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Assessing the transport impacts of e-business in Australia

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Abstract

E-business (B2B and B2C) is expected to dramatically change the way business is conducted. Assessment of the likely impact of e-business on the transport system, and hence on the natural and built environment, is thus needed. This paper reports some early findings from a study to consider e-business trends and design a procedure for rating and ranking transport impacts of e-business for Australian conditions. The study is based on interviews with experts and the results of a review of current evidence. There is an emphasis on assessing likely environmental implications such as changes in levels of greenhouse gas emissions.

Introduction

Here we define e -business as including e-commerce, either between businesses to business (B2B) or business to customers (B2C), and the adoption of electronic technology within businesses. Figure 1 shows the main linkages between e-business and transport demand. B2B and B2C impacts on travel and location decisions are shown separately.

Travel Demand – Person Trips

B2C – Shopping Trips

The concept of accessibility has been expanded from being measured in travel time or cost, to the notion of virtual accessibility to many activities [1]. Major changes in emphasis are required for travel behaviour modelling to take into account the significant changes in business and personal information flows.

B2C has been dominated by online purchases of goods and services within a relatively narrow range. We are likely to see a marked increase in online shopping for household goods and groceries. Internet banking and on-line banking increased eight-fold in Australia between May 1998 and May 2000 replacing bank offices[2].

Golob [1], has used the fact that one in five trips in the US are shopping trips, to argue that within two years the overall impact of online shopping could be substantial. However, other authors have noted that shopping trips are often parts of a chain of trips involved multiple purposes, [3] and [4]. Moreover, travel survey data from both Sydney and South East Queensland, in Australia, show that the majority of shopping trips are short trips [5]. Some of the travel time saved by online shoppers of household goods and groceries is likely to be spent on making trips for other purposes, [6] and [3].

Tourism and Business Travel

E-business changes are likely to increase the numbers of trips for business and tourism and may also change their spatial distribution.

Increased Business Travel: Airlines are able to offer cheaper fares, due to savings in transactions costs with e-business streamlining all areas of operation, right down to on-line booking. A bigger change is the opportunity for travelers for both business and leisure to access bargain seats. While airlines have long practiced *yield management*, via sophisticated booking and allocation systems, they, rather than their customers, have been the main beneficiaries.

As noted in Smith [7], e-commerce expands the reach of business beyond current boundaries. B2B contacts will lead to increased trips to visit new clients and collaborators. Earlier significant changes in communications had exactly that effect. Introduction of the telephone increased rather than decreased trip making [8] and [9]. In Australia, this will particularly increase international and interstate air travel. While new technology offers increasingly improved opportunities for teleconferencing, it has proven to be a poor substitute for face-to-face communication in many applications [10].

Tourism should be boosted by both low-cost air travel opportunities and more significantly, access to wider markets. For the first time, small individual suppliers or regional tourism associations are able to contact potential tourists directly.

