAS is a NSW initiative established under its state legislation, carbon abatement credits can be created by electricity generators anywhere in the National Electricity Market (NEM). This includes Victoria, South Australia, Queensland, Tasmania, NSW and the ACT: Figure 6.8. Thus all states within the NEM benefit financially from GGAS.
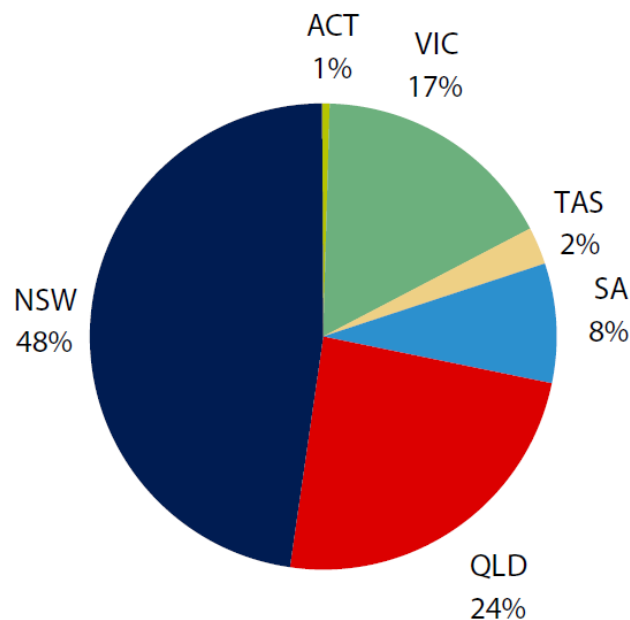
Figure 6.8: GGAS certificates created in 2009 by jurisdiction (IPART, 2010)

The administrative procedures within the current NSW GGAS are outlined below and illustrated in Figure 6.9.

NEW SOUTH WALES

NSW GGAS requires benchmark participants (mainly electricity retailers) to meet mandatory greenhouse gas emissions targets, in order to abate emissions from the consumption of electricity in NSW. The information flows within the first three stages of the information flow lifecycle are presented in Figure 6.9 and discussed below (refer numbers [1-5] to the respective annotated sections of Figure 6.9).

Inter-governmental information flows

[1] Benchmark participants can meet their targets by purchasing abatement certificates from abatement providers. Each abatement certificate represents one tonne of carbon dioxide or its equivalent. If a benchmark participant's emissions exceed the specified target, it must offset its surplus emissions by surrendering abatement certificates.

[2] Abatement certificate providers undertake activities or projects to reduce greenhouse gas emissions. This can be done through a variety of means such as improved, low emission electricity generation and management of forests to capture and retain atmospheric carbon.

[3] The main state government agency responsible for registering and administering trades in abatement certificates is the Independent Pricing and Regulatory Tribunal of NSW (IPART). IPART assess abatement activities to create certificates and also monitors compliance. As part of audit requirements, benchmark participants are required to lodge an annual compliance report or Greenhouse Gas Benchmark Statement with IPART.

[4] IPART also manages the Greenhouse Registry, a public, online registry that records the ownership and status of abatement certificates. New abatement certificates are registered in the Greenhouse Registry, as are transfer of certificates created from abatement projects. The day-to-day operation of the registry has been outsourced to the private sector.

Transactions in abatement certificates are currently not taxed by the Office of State Revenue in NSW.

[5] There are currently no processes in place that share information about trades in carbon certificates in NSW with the ATO and RBA.

Figure 6.10 highlights the main issues within the NSW carbon market with regards to the land market information flow lifecycle.
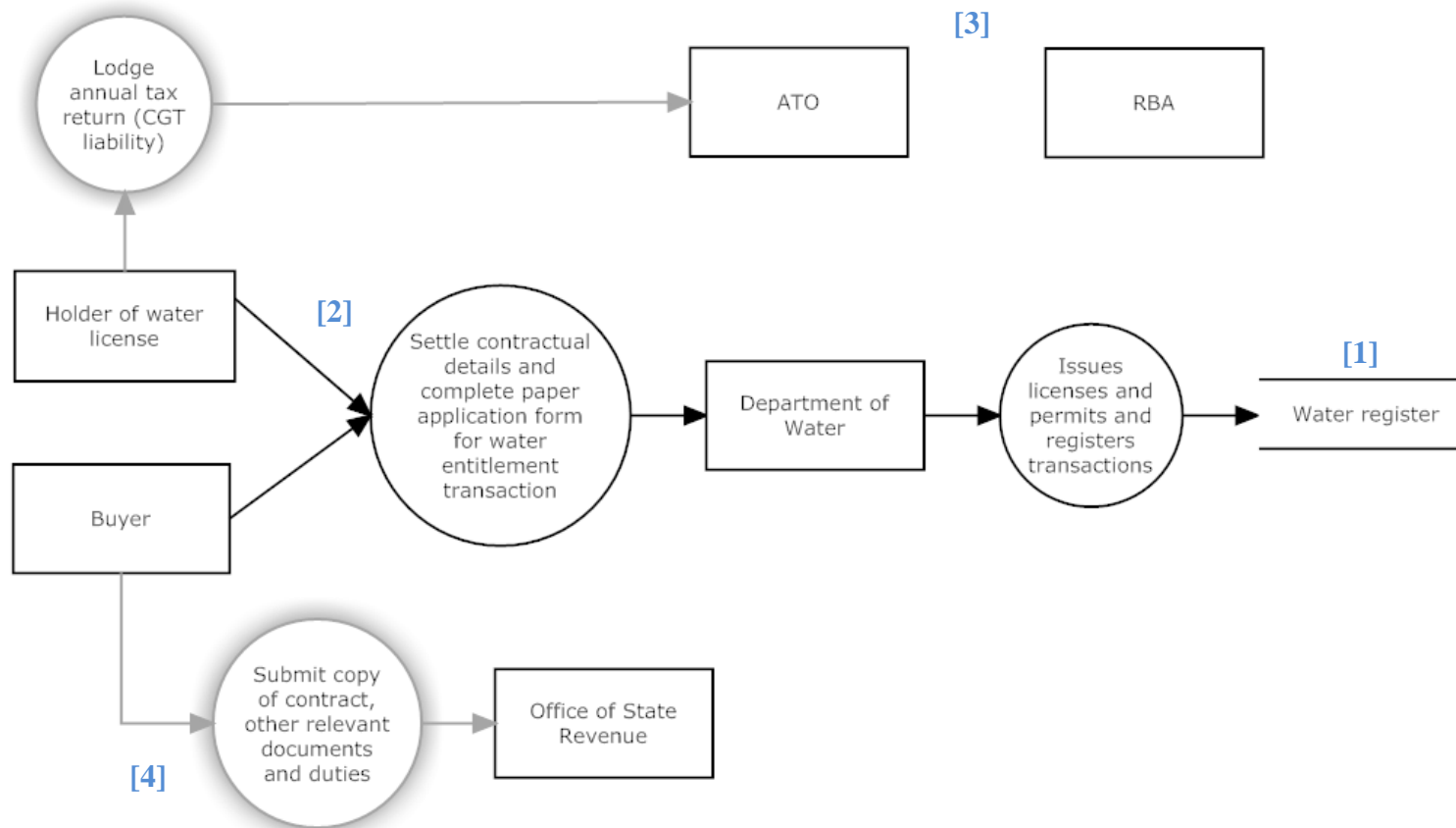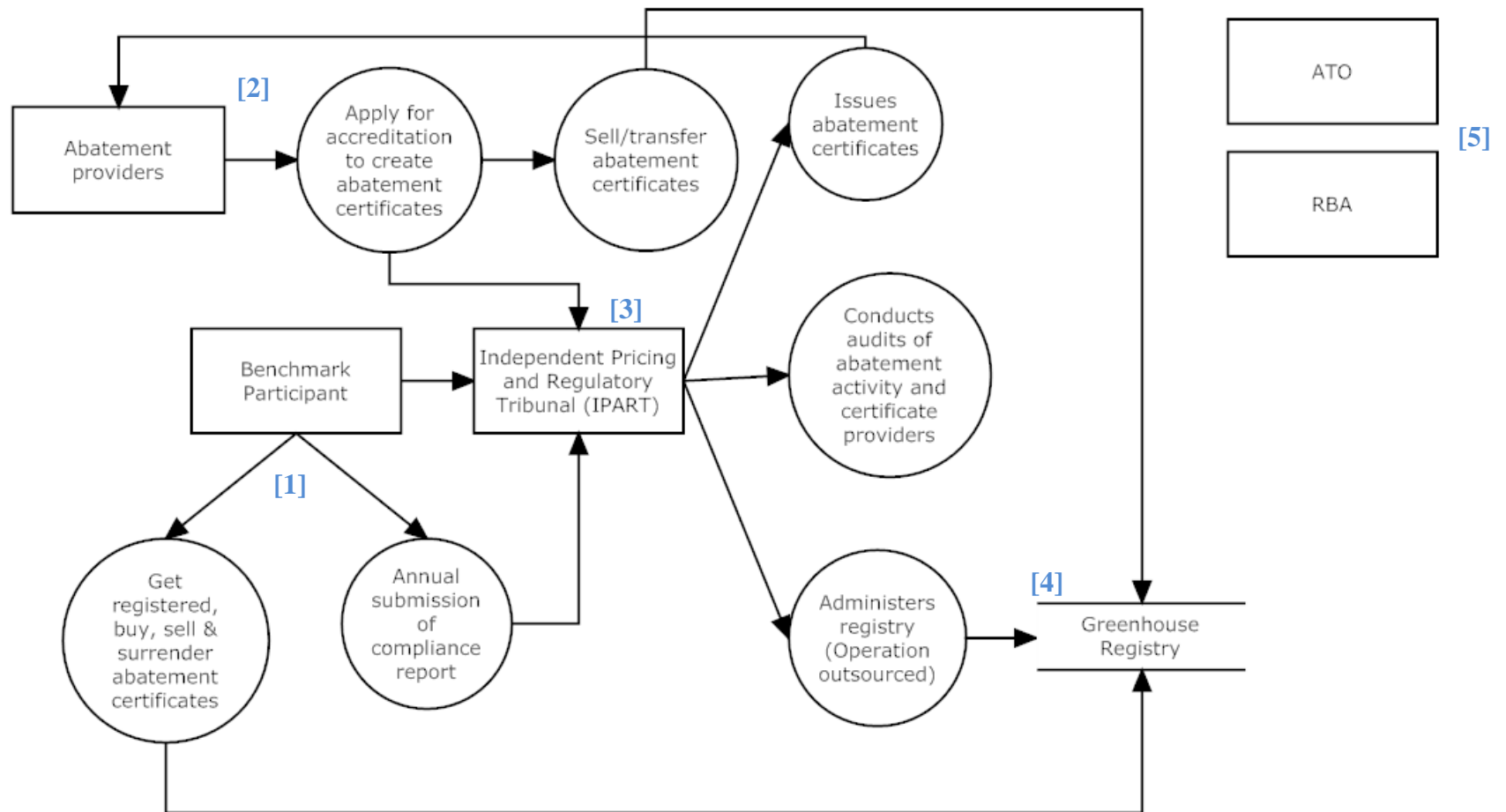
Figure 6.9: Information flows between state administration agencies within the NSW carbon market and central macroeconomic policy agencies
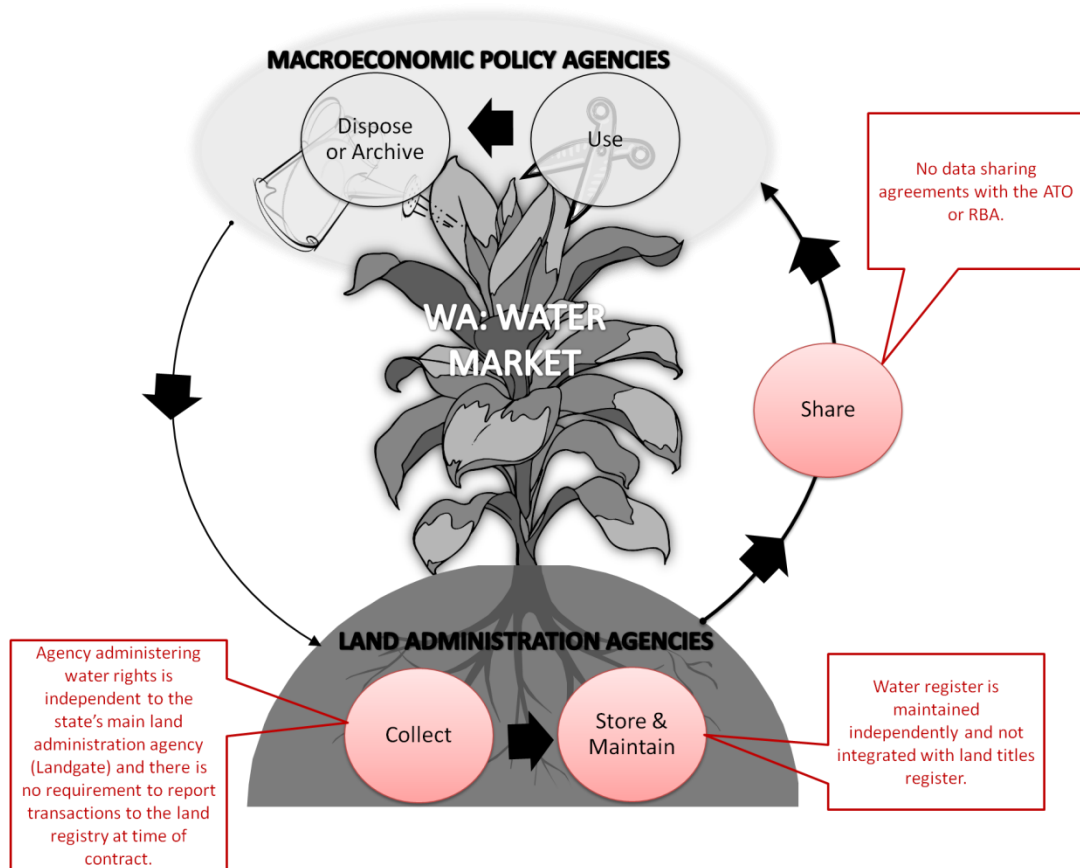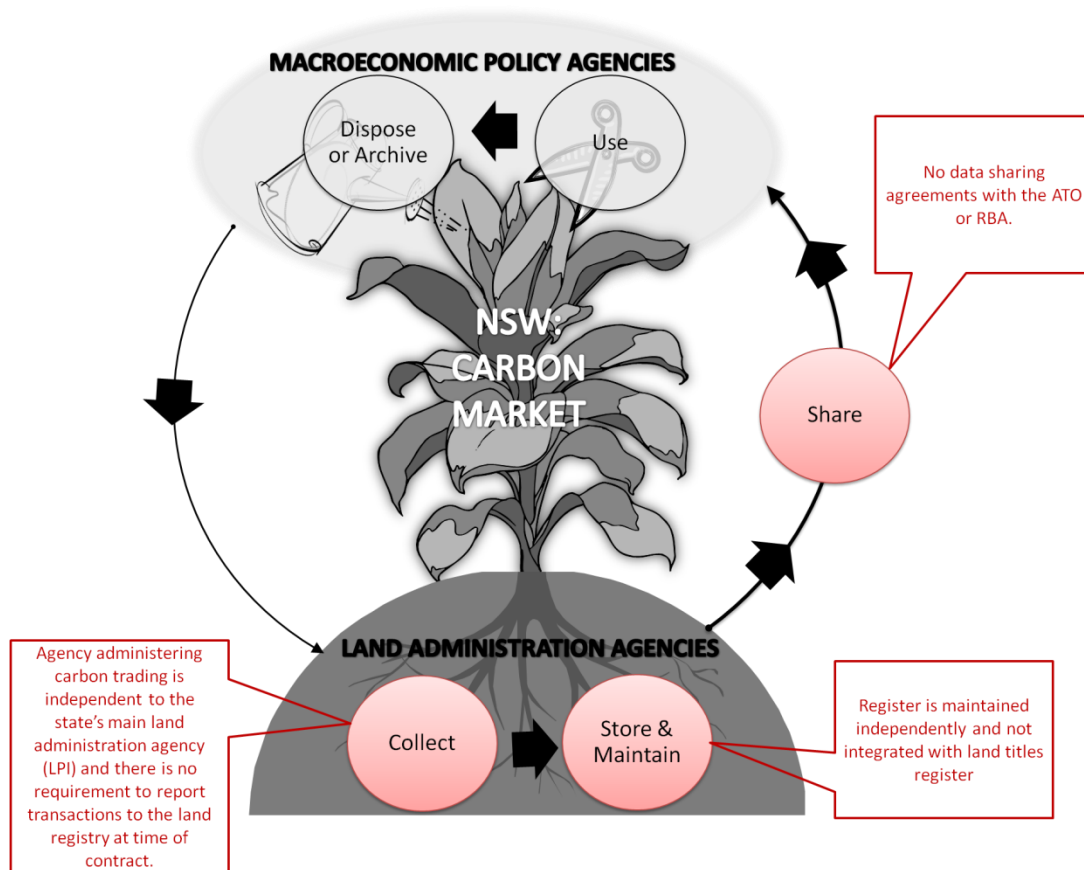
Figure 6.10: Overview of main issues within the NSW carbon market with regards to the land market information flow lifecycle

