EXPLORING CHALLENGES OF TRANS-DISCIPLINARY RESEARCH: AN AUSTRALIAN CASE STUDY

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Abstract

If multidisciplinary research is described as 'additive' and interdisciplinary work as 'interactive', then a trans-disciplinary project might be best characterized as 'holistic'. The $10 million Australian research program *Securing Australia's Future* (SAF), runs from 2012 to 2016. The aim of the SAF program is to develop evidence-based findings to support public policy-making. The program includes a number of projects that are clearly interdisciplinary in nature. In each case, the research makes use of a conceptual model to link theoretical frameworks from several disciplines. This approach has already been usefully applied across studies as diverse as scientific and cultural diplomacy; economic competitiveness; and shale gas production. One of the latest studies in the SAF program is concerned with sustainable urban mobility. In this case, it might be said that the aim is more than interdisciplinary. The ambition is to develop new conceptual structures beyond discipline-specific views. In other words, the study aims to be trans-disciplinary. The paper describes the unfolding plan for delivering such a trans-disciplinary study; identifies critical components of an holistic approach; and proposes methods for evaluating the relative success of the project.

Keywords: ACOLA, Australia, trans-disciplinary studies, sustainable urban mobility, research management

Introduction

Both interdisciplinary and trans-disciplinary research typically involve collaboration between investigators or scholars from different disciplines. In one definition[89], what distinguishes the one from the other is

[89] Choi BC and Pak AW Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy *Clinical and Investigative Medicine* 2006 Dec

the fact that while interdisciplinary work makes use of a conceptual model to link or integrate theoretical frameworks from those disciplines, the trans-disciplinary approach seeks to "integrate natural, social and health sciences in a humanities context"[90] and thereby transcend all the traditional boundaries.

Take the simple example of a woman walking across a footbridge over a deep chasm, on her way from one village to another: something one might see happening in a rural area anywhere in the world. An interdisciplinary study could make use of, for instance, principles of architecture or building science, engineering, public health, sports medicine and social behaviour to understand how the woman negotiates the bridge. We will learn the size of the bridge, its load-bearing capacity, the formulas used to determine the strength of beams, cables and ropes. The study might explore the bio-mechanics of an active mode of transportation; energy expended and the balance of exercise and diet. And we may learn something about how frequently the woman makes the journey and what the economic implications are.

A trans-disciplinary approach would also want to understand *why* the woman might be crossing that bridge; what the crossing says about her personal beliefs and values; what the journey signifies to her; and what it could mean to the people on either side. Clearly the trans-disciplinary approach is likely to lead to a richer understanding of what is taking place, possibly even a universal understanding, common to many cultures.

But the difficulty is this: trans-disciplinarity extends beyond the exact sciences into the realm of art, literature, poetry and even spiritual experience. Trans-disciplinary work is therefore complex, contestable, often culture-specific and inevitably messy. It involves "an acceptance of the unknown, the unexpected and the unforeseeable."[91]

ACOLA manages projects that aim, in one way or another, to build such conceptual bridges. The purpose of this paper is to describe a major Australian interdisciplinary research program and then to use one of the twelve projects of that program as a case study, to explore some of the challenges of the trans-disciplinary approach.

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[90] ibid

[91] Holistic Education Network of Tasmania, www.hent.org/transdisciplinary.htm (14 Jan 2011)

Arunachal Pradesh, India *tectonicablog.com*

The research program securing australia's future (saf)

In June 2012 the Australian Government announced a project called *Securing Australia's Future* (SAF), a $10 million investment in a series of strategic research projects selected by the Prime Minister's Science, Engineering and Innovation Council (PMSEIC[92]) and the Chief Scientist. Coordinated by the Australian Council of Learned Academies (ACOLA), Australia's four Academies[93] began collaborating to deliver evidence-based interdisciplinary research in support of policy development.

Securing Australia's Future is a response to global and national changes and the opportunities and challenges of an economy in transition. Maintaining the status quo is not seen as an option. The topics ACOLA investigates have discrete problems to be explored, but they are also multifaceted, crossing a range of related matters and interconnecting with social, cultural, scientific, economic, technological and governance factors.

Managing this program for ACOLA has thrown up many significant challenges for the Secretariat. Those were reported on at the *1st Annual International Interdisciplinary Conference*, held in Ponta Delgada in 2013.[94]

The *SAF* program was conceived as a series of interdisciplinary studies that would produce findings. These findings might then serve as the basis for policy recommendations from the Chief Scientist to the Australian Federal Cabinet. The policy environment that prevails in Canberra varies

[92] In 2014, the Australian Government announced the Commonwealth Science Council, to replace PMSEIC

[93] Academy of the Social Sciences in Australia, Australian Academy of the Humanities, Australian Academy of Science, Australian Academy of Technological Sciences and Engineering

[94] de Vos Malan, J *Collaboration, Knowledge and the Trans-disciplinary Manager: Helping interdisciplinary research projects to flourish* European Scientific Journal (June 2013)

with changes in Government and the Government has already changed once since the program began. Enough to say that at present ACOLA reports are delivered into a conservative political culture based on the ideals of neo-liberalism. The widespread view of scholars is that neo-liberalism is not a positive environment for the humanities.[95] The confusion of market values with ethics has led to all sorts of contradictions[96] and a situation where too many policy-makers know "the price of everything and the value of nothing"[97], as Oscar Wilde wrote.

To return to the analogy of the woman crossing the footbridge from one village to another: there may be some purpose in understanding her journey through an (however-multi-disciplinary) economic-rationalist lens. Yet, in the words of Joseph Stiglitz, "the power of markets is enormous, but they have no inherent moral character".[98] The deeper understanding of the journey that might include the answers to: *why?* and *what-does-it-signify?* and *how does it add to the quality of people's lives?* – those will come only with a trans-disciplinary approach.

