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Understanding the Australian Airport Metropolis

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Abstract: In Australia, the role, scale and meaning of major urban airports have changed over the past decade as a result of corporate and economic transformations. Modern airports are very different from traditional airports as they emerge as important sub-regional activity centres. As a result of these changes, airport impacts now pose considerable challenges for both airport operation and the surrounding urban and regional environment. The current issues surrounding airport development and expansion need to be defined by an understanding of the complex roles and spatial interactions now associated with airports. The airport can no longer be managed in isolation from the metropolis that it serves. However, a conceptual framework for understanding regional conflicts and opportunities is yet to be developed. This paper identifies and documents a range of issues and impacts to assist in understanding the changing role of airports in Australia. These various dimensions are conceptualised as interfaces. Interface areas include land use, infrastructure, economics, and governance. The paper provides a conceptual framework for understanding the interfaces that typify major airports, allowing for comparative analyses across a range of airport contexts and to inform policy prescriptions.

Introduction

Transport infrastructure, and its adequate provision has played a part in urban form since towns were established at crossroads and along ancient trade routes thousands of years ago. Urban growth has continued to evolve from transport induced innovation, seaports in the 18th Century, railways in the 19th Century and highways and freeways in the 20th Century. In addition, transport infrastructure has been the basis for nearly all models of urban progress, from the rail connections of Ebenezer Howard to the highways and the airports atop skyscrapers of Le Corbusier. Harris and Ullman (1945) recognised that 'changes in transportation are reflected in the pattern of city distribution' and that 'airways may reinforce this trend or stimulate still different patterns of distribution for the future city' (p3).

Airports are now established as an important component of the transport infrastructure of modern cities and have proven increasingly influential to urban structure, form and development. The reciprocity of impacts between city and airport have evolved in the last 30 years and been amplified under the neo-liberal processes of economic and corporate transformation. Government and corporate strategies of economic development, commercialisation and privatisation are giving rise to a new form of airport that is far more complex and interactive than the landing fields of the past.

Graham (2003) suggests that airports may be classified according to their economic impact characteristics, outlining six main groups: international gateway airports, national hub airports, regional airports, tourist generator airports, tourist receiver airports, and transit and interline airports. In this paper we are primarily concerned with capital city airports, which may function as international gateway airports and with the ability to generate significant off-airport business, and national hub airports, which may act as airline bases and encourage capital city and hinterland tourism.

The paper provides a review and prospectus of airport issues in Australia. Establishing the complexity of interactions of the modern airport from the outset and more recent commercialisation trends, it then canvasses some of the past literature on airport development to convey a growing awareness of the complexity of the airport phenomenon from the early 20th century. Contemporary 'integrated' conceptual models focusing on the airport as activity centre begin to address the reciprocity of the airport phenomenon. This discussion introduces a more holistic schema based on the concept of interfaces. Underlain by notions of sustainability, this model seeks to capture the many urban planning issues which are generated by the modern airport within a simple framework to aid description, understanding and policy responses. It is organised around four fundamental 'interfaces' of land use, infrastructure, economics, and governance.

Impact of Airports

The scale of passenger and freight activity at Australian airports has increased significantly in recent decades and this trend is likely to continue in line with global trends. The expected growth of passenger traffic internationally is forecast to reach 5 billion by 2010, and surpass 9 billion passengers annually by 2025. The highest global passenger growth of 7.9% (2005-10) is forecast for the Asia Pacific region. The global air freight task is expected to out perform the passenger market with a

tripling to 214 million tonnes by 2025. The Asia Pacific region is again forecast to grow the fastest averaging 6.5% per annum (ACI 2007).