As Figure 6.10 shows, information flows within the NSW carbon market are not sufficiently effective within the Collect, Store and Maintain and Share stages of the land market information flow lifecycle. The major issues identified are similar to the issues within the WA water market. These are:

- *Collect stage:* The agency administering carbon rights in NSW is independent to the state's main land administration agency for real property and water rights. Like the other case study states, there is also no requirement to report transactions to the land registry at the time of contract.

- *Store and Maintain state:* The carbon register is currently maintained independently and is not integrated with the land titles register.

- *Share stage:* The state land agency that administers carbon rights in NSW has no existing data sharing agreements with the ATO and RBA.

6.4   Key Comparisons and Discussion

The case studies show that new markets in land resources are developing their own independent administrative structures and data repositories. They are mostly independent to current land administration practices in real property markets. A new breed of silo-like approaches is emerging.

Water markets

Though legislative and administrative arrangements for trading water are in place in each of the case study states, there is a lack of consistency in information collection, storage and maintenance. Processes in the different states are vastly different, as are the water entitlements that can be traded. WA has the least administrative complexity; however its market is not as mature as NSW or Victoria. Processes to trade water entitlements are comparatively complex in NSW, with multiple land administration agencies maintaining their own databases and registration systems.

The issues with decentralised water resource management are faced by many countries other than Australia. The 5th World Water Forum in Istanbul in 2009 was attended by Brazil, India, Mexico, US and Canada among others, to discuss the issues of river basin management in counties with a tiered government structure. The discussions found vertical integration is often missing in the management of water resources and intergovernmental cooperation is needed. The need to take into account the different jurisdictions' political and administrative systems was acknowledged, as was the understanding that no ideal model currently exists (Braga 2009).

Initiatives are in place to establish interstate water trading in Australia. Of particular significance is the Murray Darling Basin Agreement, entered into by the central government, New South Wales, Victoria, South Australia, Queensland and Australian Capital Territory governments. In 1998 the Murray Darling Basin Ministerial Council trialled a pilot interstate water trading project within a small area of the Murray Darling Basin: Figure 6.11. The pilot program developed procedures to ensure that purchasers of water received a water entitlement that is valid in their respective states (Murray Darling Basin Authority, 2004). The success of the project led to the Intergovernmental Agreement on a National Water Initiative in 2004 which, among other matters, agreed to expand the area where interstate trade in water entitlements can occur.
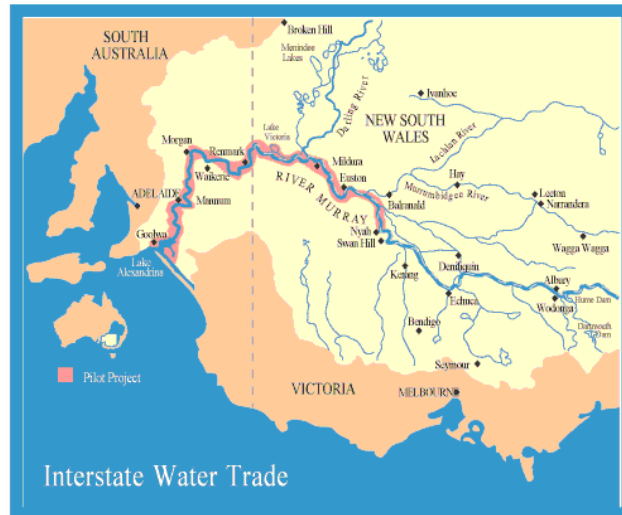
Figure 6.11: Pilot interstate water trading project (Murray-Darling Basin Commission, 2004)

However, vertical information sharing of market transaction information with central government agencies that manage the economy is still lacking. Water transactions are subject to CGT, however according to current legislation, government agencies that are responsible for administering water entitlements are not required to advise the ATO and RBA where licences and other entitlements are transferred to a new owner. The underlying objectives of the land market information flow lifecycle are yet to be achieved.

Carbon market

A similar lack of information sharing is evident within the only formal carbon market in Australia, the NSW GGAS. There are many other players in voluntary carbon offset markets in other parts of the country. However, the markets are highly fragmented with little regulation and differing quality standards (Campbell, 2007).

In Australia, and other countries like the United States (US), the debate over an ETS is contentious and politically fraught (Kruger, 2011). Twenty US states have 'cap-and-trade' programs in place, or legislation in the making (Kruppa and Allan, 2011). Increased cooperation between the states is essential for the development of a nation-wide carbon market; a major issue discussed at the Annual Summit of The North American Free Trade Agreement (NAFTA) countries in Mexico in 2009. Since then it

has been suggested that state-based initiative can be linked to eventually reach a multi-jurisdictional carbon market (Mehling, 2009).

In Australia, the federal government passed a bill on the 8th of November 2011, which will cap emissions and allow companies to trade permits. This is a national initiative backed by national legislation. The announcement in 2007 of the federal government's intention to develop a national ETS had detrimental effects on GGAS. The NSW state initiative was intended to end at the commencement of a national trading scheme, with certificates issued under GGAS not eligible under a federal scheme (Kossoy and Amrosi, 2010). For this reason many GGAS credit holders discarded their holdings and there was a significant reduction in the price of carbon credits in the state market (Wells, 2007). At the time of writing, the NSW GGAS was still in operation, scheduled to end on the 1st of July, 2012. Though a national scheme is desirable, the closure of GGAS will leave current participants in the scheme stranded with carbon abatement certificates worth about AUD16 million rendered worthless (Salusinszky and Hepworth, 2012). A more efficient and economically viable solution is for the national scheme to take into account current administrative structures, practices and certificates issued within the carbon market in NSW. On this front, NSW initiated the National Emissions Trading Taskforce, which is a collaborative effort between the states and territories to design and implement a national ETS. A number of submitters to the taskforce suggested that existing GGAS rules be used to develop the administrative procedures for a national ETS; and a collaborative approach between the state and federal governments be used to develop transitional arrangements between the two carbon offset schemes (National Emissions Trading Taskforce, 2007).

6.5   Conclusion

Figure 6.12 summarises the overall issues within the state-based land resource markets studied in Australia, with regards to the land market information flow lifecycle.
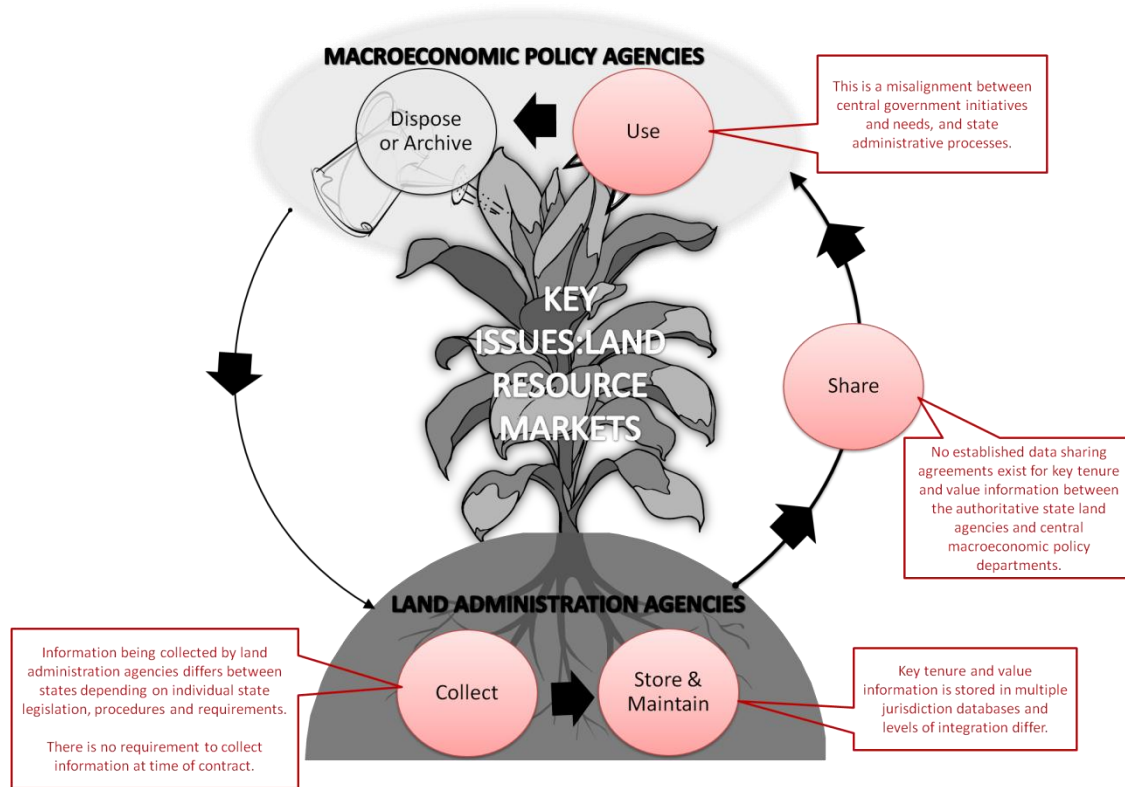
Figure 6.12: Summary of key issues within state-based land resource markets in Australia with regards to the land market information flow lifecycle

The main issues that exist are very similar to the ones identified for the real property markets in Australia; and affect the functionally of each key stage of the land market information flow lifecycle in the following ways:

- *Collect stage:* Information being collected by land administration agencies differs between states depending on individual state legislation, procedures and requirements. This is also no requirement to collect information at time of contract. This affects the timeliness of this data and its ability to accurately reflect the state of the market at the time of transaction.

