

**BARRIERS TO REFORM: INSTITUTIONAL AND  
POLITICAL BARRIERS TO THE IMPLEMENTATION  
OF ADVANCED TECHNOLOGY**

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**ABSTRACT**

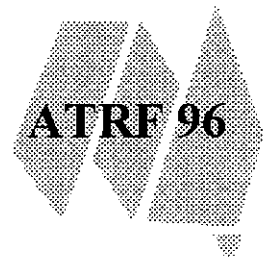
An integrated transport management system was trialed in Shellharbour, New South Wales, Australia, in the early 1990's. The trial area was a fringe metropolitan growth area with a population of some 50,000 people, some 100kms south of the Sydney CBD. The trial took place under the bilateral agreement for science and technology between the Australian and German Federal Governments.

The trial, although achieving limited success with coordination of bus transport, failed to achieve the broader aim of providing an integrated information and management system for public transport throughout the local government area. This failure was predominantly because of failures at the institutional, government and political level. These failures were associated with caution on the part of private sector participants with respect to new technology, a lack of understanding of private sector imperatives by government, a complex (and changing) regulatory regime and suspicion of government by some private sector participants (largely because of prior political interference in their operations). In addition, significant difficulties were experienced in implementing the technology due to poor support and commitment by some overseas participants. Language and cross-cultural issues were also significant. Difficulties in intermodal coordination, particularly involving public/private sector and private/public sector were also highlighted.

Important lessons were learned from the project in terms of the political role of both Federal and State Government in developing appropriate regulatory frameworks, and about directions for the future for both local and central government in facilitating technology based project implementation with private sector involvement. The paper closes by presenting a model framework for the future development of transport technology initiatives of this type.

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## **1. Introduction**

Introducing new technology, whether in the transport or other spheres, is fraught with difficulties. It usually costs more and takes longer than was originally anticipated and, all too frequently, fails to achieve the performance goals established for it. Nevertheless, appropriate technology, carefully applied, can significantly improve the delivery of transport services. This paper explores some of the political and institutional issues involved with implementing new technologies. The paper examines a case study, the Shellharbour Transport Project, a computerised transport management system trialed in the early '90s. Through the case study the paper attempts to draw out key aspects of the political and institutional environments that constrain the adoption of new transport technologies and to draw some conclusions regarding the appropriate role of government in minimizing these constraints.

In addition, the paper addresses the question as to what is an appropriate technology. The selection of appropriate technologies to achieve a certain outcome is critical for the success of innovation. The choice of technology also relates to the political and institutional environments - in other words a technology that may be appropriate from a technical point of view may be inappropriate within the political and institutional context in which it is intended to be applied.

Finally, conclusions are drawn regarding the nature of the implementation task. Particularly when new technologies are involved and combinations of technologies are being applied in a single project, the implementation task becomes exceedingly complex requiring political, organisational and technical skills in equal measure. Key implementation issues for technology innovators are therefore drawn out.

## **2. International Context and Background**

The Shellharbour Transport Project relied on overseas technology (German) that had, to an extent, already been implemented within that context. A brief examination of the contexts within which such systems either have been implemented or are being implemented at the present time will assist to gain a better picture of the role of political and institutional constraints in transport technology developments within Australia.

A distinctive component of high technology transport systems is that they are considered to be items of national pride. Very fast train systems, whether in France, Germany or Japan, are cases in point. This is a similar situation to national flag carrier aircraft - every country needs its international airline. By linking specific technologies to national pride, governments create the political space whereby the investment of large sums of money in research, development and implementation can be politically justified. Until the amalgamation of the two Germanies, for example, the West German Federal Government devoted substantial sums of money each year through the Ministry for Research and Technology (BMFT) to the development and enhancement of transport systems including bus, rail and air. These considerable sums constituted substantial

societal investment in "risk capital" for the development and testing of technologies prior to their public implementation.

A second issue is the degree to which a technology which is "proven" within one cultural, economic (and in fact climatic!) context can be considered to be transferable to another context. Certainly it seems that high technology transport solutions tend to find their greatest success within their indigenous culture of origin. It is suggested that it occurs because of the strong interrelationship between technology and culture, institutional arrangements and politics. In other words, technology cannot be treated as culturally neutral, even within a "Western" paradigm. (As an aside I would note that these problems and difficulties are significantly magnified when transferring technologies to non-Western contexts.)

Turning to bus management systems, again the institutional environment in Germany is very different. For a start, public transport does not exist in the same form as in Australia. Even the so-called private bus companies in Germany usually have ownership holdings by the state in the order of 80% of total shares. In addition, the role of transport within the society as providing certain welfare benefits is well entrenched and it is not considered operationally as a profit producing good. As will be demonstrated, this contrast did not bode well for the successful transfer of technology to an Australian context in particular given the cultural expectations of the Germany companies involved.

It is noted that computerised public transport management systems are now having considerable success in the United States. At least two German companies are now active in the US market and have secured significant contracts with US service providers. It will be interesting to see how implementation proceeds in those contexts, noting that in each case the supplier concerned has established a firm presence in the US market and has established licensing links with local US firms. It appears that the messages from the failure of the Shellharbour project have been learnt by the Germany supplier companies but not, unfortunately, to Australia's benefit.