The changing role and importance of Australian airports, in aggregate economic terms for trade and tourism, is well documented. In Australia (1995-2005), domestic, regional and international air traffic increased by annual averages of 4.6%, 4.1% and 5.9% respectively (DOTARS 2006). In addition, while only 0.1% of international freight, by weight, was transported by air in Australia in 2003/04, it had a value of \$AUD65.5b, representing 26.4% of total freight value (DOTARS 2005). Contemporary models of freight traffic growth predict that the value of manufactured goods traded inter-regionally will increase significantly (ATAG 2005). International tourists, whose expenditures are major contributors to regional economics, typically arrive by air and the presence of an airport is recognised as fundamental for the realisation of regional tourism and economic potential (Bieger & Wittmer 2006). Over the next decade, the number of international visitors to Australia is estimated to grow at 5.6% per annum, to reach around 10 million (TRA 2005).

This sort of growth and its implications for support services and city regions ultimately lies behind the rising importance of airports as an urban phenomenon. Increasingly, airports represent a phalanx of considerations, both intentional and causational, when their impacts on economies, populations, trade, tourism, employment, industry are considered. They are 'the most intensely geographical manifestations of all the forces of mobility' (Serebrisky 2003 p105) and in understanding the role modern airports play in the urban development of our cities and towns, a variety of relationships need to be recognised.

- Understanding the impacts and trade offs, for economic, environmental and social issues, of increasingly shared decision making through the appliance of public and private sector partnerships.
- Public service divestiture and division of responsibility, coordination and consideration of three tiers of government policy and priority, in consideration of community needs and expectation.
- Interpreting development trends and locational analyses. Understanding the catchments and catalysts for industrial, commercial and residential development within airport regions.
- Compatibility of land uses for minimal conflict and increased amenity, land use determination through policy and plans recognising the motivation of all stakeholders and the needs of the broader community.
- The reciprocity of airport and regional direct, indirect and catalytic economic impact and dependence.
- In the rationalisation of economic impacts, recognising and understanding social economic benefit with the expectations of immediacy and equity in the delivery of goods, services and people.
- The strategic, financial, compliance, economic and operational risks associated with airport and regional relationships and the need for the management and planning for contingencies of each.

Airports are a dynamic and integral part of the urban fabric. Their management and future development are integrally interlinked with urban and regional land use, infrastructure planning and economic development. The coordination and governance of airports in Australia must be integrated in this larger geographic framework.

Airport Ownership

Within an increasingly globalised world economy, the ownership and management of airports has been a key consideration in their transformation to major urban activity nodes. Historically, the majority of airports worldwide have been public sector owned and operated. In the US and Europe, after the second world war, most major airports were handed over to local and regional municipalities (Graham 2003). In the 1950s and 1960s many countries, including the UK, transferred ownership to civil aviation authorities. During this time, regardless of ownership structure, airports were managed as publicly owned and controlled utilities with public service obligations and limited priority on commercial or financial management (Humphreys 1999).

The mid-1980s saw fundamental policy changes towards ownership in several countries. Governments faced enormous pressure from tax payers to control deficits. State funding for airports was out of favour and airports were considered a 'mature' industry with little development potential (Tretheway 2001). The perceived drain on public resources motivated some national governments to undertake a variety of strategies to minimise loss and seek a return on decades of unfulfilled investment. The UK was the first country to introduce a new national policy of privatised airport ownership in 1987. The deregulation of the airline industry proceeded in parallel, and the

management of major airports also underwent a revolution. Introduction of commercial objectives by airport operators was considered an efficient way to maximise revenue, improve customer service and quality standards, while reducing risk and dependence on aeronautical revenue alone (Freathy and O'Connell 1999). Initially much of the commercialism was focussed on the airport terminal, providing an array of shopping facilities. Later came an emphasis on full exploitation of the airport site and further diversification of business, with a similar expansion of airport-linked development in the vicinity.