The sort of projects ACOLA undertakes are very complex[99]. They include understanding a sustainable future for agriculture, on the driest continent on earth; engaging young people in mathematics, science and technology – the *hard* stuff – rather than just fashion and celebrities; maximizing Australia's relative proximity to the booming economies of Asia, in ways that will last longer than the current demand for Australian raw materials; and deciding whether or not hydraulic fracking is safe *enough* that the benefits outweigh the risks. These are often what are called 'wicked problems'. Apart from requiring multiple, innovative solutions that can be modified as the problem evolves, they also demand engagement and consultation with citizens and stakeholders in policy-making and implementation: the complex, contestable, messy 'human factor'.

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[95] Sukys, PA Dehumanizing the Humanities: Neoliberalism and the Unethical Dimension of the Market Ethic Forum on Public Policy Spring 2009; Hyslop-Margison, EA and Leonard HA Post Neo-Liberalism and the Humanities: What the Repressive State Apparatus Means for Universities CSSHE Vol. 42, no. 2 (2012)

96 Duménil D and Lévy D The Nature and Contradictions of Neoliberalism CEPREMAP-CNRS (10 May 2005) http://www.jourdan.ens.fr/levy/dle2002c.pdf

[97] Bill Shorten MP, Leader of the Opposition, Interview at Shepparton (3 Feb 2014): "The problem with the Abbott Government is they know the price of everything and the value of nothing..."

[98] Stiglitz, JE The Price of Inequality: How Today's Divided Society Endangers our Future (2012)

[99] http://www.acola.org.au/index.php/projects/securing-australia-s-future

Specific case study: sustainable urban mobility project

The formal project summary reads in part as follows: **"**Projected urban expansion and the residential expectations of many Australians, are raising acute questions relating to the planning and provision of social, economic and physical infrastructure, with mobility and accessibility at the centre..... This project will synthesize cutting-edge research on alternatives, which look at optimising the transport system for lower emissions within and between innovative urban infrastructures, and will examine effective ways to counter the institutional and cultural obstacles to transformational change".[100]

To understand the context in which this project arose, it is necessary to highlight three different concepts:

- The phenomenon of urbanization and its impacts
- The concept of the 'smart city'
- The growing international interest in 'sustainable urban mobility' planning

Global urbanization[101]

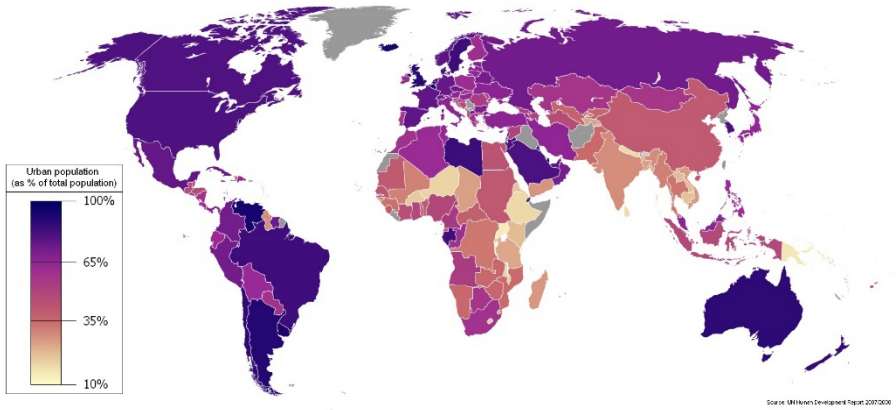
We have been establishing large and permanent human settlements since the time that agriculture first became stabilised. There were early cities in Mesopotamia, Syria and Anatolia. In the first millennium BC, the Greeks created the original city-states and the notion of 'citizenship' arose. There were ancient cities in Africa, the Americas, Europe and Asia. Wherever humans assembled a surplus of resources, a city arose: to defend itself and to trade with others. Cities demand infrastructure and we have been fitting and re-fitting the built landscape ever since. Not all of these cities succeeded. Natural catastrophe – including fire, flood and volcano (Pompeii), war (Troy) and even divine intervention (Sodom and Gomorrah) have destroyed cities.

In modern times, the scale and speed of urbanisation has reached unprecedented levels across the world. 'Megacities' are often defined as metropolitan areas with a population of more than 10M. In 1950, only New York would have qualified as a megacity. There are now 33 of these worldwide. Together, they are home to 600 million people, or nearly 10% of the world population. Most megacities are in the northern hemisphere in Asia, North America and Europe. However, there are 3 in Africa (Cairo, Kinshasa and Lagos) and 3 in South America (Rio de Janeiro, Sao Paulo and Buenos Aires). Within the next eleven years, it's expected that Asia alone will have another 5 megacities.

[100] *Securing Australia's Future – Sustainable Urban Mobility* http://www.acola.org.au
[101] Kleeman, Grant et al *Pearson Geography 8* (2013)

It's been calculated (by Karen Seto of Yale University) that if the population increases to add another 3.2 Billion people by 2100 and those people are accommodated mostly in 1-million person cities, then we will need to build a new 1 million-person city every 10 days throughout the twenty-first century.

So, whereas two hundred years ago, only 3% of the world's population lived in cities at all, the figure will soon be 60%. Clearly urbanization is here to stay.



World urbanisation in 2005 UN Human Development Report 2007/08

Impacts of this trend

The most rapid rates of urbanisation are in developing countries. For many people, life in the city has not lived up to the expectations that attracted them in the first place.[102] At least 1Billion (or 14%) of the world population lives in shantytowns or informal settlements on the fringe of cities. In 15 years time, we expect the number living in shanties and slums of all kinds to double. This ongoing shift of people around the world has major consequences for family life, rural economies, carbon emissions and water consumption. Urbanisation has provided an escape from rural poverty for many, but also led to disastrous changes in quality of life for others.

The uneven impact of urbanisation is just one of the major transitions that are characteristic of our time identified by Aromar Revi, Director of the Indian Institute for Human Settlements[103].

[102] World Health Organisation www.who.int/ceh/indicators/informalsettlements.pdf

[103] Revi, A Video presentation to the *Cities in Future Earth Conference*, Canberra (8 Dec 2014)

Soweto, South Africa (pop 2 million) *Matt-80* Tondo, Manila (after 2012 fire) *AFP/Getty*

Others include changes to demography, health patterns, education, livelihoods and energy.