The situation regarding deregulated markets such as New Zealand and the United Kingdom is also worth monitoring. With the recent deregulation in those markets there is now the opportunity for innovative private sector providers to implement high technology information management systems in an attempt to gain a performance and customer service edge over the competition. Nevertheless, projects within a New Zealand context or a UK context still are exposed to the substantial risks associated with the technology transfer as revealed by the Shellharbour project.

### **3. Australian Context and Background**

Australia has traditionally been an early adopter of domestic technology. This ranges from televisions through to other consumer goods such as mobile phones, fax machines, computers and the like. In addition, Australia also has a growing reputation as a niche innovator in various technical fields - for instance biomedical technology. This apparent

enthusiasm for rapid uptake of high technology and creative innovation does not, however, appear to translate into similar enthusiasm for new technologies in the field of transport. There are a number of key historical factors which have contributed to this.

### **Transport Technology and Management - Historical Background**

The transport scene in Australia must be seen within its constitutional setting. Australia, being a federation of states, has historically placed powers regarding control of transport with state authorities. Only in the case of overseas shipping and air has the Commonwealth (Federal government) taken a leading role.

Transport management has been characterised by significant involvement of the state authorities firstly in the provision of rail services and, more recently in the provision of bus services in particular in major metropolitan areas. In addition, legislative arrangements have granted monopoly or semi-monopoly status to transport providers. This can be seen, for example, in New South Wales legislation which specifically prohibited (until quite recently) long-haul coaches operating on intra-state routes where rail services were run. A further example in the area of bus management in NSW has been the traditional allocation of areas, whether to state or private companies, on a monopoly basis. (Industry Commission, 1993, B52). This was also characterised by tight prescriptions on routes, timetables, fares and the like through detailed government regulations.

Additionally, there have been only sporadic attempts at true multi-modal integration of transport management within Australia's metropolitan areas. Where these have been attempted, they have generally taken the form of administrative amalgamations of the relevant state authorities which has frequently failed to translate into truly integrated multi-modal management.

### **Outcomes and Implications**

There are a number of significant outcomes and implications of this context.

#### **1. Conservative Approaches to New Ideas/Ways of Management**

The legislative restrictions described and the comparatively late implementation of micro-economic reform in the transport sector in Australia have led to a conservative approach to new ideas and ways of management in both state and private sectors. Without the spur of truly competitive arrangements and without a significant lightening of the heavy hand of legislative control there has been little incentive or pressure to innovate (Industry Commission, 1993, A.84).

#### **2. Reliance on Imported Technology**

Notwithstanding Australia's record of innovation, Australia has a particularly poor record at translating that innovation into viable commercial products. Indeed there is

still something of a "cultural cringe" to the effect that "if it's Australian it can't be any good". This attitude has tended to result in Australian transport companies and authorities looking to overseas for innovative transport solutions. There is a long list of examples including trials of the tilt train from the United Kingdom for use in high speed country services in New South Wales, the use of imported ticketing systems, and the like.

Nevertheless there have been some local success stories. Australia now has a well-established industry in vehicle body design, in particular for buses. Although still frequently using imported chassis, Australian manufacturers are now producing buses of world class standard. Australia is also producing world class suburban train carriages - a recent example being the Tangarra trains produced by Goninan in Newcastle for New South Wales State Railways. A third example is the development by Perth-based company AES of computerised ticketing systems involving Smart Cards.

### 3. Tight Government Control

As mentioned previously, tight control by the state authorities has tended to manifest in traditional anti-competition monopoly arrangements in bus and rail. Notwithstanding recent changes to legislation in states such as New South Wales, there is nowhere in Australia which has fully deregulated the bus industry (Industry Commission, 1993, B.50). In New South Wales, for example, private operators and state operators are still granted monopolistic rights over service areas. Unlike previous years, however, the operator is required to meet certain performance guarantees otherwise at the end of the initial contract period other tenderers can be invited to take over the operation. In addition, bus operators now have a somewhat freer hand as to how those performance criteria can be met (National Capital Planning Authority, 1994, 57). Nevertheless, this system although an improvement on previous systems, still provides relatively little competitive pressure provided contract conditions are being met. In addition the five year contract span, whilst providing a reasonable period for the operator to invest, also means that tightening and adaptation of performance requirements can only occur very slowly.

A further area of government regulation has manifested in the strict categorisation of different public transport modes. For instance, particularly in many fringe metropolitan areas, there is significant evidence of the need for modes of transport that fulfill a function lying somewhere between that of a bus and a taxi (National Capital Planning Authority, 1994, 78). At the present time systems which sit "between" traditional line haul bus services and the completely free demand responsive nature of the taxi industry are administratively difficult for state legislators to cope with. In part this difficulty has arisen because of the very high value attaching to taxi licenses. In parts of New South Wales, for example, taxi licenses are valued at over AUD\$250,000 (Industry Commission, 1993, B.89). This excessive value, largely created through artificial restriction on the supply of licenses, has created a situation where the industry would be under significant threat should alternative forms of public transport become common that would challenge its traditional markets.

The above discussion is not to suggest, however, that the author fully supports a totally deregulated public transport market. It is clear from experiences in the United Kingdom, in particular, that total deregulation tends to result in excessive industry focus on high volume high profit routes at the expense of those which perform a broader public service function (National Capital Planning Authority, 1994, 56-60). Nevertheless, it is felt that considerably more flexibility in legislative and administrative arrangements could occur in the Australian context whilst still ensuring appropriate community service obligations are met.