The post-war devolution of airport ownership was also characteristic of the Australian scene. The Federal Airports Corporation when formed in 1988 had responsibility for only 17 airports. The FAC operated on commercial lines utilising the governance, management and incentive strategies of the private sector. The deregulation of the Australian domestic airline industry in 1990 when the Airline Agreement Termination Act came into effect had a catalytic effect in making domestic air travel accessible to the broader public (Quiggin 1997). Consequently, significant increases in airport revenue were generated in the prelude to full privatisation (Hooper et al. 2000; Graham 2003). From 1996 FAC airports were put to tender in a two phase process under the provisions of the new *Airports Act 1996*. The Federal Government netted billions of dollars in the sale of airport leaseholds. Despite the Asian economic crisis at the time, the price earnings ratios for Australian airports were high because of limited opportunities to purchase international airports in the Asia Pacific region, the high degree of corporate autonomy bestowed, and the significant geographic monopoly power involved (Hooper et al. 2000). Airport operators purchased a wide range of development rights with no restriction on land uses other than compliance with the *Airports Act 1996*. The government sales team marketed the investment potential and opportunity for revenue from property development, car parking and commercial initiatives (Freestone et al. 2006).

Airport Conflicts

State, territory and local governments are ultimately responsible for making and implementing land use planning strategies, frameworks and decisions in their jurisdictions. However, incompatible land use and development decisions in areas surrounding airports have led to increased pressure to place constraints on Australian airports. Recent planning strategies have seen airport regions continuing to become increasingly populated through urban consolidation strategies. Suburban low density areas, beyond the airport buffer, are now being granted local government approval for medium density development, further adding to the conflict (Uyeno et al 1993). The source of many complaints may be attributed to poor or inadequate urban and regional planning by past (and present) government stakeholders and airport operators. Some of these conflicts have emerged as residential development has encroached on airports that were 'out of town' and air traffic movement has accelerated toward larger and faster aircraft; this has resulted in increased noise, increased frequency of air traffic, and increased airport and surrounding infrastructure use.

Most of the issues surrounding Australian airport development and expansion may be attributed to the insular legislative and policy arrangements under which airports have long been managed. Airport operators and the local and state governments feel that the legislation could go further in representing their respective interests. Stakeholders want the legislation to determine the appropriate roles of government, all tiers, compared to market forces and the appropriate roles for airports compared to social responsibilities. In balance, the yet to be determined solutions to airport and regional conflict, and the assurance that the emerging airports are managed to mutual benefit, are also based in the governance arrangements of legislation, policy and institution.

Airport privatisation was primarily an opportunity to unburden the nation from public sector funding of airport development, yet it has resulted in airport operators wanting highest returns on their investment, and they have been quick to outline expectations for the capitalisation of their land assets in the legislatively required master planning process. Airport corporations recognise that they cannot survive by landing planes, and need to diversify their commercial interests as means of ensuring profitability. These recent commercial developments at airports are another source of conflict within airport regions along with more longstanding concerns about noise, traffic and loss of environmental amenity, often sparked by rounds of airport expansion.

It has been argued in the Federal Court of Australia that non-aviation commercial development at airports, in particular the intention to develop retail shopping 'was or will be in contravention of various provisions of the Airports Act 1996' (FCA 2005 p 2). All airport companies in Australia closely followed this court case, as it was considered a test of non-aviation airport development and the strength of the *Act* to enable such development. The feeling was that should the application succeed in limiting development, the value of Australian airports could be slashed (Greenblat 2003). This protracted legal battle came to end when Federal Court Justice Cooper dismissed the application, finding in favour of

airports in February 2005. This verdict reaffirmed the independence of airport operators to determine airport non-aviation land uses outside of surrounding municipal land use regulation.