- *Store and Maintain stage:* Key tenure and values information is stored in multiple jurisdictional databases and levels of integration within the state land agencies differ.

- *Share stage:* There are currently no established data sharing agreements for key tenure and value information between the authoritative state land agencies that administer water and carbon rights and the central macroeconomic policy makers.

- *Use stage:* Central government initiatives in land resource markets and information needs of macroeconomic policy makers are currently not aligned with the land administration processes at state level.

The issues of vertical information sharing and horizontal information integration need to be addressed. New land resource markets will need to be tied to the underlying land parcels and land titles in order to be functional. The management of these is, and will remain, the constitutional authority of the state governments. For any land resource market to be effectively managed within the national economy, a dynamic land information flow lifecycle needs to be established.

6.6 Chapter Summary

New emerging markets have a significant impact on the national economy and need to be managed holistically with real property rights. For efficient fiscal and monetary policies to manage the economy, the large central departments and agencies need national information about market transactions and taxable objects, which are currently held in separate jurisdictional databases. Case studies of carbon and water markets within Australia show new silo-like approaches emerging that need to be incorporated into a nation-wide land market information flow lifecycle. Better integration at a nation level can be achieved if new options for enabling authoritative land information flows are prioritised in all land and resource markets.

CHAPTER 7:
A REFINED LAND MARKET INFORMATION FLOW LIFECYCLE
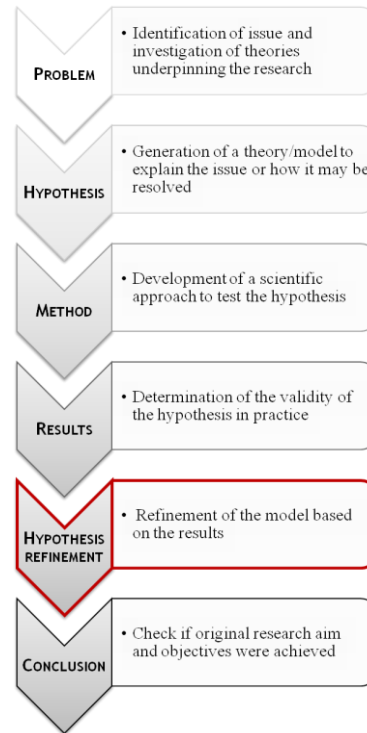
- *The following chapter refines the land market information flow lifecycle, by outlining principles for each stage that can support synthesis of land administration information with macroeconomic management. The principles are derived from the case study results and supported by best practice in land administration.*

7.1 Introduction

The proposed lifecycle approach to national land market information for central economic management, promotes cross-governmental flows of high quality market transaction information. The lifecycle is divided into five stages of land information management: *Collect*, *Store and Maintain*, *Share*, *Use* and *Dispose or Archive*.

Case studies conducted review current land administration systems as geographically distributed information ecologies. Relationships and interdependencies between different entities are examined by looking at cross-governmental information flows in the context of state-based real property and land resource markets in Australia. The results are summarised below:

- Information being collected by land administration agencies differs between states depending on individual state legislation, procedures and requirements.

- There is no requirement to collect information at time of contract. Reporting requirements differ from 30-60 days following contract.

- Across the three case study states, real property market information (tenure and value, including historic sales data) is stored in 8 different state databases and levels of integration differ.

- Data sharing between the authoritative state land agencies and central macroeconomic policy departments is limited.

- Information needs of the central macroeconomic policy departments are generally beyond the current capabilities of land administration agencies to deliver. Specific information needs relating to the tenure and value of land transactions include:
  - Accurate owner identities
  - Primary places of residence
  - A cost base – authoritative historic sales data
  - Current house price information
  - Mortgage information – amount and date of discharge
  - Unimproved land values

- New land resource markets are also developing independent approaches and data stores, which are generally not linked to established administration structures within the states' respective real property markets.

- Economic activity in these new land resource markets is currently not adequately considered by central macroeconomic policy makers.

- The full potential of the proposed land market information flow lifecycle is yet to be achieved. However this model needs to be refined in order to achieve consistency in information collection, storage and maintenance across the state land agencies; optimise information sharing and meet the information needs of central macroeconomic policy makers. This will enable better horizontal and vertical information integration to support synthesis of land administration information and macroeconomic management.

The following section draws on the results from the case studies to refine the proposed land information flow lifecycle model with principles for each stage; that will enable an operational link between land administration and macroeconomic management. Information needs derived from the case studies are Australia specific; however they are a good indication of the general needs of central macroeconomic policy makers in mixed capitalist economies.

7.2   A Refined Land Information Flow Lifecycle

The proposed land information flow lifecycle is refined by defining principles for each of the first four stages that will enable current cross-governmental information asymmetries to be minimised or overcome. In this context principles are defined as *fundamental nested processes that help to achieve an activity with a clear purpose; and whose functionality is part of a larger process*. This definition of a principle is adopted in keeping with the system design nature of this research and is well suited to information management. Furthermore the definition focuses on achieving an outcome while maintaining the traditional implications of a principle as a standard or fundamental idea. Achieving or meeting a principle requires undertaking and completing the process within the existing land administration system. Achieving each principle will enable a dynamic land market information flow lifecycle to be established. The *Dispose or Archive* stage of the information flow lifecycle requires further evaluation and is beyond the scope of this research.

Principles recommended for each stage are based on the results of the case studies. Additionally they are supported by best practice in land administration recommended by the United Nations Economic Commission for Europe (UNECE)'s Land Administration Guidelines (UNECE, 1996), International Federation of Surveyors (FIG)'s Cadastre 2014 (Kaufmann and Steudler, 1998), UN-FIG Bathurst Declaration on Land Administration for Sustainable Development (UN-FIG, 1999) and the World Bank's Land Administration Reform: Indicators of Success and Future Challenges (Burns, 2007). Various parts of these documents are used to add further rigour to the recommendations drawn from the case study results. Comparisons are also drawn with the concept of key registers being adopted by a number of European counties. Details are outlined in the sections that follow.

Collect

The *Collect* stage refers to the entities and processes involved in registering a transfer of ownership.

Zevenbergen(2007) asserts equitable taxation of land as one of the original functions of a cadastre and the ability to identify ownership one of the primary functions of a land registry. Additionally, he comments on the sale of land as a good opportunity for taxation based on the value of the contract. Negative impacts of such a tax include increased opportunities for fraud, such as stating in the contract a lower price than was actually paid. Particularly where sales are taxed by different authorities, collecting accurate information about the value and time of contract is integral to equitable taxation.

Land administration best practice guidelines also provide a number of recommendations that relate to this stage of the land market information flow lifecycle. There are outlined below:

UNECE's Land Administration Guidelines:

- State that good land records improve land tax collection by helping to identify land owners and judge the performance of the market through current price information and the volume of sales.
- Advocate customer-focused land information systems.

- Recognise the benefits of computerisation within land administration for greater efficiencies and increased standardisation.

FIG's Cadastre 2014:

- Advocate customer-focused land information systems.
- Recognise the benefits of computerisation within land administration for greater efficiencies and increased standardisation.

UN-FIG Bathurst Declaration:

- Advocate customer-focused land information systems.

World Bank's Land Administration Indicators:

- State timeliness as an important factor in administering legal rights in property
- Advocate customer-focused land information systems.
- Recognise the benefits of computerisation within land administration for greater efficiencies and increased standardisation.

In addition to the above, the Dutch system of key registers uses a system of unique identifies to link information between registers. For instance an address is linked to a person by combining the unique identifier of the property with the unique identifier of the person (Ellenkamp and Maessen, 2011). Unique identifiers allow for the integrity of data to be maintained, easier data integration between systems; and enable information changes and updates to be effectively and efficiently incorporated into all linked systems. For data integration at a national level unique national identifiers, like the ones that form the basis of the key electronic identity management system (eIDM) in the Netherlands (Interoperable Delivery of European eGovernment Services, 2009), will improve cross-border usability of information resources. A similar system of public key registers is also being considered in Denmark (de Vries, 2012).

To collect accurate information about ownership, value and time of contract; and to achieve the benefits of standardisation, timeliness and computerisation in land market information collection, 14 principles within the *Collect* stage of the information flow lifecycle are recommended for land administration agencies: Table 7.1. Supporting

evidence from the case studies for each recommended principle is also provided in the table.

Table 7.1: Recommended principles within the Collect stage of the land market information flow lifecycle. Identity is abbreviated to ID

COLLECT PRINCIPLE	COMMENT	SUPPORTING EVIDENCE FROM CASE STUDIES	BEST PRACTICE DOCUMENTS & OTHER INITIATIVES THAT SUPPORT THIS RECOMMENDATION
Information collected should include			
● *Buyer national ID*	Transferrer details	All case studies – new owner information for tax purposes.	UNECE Guidelines, key registers
● *Seller national ID*	Transferee details	All case studies – prior owner information for tax purposes	UNECE Guidelines, key registers
● *National property ID of property or land right transacted*	Street address or geographical coordinates of the property/right being transacted	All case studies – location of transaction to accurately reflect the economic nature of the market in an area	UNECE Guidelines, key registers
● *Is the property transacted the primary place of residence?*	The primary place of residence is the main dwelling (house or flat) where the transferrer usually resides. A person may only have one primary place of residence at any given time.	Identified need of central fiscal policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
● *National property ID of contact address of buyer*	Address where the transferee may be reached during/after the transfer	All case studies – for tax purposes	UNECE Guidelines, key registers
● *National property ID of contact address of seller*	Address where the transferrer may be reached during/after the transfer	All case studies – for tax purposes	UNECE Guidelines, key registers
● *Value of transaction (sale price)*	Consideration paid for the transfer	Identified need of central macroeconomic policy makers. Also for state valuations and tax purposes.	UNECE Guidelines, Bathurst Declaration, World Bank Indicators

● *Unimproved land value*	The value of the land without physical improvements such as houses, fences etc	Identified need of central monetary policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
● *Date of contract*	Date of the actual contractual agreement to transfer the land right between the parties involved in the transfer	Identified need of central monetary policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
● *Mortgage amount*	The amount of debt owed to a creditor if the land right is acquired under a mortgage	Identified need of central monetary policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
● *Date of discharge of mortgage*	The date the debtor satisfies the mortgage and the encumbrance against the land right is removed	Identified need of central monetary policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
Identity checks performed before registration	National IDs are verified prior to registration of the transaction.	Identified need of central fiscal policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
Timely acquisition of data following contract (at time of contract)	The land registry is informed of an arrangement to transfer a land right when a contractual agreement is made between the parties	Identified need of central macroeconomic policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators
Online registration available and operational	The ability to submit documentation to the registry and apply for registration via the internet is available and in use	All case studies - to digitise the processes of land registration	UNECE Guidelines, Cadastre 2014, World Bank Indicators

Store and Maintain

The *Store and Maintain* stage includes the entities, databases and processes currently involved in the storage and maintenance of land transaction and historic sales information.

The following outlines the recommendations of land administration best practice guidelines that relate to this stage:

UNECE's Land Administration Guidelines:

- State that the usefulness of a land information system depends on the system being up to date, accurate, complete and accessible.
- Recommend that land data should be registered only once and kept up to date in one place.
- Advocate customer-focused land information systems.

FIG's Cadastre 2014:

- Recognises state guarantee of title as an important strength of existing cadastral systems.

UN-FIG Bathurst Declaration:

- Advocate customer-focused land information systems.

World Bank's Land Administration Indicators:

- Advocate customer-focused land information systems.

In addition to the above, Ellenkamp and Maessen (2011) promotes the importance of establishing the relation between key registers as integral to the future of a national system. In the Dutch system, local registers maintained by independent government bodies feed into a central registry. Horizontal and vertical information integration is vital to the successful operation of a national system.

To maintain an authoritative, timely, accurate and integrated repository of land transaction information, 3 principles within the *Store and Maintain* stage of the information flow lifecycle are recommended for land administration agencies: Table

7.2. Supporting evidence from the case studies for each recommended principle is also provided in the table.

Table 7.2: Recommended principles within the Store and Maintain stage of the land market information flow lifecycle

STORE AND MAINTAIN PRINCIPLE	COMMENT	SUPPORTING EVIDENCE FROM CASE STUDIES	BEST PRACTICE DOCUMENTS & OTHER INITIATIVES THAT SUPPORT THIS RECOMMENDATION
Custodian is accountable for the integrity of tenure and value data	The person/agency responsible for collecting, storing and maintaining market transaction data is also under obligation to ensure the integrity of that data and can be held accountable for data inaccuracies	All case studies – to ensure authoritative transaction data that is guaranteed by the state land registries	Cadastre 2014
Key tenure and value databases are integrated (not stand-alone or maintained in isolation)	The key land tenure and value databases are maintained in cooperation to form an inter-related whole	Victorian real property case study and all land resource case studies	UNECE Guidelines, key registers
Historic sales data maintained	Information showing the transaction history of a land right are maintained together will current ownership details	Identified need of central fiscal policy makers	UNECE Guidelines, Bathurst Declaration, World Bank Indicators

Share

Share refers to the entities and inter-governmental process and services that dissimilate information.