#### 4. Low Levels of Innovation

There are two major elements which are tending to act against high levels of innovation. The first of these is lack of competitive pressure as previously outlined. In addition, the public transport industry, being either perceived as a drain on the public purse or a low profit activity of the private sector, is not structured in such a way as to enhance the climate for risk taking by management. Management generally therefore prefers conservative and proven methods of doing business and is reluctant to invest in technologies and management methods that have not already got a substantial and proven track record. A further issue driving the low levels of innovation is the comparatively small size of the Australian market place. Development of innovative technology is expensive. Unless there is a substantial and significant market it is difficult to have confidence that development of these technologies can be amortised over a reasonable timeframe. The fragmented market situation is exacerbated by the state-based system of control of transport (in particular enabling legislation and regulations). Despite intermittent efforts by the Federal Government over the past ten to fifteen years to introduce common national standards in a variety of areas to do with transport (including road rules, vehicle dimensions and loadings and the like) there is still a significant risk that an innovation developed within the context of one state's situation may not be implementable in the other states.

#### 5. Undercapitalisation

The public transport industry in Australia has generally been undercapitalised. Significant investments in new technology, such as the electrification and re-equipping of the metropolitan rail network in Perth (which also involved the construction of a major new line) are exceedingly expensive. The cost of the Perth improvements, for example, was in the order of \$M427 - a very substantial amount for a city with a population of around 1 million people (Industry Commission, 1993, B.16). In addition, there is little political incentive to invest these very considerable sums of money in major infrastructure when they will have a comparatively long return life in terms of providing the full public benefits which can accrue. The current three or four year political cycle is a substantial disincentive to taking these long term and strategic approaches. The general reluctance of government to invest can also be seen in state-based bus and ferry fleets. Traditionally these have been a significant drain on the public purse and have been

seen largely within a context of attempting to cut costs whilst still providing a "safety net" function for those unable to travel by private car.

The emphasis on cost minimisation both in rail and bus systems has traditionally led to the classic declining spiral of public transport use. Use declines, investments are reduced, services are withdrawn and use continues to decline. It needs to be noted, however, that there are now some signs that this environment has now begun to change. In particular, the increasing and vocal emphasis on air quality in Sydney has resulted in substantial public attention being devoted to the need to enhance the public transport system - both rail and bus. As society becomes more aware of the externalities associated with heavy motor vehicle use within metropolitan areas it can be anticipated that there will be sufficient political pressure to allow state governments to make the necessary investment decisions to begin to reverse the public transport decline spiral. There is evidence, for example, that in many Australian cities that spiral has now "bottomed out" (National Capital Planning Authority, 1994, 81) with some modest signs of public transport growth being experienced. It should be noted, however, that whilst public transport is tending to grow in numerical terms it is still either static or declining in relative terms to population.

A final issue related to undercapitalisation and of significance is the question of undercapitalisation of private firms. It is this sector which tends to dominate the fringes of the metropolitan areas, and which most needs to respond to the changing environment. Noting that the private public transport industry is a low profit industry, and noting that firm sizes are often very small (frequently with traditional family management) it is not surprising that minimal levels of capital have been available to invest in new technology. As recently as 1990, the average private bus fleet in Australia had eight employees (Gee and Hensher, 1991). Fleets of fifteen to twenty vehicles were fairly common and large operators (more than two hundred vehicles) very rare. Vehicle ages were also quite high. In fact, with recent efforts to improve average fleet ages, firms are needing to devote substantial sums of capital merely to improving fleet turnover rather than necessarily adding innovative technology at the same time. Thus small size, and the need to devote capital to fleet upgrading, combined with low profits, substantially reduces the available pool of investment capital for new technology.

### **Changes to the Culture?**

Coming out of the above general synopsis there are nevertheless some clear signs of change which it is appropriate to summarise. Firstly, the general legislative environment is clarifying and providing a framework within which slightly more flexibility is possible. Secondly, there are now some slight competitive elements entering into the provision of public transport within major metropolitan areas. Thirdly, particularly within Sydney, Australia's largest city, there is growing community pressure to address air pollution and other externally problems generated by the private car. This pressure will hopefully translate into enhanced spending by the state on public transport. Recent changes to licensing arrangements in New South Wales have also led to substantial numbers of

amalgamations of smaller bus operators and have seen the emergence of larger operators with the capital base to innovate.

### **Three Key Questions**

There are three key questions that need to be addressed when considering the introduction of new transport technologies within the general climate and market outlined. These are:

- o What creates the need for new technology?
- o What creates the climate for new technology?
- o What are the barriers to new technology?

The balance of this paper will address these three questions through a case-study approach. The case studies will focus on the implementation of a computerised public transport management system in the Shellharbour area of New South Wales, 100 kms south of Sydney.

#### **4. The Shellharbour Transport Project (after Department of Immigration, Local Government and Ethnic Affairs, 1990)**

This project has previously been reported to the Australasian Transport Research Forum (Witherby, 1994). This examination of the project will not, therefore, focus on the technology but will rather focus on lessons learned from the implementational process. Before doing so, however, it is necessary to provide a basic description of the system so that it can be seen in context.