Studying Airports

The study of airports as urban and planning phenomena has progressed along with the technological changes which have shaped the airline and airport industries over a century. The literature is but a sub-set of a broader suite of technical investigations into airport issues, but a distinct progression is evident from the accommodation of a new transport technology, to the economic, management and legal issues arising, and onto broader infrastructure and environmental impacts by the 1970s. Security and sustainability have been more recent preoccupations. The evolving complexity of issues is most immediately captured in airport design and management manuals (Coles 1929; Richard 1936; Froesch and Prokosch 1946; CAA 1952; Legault 1960; de Neufville and Odoni 2003). Many urban planning, geography and indeed global city texts have surprisingly little to say about airport development and generally shoe-horn it into a narrow transportation planning paradigm. However, the need to appreciate a more complex set of environmental considerations in the broadest sense is evident from the locational conflict and site selection literature of the 1970s (Haggett 1979, 536-539).

The earliest Australian airport literature documented the military importance of aviation (Harrison 1914). At the time an understanding of airport engineering requirements was rudimentary but progressed rapidly as general standards of airport design and runway construction were refined and developed in parallel with evolving aircraft technology (Arthur 1927; Coles 1929; Cochrane 1947; Loxton 1950). Over time a greater appreciation of management issues in relation to airports as public transport infrastructure developed (Richard 1936; Pitcher 1943; Mayer 1945; Pope 1947). Early town planning interest was muted. John Sulman (1921) briefly dealt with the space demands of modern aerodromes as a form of specialised urban space alongside racecourses, drill grounds, and zoos. Brown and Sherrard (1951) provided a more expansive treatment, emphasising the importance of physical planning, design standards, site selection, and the 'general effect of an airport on the planning of a town' (p118). The significance and influence of airport site selection and its implications in determining adjacent land uses, primarily in relation to the impact of noise and in the interests of safety, were key aspects of early airport literature. The value of adequate transport connections between the airport and town to ensure maximum benefit from the provision of air services was also recognised. In parallel the problems and costs associated with congestion of airport access due to adjacent built up areas was also appreciated (Brown and Sherrard 1951). The vast distances and continental periphery settlement patterns of Australia quickly highlighted the economic and social significance of airports, tempered by international awareness of growing environmental externalities (Lambert 1953; Rosendahl 1955; Friend 1958; Harvey 1958).

The 1960s and early 1970s saw spectacular growth in aviation and airports both through technological advancement and the growing accessibility of air travel to the greater public. The benefit and impact of necessary airport expansion plans and duplications of runways was evaluated, modelled and debated (Moffat 1968; Davidson et al. 1969; Weston 1972; ABTE 1975). By the 1980s, airports were stigmatised as an urban inconvenience and their public costs versus urban impacts were questioned by government and the public alike (Carlton 1978; Holsman and Alexsandric 1977; Seymour 1979; Lucas 1982; Deaves 1986; Thorn 1988). The expansion of the existing airport and aborted development of a second facility in Sydney attracted significant academic interest (Sanders 1991; Adam 1993; Fitzgerald 1998), and by the 1990s the environmental and social disbenefits of airports were a major concern (Vandebona 1997; Lammerts 1996; Fitzgerald 1999). A broader management-oriented literature addressed new issues of deregulation and entrepreneurial approaches to airport management and policy (Kunkel 1990; Mills 1995; Truitt and Esler 1996; Forsyth 1997; Quiggin 1997; Kissling 1998; Quinlan 1998; Graham 1999). The nature of privatisation and the capitalisation of development potential of airport lands are contemporary concerns (Hooper et al. 2000; Carney and Mew 2003; Freestone et al. 2006; Spiller 2006).

Integrated Models of Airports as Activity Centres

The list of airport impacts beyond the airport boundaries has grown through time, but treatments have remained highly specialised and contained within disciplinary paradigms. Empirical analysis has been generally limited to the isolated evaluation of the components of a complex system. What conceptual advances are evident regarding the changing role and multifaceted impacts of airports in their urban settings?

Airports are increasingly recognised as general urban activity centres; that is, key assets for cities and regions as economic generators and catalysts of investment, in addition to being critical components of efficient city infrastructure. The entrepreneurial idea of the modern airport goes beyond the

movement of aircraft towards providing a variety of commercial and industrial opportunities. This may focus on the encouragement of aviation reliant and related industry but may also provide for the industries of the new economy, or alternatively businesses and services that have limited direct reliance on air transport or aviation at all.