Inter-governmental information sharing is a fundamental function of the system of key registers (Ellenkamp and Maessen, 2011). Land administration best practice guidelines also provide a number of recommendations that relate to this stage of the land market information flow lifecycle. These are outlined below:

UNECE's Land Administration Guidelines:

- Encourage public access to land information to assure certainly and maintain confidence in land market transactions.
- Recognise the need to maintain the privacy of individuals.
- Support easy and cost-effective access to land information.
- Acknowledge the benefits of technology and online delivery in land administration reform.
- Recommend cost-recovery procedures.

FIG's Cadastre 2014:

- Encourage public access to land information.
- Support easy and cost-effective access to land information.
- Acknowledge the benefits of technology and online delivery in land administration reform.
- Recommend cost-recovery procedures.

UN-FIG Bathurst Declaration:

- Encourage public access to land information.
- Support easy and cost-effective access to land information.
- Acknowledge the benefits of technology and online delivery in land administration reform.

World Bank's Land Administration Indicators:

- Encourage coordination and established lines of communication between government agencies.

- Encourage public access to land information.

- Support easy and cost-effective access to land information.

- Acknowledge the benefits of technology and online delivery in land administration reform.

- Recommend cost-recovery procedures.

Additionally, Bennett et al (2013) show land administration systems and land information to be critical, public good infrastructures that should exhibit low excludability and rivalry of use. The exception is person identification information, which should have a higher excludability from public use.

To achieve defined lines of communication with macroeconomic policy makers and open, easy, online and cost-effective access to land transaction information; 11 principles within the *Share* stage of the information flow lifecycle are recommended for land administration agencies: Table 7.3. Supporting evidence from the case studies for each recommended principle is also provided in the table. Some of these recommendations aim to improve information sharing between government data custodians and the public, while others aim to improve cross-governmental sharing.

Table 7.3: Recommended principles within the Share stage of the land market information flow lifecycle

SHARE PRINCIPLE	COMMENT	SUPPORTING EVIDENCE FROM CASE STUDIES	BEST PRACTICE DOCUMENTS & OTHER INITIATIVES THAT SUPPORT THIS RECOMMENDATION
Public access to tenure and value data	Tenure and value datasets are publically available	All case studies	UNECE Guidelines, Cadastre 2014, Bathurst Declaration, World Bank Indicators
Public access to historic sales data	Historic market transaction data is publically available	Victorian real property case study	UNECE Guidelines, Cadastre 2014, Bathurst Declaration, World Bank Indicators
Capable of online delivery	Market transaction information is available online	All case studies.	UNECE Guidelines, Cadastre 2014, Bathurst Declaration, World Bank Indicators
Open standard format	Information is provided on a platform that is independent, machine readable and free from restrictions that would prevent the re-use of that information	All case studies	UNECE Guidelines, Cadastre 2014, Bathurst Declaration, World Bank Indicators
Single licensing environment	One point of contact, or source, for licences to use data	NSW water case study	UNECE Guidelines, Cadastre 2014, Bathurst Declaration, World Bank Indicators
Different levels of access	Different data access permissions for system administrators and data custodians, registered and unregistered users	All case studies	UNECE Guidelines
Low rivalry of use for all datasets	Since land information is a public good, access to land information by one individual or agency should not affect the use of this information by another	All case studies	UNECE Guidelines, Cadastre 2014, Bathurst Declaration, World Bank Indicators
Low excludability of use (except for personal identification data) that is, access charge is based on cost-recovery	Since land information is a public good, individuals or agencies should not be excluded from its use, particularly due to high access	Victorian real property case study	UNECE Guidelines, Cadastre 2014, World Bank Indicators

	changes. The exception is personal identification data.		
High excludability of use for personal identification data	To protect the privacy of individuals, personal identification data such as owner names, should have a high excludability from use, that is individuals and agencies can be excluded from obtaining this data unless they are appropriately authorised to do so	All case studies	UNECE Guidelines
Intergovernmental arrangements to facilitate equitable sharing of tenure, value and historic sales data with the central fiscal policy department	Fair and impartial data exchange agreements are established between the central fiscal policy department and the state land administration agency who is the custodian of this data	All case studies	World Bank Indicators, key registers
Intergovernmental arrangements to facilitate equitable sharing of tenure, value and historic sales data with the central monetary policy department	Fair and impartial data exchange agreements are established between the central monetary policy department and the state land administration agency who is the custodian of this data	All case studies	World Bank Indicators, key registers

Use

Land data requirements of central government policy makers relate to the *Use* stage of the information flow lifecycle.

None of the best practice guidelines outlined earlier examines the land information needs of macroeconomic management. However, as mentioned earlier, the UNECE guidelines, World Bank indicators and the Bathurst Declaration all advocate land information systems that are customer-focused, that is, for the benefit of the user rather than the information producer (UNECE 1996; Williamson and Grant, 2002; Burns, 2007).

Recommended principles for the *Collect* stage ensure that information collected meets the needs of users, that is, central macroeconomic decision makers. However, government agencies that require land market information for decision marking should ensure that data they use is from high quality sources. This is a key component of evidence-based policy marking (Head, 2009). Ideally, tenure and value information should be sourced from the authoritative land administration agencies that are the custodians of this data and accountable for its integrity. 'Obligation to use' is also one of the fundamental principles of key registers (Ellenkamp and Maessen, 2011). Additionally, as Ellenkamp and Maessen (2011) points out, no key register is 100% accurate. This makes an 'obligation to report errors or other irregularities' also a key principle of the system. As van der Molen (2007) points out, feedback that is regulated by law is one of the twelve requirements of a key register. With regards to the land market information flow lifecycle, an obligation of data users to report any errors to the data custodians represents the integral feedback loop of the lifecycle. To ensure this, 3 principles within the *Use* stage of the information flow lifecycle are recommended for central macroeconomic agencies: Table 7.4. Supporting evidence from the case studies for each recommended principle is also provided in the table.

Table 7.4: Recommended principles within the Share stage of the land market information flow lifecycle

USE PRINCIPLE	COMMENT	SUPPORTING EVIDENCE FROM CASE STUDIES	BEST PRACTICE DOCUMENTS & OTHER INITIATIVES THAT SUPPORT THIS RECOMMENDATION
Base data used for decision making is authoritative	The original database of market transaction information that supports decision making is obtained from authoritative sources	All case studies	key registers
Regular updates from authoritative sources	The original, base data set of land transaction data is regularly updated by information sourced from the authoritative public land administration agency who is the custodian of this data	All case studies	key registers
Users are required to inform data custodians if errors are found	If errors are found in land transaction information, the data users are required to inform the land administration agency who is the custodian of this data	All case studies – feedback loop	key registers

Altogether, 31 principles derived from the case studies and backed by best practice in land administration are designed, to refine the land market information flow lifecycle into a functional outcome. The principles aim to establish dynamic land information flows to enable synthesis of land administration information and macroeconomic management. The chapter that follows will test the operation of this refined model by showing its implementation.

7.3   Chapter Summary

The refined national land information flow lifecycle is designed to establish cross-governmental flows of high quality tenure and value (market transaction) information, between government land administration agencies and macroeconomic policy makers. All recommended principles of this model are based on the results of case studies and backed by established best practice in land administration. Prior to this, no individual document detailed the principles of establishing synthesis between land administration information and macroeconomic management for sustainable development of a country's land and resource markets.

CHAPTER 8:
IMPLEMENTING THE LIFECYCLE
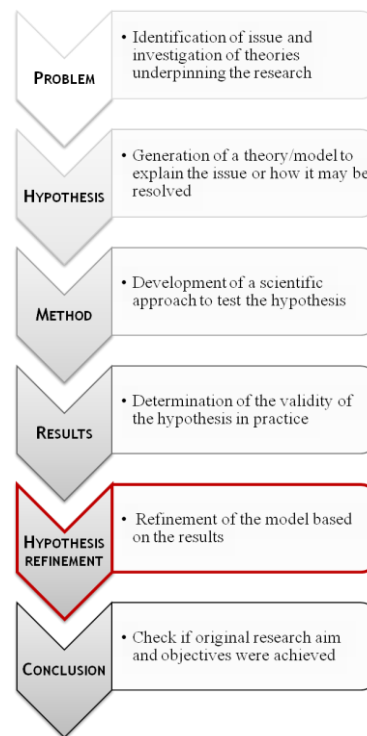
- *In the following chapter the operation of the refined land market information flow lifecycle is tested by implementing it on the case studies. Additionally, an application of integrated land market information is presented for demonstrative purposes.*

8.1   Implementing the Lifecycle

The refined land market information flow lifecycle provides 31 principles to make each stage of the land market information flow lifecycle dynamic and establish a functional link between land administration information and macroeconomic management. To test the operation of this refined model, it is implemented on the land and resource markets from the case study states. These are:

- real property and water markets in Western Australia

- real property, water and carbon markets in New South Wales

- real property and water markets in Victoria

This helps to articulate the model as an operational outcome; and provides a standard platform for evaluating state, provincial or local-based systems with respect to achieving a functional link between land administration information and macroeconomic management. A demonstrator application is also presented to show how integrated land market information can be visualised to aid fiscal and monetary decision making.

Table 8.1 provides the overall results of the implementation. Data for the model implementation is derived from information collected for the case studies in chapters 4 and 5. A value of '--' is assigned where a principle is not applicable to a particular land or resource market.

Table 8.1: Overall results of the refined land market information flow lifecycle implemented on the case study states

Process	Number	Recommended sub-process for state land registeries	WA Real	WA Carbon	WA Water	NSW Real	NSW Carbon	NSW Water	VIC Real	VIC Carbon	VIC Water
		Information collected should include:									
Collect (at time of registration)	1	o Buyer national ID	N		N	N	N	N	N		N
	2	o Seller national ID	N		N	N	N	N	N		N
	3	o National property ID of property or land right transacted	N		N	N	N	N	N		N
	4	o Is the property transacted the primary place of residence?	N		--	N	--	--	Y		--
	5	o National property ID of contact address of buyer	N		N	N	N	N	N		N
	6	o National property ID of contact address of seller	N		N	N	N	N	N		N
	7	o Value of transaction (sale price)/consideration paid	Y		Y	Y	N	Y	Y		Y
	8	o Unimproved land value	Y		--	Y	--	--	Y		--
	9	o Date of contract	Y		Y	Y	N	N	Y		Y
	10	o Mortgage value	Y		N	N	N	N	Y		N
	11	o Date of discharge of mortgage	Y		N	Y	N	Y	Y		Y
	12	Identity checks performed before registration	N		N	N	N	N	N		Y
	13	Timely acquisition of data following contract (within 2 weeks)	N		N	N	N	N	N		N
	14	Online registration available and operational	N		N	Y	Y	Y	N		N
Store & Maintain	15	Custodian is accountable for the integrity of tenure and value data	Y	--	Y	Y	Y	Y	Y	--	Y
	16	Key tenure and value databases are integrated (not stand-alone or maintained in isolation)	Y		Y	Y	Y	N	N		Y
	17	Historic sales data maintained	Y		Y	Y	Y	Y	Y		Y
Share	18	Public access to tenure and value data	Y		Y	Y	Y	Y	Y		Y
	19	Public access to historic sales data	Y		N	Y	Y	Y	N		Y
	20	Capable of online delivery	Y		Y	Y	Y	Y	Y		Y
	21	Open standard format	Y		N	Y	N	N	N		N
	22	Single licensing environment	Y		Y	Y	Y	N	Y		Y
	23	Different levels of access	Y		Y	Y	Y	Y	Y		Y
	24	Low rivalry of use for property sales dataset	Y		Y	Y	Y	Y	Y		Y
	25	Low excludability of use (except for personal identification data) that is, access charge is based on cost-recovery	Y		N	Y	Y	Y	N		Y
	26	High excludability of use for personal identification data	Y		Y	Y	Y	Y	Y		Y
	27	Intergovernmental arrangements to facilitate equitable sharing of tenure, value and historic sales data with the central fiscal policy department	Medium		N	Medium	N	N	Low		N
	28	Intergovernmental arrangements to facilitate equitable sharing of tenure, value and historic sales data with the central monetary policy department	Low		N	Low	N	N	Low		N

Process	Number	Recommended sub-process for ATO & RBA	ATO Real	ATO Water	ATO Carbon	RBA Real	RBA Carbon	RBA Water
Use	29	Base data used for decision making is authoritative	Y	--	--	Y	--	--
	30	Regular updates from authoritative sources	N	N	N	N	N	N
	31	Data custodians are informed of any errors in the data	N	N	N	N	N	N

Real property market

Table 8.1 shows distinct trends in the Australian state-based real property markets, with respect to missing links within the land market information flow lifecycle. All case study states fall short of including unique national identities for persons and properties; and conducting identity checks before transfer of ownership. Also, the timely acquisition of data following contract is lacking in all three states. Overall, the Store and Maintain stage is fairly well achieved, as is the public sharing of land information within the real property market. Victoria is the exception here. This was evident from the case studies in chapter 5.

