

CRCSI Urban Sustainability Research Program

We will produce a new approach to sustainable urban development. We will devise spatially enabled sustainability indicators, models and standards. This will create a fact-based approach to support decision making for sustainable urban development.

Tools will be created for planners and regulators to communicate across the tiers of government, to one another, and with their key client bases.

Different versions of these tools will be used by all the communities of interest in urban planning – developers, investors, politicians and the broader community, etc. The tools will be used for both regional and city sustainable urban development.

Introduction

Urban environments include man made structures that support human activities. We call these areas cities, suburbs and towns. Amongst the more prominent structures in these areas are collections of human dwellings, transport systems, water and energy handling and cultural/recreational assets.

The capacity to understand the interaction between the economic, social, natural and physical aspects of urban environments, and the interplay between these and the adjacent natural environment, is essential to improving the sustainability of Australia's cities, suburbs and towns. On one hand, development choices can impact the natural environment. On the other, the spatial structure and development of agglomeration areas within our settlements will be key determinants of Australia's international competitiveness.

Research to enhance understanding of urban sustainability requires the collection and integration of data on the critical measures of economic, social, natural and physical activities. Understanding and modifying the interplay between these activities, where the majority of people live, provides the lynch pin to achievement of urban sustainability in Australia.

The collection and integration of spatial data on human behaviour, including the consumption of natural, urban and economic resources, can significantly accelerate our understanding of how best to modify urban environments so that they can adapt to change and influence human behaviour towards minimising its impact on sustainability. This will be achieved by forming linkages between physical and social scientists to facilitate collaboration and 'systems' approaches to studies into the sustainability of Australia's cities, suburbs and towns.

To optimise sustainability in urban development we need a system of urban sustainability measurement. Indicators of urban sustainability can provide a fact-base to support decision-making and enable comparisons of sustainability outcomes for different development scenarios. A recognised and endorsed set of indicators will encourage integration of specialist expertise across the urban development professions, environmental scientists, engineers, the creative professions as well as business and investors. This will increase cross disciplinary understanding to deliver the design of better sustainability strategies at city and township scales.

Putting the principle of sustainability into practice is one of the greatest challenges facing Australia. A sustainability measurement system will enable the definition of win-win solutions to economic, social and environmental problems. It will also help identify urban design that will deliver mutually reinforcing wealth creation, social inclusion and environmental protection.

Context

Cities are home to more than half the people living in OECD countries and almost 50 percent of the output and jobs of many nations is found in its largest city. Though most cities have higher economic growth, foreign investment and labour productivity than the rest of the country, they are also more polluted, crime challenged and socially disrupted.

Successful cities attract talented, young, highly skilled workers, are centres of innovation and entrepreneurship and offer competitive locations for global and regional headquarters. The proximity of universities to research and production facilities means cities are where most new products are developed and commercialised. The inventions that underpin more than 80% of patents are created in cities.

Cities are not always synonymous with success. Cities can falter. Concentration of population, which may account for a significant part of a region's dynamism, can also cause congestion, a degraded environment, housing shortages and the formation of socially disadvantaged neighbourhoods. Urban sprawl creates undesirable outcomes – which are likely to be amplified in the face of inevitable rises in fuel price driven by “peak oil”.

Is there an approach to city design, management and leadership that allows a community to engage with the benefits of economic dynamism, achieve a high quality of life for all and leave no footprint that future generations will need to fix?

Australia is amongst the world's most urbanised countries, with about 70 per cent of the population living in its 10 largest cities. Given this, it is critically important - perhaps more important than for any other nation on the planet - that we develop a better understanding of cities and towns and how we manage their growth and development to maintain a higher quality of life for all our people.

It is clear that a significant part of the answer lies in maximising the sustainability of urban systems. Urban sustainability is about making planning decisions that minimise the extent to which options for future decisions are limited. Sustainable Development encourages the conservation and preservation of natural resources and of the environment, and the management of energy, waste and transportation. Sustainable Development is development based on patterns of production and consumption that can be pursued into the future without degrading the human or natural environment. It involves the equitable sharing of the benefits of economic activity across all sections of society, to enhance well-being, protect health and alleviate poverty. In order to achieve the goal of sustainable urban development, we must be able to measure the impacts of current decisions regarding resource allocations on future decisions.

The success of cities is often associated with a phenomenon called agglomeration economies. Agglomeration economies occur when concentrations of people, infrastructure, institutions, natural and physical amenity and knowledge networks result in higher than average labour productivity and a higher quality of life for inhabitants.

In Australia, past and present interventions controlling urban development have been implemented through placing limitations on ‘land-use’. This has been the primary lever for town planners to determine where residential neighbourhoods, retail activities, transport, industry and infrastructure are located. The land-use approach to planning human settlements is under serious pressure. Its considerations are too narrow to address the sustainability of urban systems. The land-use approach is demonstrably not delivering the outcomes required to achieve sustainability and a high quality of life. Cities are complex organisms. The linkages between space planning, the economy and the skills-base are more intertwined than can be handled by land-use driven planning and design.