Three models of airports as activity centres have been conceptualised. The 'aviapolis' is the marketing and development of aviation orientated and airport-centred business hubs (Finavia 2004). The 'airfront' is the collection of aviation related industries and services attracted to, and located within, an airport hinterland (Blanton 2004). The identification of the airport as a focus for logistics, and as a function of transport-based urban development, has been recognised as an 'aerotropolis' (Kasarda 1991a).

The 'aviapolis' is the development of strategic opportunity to revitalise a city region and adjacent airport. It is intended to function as a mixed use commercial, industrial and residential centre capitalising on the advantages that an international airport may bring. Through cooperative agreement the Finnish government and industry stakeholders were able to establish cooperative administrative arrangements: a district wide comprehensive plan; an economic development and marketing strategy; and a governance framework built around this shared goal (Finavia 2004). The development of the 'aviapolis' is the strategic re-organisation of an existing urban area into an aviation orientated business hub, utilising the anchors which exist within the region and maximising their potential. A perceived limitation may be the continued requirements of investment and international marketing, yet the 'aviapolis' still provides a model of the integrated planning and development of an airport and its hinterland, functioning as an international activity centre.

Blanton (2004) conceptualises the 'myriad of commercial, industrial, and transportation facilities and services intrinsically tied to the airport' as the 'airfront'. Highlighting regional economic integration, the aim is to understand 'how planners can shape emerging airfront districts to achieve regional and local objectives' through a scenario planning approach (p36). The airfront is not part of the airport, but of the region and recognised as a location of potential and unrealised opportunity. It supports the airport with an array of services based on industrial clustering. The better coordinated planning and development of this airfront provides for economic strengthening and revitalisation of the region for mutual benefit. However, little attention has been given to commercial districts surrounding airports, and few planning authorities understand how to plan development to best leverage this economic resource, let alone how it may best fit into broader transportation and regional land use planning (Blanton 2004).

Kasarda champions the development of the 'aerotropolis', a logistics based model of airport city development (Kasarda and Green 2005; Kasarda 2001; Kasarda 2000; Kasarda 1996; Kasarda 1991a). The aerotropolis is an urban form, centred on multimodal logistics, with an aviation focus, where low weight / high value goods can be moved quickly and efficiently. Companies are able to maintain zero inventories: take customer orders, fly in raw materials, assemble them and fly them out again, at the one airport location (Kasarda 1991b). This 'industrial/aviation complex' is intended as an actual metropolis, where the airport and surrounding hotels, retail, distribution centres, light industrial parks, and even some residential zones all serve as a central business district. It is imagined as a 'centre' with excellent highway transport links, 'aeroplanes', to the regional hinterland to ensure the unimpeded flow of goods, services and people (Kasarda 2001). The 'aerotropolis' as a freight and logistics model is based in the notion of '*survival of the fastest*' (Kasarda 2000). It may well be considered this paradigm presents limitations for tangible implementation where the notions of sustainability and equity in local access are significant.

All three descriptive models portray the modern airport as a dynamic new economic engine calling forth the need for new and appropriate planning responses to better seize this potential. However, they are mostly economic conceptualisations and lack explicit acknowledgement of the wider urban system, neglecting the reciprocity of impacts which may often be considered as a consequence of each other: airport access, regional transport congestion, noise, land use compatibility, economic impacts, airport competitiveness, privatisation, infrastructure capacity, and so on. There is also insufficient weight given to environmental, social and governance issues alongside economic benefits.