Australia

Settlement in Australia has followed its own rules. Estimates of the Indigenous population prior to European settlement range between 300,000 and 1,250,000. It is agreed that European colonisation had a disastrous effect on the Aboriginal population, through frontier violence and the impact of new diseases.[104] In June 2001, the Australian Bureau of Statistics estimated the total resident Indigenous population to be 458,520 or 2.2% of the population. Aboriginal settlement or at least areas-of-association may once have been as widespread and diverse as illustrated in the map shown at figure 1. But Indigenous people, as elsewhere in the world, sat very lightly on the landscape in environmental terms. Since the eighteenth-century, a different pattern of industrialised settlement has emerged and the 23 million people who live in Australia today are heavily concentrated. As shown in Figure 2, 76% of the population lives on less than 10% of the land.[105] This is a continent roughly the same size as the United States or 150% the size of Europe. Some 20% of the continent is technically desert and another 70% is what we call 'outback' or 'the bush'.

[104] Australian Government Director of National Parks http://learnline.cdu.edu.au/tourism/uluru/downloads/Aboriginal population statistics.pdf

[105] *A Greater Australia: Population, Policies and Governance* CEDA (2012)

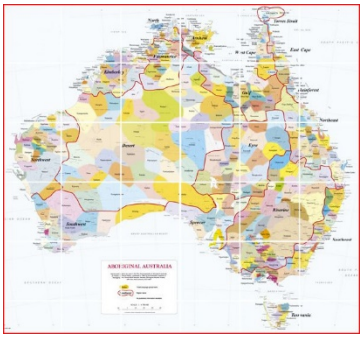


Figure 1 *David R Horton*

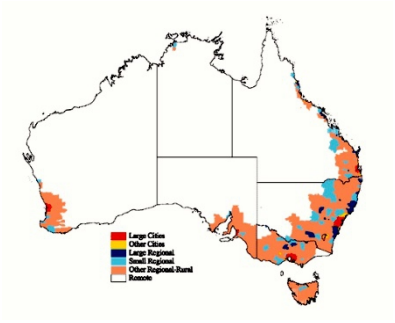


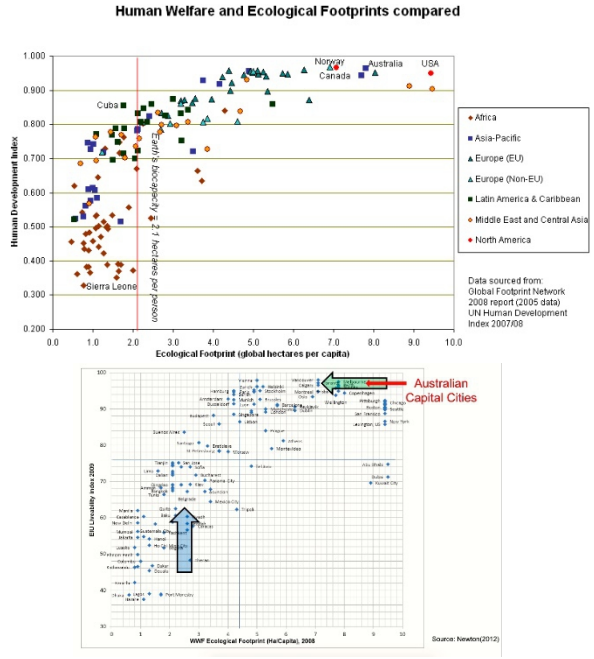
Figure 2 *ABS (1995)*

Outback Australia Brian Voon Yee Yap Melbourne, Australia (pop 3.7 million) Mark Smith

Australia has no megacities. We have five state capital cities with populations of between 1 and 4M and three capital cities with considerable smaller populations. Our cities rate high on measures of liveability, but they have environmental footprints that are not sustainable.[106] Buenos Aires, for example, is placed only slightly below Australian cities on the liveability index, but with a considerably lighter ecological footprint (2.5 Ha/cap instead of 7.6 Ha/cap)[107].

What characterises the five larger Australian cities – and what they share with megacities - is their sprawl. Population density may be only 20% of the average European city, but both Sydney and Melbourne stretch over areas four times larger than comparable European cities[108]. Sydney (with not quite 4 million people) covers an area 97% that of London (9.5 million people). Melbourne (pop. 3.7M) is already 135% the area of Paris (pop. 10.8M).[109]

[106] UN Human Development Index Global Footprint Network (2008)
[107] Newton P *Challenges and prospects for a sustainable development transition of Australia's cities* (2012) presented at *Cities in Future Earth* conference (Dec 2014)
[108] http://www.citymayors.com/statistics/largest-cities-area-125.html
[109] http://en.wikipedia.org/wiki/List_of_urban_areas_by_population



UN Development Programme and Global Footprint Network Peter Newton (2012)

This sprawl has consequences for water quality, air quality and ocean cleanliness. And of course, it has major consequences for transport. And perhaps we should remind ourselves that while the trend is overwhelmingly towards urbanisation, we never leave the rural areas behind. The countryside that surrounds our cities (and the people who live there) remain essential as providers of food and other resources, including water catchment, which make urban life possible. The same applies to rivers and oceans. For many cities, nearby marine, estuarine and fresh water resources are vitally important for fishing. We're told that it's possible that the Australian population may double in this century.[110] We're going to have to become a lot smarter about how our cities develop and to learn to think long-term.

Connie Sue Highway, Nullarbor Plain *Gazjo*

Road Train, NT *Thomas Schoch*

[110] Australian Bureau of Statistics Media Release 26 Nov 2013

Sydney *Torsten Blackwood/AFP/Getty* Goldcoast, Queensland *marty.vdh*

The 'Smart City'

The growing pressures on large and small cities around the world have encouraged a number of responses. In one view, a city with a population of around 800,000 is seen as the ideal 'liveable' city; big enough to bring people together in ways that ensure that the whole is greater than the constituent parts, but not so big that congestion and pollution diminish the quality of life.[111] Certainly the technology of the twenty-first century is increasingly making decentralisation feasible, apparently even favouring the concept of 'metros'[112] of sustainable scale, rather than large cities. But whether we are dealing with a smaller city, a metro or a megacity, the ideal is that it should be a 'smart city'.