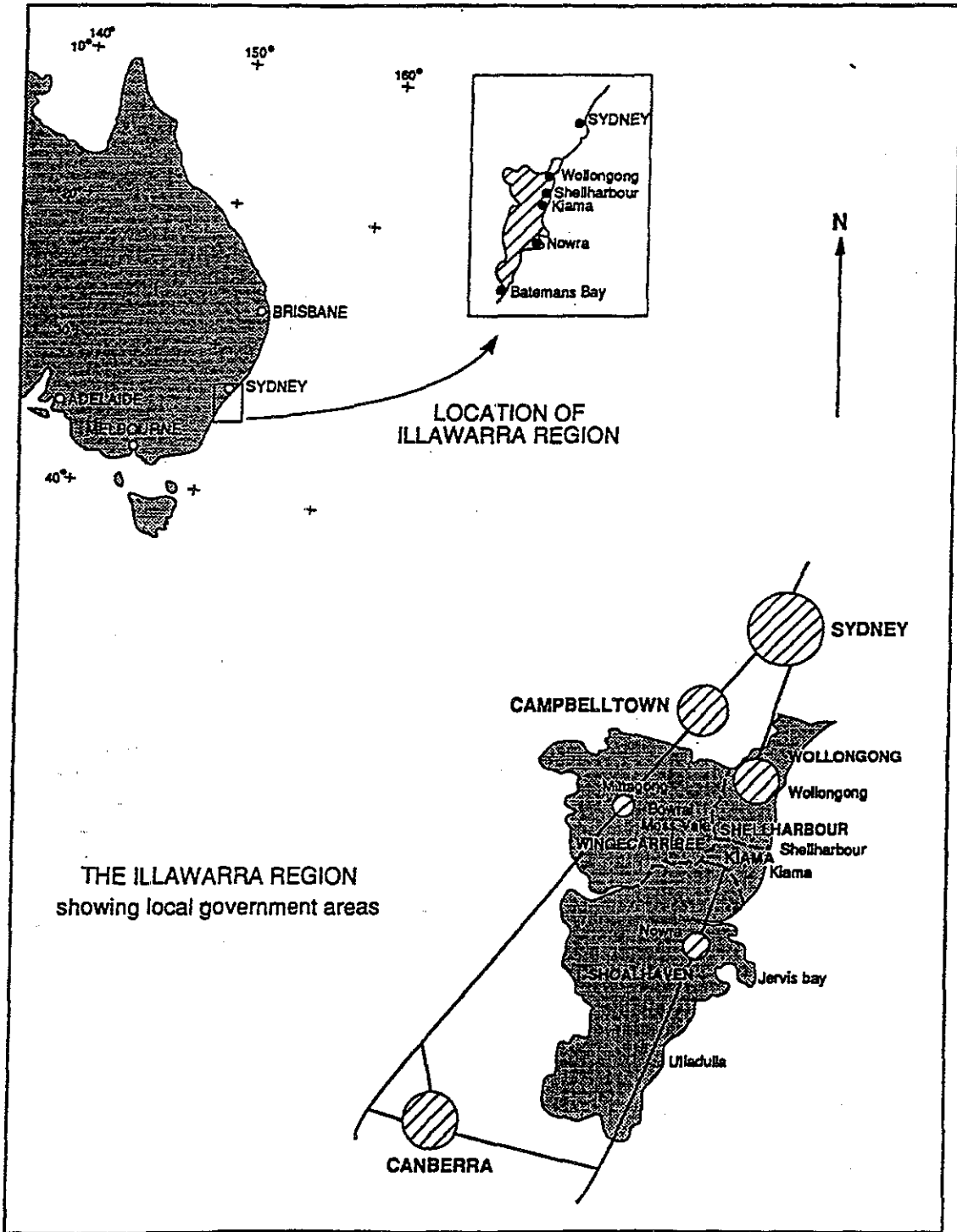
The Shellharbour project was intended to provide a "total system approach" to the management of public transport within a fringe metropolitan area located 100 kms south of Sydney. Shellharbour, with a population of 50,000 people, occupies the southern portion of the Illawarra plain which has a total population now approaching 300,000 people. The concept in Shellharbour involved providing a computerised management system to cover the two private bus operators who operated within the municipality and northwards to the City of Wollongong which is the core of the Illawarra sub plain (Figure 1). The management system was intended to provide operators with real time information regarding fleet disposition allowing a development of a real time information system which would allow passengers to obtain up-to-date timetable information and comprehensive access to trip planning facilities. The system also implemented demand responsive services, these being based on deviations from line haul routes rather than "free demand" call-bus type systems. The intention was to substantially improve accessibility to public transport without major cost implications in terms of numbers of vehicles or running kilometres.