The Need for a Conceptual Framework

It is timely and appropriate that conceptual frameworks for understanding airport and regional conflicts and opportunities are established. The complex issues attached to airports need to be placed within a context which will assist in better understanding the airport's changing role. Integrative models are required which recognise and attempt to understand the nature and importance of international,

national, regional and local drivers of airport growth and the need for sustainable balanced development. It is desirable to have a better means of describing, explaining and ultimately improving corporate, public, and institutional governance processes.

An understanding of the influence of airports as urban phenomena and their catchments of influence will assist all stakeholders in the management of future growth and associated change. The appropriate management, understanding and consequent development of airports has direct relevance to the urban character and design of our cities, their liveability, safety and connectivity regionally, nationally and internationally.

A different set of airport operating environments are created when airports draw on regional catchments of the non-travelling public to generate an increasing proportion of their revenues. We need a greater understanding of what the issues and implications are for airports and their host regions, and how these issues must be considered as united, interdependent and integrated (Stevens 2006).

An Interface Model

Our approach is to draw on the meta-concept of interfaces of an 'airport metropolis' as an organising device for comprehending the complexity and planning aspects of airport activity centres. Four interface domains are recognised as integral to the acknowledgement and development of the airport metropolis concept: Economic Development, Land Use, Infrastructure, and Governance.

Economic Development occurs at the airport and its host region as a result of airport-centric activities. It is important for all stakeholders to be able to understand the range of financial and social economic impacts of the airport and ensure opportunities for regional, national and international benefit are maximised. *Land Use* involves the geographical/geophysical resources of the airport and the region. Land use has both social and biophysical environmental impacts that may be best managed by the use of planning schemes and strategies which incorporate development trends, existing land use patterns, land characteristics, identified human and physical characteristics of the land, and desired and possible future uses. A fundamental need is compatibility between airport master planning and land use planning beyond the airport boundary. *Infrastructure* includes large-scale installations that connect and service commercial, industrial, residential and cultural nodes of the region. Typical elements are roads, railways, utilities, ports, airports, freight and service interchanges, and, of increasing importance, information and communication technology (ICT). Infrastructure is recognised as fundamental for airport efficiency and development capacity, but must be balanced with ensuring regional connections are not made at the expense of local connectivity. *Governance* refers to the legislative arrangements and institutionalised processes that have been designed or have evolved to guide the social structures and behaviours of individuals and organisations. Governance may also be

recognised as the function or administering of policy and actions of all kinds, often relating to decisions made. Governance in its many forms is recognised as leading to the emergence of a variety of models of airport development and operation. We discuss each of these major dimensions in turn. All are interrelated and underpin the long term sustainability of the airport metropolis (Figure 1).

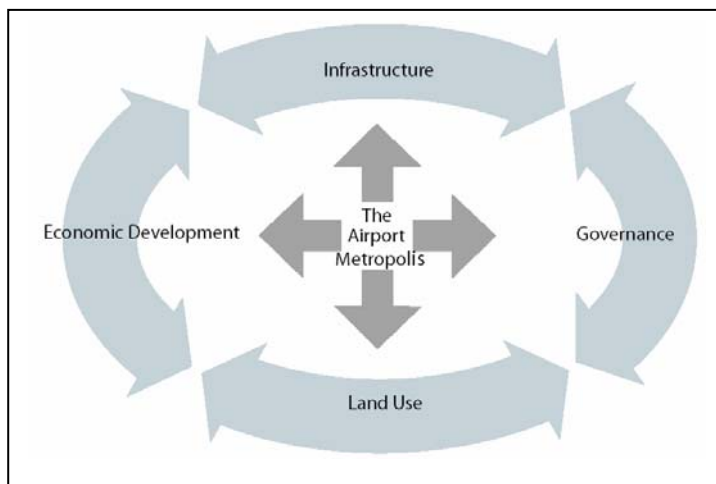


Figure 1. The airport metropolis interface model

Economic Development

Airports are widely acknowledged as having significant economic impacts. Virtually all airports undertake economic impact studies, whether to demonstrate the virtues of strategic airport investment in airport facilities or infrastructure; inform debate on, or assess new commercial projects; and even as a necessity for regulatory approvals and reporting. It is increasingly important for all stakeholders to understand the economic impacts an airport may provide, as both significant generators of economic activity, and as catalysts in supporting wider business and tourism activity (Graham 2003; Wells and