In the digital infrastructure sphere, this means seeking more efficient ways of managing the built environment. Ideas that stretch from 'green' buildings, designed to minimise their environmental footprint, to the creation of intelligent transport networks have contributed to the concept of the 'smart' city. The idea has captured people's imagination and cities are using technology to help manage traffic congestion, to police the streets, to allocate resources on the basis of real-time evidence and even to deliver education packages.

To illustrate the extent to which digital technology has become a part of our urban landscapes: a 2011 survey estimated that there were 1.85 million CCTV cameras operating in the United Kingdom, the purpose ranging from traffic management on motorways to crime prevention in shopping centres and anti-terrorism surveillance in public spaces. The report calculated that on a typical day, the average person would be seen by 70 CCTV cameras.[113]

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[111] Bolleter, J Urban Design Research Centre, UWA ABC Catalyst (4 Dec 2014)

[112] A 'metro' or metropolitan area comprises one or more urban areas with satellite cities, typically defined by commuting patterns

[113] *CCTV Image* Security Newsdesk http://www.securitynewsdesk.com/wp-content/uploads/2011/03/CCTV-Image-42-How-many-cameras-are-there-in-the-UK.pdf (Winter 2011)

Greater Los AngelesToffel Mumbai Reuters

There are many other examples, including the Metropolitan Tokyo Traffic Control Centre; the traffic management system in the San Fernando Valley in Los Angeles[114]; the system used to monitor shipping at the Municipal Port Authority of Rotterdam; and in Spain, Santander's use of sensors to dim street lights when they're not required and to signal when rubbish bins need to be emptied.

A workshop hosted in December 2013 by the Brookings Institution and ESADE Business School of Barcelona[115] identified prerequisites for success in 'smart' city planning, including an economically-driven, technology-focused vision that embraces productivity, inclusivity and resilience; government reforms to implement the vision; a balance between project scale and risk tolerance; stronger networks and improved communication tools

And of course, technology and behaviour are deeply interlinked. The Internet, free Wi-Fi and good coffee make it possible to use a café in place of an office. That flexibility in turn influences the general demand for urban transport.

The largest engineering venture in Europe at present is the Cross Rail project: a 118-kilometre railway that will include ten new stations. The crucial part of the line involves tunnelling through central London, creating a route expected to handle up to 24 trains per hour. The builders anticipate that Cross Rail will transport 200 million people per year, many of them making a switch from road transport to an environmentally sustainable railway. What is ironic though is that the cost of housing in London is now so high that, along with many of the people who are needed to deliver essential services to the city, the 10,000 people currently building Cross Rail can no longer afford to live in the city.[116] Perhaps the new line will facilitate their daily commute

[114] *Sensor System Activated to Help Speed Traffic Flow* Los Angeles Times (27 Sept, 1995)
[115] Brookings Institution/ESADE *Getting Smarter About Smart Cities* (April 2014)
[116] John Finnigan, addressing the *Cities in Future Earth Conference*, Canberra (8 Dec 2014)

to and from work.

Irregular migration

The use of new infrastructure and technology to better serve the built environment is just one aspect of city life. At the opposite end of the conceptual spectrum is the question of who lives in these cities and from where do they come? According to the US Department of Homeland Security[117], an estimated 2.8 million illegal immigrants lived in California in 2011, making up about 7.5% of the population. This would mean that more than 700,00 people live 'illegally' in Los Angeles County, which has a recorded population of 10 million.

Anna Triandafyllidou, author of the *Clandestino Project Report* published by the European Commission estimated that by 2008, 1.9 to 3.8 million irregular foreign immigrants resided in the territory of the EU27,[118] which has a population of 500 million. Clearly there are many challenges involved in planning effectively for urban life.

Canary Islands UNHCR

'Sustainable Urban Mobility' Planning

A city is about buildings, open spaces, products, services, information, transport, energy, food, waste and water, all the things we need to be people. To be sustainable it's not only these resources we need to consider, but also how we source these; the way in which we construct infrastructure, what we do with it, the ways in which we behave and how we govern ourselves.[119]

Cities have to face the reality of climate change in a number of ways. Firstly the construction of cities has contributed to climate change, by reducing forestation and wetlands. Secondly, cities now serve as amplifiers of climate change through the phenomena of urban heat islands and carbon emissions, which on a large enough scale have the capacity to influence the weather above and near cities. Finally, of course, cities are being impacted

[117] http://www.laalmanac.com/immigration/im04a.htm

[118] Triandafyllidou, A *Clandestino Project Report* European Commission (2009)

[119] After Chris Ryan, Victorian Eco-Innovation Lab, University of Melbourne *City Systems are Socio-cultural-physical-technical: you can't deal with one without the othe*r address to the *Cities in Future Earth Conference*, Canberra (8 Dec 2014)

by climate change: by drought, bush fires and floods linked to extreme weather events. The size, the function and the built forms of our cities are all factors in this.

A 'Sustainable Urban Mobility Plan' is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. The idea of 'Sustainable Urban Mobility Plans' has gained considerable momentum in recent years. Encouraged by the European Commission, many cities across Europe are working to integrate this concept in their daily transport planning practices.

Sustainable Urban Mobility Plans (SUMPs)[120] involve a different approach to planning from the more traditional. Above all, the aim is planning for people and the guiding purpose is to help achieve a better quality of life. In some European countries, it is the largest cities that are responsible for rising to the challenge, even though there may exist no national guidance. The site at www.eltis.org provides a rich variety of examples of plans developed for large and small cities.

Outside Europe, there are cities engaged in planning of their own within a sustainability framework. These include small, medium and larger cities and examples are Bogota, Durban, Portland, Singapore, Sydney and Tel Aviv.

Pascal Perez of Wollongong University has developed what he calls the *Factor 8 Conundrum*.[121] What happens, he asks, if we have to accommodate double the number of people in our cities, with half the resources and the aim of providing twice the liveability? It turns out that this is achievable, at least in theory. But it won't be so or won't be sustainable without major behavioural change.