A new approach to planning that responds effectively to the complexity of cities is required.

The Urban Sustainability Research Program will research, trial and demonstrate a new approach to achieving sustainable urban development. It will devise spatial sustainability indicators, metrics, models and standards that will create a fact-based approach, driven by sustainability outcomes, to support decision making in urban development. The program will also create tools that transform the ability of planners and regulators to communicate across the tiers of government, to one another, and with their key client bases. Typically, the communities of interest surrounding urban planning also consist of developers, investors, politicians and the broader community.

The Significance of Agglomeration Economies

Agglomeration economies are vital to urban development because of the positive externalities¹ that are generated from having similar and complementary activities located in close proximity to each other. These positive externalities arise because they bring together both inputs and customers for businesses. Cities are trading economies and have always provided the benefits of bringing together trading businesses, their customers and suppliers in a single location. In modern economies, as transport between destinations has become reliable and convenient, cities also perform the role of bringing together skilled workers and businesses in places where transport networks can deliver traded inputs. An additional feature of cities is the innovation that occurs from the co-location of a large number of disparate activities – that results from knowledge spillovers.

Also important is the role of networks in addressing the negative externalities generated from unsustainable use of natural resources. Using fewer resources to support quality of life is equally important to raising productivity as increasing output from fixed resource inputs. Both are valid means of raising productivity and quality of life in urban economies. By investigating way to internalise externalities through innovation, agglomeration and network economies are essential to promoting sustainability of urban systems.

End Users

This is an end-user driven research program. All research topics, their methodologies and outputs are directed towards meeting the needs of clearly identified user segments. Members of each segment are classified by the things that make them similar (within segments) and make them different (between segments). For simplicity, three segments are defined:

Who they are...	What they do.....	What they need.....
Planners	These people conduct urban-development research, formulate policy, strategies and operational procedures to drive urban outcomes towards specific goals. They work for local and state governments and for development companies and urban development consultancies. There are tens of thousands of them.	Planners need just-in-time access to a range of urban development data; assistance with analysis and interpretation of data, benchmark services to compare their places with similar places in other jurisdictions and rules to govern decisions based on insights from the data
Gatekeepers	These people make decisions on where resources are allocated for urban development projects - both public and private. They take the rules and insights created by the planners and apply internal metrics to determine the relative merits of competing priorities for scarce resources. There are thousands of them.	Gatekeepers need data specifically for input into their decision-making models. For intangible items they need pricing or other quantification methods to complete holistic assessments (eg: pricing of environmental externalities for input into benefit:cost ratio analysis)
Deliverers	These people are the agencies, corporations and individuals charged with the responsibility of implementing the projects suggested by the planners and approved by the gatekeepers within (visible and invisible) constraints like budgets and timelines. There are hundreds of thousands of them.	Deliverers need performance measurement and reporting systems to show their stakeholders that project parameters are on target (as specified by Planners and Gatekeepers), and that desired outcomes are being achieved. Post-delivery performance-review services and particularly valuable to Deliverers.

The research program has been defined through consultation with a cross-section of these end-users.

¹ An externality is a cost or benefit arising from an economic transaction that falls on a third party and that is not taken into account by those who undertake the transaction.

There has been a lack of innovation in urban development decision-making practices in recent decades, which has caused Australian urban systems to become less competitive in a global context. In one recent study, Australia was ranked thirty second by rate of improvement in international competitiveness and innovation capacity over the last decade as part of a sample of 40 nations/regions. To compound this problem, there is also a lack of urban sustainability measurement, so that Planners, Gatekeepers, and Deliverers cannot easily compare performances of regions in order to improve urban systems.

The importance of sustainable urban development and measurement is obvious in the need to critically evaluate the currently proposed nation-building infrastructure investments.

So is it better to spend Australia Fund money on public swimming pools, universities, freeways or urban food production systems? Where is the greatest return on the public investment? Is it desirable to have sprawled urban forms or compact urban forms. What is the future cost associated with people living further and further from their place of work? How will the increase in knowledge-industry employment affect urban places in future? All of these questions have spatial dimensions and all are vital to the future of our urban environments. The research themes proposed in this program offer a structured approach to finding answers to these and many other related questions.