Young 2004). Four broad categories of airport economic impact can be recognised (ACI-Europe & York 2004):

- Direct - employment and income that is wholly or largely related to the operation of an airport;
- Indirect - employment and income generated in the economy of the region in the chain of goods and services (both on and off site);
- Induced - employment and income generated in the economy of the region by the spending of incomes by the direct and indirect employees; and
- Catalytic - employment and income generated in the economy of the region by the wider role of the airport in improving the productivity of business and in attracting economic activities such as inward investment and inbound tourism.

It is important also to acknowledge the growing influence of perpetuity effects. These may be defined as the economic growth from catalytic impacts that become self sustaining in an airport region (Button & Taylor 2000).

Cities with major airports play 'critical roles in serving as key points of exchange in the world economy' (Smith and Timberlake 1998 in Debbage and Delk 2001). With a considerable proportion of airline passengers travelling for business, there is 'a close relationship exists between business activity on the ground and airline networks in the skies' (Debbage and Delk 2001, p159). Button and Taylor (2000) identified air transportation as of particular importance to industry sectors concerned with information sharing, research and development and management, or those businesses engaged in what are termed 'new economy' activities. Air travel facilitates face-to-face contacts and together with the need for efficient distribution networks, footloose activities have gravitated towards airport locations often in planned business park environments. Airports are also vital to tourism. Air transport and tourism are intrinsically linked, leading to both positive and negative outcomes (Bieger and Wittmer 2006). An airport is a tourist's first and last experience with their destination, and that experience can have a profound effect on the overall visitor experience (Tretheway & Mak 2006; Kasarda 2001).

Land Use

The increased growth in air transport has resulted in significant environmental impacts at the local, national and international levels with costs that are being borne by all. In line with the expected growth of air transport there is a growing awareness and recognition of the environmental effects of the industry, the need for environmental appraisal of these effects at airports, and the requirements of airports to operate as socially responsible 'good neighbours' within the region (Button 2003; Graham 2003, Upham & Mills 2005).

Land use both on and off the airport needs to be recognised in view of the issues that arise from the growth of airports as regional and national activity centres (Stevens 2006). The need for compatible and coordinated land use is crucial to the discussion of airport and regional planning and whilst this fact is well documented its effective implementation is exceedingly difficult to establish (WAPC 2004; Blanton 2004; AOPA 1999; DoT 2002). Even when airports are owned and operated by the same government that controls surrounding land use, as is often the case in the United States, there is ongoing conflict. The situation is further complicated under the airport ownership structure in Australia where local and state government control of on-airport development is limited to consultative processes, and no mechanism exists for airport operator input into regional development. Local and state governments may consider airport commercial development is conflicting with, and restricting, their strategic intentions, while airport operators may be alarmed at incompatible regional land use (May and Hill 2006). Neither stakeholder is able to endorse, influence or veto land use planning decisions of the other. Airport master planning processes and local government planning processes need to overlap and recognise that the value of each is increased within a consistent and cooperative framework (Stevens 2006).

Infrastructure

Infrastructure networks do not operate in isolation, nor do they have impacts in isolation, a change in one is always reflected and reverberated through others (Graham and Marvin 2001). Airports are dependent on various utility networks (power, water, sanitation, ICT) for their ongoing operation and at the same time is an integral part of a city's transport infrastructure network.