Inter-governmental arrangements to share land information with the central macroeconomic policy agencies are currently not well established in all three states. Hence the Use stage is also currently not functional according to the land market information flow lifecycle. All three states have significant potential to improve land information collection and administration, and establish improved cross-governmental sharing, in order to fully recognise the benefits of the lifecycle.

Water market

A similar situation to the real property market is evident when comparing the achievement of the recommended principles within the water markets in the three case study states. The lack of national identifies is evident and none of the case study states collect information regarding the amount of a mortgage where applicable to a transaction. There is also no data collected at time of contract, and no established cross-governmental data sharing agreements with the central macroeconomic policy agencies. Though the registries of all three states are publically available, the data is not in an open, standard format. Also, the state water registers are maintained independently and not integrated with the land titles registers in each state. The states land agencies have significant potential to improve their administrative structures and cross-governmental sharing arrangements towards achieving the land market information flow lifecycle.

Carbon market

In terms of the carbon market, NSW falls short of meeting the proposed requirements for a land market information flow lifecycle in the following recommended principles:

- Collecting information about
    - Date of contract
    - Mortgage value
    - Date of discharge of mortgage
- Collecting national indentifies of persons and property and performing identity checks before registration
- Timely acquisition of data following contract
- Integration of carbon register with land titles register
- Open standard formation for online access
- Cross-governmental arrangements to share market information with the central macroeconomic policy agencies.

These shortcomings represent the common trend across all the studied land and resource markets. In terms of the ATO and RBA, though their base data for decision making is authoritative, as the case studies in chapters 5 and 6 show, they struggle to regularly access the authoritative data bases of land transaction data maintained by the state land administration agencies. Where data is provided, there is no established feedback loop, that is, there is no requirement for data users in the central policy agencies to inform the state land agencies where errors in data are found. Transactions within the state-based water markets and NSW GGAS are currently not adequately considered by the central macroeconomic policy makers.

The above implementation shows the operation of the land market information flow lifecycle model. A dynamic land information flow lifecycle will establish a functional link between land administration and macroeconomic management. All stages within the lifecycle are important and as the implementation in the previous section shows, one dysfunctional stage degrades the performance of the entire cycle. For the cycle to be dynamic, every stage must be functional and operational by achieving the recommended principles. The following section extends the model implementation by presenting a sample demonstrator that shows how integrated market transaction information can be visualised, as an added tool to aid economic decision making.

8.2   Demonstrator application

If all recommended principles within the land market information flow lifecycle are achieved, synthesis between land administration information and macroeconomic policy marking can become a reality. This can enable authoritative and integrated market information to be used for *spatial analysis* by central macroeconomic policy makers. Spatial analysis involves taking into account the geographical location of any object or event under analysis. It can help to refine fiscal and monetary solutions, potentially enabling policy by location.

Location or place-based policies, "*target the prosperity, equity, sustainability and liveability of places*" (Orszag et al, 2009). The concept was proposed in the Barca Report (2009) and is advocated in other recent OECD publications (2010, 2011). Government place-based policies have been adopted by many countries, for instance in the Netherlands to focus infrastructure and housing investments on 'strong city-regions' (OECD, 2010). In Australia place-based initiatives are used in the provision of employment services and support for jobless families (Australian Government, 2012). In the United States, the Obama Administration openly endorsed place-based policies and evaluated a number of existing federal place-base initiatives to improve inter-governmental coordination (Cytron, 2010).

As discussed in chapter 3, location is a unique variable in understanding property markets. The land market information flow lifecycle will enable land transaction information to be disseminated to central governments; allowing many location-based economic decision-aiding applications to be developed, using authoritative information that best reflects the economic condition of different regions in the country. Authoritative land information can be used to visualise the land and resource markets in a country as an added tool to make economic decision making spatially intelligent.

Figure 8.1 illustrates a sample workflow to show how macroeconomic policy makers can benefit from authoritative land market information, if all the relevant principles within the lifecycle are achieved. All processes that align government macroeconomic policy maker needs with authoritative land information suppliers are shown in the workflow. Though public sharing of authoritative land information is an integral part of the land market information flow lifecycle, the focus here is on government land

information needs. Hence the government-to-public information sharing processes are not shown. Red numbers in parenthesis correspond to recommended principles within the lifecycle as indicated in Table 8.1.
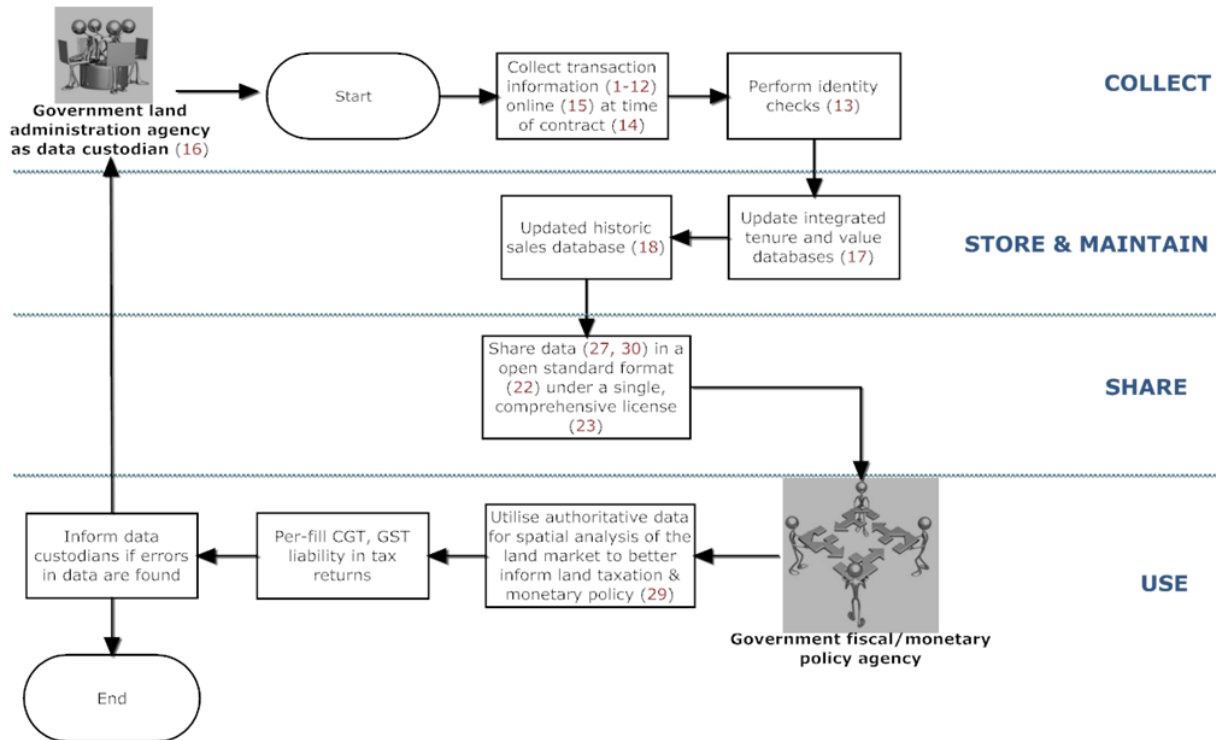
Figure 8.1: Workflow to show how monetary policy makers can access authoritative land market information for spatial analysis, if principles within the land market information flow lifecycle are achieved

Using the property object approach (Kaufmann and Steudler, 1998, Van Oosterom et al, 2006, Bennett et al, 2008), from the perspective of monetary policy, market visualisation can take the form of *interest objects*. An interest object is a property object that accrues interest and is hence affected by changes to interest rates for debt financing. In the marketplace this would be transactions that have an encumbered mortgage. For fiscal property, *tax objects*, that is, property objects that are taxable can be mapped. These can include any taxable transaction in the market place.

This section presents a sample demonstrator, 3D Property Market Tool that visualises transactions in the market place via tax/interest objects. It is one example of the spatial analysis possible using authoritative data derived from a dynamic land market information flow lifecycle. Due to data availability, the sample area selected for this

demonstrator is the suburb of Camberwell in Melbourne, Victoria, Australia; however the demonstrator is scalable to regional, state, provincial or national level. Though parcel boundaries and address data have been obtained from PSMA Australia, transaction and ownership data has been simulated due to the current lack of publically available historic sales data in Victoria. Software used to create this demonstrator include ESRI ArcMap, ArcScene and Google Earth.

Figure 8.2 shows the sample 3D property market tool. Properties highlighted are those transacted within the last year of a particular query date. The height of each object represents the value of the transaction or the consideration paid for transfer of ownership. The greater the height of the object, the greater its relative transaction value in comparison the other properties in the study area. The colour represents the date since the object was last transacted. The darker the colour of the object, the greater the number of days (from the date of the query) since the object was last transacted, in comparison to the other properties in the study area.

Clicking on a particular object can bring up recent transaction details including transaction type, tenure (ownership), market value, mortgage details and historic sales information to support evidence-based policy by government macroeconomic policy agencies: Figure 8.3.
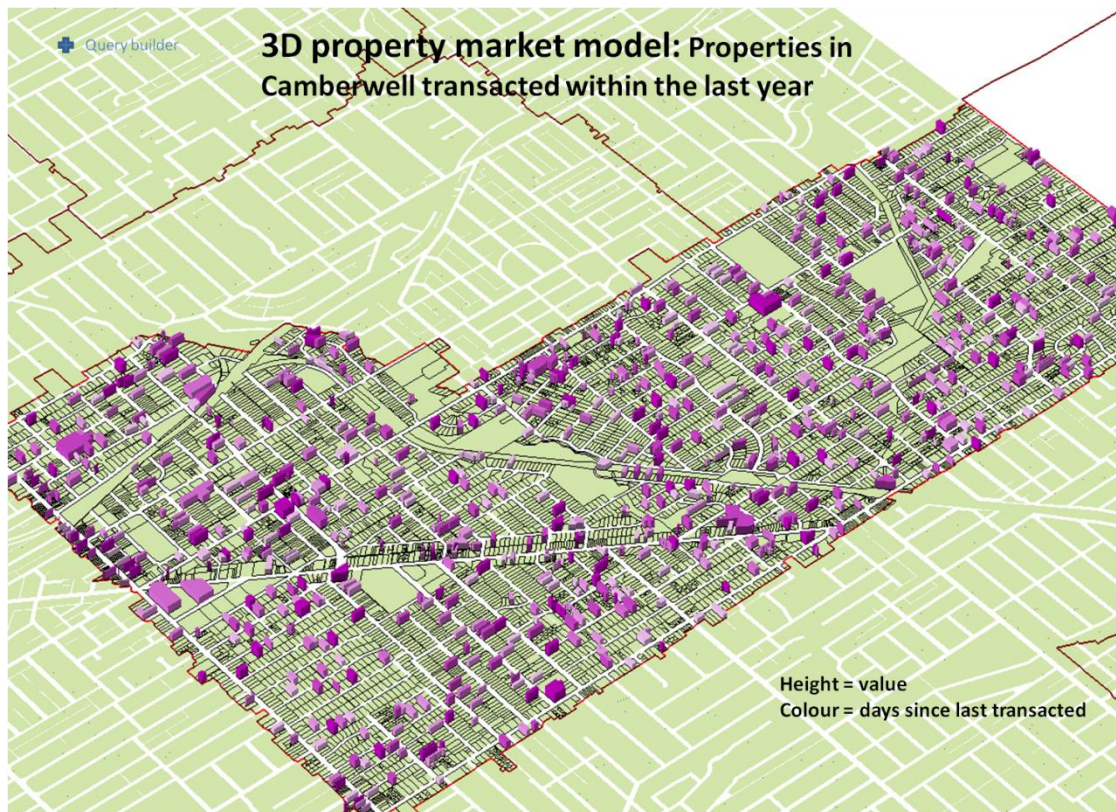
Figure 8.2: 3D property market tool showing properties in Camberwell transacted within the last year of any query date
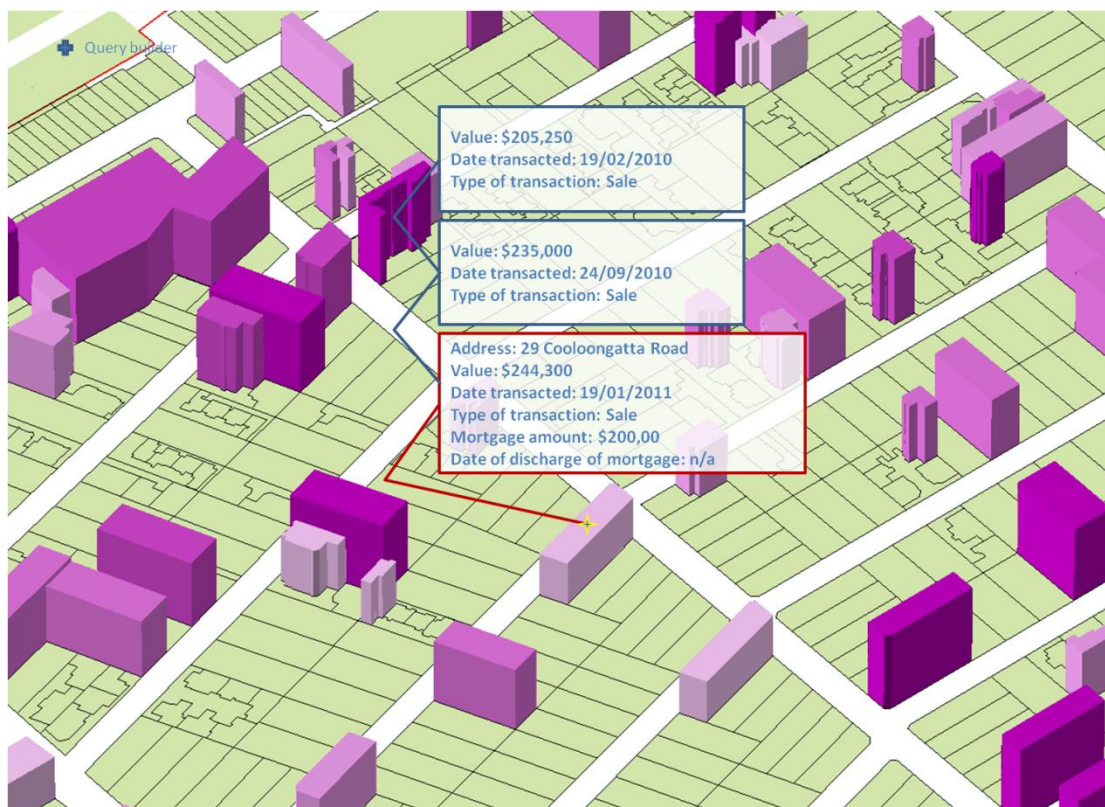
Figure 8.3: 3D property market tool showing attribute data attached to an interest/tax object