In addition to managing bus operations, the system was intended to provide access to real time information on the rail system which connected Shellharbour to Wollongong



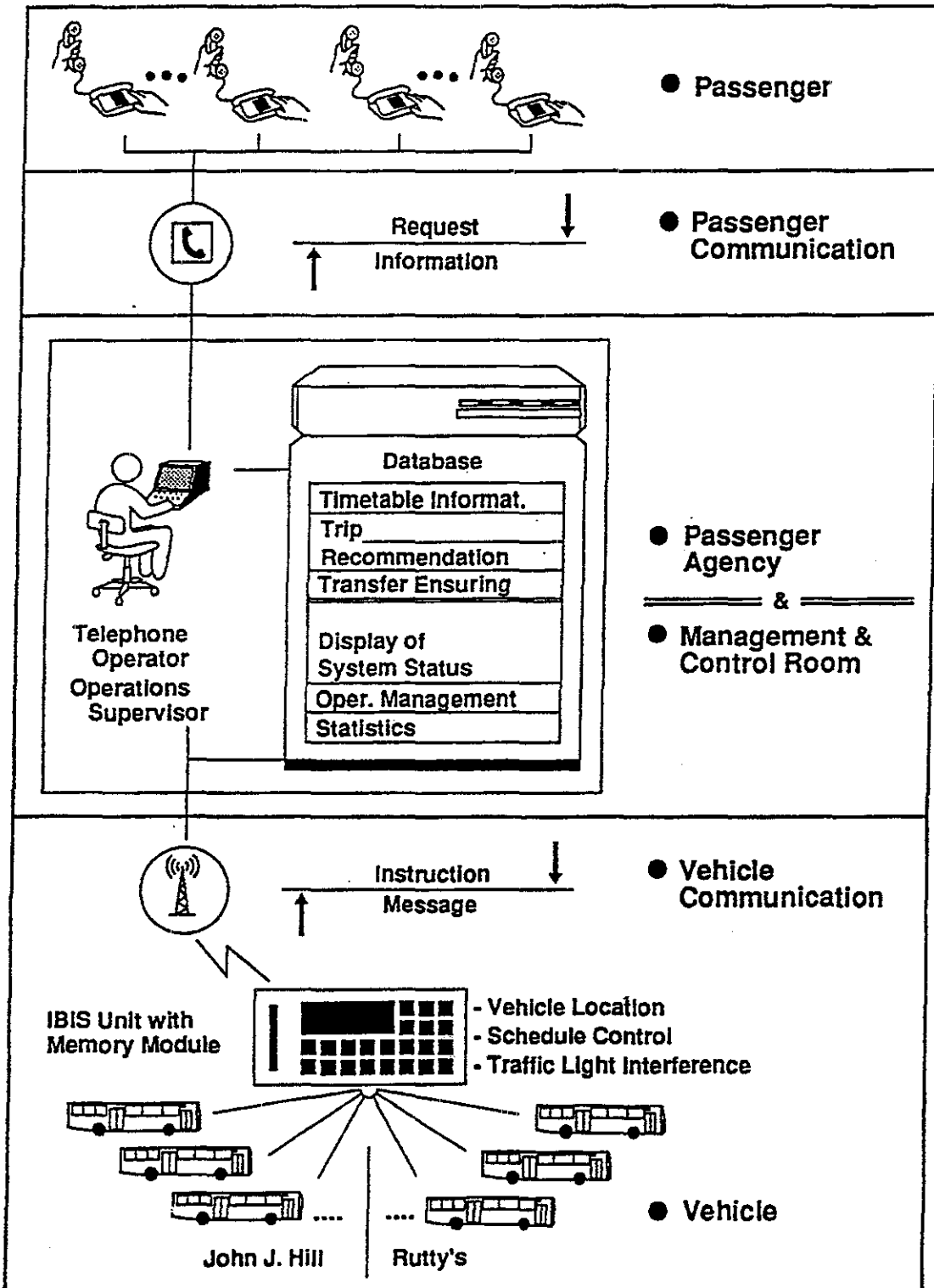
and thence to Sydney. This would ensure that transfers could be guaranteed - not only between bus operators and bus lines but also between bus and rail. To complete the system it was also intended that the taxi system be integrated with the ability for customers to book trips that were combined line-haul public transport and taxi trips.

Figure 1.



This would, for instance, include the possibility of taxi services substituting for buses on low volume off-peak routes and also arranging for taxis to meet buses or trains, for instance late at night. The general system concept is outlined in Figure 2.

Figure 2.



From a technical point of view the bus management system involved a centralised control centre jointly staffed by the private bus operators and located in the council building. That centre had real time digital and voice radio communication with each of the vehicles of the two operators. It was also intended that real time information would be transferred from the State Transit Authority computer to this information system. The control centre was to have a link with the taxi cooperative which had its own radio base station and connections to its own vehicles. Individual vehicles, in addition to being provided with radio communication, had an on-board computer which carried out numerous functions including, potentially, traffic light pre-emption, Smart Card and/or automated ticketing, in-bus destination displays and announcements, real time vehicle monitoring including vehicle location and performance and also the systematic and comprehensive collection of operating data including loadings and run times for subsequent down load and analysis. This technical description is relevant as there were a number of institutional constraints to its introduction which are of significance.

The Shellharbour system was coordinated by the local authority and involved participation from the taxi cooperative, State Rail Authority, two private bus operators, and the State Department of Transport in addition to a number of Australian and German consulting firms and a German equipment and systems provider. As will be outlined, the complexity of the system, the number and type of organisations involved and the international flavour of the project all contributed significantly to the failure of the project to ultimately achieve its intended outcome.