An airport is realistically only as good as the access to and from it. In this regard it is important that transport infrastructure supporting the airport is also secure, and resilient, to intentional or accidental disruption. Airports are vulnerable to disruptions to movement on major access transport links, and incidents can result in a loss of capacity, and cause congestion. As airport related networks expand in size and interactive complexity, they become more vulnerable to failure, often triggered by seemingly

insignificant events (Lagadec 2004). With limited access points to the airport by road, traffic incidents on key connecting roads can have a dramatic impact on access to the airport for air passengers (Charles and Ferreira 2006). The regional commercial strategies of many airports are also recognised as having the potential to imperil airport access as transport connections are increasingly congested with retail and commercial traffic (MIC 1999; SGS 2003).

Transport infrastructure, as a facilitator of access, is recognised as fundamental to the development of the new airport and the emerging airport metropolis (Kasarda 1991a). Access to and from the airport is important for a variety of users; those that work within the airport site, both in the functioning of the airport and commercial and retail precincts; the travelling public and their associated entourages; and increasingly the public arriving at the airport as a destination for retail and commercial opportunities. Access, and its adequate maintenance, can only be understood through defining the critical package that binds together the built environment, land use and transport infrastructure (Ferreira et al. 2006).

Governance

Governance is intended to cover all aspects of airport operations that may be considered to be the result of decision-making by both the airport operator (private) and administering authorities (public). It thus encompasses airport ownership, the commercialisation and privatisation of airports, consultative procedures and conflicts, airport and air transport security, legislation and policy, institutional arrangements and public private partnerships. Issues of governance are fundamental in the consideration of the changing role of airports in a regional context. Stakeholder relationships have been recast in the wake of commercialisation and privatisation of public infrastructure. New frameworks of cooperative governance and partnership are needed, yet these can only begin from an understanding of how influence and power are exerted in the new models of devolved decision-making. Effective and agreed models of governance, as legislative and regulatory process as well as shared responsibility have the potential to ensure stakeholder partnerships appropriately communicate, administer and deliver the interrelated key dimensions of the airport metropolis: land use, infrastructure and economics.

Operationalising the Interfaces

In operationalising the airport/regional conceptualisation an integrated understanding and evolution of the cost, benefit, opportunity and potential of the airport metropolis, both spontaneous and as strategic development is necessary. The *interfaces* require both internal and external rationalisation facilitated by the posing of questions past, present and future. By questioning the parts of the system we may better detail the motivations and reciprocal considerations of the (shared) decisions from which the airport and region have been influenced and may continue to be so.

A primary goal in developing this conceptual framework is to affect management and governance practices by its potential application within the framework of decision support and scenario development. As such, applied research of the interfaces would involve substantive empirical and theoretical analyses evaluating airport management and operations (both airside and landside) with regional decision-making. Scenario development may be used to estimate the impacts of policy options based on holistic case study analysis in the substantive interface areas of infrastructure, governance, land use and economic development, something new in airport regions.

The construct of sustainability although much maligned; suffering from exposure and manipulation, may be of benefit here when applied in its capacity to assist in the establishment of benchmarks and indicators required for comparative analyses. It is imagined that each of the interfaces may be defined by applying a range of best practice sustainability criteria organised into four specific heads of consideration: *economic efficiency*, *environment*, *coordination*, and *community*. To these, we add a fifth, *security*, as a vital consideration given the national importance and international connections of the modern airport region.

Conclusion

The interface model of the Australian Airport Metropolis conceptualises the changing and complex role of airports in the urban environment. We provide this model principally as an organising tool to identify key policy areas for improved integrated decision-making and as a conceptual framework for future research. The strength of the conceptualisation of the airport metropolis as *interfaces*, and the potential application of cross cutting sustainability criteria is that it allows for the recognition and examination of the relationships between, and impacts of, multiple systems. It is not sufficient to continue the ad-hoc compartmentalised analysis of issues.

This conceptual framework is intended to provide support for, and insight into airport and regional decision-making, achieved through the understanding, analyses and evolution of the interfaces, underpinned by the notion of sustainability, incorporating benchmarks and indicators accessible to all within the framework of a decision support and scenario development.

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