Particularly since the failure to reach agreement on how to effectively address climate change at Copenhagen in 2009, many cities have begun to act without waiting for countries to agree on national targets. This seems to foreshadow a sense that future sustainability planning might have to take place at a new tier of government.

Aromar Revi[122] speaks of the tensions between national, regional and local governments as one of the global dichotomies that require resolution. It's a train of thought that might lead us to ask: where does the power reside now and into the future to bring about transformative change? If international agreements are impossible and national policies fail us, can we

[120] *The State-of-the-Art of Sustainable Urban Mobility Plans in Europe* (Rev. Sept 2012) www.mobilityplans.eu

[121] Perez, P *The Factor 8 Conundrum: How will cities meet the needs of twice today's population with half today's resources while providing twice the liveability? Cities in Future Earth Conference,* Canberra (8 Dec 2014)

[122] Revi, A *op.cit.*

devolve the power, so as to respond to climate change and develop sustainable plans at a more local level instead?

At this *1st Pan-American Interdisciplinary Conference*, perhaps the most important international example of a mega-city planning for its own sustainable future is just outside this building on Avenida 9 de Julho. In a 2012 report titled *Indicators for Sustainability: How cities are monitoring and evaluating their success*[123] one can find a useful set of case studies from cities in Europe and the Middle East; Asia and Australia; Africa and the Americas. The report sets out to summarise the key sustainability indicators these cities are using and the frameworks employed to track those indicators. It offers a toolkit to support cities that are in the process of identifying which sustainability indicators they can use to accurately reflect the progress of their sustainability plans. The only mega-city included in the study is Buenos Aires, though in this case it is the central area of the city, with a population of 2.9 million that is dealt with, rather than metro Buenos Aires (pop. 12.7M).

Avenida 9 de Julho, Buenos Aires

Buenos Aires

"The City of Buenos Aires has a unique plan for sustainability. Unlike other cities that have umbrella strategies or goals, Buenos Aires has adopted individual action plans to reach a common sustainable future".[124]

These action plans include a twenty-year climate action plan, a plan for energy efficiency in public buildings, a plan for sustainable mobility; a pedestrian priority policy and plans for water, sanitation and air quality management. In 2008, Buenos Aires formalized the creation of its Technological City to make the city a global ICT hub. In 2014, Buenos Aires won the *10th Annual Sustainable Transport Award*, in recognition of all these initiatives.

At the heart of the transport thinking in this city are

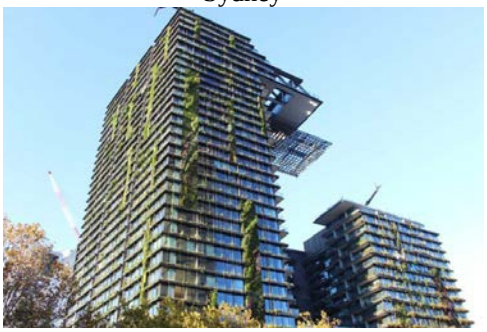
- Priority of the public transport program

[123] *Indicators for Sustainability: How cities are monitoring an evaluating their success* Sustainable Cities International, Canadian International Development Agency (2012)
[124] *Ibid*

- Exclusive bus lanes
- The implementation of Metro bus (bus rapid transit system)
- The introduction of a better bicycle program
- The pedestrian priority program; and
- The integration of different types of transports

To contrast that, a brief view of the largest Australian city, Sydney.

Sydney



Central Park building in Sydney Ann Jones

In 2011, the Australian Government released the country's first National Urban Policy. [125] The policy addressed productivity, sustainability, liveability and governance. It established short-term and long-term goals for the Council of Australian Governments (COAG), the vehicle whereby State governments interact with the Federal government. Two years later, the Federal government changed and several State governments have changed since. The effect is that the only national guidance that Australian cities might have had in the area of sustainability planning has been put back on the shelf.

This is worrying, because Australia is a first-world country with a third-world population growth profile. By 2060, the population is expected to double. Yet the only city with something approaching a sustainability plan is Sydney (though the discussion of many of the key aspects of SUMP planning is certainly underway in Melbourne).

Sydney was founded in 1788, though radio carbon dating suggests the Sydney region has been inhabited by Indigenous Australians for at least 30,000 years.[126] The 26 square kilometre inner city includes close to 200,000 people, as opposed to metro Sydney, which is home to 4.5 million. Sydney is considered by many to be the financial and economic hub of Australia. Based on the number of people employed, the largest economic sectors in

[125] *Our Cities, Our Future: a national urban policy for a productive, sustainable and liveable future* Dept of Infrastructure & Transport, Australian Government (2011)

126 Attenbrow, Val (2010). Sydney's Aboriginal Past: Investigating the Archaeological and Historical Records UNSW Press

Sydney include property and business services, retail, information technology, and health and community services.

In 2006 the City of Sydney initiated actions to develop the *Sustainable Sydney 2030* plan. The plan has three pillars: it aims to make Sydney green, global and connected.[127] Within the vision are 10 targets, broken down into objectives and specific actions. Once again, integrated transport, a local network for walking and cycling as well as transit routes connecting the various parts of the city feature in the sustainable transport thinking. Indicators include increasing trips to work using public transport; increasing active transportation (meaning cycling, walking, jogging, scooters, roller-blades); and addressing quality of life by ensuring that every resident is within a ten minute walk of fresh food markets, childcare and health services, as well as leisure, social, learning and cultural infrastructure.

The fact that the National Urban Policy is no longer on the Government's policy agenda and the focus in the Sydney Vision on local, state and federal government linkages serve to highlight one of the most important challenges facing sustainable urban mobility planning in Australia and that is governance.