### **Key Steps of the Implementation**

The idea for the project originated with a councilor of the Council in 1978. Various investigations of management technology took place over the next few years however at that time it was not possible to obtain funding support from higher tiers of government to implement a system. Serious work on undertaking a feasibility study into the investigations commenced in May 1984. It was not, however, until 1986 that the Council was in a position to host a two-day conference dealing with fringe metropolitan transport issues. Following this conference it appeared that there was sufficient support to proceed to a full feasibility study. The feasibility study was carried out in five stages and was funded by a total of seven bodies including local, state and federal government. Additional funding support was provided by the (then) West German Federal Government. No funding was forthcoming at this stage from the private sector, although two German companies contributed in kind contributions by way of staff time and computer modeling.

The full feasibility study covered a number of main areas: these included:

- (1) A comprehensive transport model of the municipality covering all modes of transport.
- (2) Modeling the impact of demand responsive operations running in parallel with existing public transport systems to estimate impacts on patronage, fares and profitability.

- (3) A report on available technologies which could potentially implement the preferred system outcomes.
- (4) Preparation of a pilot project design which looked at the specific software and hardware requirements for the system and price, on a comprehensive basis, its introduction.

An additional report, being a funding submission to the State Government, was also prepared.

The project was funded in 1991 by the New South Wales State Government using funds provided by the Australian Federal Government under the urban public transport improvement program. Australian funding of \$900,000 was matched by equivalent funding from the German Ministry for Research and Technology who were interested in the system as a demonstration project to examine the feasibility of adapting existing technologies to use in a suburban transit situation. This combination of "real project" plus research project is not, in fact, unusual when dealing with innovative technology. As will be seen, however, it had major implications for the project's ultimate success.

Following receipt of funding it was then necessary to negotiate final arrangements between the project participants including two private bus operators, the local council and the State Department of Transport. Preliminary discussions were also held with the State Rail Authority, Taxi Cooperative and the Roads and Traffic Authority (to do with traffic light pre-emption). It was also necessary to hold discussions with and seek approvals from the Spectrum Management Agency because aspects of the radio communication system fell outside their framework for system licensing. Involvement with a number of private sector suppliers was also required. These included a German company providing hardware and software, a local Australian company providing radios and radio interface equipment, negotiations with vehicle suppliers for the supply of midi-buses, negotiation over registration procedures with the Roads and Traffic Authority, negotiation and liaison with advertising consultants, links with customs and import firms, and the seeking of professional advice regarding such areas as import duty and sales tax liability.

Day-to-day control of the project was vested in the Council's strategic planning manager who had some background in radio and electronics. As it was not possible to release him from his normal duties the project constituted a separate exercise over and above these. Within the Council significant delegation of authority was given to the project manager who operated directly under the Council's CEO. This was intended to ensure fast response times to implementational issues. In addition, the Council established a project support group with a balance of staff and elected representatives to provide advice, assistance and support to the project implementation process. Because of the nature of the grant arrangements it was also necessary for the Council to establish a completely new accounting system to handle the financial transactions associated with the project.

With the above framework in place the implementational process could begin. There were a number of significant issues to be overcome. Locally, the private bus operators

were, to a degree, reluctant to engage in the process because of concerns that it may pose a risk to the viability of their operations and public confidence in their system. The implementation process had therefore to be planned so that existing service levels were guaranteed to be able to be maintained throughout the entire project irrespective of difficulties. In addition, there were various problems with the technical delivery of the project. In particular these arose because the German supplier company did not have an Australian based operation. Therefore access to detailed technical knowledge required for systems design of things such as the radio interface was difficult to obtain. The language barrier did not improve matters. Although bilingual staff members were eventually employed by the German company in Australia this did not overcome all problems. The Australian radio supplier was unable to deliver a functional interface between the vehicle radios and the on-board vehicle computers. This delayed full implementation by nearly a year. In addition, vehicle installation of equipment proved daunting as there were many different models of vehicle to be fitted - all, including those of the same make and model, having unique and idiosyncratic wiring systems. Further complications also arose in licensing of the system through the Spectrum Management Agency. At that stage the licensing rules in Australia meant the system did not fall clearly within one of the identified categories. Liaison with third party system suppliers for access to transmitters at a time when the legislative arrangements surrounding radio licensing were undergoing rapid change was also an obstacle. Additional difficulties were also occasioned by the failure of the initial system software to meet all design specifications. Significant Australian further development of the software was required to achieve the necessary functionality.

The above climate of technical difficulties did not assist public perceptions as to the ability of the project to deliver enhanced transport outcomes. Significant sums of money were spent on advertising including the provision of specifically targeted information to every household in the local government area. Nevertheless a number of public misconceptions about the system were never entirely overcome. For instance, the public were reluctant to accept that the system could be accessed for the same cost as a normal bus trip. In addition, the extended delay in the implementation of the full demand responsive system contributed to a level of public skepticism. A final difficulty was that the funding provided, because of the delays experienced, was inadequate to provide for the full twelve month full trial period that was expected to be necessary to obtain meaningful information regarding the ability of the system to deliver enhanced transport outcomes.

In addition, it should be noted that elements such as Smart Card ticketing, information integration with rail and taxi, and traffic light pre-emption were never able to be achieved. Also, real time in-bus information displays were limited to two vehicles and stationary displays at major interchanges were not able to be implemented.