The concept can be extended to markets in land resources, and overlayed on satellite imagery as shown in Figure 8.4. Each image in this figure displays transaction in a carbon or water market as a tax or interest object, providing a visual representation of the economic condition of the market at any point in time, to add spatial intelligence to fiscal and monetary policy making. Transactions are simulated to show the application of this tool. Colour and height scales are the same as with the real property objects represented in Figure 8.2. Aerial imagery provides a familiar interface for users and allows for additional verification of the presence of land resources.
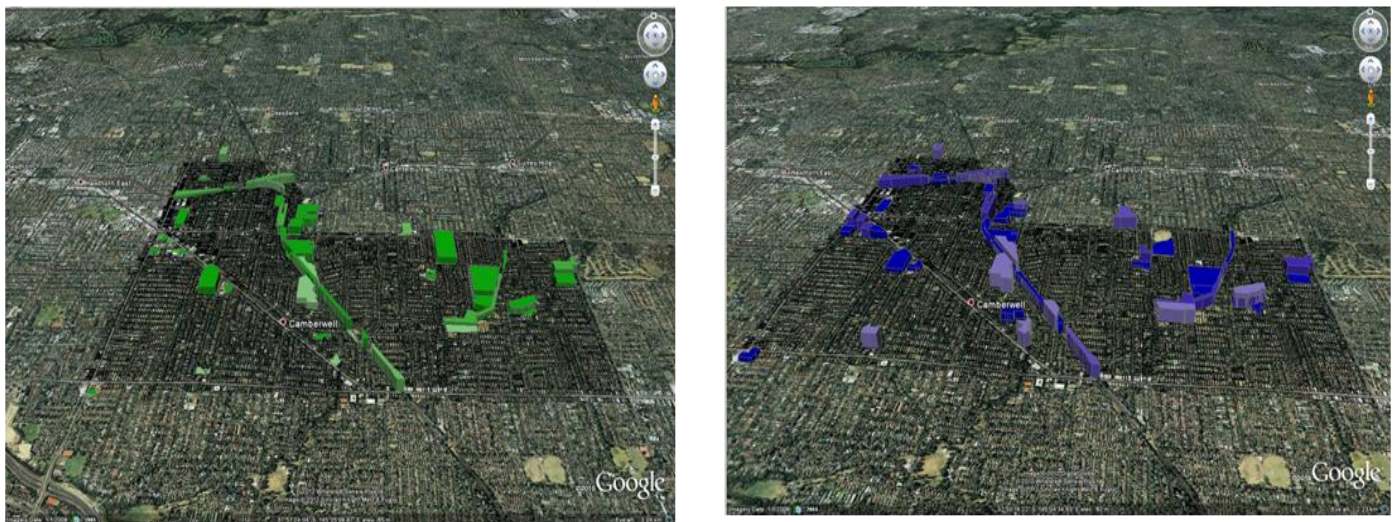
Figure 8.4: Simulated carbon and water market transactions visualised via the 3D property market tool (shown in Google Earth)

The 3D property market tool is based on a parcel system, not a building system. As such, issues with vertical strata titles need to be resolved. As the tool is based on tax/interest object, there is potential to store multiple property objects per parcel. Additionally, the tool has the potential to store up-to-date owner information, with access permissions to ensure high excludability from use of this personal information to meet privacy standards.

Essentially the 3D property market tool spatially-enables market transactions, allowing for location-based trends to be easily identified. According to Tobler

(1970)'s first law of geography, "*Everything is related to everything else, but near things are more related than distant things*." If government macroeconomic policy agencies have access to authoritative market transaction information, made possible by a dynamic land market information flow lifecycle, they can improve the effectiveness of their policy decision using this type of spatial intelligence.

8.3   Chapter Summary

Implementing the refined model on the land and resource markets in the case study states shows an overall lack of identity verification at time of contract, lack of timely reporting requirements following contract and a lack of user-driven land information collection. A holistic approach to the management and administration of land and resource markets is also lacking. Current cross-governmental sharing between decentralised land agencies and central policy markets is at a minimum.

Achieving the recommended principles of the land market information flow lifecycle will enable information asymmetries to be overcome by establishing a functional link between land administration and macroeconomic management. Consequently government macroeconomic policy makers can have access to authoritative land market information for spatial analysis and added location intelligence for economic policy decisions. The 3D Property Market Tool demonstrates one spatial application of integrated land transaction information to visualise markets in real property and land resources.

CHAPTER 9:
SUMMARY – LOOKING BACK, MOVING FORWARD
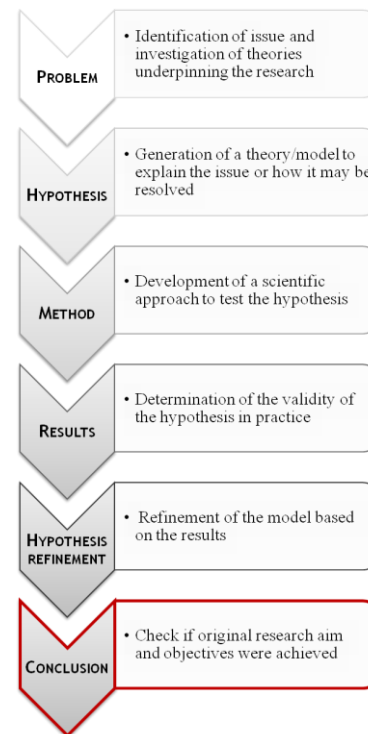
- *The following chapter provides a summary of this thesis by outlining how each research objective was achieved, along with the major contributions of this work. Directions for further research are also discussed.*

9.1 Looking Back: Summarising this Work

This research aimed to address the following problem statement:

The separation between land administration information and macroeconomic policy making hinders the economic management of a country as a whole.

The overall research aim was:

To develop a set of principles for enabling the synthesis of land administration information with macroeconomic policy making, in order to better support the economic management of a country as a whole.

Objectives to achieve this aim were:

   i.   To understand the current theoretical link between land administration information, macroeconomic policy, sustainable development and the impact of natural capitalism.

  ii.   To develop a conceptual model to show the idealised relationship between land administration information and macroeconomic policy making.

 iii.   To assess the model in real-world situations, to understand in-depth, the existing relationship between land administration information and macroeconomic policy making.

 iv.   To refine the model with functional principles derived to enable the synthesis of land administration information with macroeconomic policy making in practice.

Additionally, the following research questions were articulated to help formulate a hypothesis and guide the research:

1.   (i) What are the current theoretical linkages between land administration information, macroeconomic policies and sustainable development?
(ii) What is the ideal relationship between land administration information and macroeconomic management?

2.   (i) What is a valid design methodology for building integrated land administration information and macroeconomic processes?
(ii) How can existing real-world relationships between land administration information and macroeconomic management be examined?

3.   What tools or principles can be designed to change the existing situation into the ideal situation with respect to a functional synthesis between land administration information and macroeconomic management?

The objectives and research questions were designed to help achieve the overall research aim and evaluate the following research hypothesis:

A dynamic land market information flow lifecycle, based on the property market tree, is required for appropriate macroeconomic policy making.

The sections that follow provide a summary of this thesis by outlining how each research objective and research question was achieved, including the major contributions of this work. How the research hypothesis was evaluated and refined is also discussed.

Achieving research object i and research questions 1(i) and 2(i)

Objective: *To understand the current theoretical link between land administration information, macroeconomic policy, sustainable development and the impact of natural capitalism.*

A review of existing literature helped to understand the link between the disciplines outlined in this objective: Figure 9.1. This helped to answer the first part of research question 1: *What are the current theoretical linkages between land administration information, macroeconomic policies and sustainable development?*
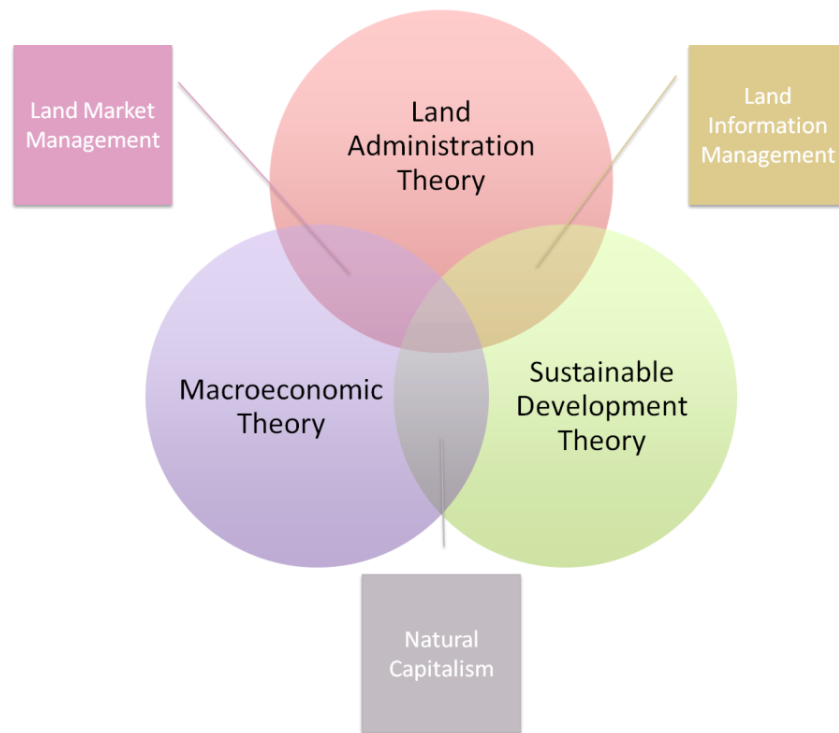
Figure 9.1: Theories that underpin this research

Existing economic and land administration literature shows the importance of property rights to wealth creation, the need for land administration infrastructures to support formal land markets and the role of macroeconomic policy in managing a market economy. However literature does not adequately exemplify the importance of authoritative land market information collected by government land agencies to evidence-based macroeconomic policy making. In many countries where land administration functions are decentralised, land market information is collected and maintained by state, provincial or local government agencies and macroeconomic policies are made at central government level. Existing literature does not adequately recognise the importance of cross-governmental flows of authoritative market information for central economic policy making in these countries.

Literature does emphasise the value of land administration information for sustainable development and the need for new, innovative approaches to infrastructure design for sustainable growth. Natural capitalism is one such approach that advocates biomimicry or using nature as a design tool. This discourse provided an answer to the

first part of research question 2: *What is a valid design methodology for building integrated land administration information and macroeconomic processes?*

Literature shows that land administration systems in many countries exhibit the characteristics of geographically distributed information ecologies. Studying these systems involves understanding the behaviour of information flow within the system and the inter-dependencies between the various entities in the system. System design and improvement must accommodate diversity and local differences.