Users will employ the spatial data to perform an array of tasks. Here are a very few examples to illustrate the diversity of potentials:

- An urban management information system might find application at state or regional level. It could contain data about essential things that need to be known about the planning of a city or town such as up to date data on whether there is adequate growth in housing stock to cater for anticipated population increases, or enough roads or sufficient sewerage reticulation.
- For disaster management planning – say floods in Queensland and fires in Victoria – it may be seen as important to enhance sustainability by designing urban areas to recognise the probability of perennial disaster risks, including minimising housing in flood/inundation prone areas and ensuring set backs from forest boundaries in districts susceptible to fire storms.
- For post disaster response, information about the inhabitants of particular properties might assist victim identification crews, the nature of construction materials ensure that extra care is taken by clean-up teams faced with hazardous domestic wastes such as asbestos.
- State planning agencies might use the capability to define policies that contain metrics for target urban sustainability outcomes. Developers seeking planning approval would know the performance targets required and would propose urban designs that exceed or meet the required standards. Development outcomes would be monitored over time and developers incentivised or penalised depending on the sustainability performance of their initiative.
- A major national body seeking proposals for developments of national significance could request proponents to meet minimum threshold cost/benefit ratios and specific urban sustainability outcomes. Then, by providing the data and metrics for performing the measurement be confident that they were comparing apples with apples when it came to understanding the merits of one project over another.

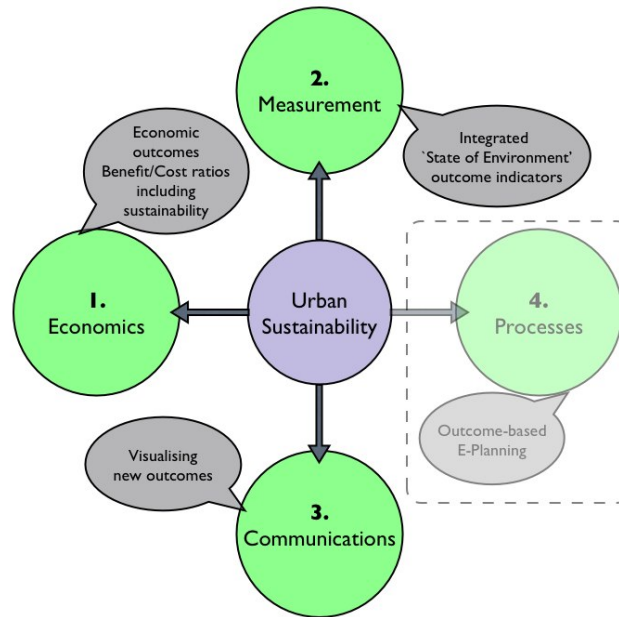
Research Program Outline

The Urban Sustainability Research Program has three sub programs:

1. Economics
2. Measurement
3. Communications

A fourth theme “Processes” will be scoped once the first three are underway.

Urban Sustainability Research Program



1 Economics

The role of the Economics Sub-Program is to understand role/importance of agglomeration and network economies in the development of Australian cities and towns.

The key output will be knowledge of the cost/benefit of promoting agglomeration economies and networks in Australia.

In summary the Sub-Program will

- Identify agglomerations and networks in cities/regional settings
- Characterise agglomerations and networks: institutional retail, CBD vs city corridor (localisation and urbanisation economies), infrastructure-related, knowledge etc
- Assess spatial data for ability to usefully describe benefit/cost ratios
- Define resource balances across agglomeration economies and networks to optimise urban sustainability

As a result of this work the following achievements will be delivered:

- Understand international perspectives on agglomeration and network economies
- Understand the agglomeration and network economies important to urban and regional sustainability in Australia
- Create a precise terminology logic framework to describe characteristics, functions and hierarchies of activity within sustainable economies – to act as a baseline and be continuously enhanced and upgraded over time – resource to be used across the project for focus, management, goal attainment and harmonisation purposes
- Understand the data (eg, transport, population, industry development, innovation, infrastructure, utilities, food) that best describes the formation, development and optimisation of agglomeration and network economies in Australia
- Understand *how* the most important factors are related to Australian urban sustainability
- Understand *where* the most important factors are related to Australian urban sustainability
- Model investment processes and how these contribute to economic, social and environmental development in Australia
- Understand for Australia, the balance between the targets for investment that drive the formation, development and optimisation of agglomeration and network economies

This will enable those concerned with urban sustainability and in particular those designing for urban sustainability outcomes to understand the parameters they should seek to measure to

understand urban sustainability outcomes. In effect, this creates the platform of knowledge that ensures that we are measuring the right things – not just reciting a grab bag of (actually) meaningless numbers for no other reason other than ‘we can’. In effect the Economics Sub-Program will define the *quality* of the indicators for Australian urban sustainability so that we can be confident that specific actions undertaken will cause urban sustainability outcomes to be generated.

2 Measurement

The role of the Measurement Sub-Program is to develop an analysis and reporting system for urban sustainability metrics.

The key output from the Measurement Sub-Program will be standards for a national urban sustainability measurement system – harmonising the approach nationally for data collection and measurement of urban sustainability – thus enabling fact-based investment decisions.