## **5. Lessons to be Learned**

Particularly in view of the large quantity of public funds expended on the project it is vitally important that key lessons be learned from this project which can improve the ability of subsequent projects to deliver.

The key lessons were as follows:

### **1 Commitment of Participants**

A key element of failure with the project was the less than full commitment of a number of the participants. Because the project concept originated from local government, there was initial suspicion and skepticism from the private bus operators. Local government in Australia has a long history of meddling in private bus operations for political reasons. Within this climate establishing a genuinely cooperative approach was difficult. In addition, local government had to undergo a very rapid learning curve about the nature of operations of the private bus industry in Australia. In particular local government needed to develop acute sensitivity to the cost implications of implementing these systems in a climate of rapid institutional and legal change and low levels of available capital for investment. This suggests that local government needs to be cautious about acting as a catalyst for public transport management unless it has the wholehearted and enthusiastic cooperation of all key transport providers who are to be involved. As an additional point, the private operators whilst bearing some (relatively limited) risk were not required to invest significant amounts of capital in the system themselves. It is felt that had the private operators been contributing substantial sums to the system funding they would have been more committed to ensuring its ultimate success. This implies strongly that wholehearted commitment can and must be matched by financial commitment.

### **2 Skills Base of the Implementation Team**

The Implementation Team faced a near vertical learning curve. The sheer range and number of matters including technical, taxation, legal, administrative and the like which needed to be overcome substantially challenged the abilities of the administration team. A clear outcome of the project is the need for an implementation team to be devoted to the project on a full-time basis clear of other work distractions. In addition, the team needs to be carefully assembled to ensure that an appropriate range of skills are able to be brought to bear on the project management. This is a significant issue in terms of the implementation of similar systems whether by the public or private sector. A resourcing and implementation team such as this is costly and is probably beyond the resources of all but a few larger private operators.

### **3. Onshore Support and Development**

A clear finding of the project was that cross-national boundary projects contain significant elements of risk. Many private sector companies (and this was the experience of the German company involved) find it difficult to operate within a different legal and administrative framework from their home country. Different cultural contexts and expectations regarding the role of public transport were also significant. This suggests that there are significant differences in terms of the institutional, political and cultural climate between technology originators in one country and technology recipients in another. It further suggests that the role of government differs in these two settings. In addition to this lack of understanding of the situation within another country, there is the problem that distance is a substantial barrier to the providing company giving the project appropriate weight and importance in their total business affairs. Crises at home tend to overwhelm crises abroad! This suggests that if technology transfer is contemplated for any projects of this type that it is essential that full technical capability be available within the country of implementation. Rather than relying on overseas suppliers, arrangements should be made to license technology within the destination country with the local licensing company having the responsibility for installation, maintenance and research and development. This implies that licensees require a high degree of autonomy in their ability to adapt, modify and develop systems sourced from overseas. Ideally, these licensing arrangements should translate into onshore manufacturing so as to avoid problems and difficulties associated with the import of equipment and the lack of control over delivery schedules.

#### 4. Legal Issues

The legal environment was a major constraint to project implementation. As outlined, the problems in obtaining radio licensing were a case in point. In addition, there was some legal uncertainty as to the ability of demand responsive systems to operate within licensing requirements of New South Wales State Department of Transport. A final complicating factor was the legal framework within which the parties could relate to deliver the project. Joint venture arrangements between public and private sector, particularly if extending across national boundaries, have particular complications. These relate not only to taxation aspects but also to legal aspects such as jurisdiction for the determination of any conflicts over contract conditions and the like. This was particularly critical in the case of failure of one of the project participants to deliver as per contract arrangements. Cross-jurisdictional exercises make it very difficult to bring legal redress to bear.

#### 5. Institutional Issues

The general nature and constraints of the private bus industry in Australia have already been described. To this needs to be added the institutional complexity involved with cross mode transport projects. Although nominally the State Department of Transport had key responsibility for licensing of bus operations, and also for operations of the taxi industry, difficulties were experienced in

coordination between key individuals involved at state government level. Not only was a new Public Passenger Transport Act being introduced, but the State Public Service was undergoing significant downsizing. This, accompanied with fairly rapid turnover of staff at the state level, made continuity difficult to maintain. In addition, the State Rail Authority and Roads and Traffic Authority were completely separate organisations not reporting to the Department of Transport. Indeed, different ministers were involved for at least part of the project, covering road and rail. A further complication was the need to ensure licensing requirements for equipment were satisfied through the Federal Spectrum Management Agency. This Agency also was undergoing quite rapid change in the administrative arrangements that were in place for Spectrum licensing.

Quite clearly there are a number of key elements that come out of this. Firstly, the plethora of state and federal agencies involved in transport make cross-sectorial project management extremely complex. In addition, the whole public sector is undergoing continued and rapid change. This rapid change not only in administrative culture but in administrative arrangements results in a situation of "moving goal posts" being quite common. Particularly with technologies that stretch the boundaries of existing administrative and legal arrangements, there is often reluctance by state and federal regulators to endorse innovation. This is particularly the case where it is perceived that this may place those organisations in some position of future risk or liability should arrangements change after substantial commitments have been made.