This research is the first of its kind to apply the ideas of natural capitalism and information ecologies to sustainable land information infrastructure design. With the growing international focus on protecting the environment for future generations, it is important that critical, public good infrastructures like land administration systems are designed with sustainability as a core focus. Nature is inherently sustainable, and this research provides an introduction to incorporating natural systems and sustainable processes into land infrastructure design. The potential benefits of such an approach include more efficient use of resources, minimal waste in the form of duplication and redundant processes; and an increased understanding of the key entity in land information ecologies, namely government land administration agencies.

Achieving research object ii and research question 1(ii)

Objective: *To develop a conceptual model to show the idealised relationship between land administration information and macroeconomic policy making.*

The Property Market Tree was combined with an information flow lifecycle, to form the overall conceptual model for this research: Figure 9.2. This helped to answer research question 1(ii): *What is the ideal relationship between land administration information and macroeconomic management?*
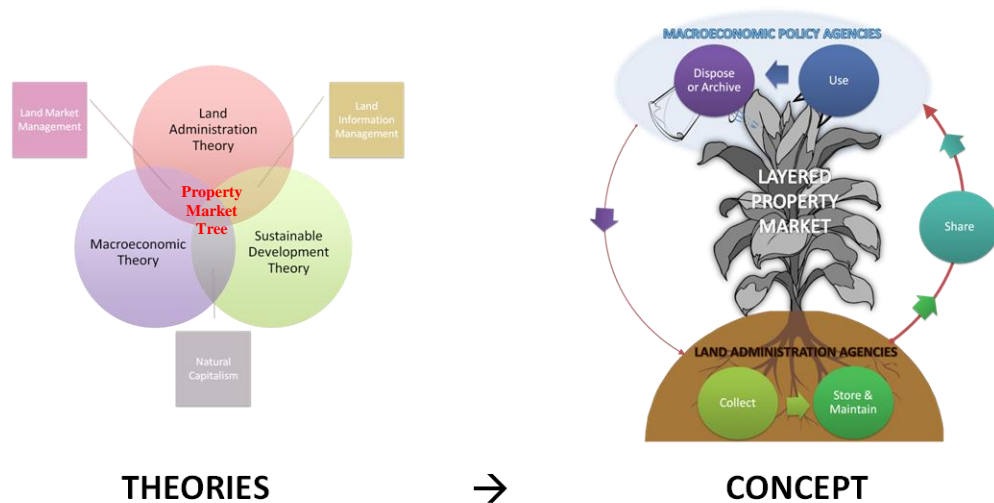
Figure 9.2: The conceptual model developed from theory within this research

The property market tree mimics closed-loop flows in nature that minimise the waste of resources. It was developed from theory to show the desired link between land administration, sustainable development and macroeconomic policy making. It is aimed at policy and decision makers in higher levels of central government, to show the importance of authoritative land information held by government land administration agencies, to economic management of a country as a whole.

The cycle of information flow overlaid on the property market tree, has evolved from the natural sciences discipline and is frequently used in information management. In this context it shows the cradle-to-grave process of land market information for central economic management. Combined with the property market tree it forms the proposed land market information flow lifecycle that represents the idealised relationship between land administration information and macroeconomic management.

Achieving research object iii and research question 2(ii)

Objective: *To assess the model in real-world situations, to understand in-depth, the existing relationship between land administration information and macroeconomic policy making.*

The following was done to achieve objective iii above, and in response to research question 2(ii): *How can existing real-world relationships between land administration information and macroeconomic management be examined?*

Decentralised land administration systems in Australia were examined as geographically distributed information ecologies. This was undertaken to understand the existing information sharing relationships between government land administration and macroeconomic policy agencies, and non-governmental entities involved in land market transactions (buyers, sellers, financial institutions, tax payers). Using a case study approach, land information flows in the following state-based land and resource markets in Australia were mapped against the conceptual model illustrated in Figure 9.2:

- Real property and water markets in Victoria
- Real property and water markets in Western Australia
- Real property, water and carbon markets in New South Wales

The assessment took place by mapping the flows of market (tenure and value) information through each stage of the information flow lifecycle, for each market in each case study state, using Data Flow Diagrams. Results show that the stages of the land market information` flow lifecycle are currently not dynamic or functional to meet the needs of central macroeconomic management. Less than optimum processes, stand-alone data stores and information asymmetries were common realities. The results showed that in the case study states, information being collected by land administration agencies differs depending on individual state legislation, procedures and requirements. Market transaction information is not being collected when the actual contract or agreement between the parties takes places. This affects the ability of the collected tenure and value information to reflect the economic state of the market in a timely manner. In the three case study states, land market information is stored across at least 14 different databases, with no integration between real property and land resource registers. Additionally, economic activity in the developing water and carbon markets are currently not adequately considered by central macroeconomic policy makers. There is significant potential in all case study states

for information collection to be aligned with user needs and formal cross-government data sharing agreements to be established.

The case study results showed that each stage of the conceptual model required further refinement in order to be operational, and to account for the complexity and diversity of real-world systems.

Achieving research object iv and research question 3

To refine the model with functional principles derived to enable the synthesis of land administration information with macroeconomic policy making in practice.

Results of the case studies were used to refine the conceptual framework, with 31 principles that will enable synthesis between land administration information and macroeconomic management in practice: Figure 9.3. The recommended principles are supported by existing best practice in land administration. This helped to answer research question 3: *What tools or principles can be designed to change the existing situation into the ideal situation with respect to a functional synthesis between land administration information and macroeconomic management?*
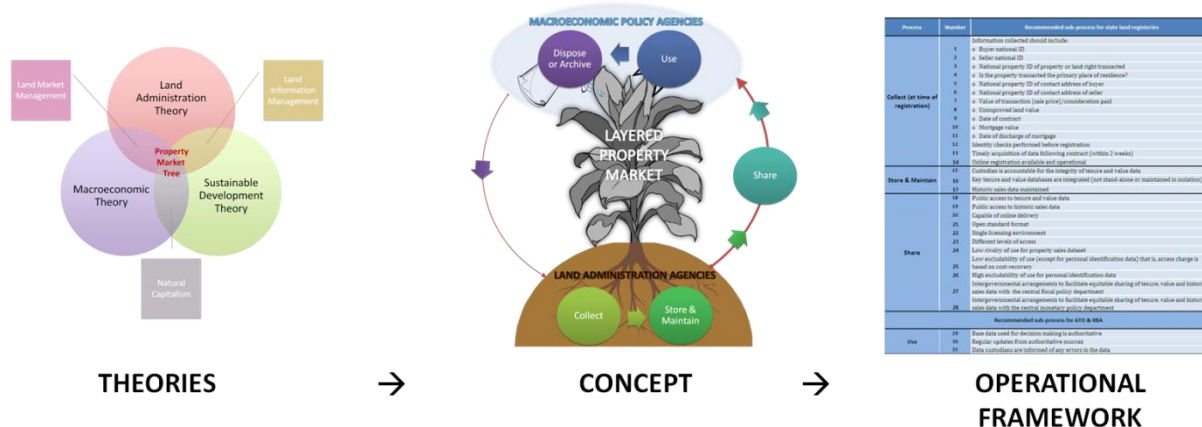
Figure 9.3: The conceptual model based on theories and the refined operational framework developed within this research

The refined model serves as a framework for countries wishing to establish authoritative land market information dissemination for evidence-based macroeconomic policy making. It enables holistic management of land and its

resources and advocates the importance of transactions in both real property and emerging resource markets, to the economy and government macroeconomic management.

The refined land market information flow lifecycle aims to establish sustainable information flow processes within geographically distributed land information ecologies. It recommends principles to which current process can be adapted to better align land information supply and demand for macroeconomic management. Hence complexity of current systems and local diversity can still be accommodated.

The framework is shown to be operational by implementing it on the case study states. The implementation shows the importance of each stage of the lifecycle for government-to-public and government-to-governmental information sharing. Overall, the implementation shows public sharing and information integration principles within state land agencies being achieved to a certain extent. However a majority of principles in the Collect stage are currently not achieved. Inter-governmental sharing processes also fail to meet majority of the principles recommended for the Share and Use stage of the lifecycle. In essence, achieving all 31 principles can make each stage of the lifecycle dynamic and establish an operational link between land administration and macroeconomic policy making. However one dysfunctional stage can undermine the operation of the entire lifecycle.

Additionally a demonstrator tool, based on tax and interest objects is presented, to show how integrated and authoritative land market information can be visualised to add spatial intelligence to fiscal and monetary decisions: Figure 9.4

WORKFLOW TO SHOW PRINCIPLES OF LIFECYCLE BEING ACHIEVIED

→

SPATIAL ANALYSIS: 3D PROPERTY MARKET TOOL
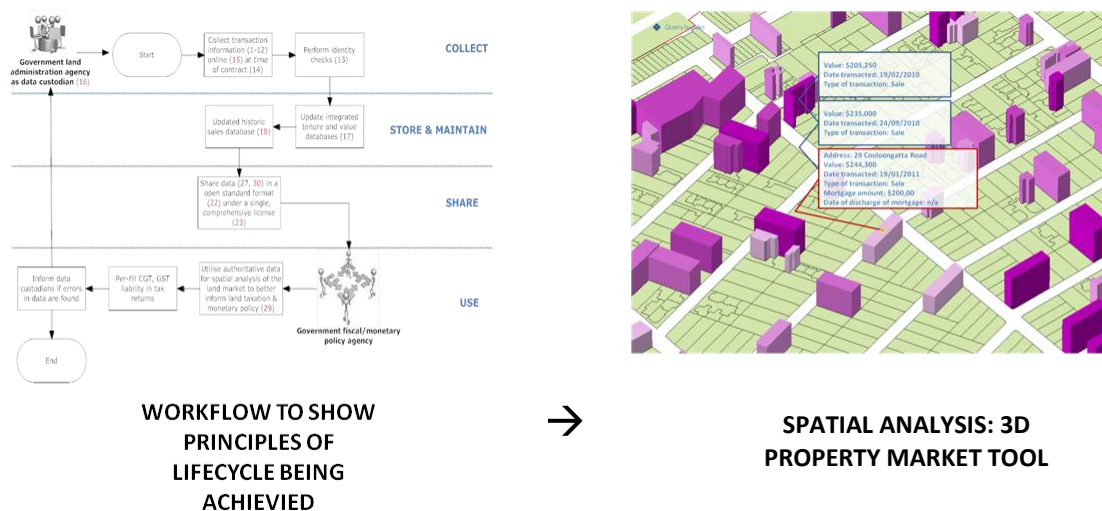
Figure 9.4: The 3D property market tool developed to show an example of spatial analysis that can add location intelligence to fiscal and monetary policy decisions, if the land market information flow lifecycle is achieved

The 3D property market tool represents one decision-aiding application that can result from a dynamic land market information flow lifecycle. It spatially-enables market transactions, allowing for location-based trends to be easily identified. It visualises the market from an economic perspective. Transactions are viewed as tax or interest objects with attribute data attached to each object to show the details of tenure, value and sales history. Hence the visualisation is not inhibited by the problems associated with trying to accurately define the boundaries of land interests. Instead it is concerned with the location of economic activity. This allows any market transaction in real property or land resources to be visualised within the same tool, enabling a holistic view of market-based economic activity in an area. Such tools can improve the effectiveness of economic policy decisions through added spatial intelligence.

Evaluating and refining the hypothesis

A dynamic land market information flow lifecycle, based on the property market tree, is required for appropriate macroeconomic policy making.

The research hypothesis was evaluated by showing:

- The land information needs of central macroeconomic policy makers.

- The need for a land market information flow lifecycle to achieve synthesis between land administration information and macroeconomic management.

- The need for each stage of the lifecycle to be dynamic, that is active or functional to effectively serve the needs of macroeconomic policy makers.

Additionally the hypothesis was refined by:

- Designing and implementing an empirical land market information flow lifecycle with 31 principles, to enable flows of authoritative market transaction information between government land administration and macroeconomic policy agencies.

9.2   Moving Forward: Areas for Further Research

This research builds on the joint UN and International Federation of Surveyors Bathurst Workshop on Land Tenure and Cadastral Infrastructures for Sustainable Development, which recommends cross-governmental land information flows, towards achieving national uniformity in land and property information, as integral to sustainable development. Additionally this research supports sustainable development of land markets and the economy by utilising a new, innovative approach to infrastructure design, as advocated by both the UN Conference on Environment and Development, RIO 1992, and the UN Conference on Sustainable Development, RIO+20.

Overall the aims and objectives of this research were achieved. Complex land administration ecologies were examined through the prism of information lifecycles for supply and demand. Results show that better integration with macroeconomic management can be achieved and needs to be prioritised. User driven information collection and cross-governmental sharing will be key to meeting the land information requirements of central policy makers now and in the future. New options for enabling more seamless land information flows need to be prioritised, enabling horizontal integration of jurisdictional datasets, followed by vertical integration from local to national level. The statutory powers of government land agencies need to allow for increased data sharing. Siloed approaches need to be acknowledged and incorporated into a nation-wide land market information flow lifecycle. Independent

land administration agencies have the incentive to make significant economic gains by repairing their institution frameworks and incorporating cross-governmental sharing into their business models. Central government policy makers have the opportunity to recognise the invaluable authoritative data stores currently available within government land agencies. There is great potential for improved access to this authoritative and assured land administration information as the evidence-base for policy marking.