Traditional Transport Plans		**Sustainable Urban Mobility Plan**
Often short-term perspective without a strategic vision	Strategic level / vision	Including a long-term / strategic vision with a time horizon of 20-30 years
Usually focus on particular city	Geographic scope	Functional city; cooperation of city with neighbouring authorities essential
Limited input from operators and other local partners, not a mandatory characteristic	Level of public involvement	High, citizen and stakeholder involvement an essential characteristic
Not a mandatory consideration	Sustainability	Balancing social equity, environmental quality and economic development
Low, transport and infrastructure focus	Sector integration	Integration of practices and policies between policy sectors (environment, land-use, social inclusion, etc.)
Usually not mandatory to cooperate between authority levels	Institutional cooperation	Integration between authority levels (e.g. district, municipality, agglomeration, region)
Often missing or focussing on broad objectives	Monitoring and evaluation	Focus on the achievement of measurable targets and outcomes (=impacts)

[127] *Sustainable Sydney 2030 – The Vision* cdn.cityofsydney.nsw.gov.au.s3.amazonaws.com

Historic emphasis on road schemes and infrastructure development	Thematic focus	Decisive shift in favour of measures to encourage public transport, walking and cycling and beyond (quality of public space, land-use, etc.)
Not considered	Cost internalisation	Review of transport costs and benefits also across policy sectors

The State-of-the-Art of Sustainable Urban Mobility Plans in Europe (Rev Sept 2012) www.mobilityplans.eu

The ongoing ACOLA project in the intersecting fields of urban transportation, energy consumption and city planning serves as an example, a case study of how a problem that stretches across engineering, economics, human health, patterns of social behaviour and political decision-making can be approached.

The acola saf08 project plan

The ACOLA *Sustainable Urban Mobility* Project began life as a proposed study of low emissions transport for Australia in the 21st century. That proposal was put through a scoping procedure[128] that has become one of the most important project tools in the SAF project selection process. The scoping phase makes use of experts from across the academic disciplines and asks these questions:

- What is the most useful scale at which to approach the problem?
- Can the problem be framed in a way that will demand a truly interdisciplinary approach?
- Can the proposed project be completed within available resources of time and money?
- Will the project lead to evidence-based findings that will be useful for public policy-making?
- Is this an area in which ACOLA can offer a valuable contribution?

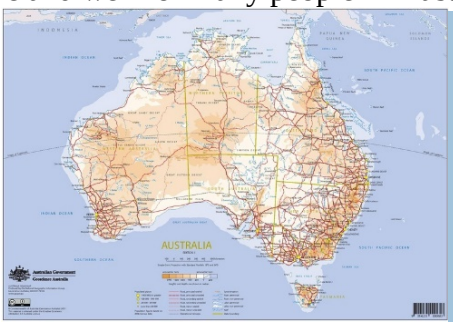
In this case, the scoping panel decided early on that the challenge of low emissions transport could more usefully be seen as part of a broader set of issues including the facts that:

- Australia has almost no oil refining capacity left
- Australia has recently abandoned motor-car manufacturing
- The Australian bio-fuel industry is still in its infancy (20% that of

[128] For the importance of a preliminary scoping procedure see Tait J, Williams R, Bruce A, Lyall C *Guidelines for Interdisciplinary Researchers and Research Managers* SUPRA (1999) and Lyall C, Meagher L *A Short Guide to Troubleshooting some Common Interdisciplinary Research Management Challenges* ISSTI (Aug 2008)

Canada or 1.5% that of Brazil)

- Very few areas of the country are well-served by public transport
- The idea of the motorcar as the ultimate freedom machine is still alive and well for many people in Australia[129].



Road network Australian Government

Rail network Australian Government

The project was now re-framed as one in which fuel, transport and urbanisation would intersect and the project was soon tied into the concept of sustainable urban mobility. However, the ACOLA project is not setting out to develop a plan for any particular city, but rather to study the concept across all the Australian cities. The first step in this process is, of course, the recognition that the *status quo* is not sustainable. 'The *status quo* is not sustainable' – it takes no more than four seconds to say those words and yet, in Australia as elsewhere in the world, we are still struggling to accept their meaning more than four decades after we first heard them.

Holden (1964)

Manly Library

[129] Abbott T *Battlelines* (2009) "...even the "humblest person is king in his own car....In Australia's big cities, public transport is generally slow, expensive, not especially reliable and still a hideous drain on the public purse. Mostly, there just aren't enough people wanting to go from a particular place to a particular destination at a particular time to justify any vehicle larger than a car, and cars need roads."

The ACOLA Expert Working Group begins to ask 'what must we do to make things sustainable?'. The project started by commissioning three principal studies in the fields of technology, social issues and public health and safety.

Technology Study[130]

The study includes an overview of current trends in transport **activity**, a review of technological **developments** expected in the next 25 years and a study of the transport sector as a consumer of **energy**. Energy production and consumption in Australia are examined in depth and consumption within the transport sector is a main focus. The report then looks at the implications of Australia's critical **dependency on auto-mobility** (including self-directed vehicles and vehicles powered by renewable energies). At this point consumer preferences, public behaviour and government policies in respect of the provision of transport infrastructure are introduced.

Social Study[131]

The report summarises key trends and 'drivers' in urban travel patterns, pointing to:

- A large increase in car use in the last 40 years in all Australian urban centres and in regional towns
- A large proportion of all trips remain short at around 7.5 km
- Modest decreases in car-use for work trips and corresponding increases in public and active transport use
- A remarkably slight density gradient away from the core of Australian cities (meaning that in many middle and outer suburban locations the market exists for improved levels of public transport service)
- Significant growth in employment in health and education services in suburban locations, offering an opportunity to start 'clustering' suburban destinations for public transport planning
- Increasing suburban congestion during weekends, when dispersed travel for multiple purposes is at its greatest

[130] Singleton, D and Pender, B *Securing Australia's Future: Sustainable Urban Mobility: Technology Study* ACOLA (MS)

[131] Stone J, Taylor E, Cole A, Kirk Y *Securing Australia's Future: Sustainable Urban Mobility: Social Study: Barriers and pathways to sustainable urban mobility in Australia* ACOLA (MS)

- Significant proportions of peak period travel for taking children to school; as well as other suburban travel for 'chauffeuring' older people
- Developer-led housing markets of most new affordable homes on the urban fringe, creating a growing imbalance in sustainable transport choice
- The first signs of emerging changes in public attitudes to car-based mobility, as particularly younger people chose not to own a car

Health study[132]

This report has examined how land use and transportation decisions impact on public health and considered potential solutions to transport-related health issues. The report suggests that a sustainable transport system, which maximises health and wellbeing outcomes, will be one that prioritises the safety, accessibility and convenience of active transport over motorised transport. This could have significant direct health benefits through:

- Increased physical activity, including facilitating older adults to remain active as people age
- Reduced respiratory illness from reduced transport-related air pollution
- Reduced mental and physical health issues associated with transport noise.