In summary the Sub-Program will

- Select key measures
- Develop generic urban sustainability decision making model (spatial data, spatial indicators, metrics, standards, decision rules, policy libraries)
- Trial applications of the model
- Pilot the model for each of national, state and local decision-makers

As a result of this work the following achievements will be delivered:

- Review design and development of management decision support models per se
- Identify and characterise the most important user segments in the urban development sector in Australia
- Identify and characterise the most important urban/regional sustainability contexts (spatial, population, economic development lifecycle maturity etc) in Australia by economic, social and environmental sensitivity and importance
- Identify and characterise existing decision-making practices within the top six user segments in the urban development sector in Australia
- Select key factors – based on outcome of 4.4.1, together with what is known about decision support models and decision-making practices within Australian urban development user segments
- Define a generic prototype decision support model for sustainable urban development in Australia – to provide common ground where each of the six user segments can meet and exchange urban development perspectives
- Identify data quality sensitivities for each selected data set and define management regime/s to ensure acceptable quality urban sustainability indicators and metrics
- Based on 4.4.1 outcomes, identify spatial/temporal data and refine/create indicators that best describe the 12 most critical factors that drive the formation, development and optimisation of agglomeration and network economies for each user segment
- For each indicator, user segment and urban sustainability context; define specific values (ie, standards) that indicate sustainability versus lack of sustainability
- Trial the standards for validity in a suitable variety of urban/regional sustainability contexts
- For each standard, define decision rules. Decision Rules define recommended actions in response to metrics achieved against defined standards
- Trial applications of the model for management decision support for each user segment

3 Communications

This Sub-Program will enable key user segments to understand and communicate clearly for urban sustainability decision-making.

Key outcome - enhanced clarity of communication and as a direct result of this, significantly reduced transaction costs right across the value chain from city planning, design and

development effecting all of the processes occurring between planners, regulators, government agencies, developers, investors and end users.

In summary the Communications Sub-Program will

- Represent urban sustainability decisions graphically
- Enable the visualisation of urban sustainability scenarios for management decision support
- Enable presentation and interaction between decision-makers
- Facilitate communication and distribution of decision processes

As a result of this work the following achievements will be delivered:

- Based on 4.4.1 and 4.4.2 outcomes, connect to the right data in the right spatial/temporal context to create indicator data sets for each user segment
- Define appropriate software components to serve information to end users over the web to facilitate communication between the various user communities
- Represent urban sustainability indicators (complex data) graphically with an emphasis on integration with maps for spatial and temporal effect
- Define visual analytics framework to support collaborative explorative data analysis based on visualising spatial metrics and indicators embedded in HTML documents
- Enable the visualisation and comparison of urban sustainability scenarios for decision support
- Enable user to visually explore and search for answers to questions about indicators/metrics and simultaneously capture and save important discoveries thus facilitating collaboration and sharing of insights to remotely dispersed users via web
- Enable presentation and interaction between decision-makers
- Facilitate communication and distribution of decision processes
- Support visual communication of gained insight, constructed knowledge and recommended decisions in order to allow team members to share their understanding of unfolding events

4 Processes

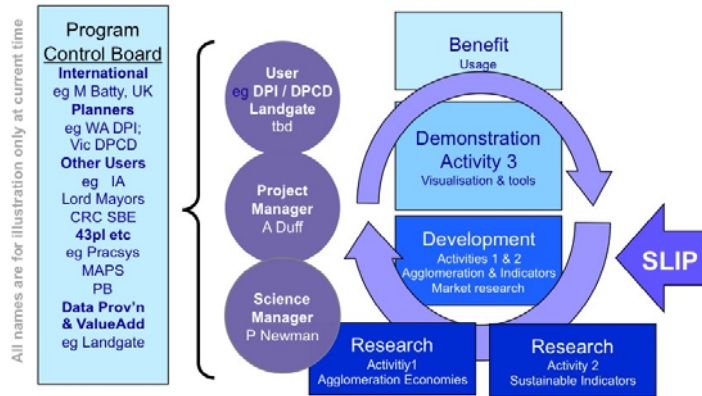
A fourth Sub-Program (greyed out in Figure above) is yet to be scoped, pending early outcomes from the first three Sub-Programs. The role of the Processes Sub-Program will be to define organisation processes for using metrics to support urban sustainability decision-making. Since the processes used by regulators, planners, investors and developers segments of the urban development market are distinct, customised processes will be defined and used by each of these segments.

Program Governance and Management

It is envisaged that the management of the Urban Sustainability Research Program will take place through a Program Control Board comprised largely of end users for the product.

The Program Control Board will have

- Science Manager
- Program Manager
- End User Group



The Program Control Board to meet quarterly to review progress and challenge the decision processes of executive management.

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