As such, this research needs to be built upon to fully understand and solve the problems associated with establishing nation infrastructures for land information. In fact, this research poses many questions and avenues for further study. Some are outlined below:

- This research is focused mainly on improving the efficiency and effectiveness of macroeconomic decision making through the provision of improved land administration information. Emerging drivers for improved land information focus on enabling broader governance goals. Further research is required to see how the land market information flow lifecycle principles can be modified or adapted to meet the requirements of good governance, transparency and accountability.

- How can the new ISO 19152 for geographic information, that is the Land Administration Domain Model, be used to operationalise the land market information flow lifecycle?

- What is the cost of authoritative land information and more importantly, misinformation from a macroeconomic perspective? How can this be quantified to better promote the value of authoritative land administration information to evidence-based policy?

- This research looks at the land information needs of central macroeconomic policy makers. What are the land information needs of other central government agencies and how can land information supply be better aligned to meet these needs? A taxonomy of central government land information needs would help to achieve a national land information infrastructure on a larger scale.

- Countries with a market-based economy where land administration functions are decentralised were the focus of this work. Further research is required to apply the outcomes of this work to other economic systems and government structures. A dissemination framework is also required with further comparisons to existing tools and systems in jurisdictions outside Australia.

- How can informal land markets be better accounted for within a country's economy and how can land information processes be designed to collect and maintain information about these markets?

- There are many resources related to land whose supply is considered fixed in the short term, for instance mineral deposits, timer and fisheries among other. Market mechanisms to manage these natural resources are emerging and require further investigation to determine their functionality in relation to land; and how they can be holistically managed within a country's economic structure.

- What is the impact of crowd sourced data on land administration information? Arguably, market participants could provide a rich sense of market activity. The role that volunteered market information can play in authoritative land administration information needs to be further explored.

- The concept of 3D cadastres, particularly visualisation schemas, will have an impact on the sample 3D Property Market Tool developed in this research. However the technical and institutional impacts on the land market information flow lifecycle principles may be broader. This requires further research.

Technological advancements have enabled land administration processes to evolve from paper-based to digital systems. Technology will continue to be an enabler. However in order to meet current land information needs without compromising the ability of future generations to meet their own needs, critical land information infrastructures need to be designed and improved to mimic the efficiency of natural systems. Diversity should not be discouraged, rather local differences should be accounted for and incorporated into national initiatives. On the other hand, silo mentalities hinder sustainable development and economic management and should be overcome. Potential benefits span the economic, social and environmental spectrum;

including fair and equitable taxation, better economic productivity, improved housing affordability, increased food and water security and better targeted climate change responses.

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APPENDIX 1
PUBLICATIONS RESULTING FROM THIS
RESEARCH (maiden name N. Tambuwala)

Journal papers

- Tambuwala, N., Rajabifard, A., Bennett, R., Wallace, J., and Williamson, I. 2011. Inter-governmental land information asymmetries in Australia. Journal of Spatial Sciences, 57(1), 83-100

- Tambuwala, N., Bennett, R., Rajabifard, A., Wallace, J. and Williamson, I. 2011. On the role of government land information in macroeconomic policies. Journal of Environment and Planning: Government Policy, 29(6), 1087-1101.

- Bennett, R., Tambuwala, N., Rajabifard, A., Wallace, J and Williamson, I., 2013. On recognizing land administration as critical, public good infrastructure, Land Use Policy, 30(1), 84-93.

Book chapters

- Wallace, J., Marwick, B., Bennett, R., Rajabifard, A., Williamson, I., Tambuwala, N., Potts, K. And Agunbiade, M. (2010). Spatially Enabling Land Administration: Drivers, Initiatives and Future Directions for Australia. In A. Rajabifard, J. Crompvoets, M. Kalantari andB. Kok (Eds.), Spatially Enabling Society, Leuven University Press (ISBN 978-87-90907-97-6)

Peer-reviewed conference papers

- Tambuwala, N., Rajabifard, A., Bennett, R., Wallace, J. and Williamson, I., 2012. Authoritative land information and Australian property markets. FIG Working Week 2012. Rome, Italy.

- Bennett, R., Tambuwala, N., Rajabifard, A., Williamson, I. and Wallace, J., 2012. Contemporary Land Administration: The Importance of Being Infrastructure. FIG Working Week 2012. Rome, Italy

- Tambuwala, N., Bennett, R., Rajabifard, A. and Williamson, I., 2011. Understanding the relationship between spatial information, property markets and macroeconomic policy. Spatial Sciences & Surveying Biennial Conference 2011. Wellington, New Zealand.

Other

- Tambuwala, N., 2012. Nature as land infrastructure design tool. SDI-Asia/Pacific Newsletter. October, 4-5.

- Tambuwala, N., 2011. The Property Market Tree. SDI-Asia/Pacific Newsletter. December, 4-5.

- Tambuwala, N., 2010. A national property information infrastructure for managing land and land related markets. SDI-Asia/Pacific Newsletter. Novemner, 4-5.

- Tambuwala, N., Bennett, R. and Rajabifard, A., 2010. A better way to manage land information: The case for a new national infrastructure to manage information. Position. 22-24.

APPENDIX 2
DETAILS OF CASE STUDY VISITS & DISCUSSIONS

The primary source data captured during the case studies is available from the author

upon request.

Case study visit to Landgate, Perth, Western Australia

Date: 22 and 23 JULY 2010

Areas of discussion	Details discussed
An Introduction to Landgate	What is Landgate? Legislative and Business Model

WALIS	Current WALIS-Location
	   o WALIS Model
	   o LIA Commercial Return
	   o Future WALIS

SLIP	Model – SLIP Enabler
	Focus Areas:
	   o SDI 2
	   o Governance
	   o Technical
	   o Collaboration

Interest Enquiry	Rights, Obligations and Restrictions (ROR)
	   o Demonstration
	   o Interest Dictionary
	   o Current Issue
	   o Referential Topology
	        ▪ How to get the Data
	        ▪ Management Approval – Reports
	Legislative arrangements
	   o Vendor Disclosure
	   o WA's Direction with AIC
	   o Interest Enquiry

Carbon Watch	Land Condition Monitoring Where is WA? – Near Shore Zone/Coastal

Survey accurate cadastre	Lodgement BPS
	   o Spatial Upgrade Processes
	   o Registering Spatial Interests

iLAND	NECS
	eLDP
	Data Models:
	   o Internal
	   o Link to Other Interests

	o Federate Data Models
Data flows	SMR, SMP, Valsys and OSR
	Documents submitted to the OSR and registry
	Property sales database
	Information exchange with ATO or RBA
Other	CORS, Innovation, CRCSI2 Projects

Visit to the Australian Taxation Office, Melbourne, Victoria

Date: 22 FEBRUARY 2011

Areas of discussion	Details discussed
Electronic conveyancing	Data acquisition is an issue. Data acquisition does not align with quality needs of ATO. Current system does not support identity checks
Inter-governmental sharing concerns	Lack of adequate communication within the states. Different objectives and integrity concerns between state registry and valuations departments. What is captured and processed by the revenue offices and land titles offices is key. However data models in each state differ.

Data acquisition	Two types:
	   o Legislated has unique identifier
	   o Not legislated has to be identity matched
	Data is acquired from both revenue departments and land titles offices because both show a little bit the same picture. Data is pieced together to meet purpose.
	   o 6 monthly data from some land titles and revenue offices due to cost of data
	   o Compulsory acquisition from the registries is not legislated. Information has been requested. Request has been denied by only one state land registry.

Privacy	ATO only allowed to use data for the purpose for which it was collected

CGT	Land information needs:
	   o Ownership
	   o Value of transaction
	   o Date transacted
	   o Primary place of residence
	   o Cost base
	Historic sales data have integrity issues
	Contract and settlement dates have integrity issues
	Western Australia
	   o Multi sales/units/building on one parcel often given one sale price (rather than one per purchaser). Problem for CGT

GST	Need land development information Close to real time information is ideal
Pre-filling	Focus on pre-tax return rather than post-tax return error/fraud detection o For pre-filling of tax returns transaction data is desired on an ongoing base so that tax returns can be populated prior to end of financial year.
Unique identifiers	Address is the main property identifier used
Statistics	12 million taxpayers About 500 million transactions per annum.
Other	Data has to right at the source. Land use codes also useful information

Case study correspondence with Land and Property Information,

Sydney, New South Wales

Date: 22 February, 2011 to 7 APRIL 2011

Correspondence via email and telephone

Areas of discussion	Details discussed
Documents submitted to State Revenue Office by financial institution/mortgage broker/individual/agent when arranging payment of stamp duty.	Are the following included: o Name of buyer with identity check? o Name of seller with identity check? o Address of property transacted, current contact address of buyer and seller? o Value of transaction?
Documents submitted to Titles Office by financial institution/mortgage broker/individual/agent to register transaction	Are the following included: o Name of buyer with identity check? o Name of seller with identity check? o Address of property transacted, current contact address of buyer and seller? o Value of transaction?
Property Sales Database	How often is it updated? What information is stored? Name of buyer, name seller, address of property transacted, date of contract, and value of transaction? How far back does it go? Is sales history and rental history also stored? Is public access available?
Data sharing	Arrangements for information exchange with the ATO and RBA
Online registration	Status

Case study visit to Land Victoria, Melbourne, Victoria

Date: 14 APRIL 2011

Areas of discussion	Details discussed

Documents submitted to State Revenue Office by financial institution/mortgage broker/individual/agent when arranging payment of stamp duty.	Are the following included:
	  o Name of buyer with identity check?
	  o Name of seller with identity check?
	  o Address of property transacted, current contact address of buyer and seller?
	  o Value of transaction?

Documents submitted to Titles Office by financial institution/mortgage broker/individual/agent to register transaction	Are the following included:
	  o Name of buyer with identity check?
	  o Name of seller with identity check?
	  o Address of property transacted, current contact address of buyer and seller?
	  o Value of transaction?

PRISM and VOTS	How often is it updated? What information is stored? Name of buyer, name seller, address of property transacted, date of contract, and value of transaction? How far back does it go? Who has access to it (internal and external)? Are VOTS and valuations databases integrated or maintained independently?
Data sharing	Arrangements for information exchange with the ATO and RBA
Online registration	Status
PSV (Property Sales and Valuations)	Online service Is there public access? Is price based on cost recovery?
Other	Is cost of online access to title information is based on cost recovery? Is the format of data provided through online services? .pdf? .shp? open source?

Visit to the Reserve Bank of Australia, Sydney, New South Wales

Date: 24 MAY 2011

Areas of discussion	Details discussed
Spatial enablement	No existing capacity
Inter-governmental sharing concerns	Lack of adequate communication within the states. Different objectives and integrity concerns between state registry and valuations departments. What is captured and processed by the revenue offices and land titles offices is key. However data models in each state differ.

Planning information for areas of urban density	Need high, medium and low.
	Generally the authorities with this information have different names. Most do not have information of this kind. RBA could only obtain data for one city of five major cities.
	    o WA could provide.
	    o Brisbane did not reply (flood recovery mode)
	    o Adelaide did not have it: has zoning restrictions on type of house product (especially to conform to the "Adelaide house model" with pitch, garage doors off side etc).
	    o Victoria provided no information.

Mortgage information	Need purchases with mortgage
	    o How much is provided. Amounts secured by mortgages at beginning of loans. However these are not revealed in many mortgages because under the Memorandum of Common Provisions they are "all monies" or unidentified sum mortgages.
	    o State of debt on a mortgage from time to time
	    o Date of discharge of mortgage
	How are discharges of mortgages from the mortgage backed certificate arranged?

House price information	Needed on actual and authoritative basis.
	    o Currently provided on a monthly basis by two non-government providers at a cost per month (few thousand dollars per month). RP Data + one other.
	    o Based on Hedonic Indices.
	They want actual transaction basis that they can analyse in house.
	Not using ABS housing prices indices – not timely enough.

Debt information	Need
	    o Level of secured household debt
	    o Level of commercial secured debt
	    o With amounts due under the mortgages.
	    o Identification of properties with mortgages.

Electronic conveyancing	RBA has already had a discussion with NECDL – no conclusions
Other	Getting balance sheet returns from the major lenders is also problematic. Also need unimproved capital value of parcels

APPENDIX 3
WATER ALLOCATIONS

Nationally equivalent terms for water products

National Term / State	Water allocation	Water resource type (surface)	Water resource type (ground)	Water access entitlement reliability (for unbundled only)
NSW	Water allocation	Regulated river (Regulated surface water for water licence 1912) Unregulated river (Unregulated surface water for water licence 1912)	Groundwater	Category (e.g. high, general, supplementary for regulated; unregulated river, aquifer for groundwater)
Vic	Water allocation	Drainage diversion Regulated surface water Unregulated surface water (waterway, spring or run-off)	Groundwater Managed aquifer recharge (MAR)	Reliability class for unbundled (high, low, spill) plus other bundled classes
WA	Water allocation	Surface water	Groundwater	N/A

Source: Australian Government 2011,
http://www.nationalwatermarket.gov.au/about/products.html