This approach could also have indirect health benefits, such as:

- Reduced levels of obesity and chronic diseases associated with limiting physical inactivity and sedentary behaviour
- Contributing to mitigating the environmental and health impacts of climate change.

However, as evidenced by this report, to encourage active modes of transport requires a re-think in the way that cities are built and the way that transportation decisions are made in Australia. It will require prioritising walking, cycling, public transport and freight movements, over private motor vehicle use. It will also require integrated transportation and land use planning.

It's a common understanding that transportation choices are shaped by, and have implications for, many policy sectors. This involves all levels of government in Australia, particularly state and local government. Several of these studies emphasise that it is vital that sectors across and between levels of government work together in an

[132] Giles-Corti B, Eagleson S, Lowe M *Securing Australia's Future: Sustainable Urban Mobility: The Public Health Impact of Transportation Decisions* ACOLA (MS)

integrated way to create urban environments that support healthy and sustainable transport.

Economics study

The fourth and final leg of the ACOLA project is an Economics Study[133] that was commissioned to complement the first three studies, with a view to understanding the financial implications of different strategies and the risks involved. The Economics Study set out to embrace not only the traditional cost-based approach to different types of infrastructure projects (road freight v. rail freight, for example), but also the deeper social and environmental costs of significant step-changes to urban mobility and the cost of failing to act.

The Economics Study investigates both macro and micro-economic aspects. It draws attention to the challenges involved in responding to declining rates of urban productivity growth. The background to this is a growing body of opinion in Australia that the country's population boom disguises real economic concerns. "The extra 400,000 or so people a year is the reason Australia has not had a recession for 23 years and it's why GDP growth is now around 2.5 per cent. On a per capita basis, Australia's economic growth is among the weakest in the world, and per capita consumption growth is zero. In other words, population growth is the only reason it looks like the economy is growing."[134] The Economics Study explores links between urban productivity, transport and other infrastructure investment and housing affordability. It draws on data from the National Institute of Economics and Industry Research to illustrate the contribution that planning and transport infrastructure can make to high-tech industry expansion.

At the micro-level, the Economic Study highlights a range of market failures associated with urban transport, including the negative impacts of traffic congestion, greenhouse gas emissions, air pollution and social exclusion – or what is often called 'transport poverty'.

Barriers to achieving change

The project brief recognised early on that there was a need to examine ways to counter the institutional and cultural obstacles to transformational change. Too many times, excellent plans have been developed for various aspects of urban life only to gather dust on a bookshelf. It is too early still to be able to identify the key findings of this project that will be reported to the Chief Scientist since report writing is still

[133] Stanley J and Brain P *Sustainable Urban Mobility: Economic Perspectives* ACOLA (MS)
[134] Kohler, A *Infrastructure deficit puts us on a road to nowhere* The Drum, ABC (30 Jan 2014)

under way. But given the evidence gathered so far, it will be surprising if the following broad areas, thrown up by the studies already completed, aren't included:

Politics

Clarity is required as to who will take responsibility for what? Cities can work together to great effect in response to the challenges of urbanisation and climate change. But the scale of change required is such that they will need the support of national governments to be able to achieve the sort of transformative change that is called for. Government at all tiers will also need to involve the corporate sector. Australia will need to confront the democratic deficit, ensuring that politicians and others who are compromised are not involved in planning decisions.

Planning

A farsighted, transparent planning process is required, one that provides the certainty essential to build confidence and attract investors. Ideally, planning will take place on a precinct or even metropolitan basis, rather than individual projects. Australia needs to confront and solve the planning deficit, ensuring that contemporary planning tools are maximised; that decentralised development is considered; that infill development replaces city-fringe developments and that existing public transport is maximised.

Some buildings, precincts and cities are already exploring removing themselves from the main distribution grids, recycling their own water and waste and generating their own energy.

'Transit Oriented Developments' (TODs) are characterised by multi-modal transport planning, prioritising active modes of transportation and public transport above private vehicles. The aim is safe, walkable and cycle-friendly neighbourhoods, people-focused developments connected to frequent and reliable transit services.

'Rapid Transit' systems are essential for sustainable cities: a high-capacity public transport operated on an exclusive right-of-way. In Australian cities, this will mean elevated rail.

Technology

At present, the Australian transport sector is the largest end user of energy and one of the most inefficient in the world. Fuels derived from oil, a non-renewable source, represent 90% of that energy. By 2030, Australia will find itself with no refining capacity and a very serious energy security risk. The country will be entirely dependent on imported motor vehicles and at the mercy of the international oil market.

The large-scale utilization of Australia's abundant and diverse clean energy resources faces a number of barriers. Shifting regulatory and approval processes, relatively high upfront capital costs, limited Australian capital markets and long distances of transmission and distribution are all impediments. However, the most serious challenges may be the lack of familiarity with renewable energy technology; the lack of sustained government commitment to supporting Australian innovation; and the unpreparedness to meet the post-automobile age. These factors will ensure that Australia becomes an importer of transport technology, whatever that form may be.

Economic factors

Failure to effectively address major contemporary issues is not only short sighted; it carries a series of significant economic costs. The growing Australian infrastructure deficit; decreasing urban productivity; green house gas emissions; traffic congestion; social exclusion (as affected by housing affordability, transport and urban form); and chronic disease associated with sedentary behavior all have a price.