## 6. Engagement of the Public

It was clear from the work done in Shellharbour that there was significant public support for enhanced public transport systems. What also became apparent, however, is that there is significant public inertia regarding change to travel patterns following the introduction of new transport technologies. In fact it is the author's view that a period of three to five years is probably necessary before effective monitoring of changes can usefully occur. One of the major reasons for this reluctance to shift to new modes of travel is the current high level of car dependency particularly in metropolitan and fringe metropolitan areas. It is probable that it is not until households reach a decision point regarding a replacement of a second vehicle that they are likely to seriously consider alternative means of arranging their transport affairs. In addition, the current price signals sent to users of the private car as to the real costs of their travel acts substantially against people making rational economic choice in travel decisions. Unless and until the impact of externalities from the private motor vehicle are sufficient to change public sentiment towards more realistic pricing regimes it is unlikely that public transport will be able to substantially increase its market share. Nevertheless it is clear that if public transport is to arrest its proportional decline compared to the use of the private car for total travel that the delivery of systems which provide up-to-date and comprehensive information for passengers and which truly respond to expressed passenger needs for travel are essential.



Significant attention was given at the World Conference for Transport Research (Sydney, 1993), for example, for the need to provide quality systems rather than lowest common denominator systems. A further point emerging from the project was the critical importance of appropriately targeted publicity. It is not enough to merely provide information to every household about a new system and how it is to be used. Instead, it is felt that the use of television as a medium is essential if key messages are to be communicated regarding new transit systems. This is not cheap.

## 7. Costs and Benefits

Work by Battellino et al. has clearly established that the Shellharbour project did not meet essential base criteria in terms of costs and benefits (Battellino et. al, 1995). The benefits to the community over the timeframe available for the project were clearly insufficient in both dollar and social terms to justify the considerable investment in the system. This raises important issues regarding the level of technology that should be attempted in order to achieve certain outcomes and, perhaps more importantly, the importance of a staged progressive upgrade path over a considerable time period, where radical change is envisaged. This is significant as it allows project participants to ensure that each stage is "bedded in" and that the benefits or disbenefits are clear before proceeding with further financial and organisational commitments.

## 6. A New Model

Multi-mode information technology systems in public transport need a fresh approach for successful implementation within the Australian context. The key elements of this new approach are as follows:

1. The project must derive from the explicit needs of transport providers and be driven by those providers. Whilst other agencies, such as local government, may have a support role, the delivering agencies should take key responsibility for coordinating project design and delivery.
2. Current institutional arrangements act against individual operators (particularly in the bus industry) coordinating to provide integrated services over a broader area. Positive incentives need to be provided by the licensing agent (at state level) to encourage cooperative and innovative arrangements.
3. In order to ensure an enhanced climate for innovation, the state needs to ensure that public transport operations are not unnecessarily constrained in terms of revenue opportunity and are not unnecessarily burdened by state taxes and charges. In addition, the present moves towards performance based outcomes rather than prescriptive standards approach need to be continued. In addition, those performance based outcomes need to be specified in such a way that they

will provide positive incentive for inter-operator coordination and for the implementation of improved quality services to the public.

4. State and national authorities need to review the pricing signals sent to users of the private motor vehicle. Where possible and feasible steps should be taken to begin to implement systems which bring home the real cost of private car travel to those using private cars. Only then, can members of the public begin to make economically rational decisions as to the allocation of their transport resources. Implementation of improved pricing signals can only be done within a generally supportive public climate. Education on the real social, financial and health costs of private car usage is vital.
5. Systems reliant on technology which is new and innovative need to be approached with some caution. As a fundamental axiom the minimum technology necessary to deliver the specified system output should be utilised. Notwithstanding this, however, system implementation needs to design in, from the beginning, the ability to adopt a number of upgrade paths into more sophisticated systems as needs should dictate.
6. Licensing arrangements for key aspects of technology, particularly including the use of the radio spectrum, need to be closely monitored by national authorities to ensure that they are not placing undue constraints on technical innovation. In addition, the public service benefit of public transit must be recognised in any charging regimes for spectrum access which are derived from user pays principles.
7. The establishment of national standards sets relating to key components of data interchange is necessary to assist in the development of a true national market for high technology transport management systems that will permit a number of entrants. In this regard consideration should be given to utilising existing standard sets within Europe particularly as these appear likely to be adopted in the United States.
8. Where technology transfer is considered, close attention is required to the different cultural, political and administrative systems within which donor and recipient agencies are operating.
9. As a fundamental principle, the technological capability to implement, maintain and develop high technologies should be fully developed within the target country prior to implementation of a project.

## **7. Conclusion**

The substantial difficulties and previous failures to implement high technology transport solutions either by way of management system or specific infrastructure technologies

should not deter us for continuing to explore new ways of providing transport and mobility to our societies. Instead, we need to learn from previous implementational mistakes to ensure that we develop an appropriate administrative and legislative framework that facilitates the exploration of new technical, administrative and management solutions to transport delivery and which provides an appropriate balance between the private sector and the need to address broader societal concerns regarding transport provision.

## Acknowledgments and Notes

The author acknowledges permission of the Council of the City of Shellharbour to report the results of implementation experiences outlined in section 4. The views expressed, however, are those of the author and do not necessarily represent the views of the Council.

It should also be noted that the author was responsible for the implementation of the project in Australia as an employee of the Council. The paper is therefore largely based on personal reflection and experience.

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