The evidence suggests promoting (particularly high-tech) agglomeration economies with appropriate public transport capacity; supporting precinct scale urban renewal, with good radial and circumferential accessibility; improving access for outer urban residents to areas of employment concentration; supporting freight and logistics movements through key trunk demand corridors and major freight hubs; supporting strong and sustainable neighbourhood communities; and providing informed choices for people to consider during the planning process.

Behaviour

The pressures of urbanisation are clearly amplified by the challenge of climate change. We need to begin the transition to more localised patterns of living if we are to maintain the social and economic fabric of sustainable urban life.

Behavioural changes are hard to bring about and happen over 25 years cycles. Certainly most of the generation now entering adulthood has a much better grasp of the sustainability challenge than much of the older generation.

The automobile is fundamentally inconsistent with the environmental, social and economic rationales for a compact city. The point of 'peak car' may already have passed – meaning that the belief in the personal freedom provided by the automobile has finally been

defeated - not by fuel costs or traffic congestion, but by the difficulty of finding city parking.

Public transport powered largely by electricity in conjunction with cycling and walking will be key components of future urban mobility. Habits, convenience, perceptions of safety and a lack of alternatives all continue to create demand for motorised 'self-directed vehicles'. The local provision of appropriate transport infrastructure and flexibility for travellers using inter-modal transport is essential in encouraging changes in behaviour.

Banksy graffiti Photo: Peter Drew

Environment & Wellbeing

Australia's ongoing fascination with the automobile at the expense of active modes of transportation is a contributing factor (as in the United States) to the obesity epidemic. The potential health benefits of walking and cycling are significant. Encouraging active transportation and choices in favour of public transport are closely tied to the provision of appropriate infrastructure, perceptions of safety and 'walkability' and the design of neighbourhoods.

Behind all of this sits one of the great unspoken issues of the twenty-first century: the limitations of GDP as the measure of all things. From that springs the concept of prosperity without growth, a 'prosperity' decoupled from wealth; a redefinition of what contributes to human wellbeing. As Tim Jackson, Joseph Stiglitz and others have argued[135], endless growth is a ridiculous notion on a planet with finite resources, particularly when some human activities are actively undermining the planet's life-support systems.

An Australia of 37.5 million by 2050 will need entirely new social and economic strategies if the country is to be more than a crowded, impoverished littoral surrounding an expanding desert.

[135] Jackson T, *Prosperity Without Growth: The transition to a sustainable economy* (2009); Stiglitz J *op cit.*

Quite apart from the ACOLA project, which will of course focus on the issues in Australia, there are two important international sources of information to mention. There is a major report prepared by UN-Habitat or the United Nations Human Settlements Programme. The title is *Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013* and its available on line. This 317-page document is the single most comprehensive study found to date of the global picture. What makes this study particularly important is the fact that it deals also with the developing world, not just the challenges facing wealthy cities.

The second document to draw attention to is *Guidelines: Developing a Sustainable Urban Mobility Plan*, produced in 2011 by Rupprecht Consult for the European Union. That report is available on line from http://www.mobilityplans.eu. It is quite literally a step-by-step guide to producing a sophisticated sustainable urban mobility plan for any urban environment.

Conclusion

Is the acola project successfully crossing over into trans-disciplinarity?

It seems the answer has to be yes. To return to the original definition by Choi and Pak of trans-disciplinary work, the ACOLA project is certainly "*seeking to integrate natural, social and health sciences in a humanities context*". But to go back to the image of the woman crossing the cane bridge in Arunachal Pradesh in India, the ACOLA project team[136] is still making that conceptual journey and the project will not be complete for some months yet. It is too early to say exactly how the story will end. Yet, as a trans-disciplinary research venture, the ACOLA project *is* working.

Between 2010 and 2014, ACOLA conducted a series of studies into the processes of interdisciplinary research. This ended last year (2014) with the publication of a report titled *Making Interdisciplinary Research Work – Evaluation Framework and Report.*[137] The evaluation framework developed for interdisciplinary projects is available on the ACOLA website.

The report details 15 criteria identified and tested, ranging from context and methodology to stakeholder roles and succession planning. In some respects, the current *Sustainable Urban Mobility* project is revealing new critical components of a successful project; in other respects it is highlighting the deep significance of components already identified, by

[136] The Expert Working Group comprises: Dr Bruce Godfrey FTSE (Chair), Prof Bruce Armstrong FAA, Prof Graeme Davison FAHA FASSA, Prof Brendan Gleeson FASSA
[137] http://www.acola.org.au [tab: Making Interdisciplinary Research Work]

ACOLA and by other researchers.[138] The four components to emphasise as critical for trans-disciplinary work are:

- A rigorous project **scoping** process
- The strength and depth of the **leadership** group; their respect for one another; and their willingness to collaborate
- The capacity for all to work with serious **ambiguity** during the project
- Keeping a clear eye on the **target audience**

The extent to which ACOLA is successful in those components in particular will serve as evaluative measures for this trans-disciplinary project as a whole.

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[i] The ddefinitions of each discipline is from Wikipedia. These definitions are slightly different than ones used in textbooks (which also differ from one another) and other places. However, it provides a consistent framework for use in this paper.

[ii] Management is the function that coordinates the efforts of people to accomplish goals and objectives using available resources efficiently and effectively. Management comprises planning, organizing, staffing, leading or directing, and controlling an organization to accomplish the goal.

[iii] Economics is the social science that studies economic activity to gain an understanding of the processes that govern the production, distribution and consumption of goods and services in an economy.

[iv] Psychology is an academic and applied discipline that involves the scientific study of mental functions and behaviors. Psychology has the immediate goal of understanding individuals and groups by both establishing general principles and researching specific cases.

[v] Sociology is the academic study of social behaviour, its origins, development, organisation, and institutions. It is a social science that uses various methods of empirical investigation and critical analysis to develop a body of knowledge about social order, social disorder and social change.

[vi] Philosophy is the study of general and fundamental problems, such as those connected with reality, existence, knowledge, values, reason, mind, and language.

[vii] Anthropology is the scientific study of humans, past and present, that draws and builds upon knowledge from the social sciences and life sciences, as well as the humanities.

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[138] Most notably Repko AF *Interdisciplinary research: Process and theory* 2nd edition (2012)