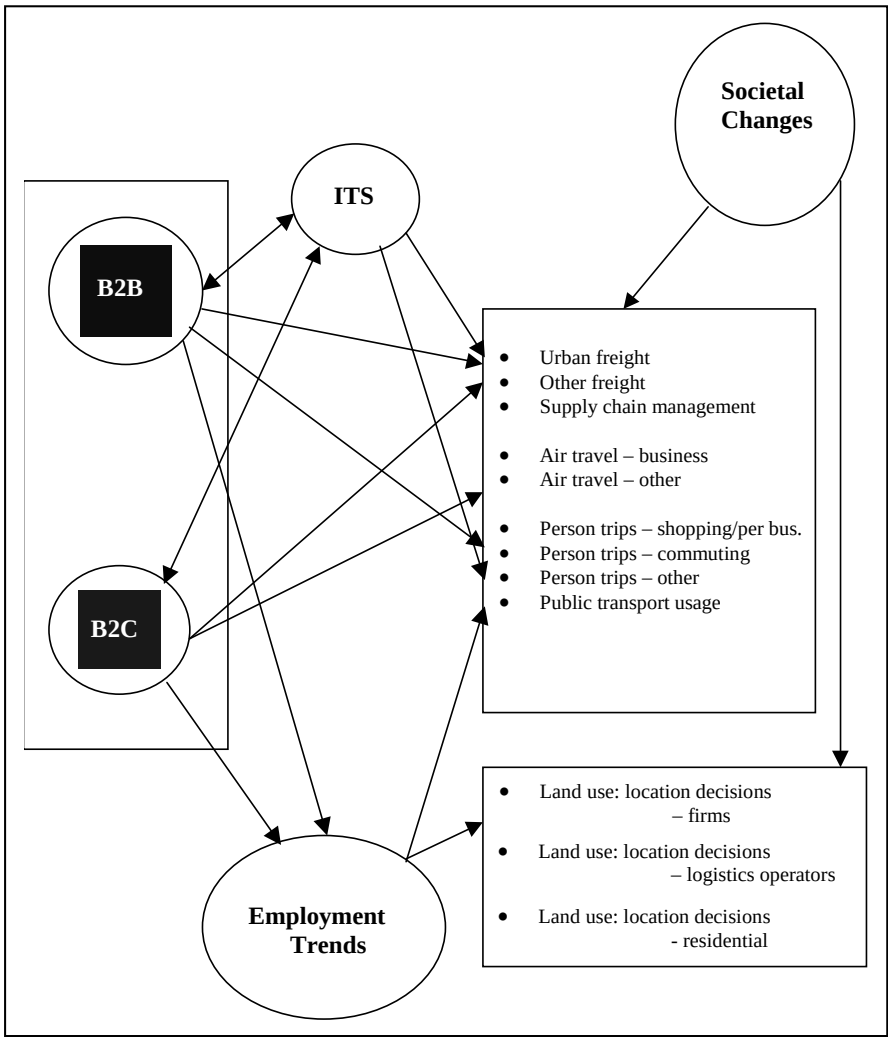

Figure 1: Transport & E-Business: Main Linkages

1. Transport Demand – Freight

Logistics

Chain monitoring (tracking and tracing systems) and auction markets for capacity trading, are now part of new logistics systems. Conventional logistics activities are highly paper intensive and costly in administration terms. Those costs should be reduced significantly with B2B and B2C. It is now possible to have direct producer-customer relationship with a single logistics provider.

The convergence of *just-in-time* practices with improved communications technologies are leading to changes in warehousing requirements and the need for freight consolidation centres. E-business is giving rise to more just-in-time supply chain management.

B2B Impacts: Application of B2B has a long tradition in the logistics sector [11]. Electronic Data Interface (EDI) systems, which have been in existence for around 30 years, have seen much promise and many failures. Part of the failure of EDI can be attributed to low benefit/cost ratios in the short term [12]. EDI systems are likely to be fully integrated within Web based B2B systems, given the software advances such as XML and other enhancements [13].

There is evidence from North America that strategic alliances and mergers are being formed to consolidate the logistics functions into multi-modal delivery of freight and warehousing services. The Internet will allow the coordination of the movement of goods and its tracking globally with clearing-houses for transportation information beginning to operate. The use of the Internet will stimulate demand for goods and freight movements with smaller vehicles being used.

*B2C Impacts**:*** Most home delivery online shopping systems are costly to operate due to the multitude of destinations and the low load factors involved. Handling and administration costs become significant for those systems. Value added services using mobile communication and data transfer technologies can increase the efficiency of urban logistics thereby lowering unit costs. Service levels will be a key factor differentiating retailers. This will include the accuracy of delivery schedule and the quality of service provided by the driver.

Possible future developments include e-fulfilment centres at current stores or at existing regional distribution centres; or centralised e-fulfilment with picked orders being distributed to existing stores for onward home distribution.

Land Use Impacts

There are subtle changes to cityscapes as electronic networking increase time, place and work flexibility [14].

'Footloose Society': We are beginning to see changes as many companies and individuals become more 'footloose' [15]. Out-sourcing non-core functions to contractors is an accepted practice, as is the location of 'back-office' information processing to locations on the outskirts of city [16]. Although in the latter case, further developments in electronic technology will relocate many of the functions of such offices into the central processor of a computer, as entire order processing becomes automated.

Demand for Pleasant Environments: Job mobility combined with a growth in multi-worker households is changing the old order, where people chose to live near work. Instead, people choose a place to live then travel longer distances to work rather than move if they change jobs. The corollary of this is that people will choose environments that have high amenity. Preference for amenity will also apply to choice between cities and regions, as companies are no longer tied to place. In a recent Swedish study, experts were asked to evaluate urban regional development tendencies to 2010, as a consequence of the introduction of information technology. There was almost unanimous support for the contention '*that jobs will move to* [regions with] *nice environments*' [17].

More Immediate Impacts: of e-business on land use include changes in storage from large warehouses on cheap land on the outskirts of the cities to smaller freight transfer depots nearer to the centre. Commentators differ in their opinions of B2C shopping on city structure. Batty [18], suggests it has the potential to have an impact on the economic health of commercial areas such as shopping malls. Local stores and other commercial sites [eg: petrol stations] have the potential to become focal points for distribution of online shopping goods.

2. ITS and E-Business

The two-way information flows between ITS components and B2B and B2C systems has the potential to reduce transit times and trip time variability through improved knowledge of transport demand, as well as improved real-time data on transport network performance. It has been estimated that the use of supply chain management and logistics and modern information and communication technologies has the potential to reduce modal interchange delays by around 20%, [19].

Congestion, unreliability and costly inventories as a result of the lack of information about road network capacities and conditions can lead to added costs. It has been estimated that these problems cost 15% of total transportation

costs in the EU [20]. Some 50% of trucks in the EU are travelling empty. The situation is different in Australia where most empty running occurs in urban areas where improved scheduling and routing may only partially reduce empty running. Most of it is due to dedicated fleets for specific commodities where firms do their own deliveries or contract operators using dedicated vehicle fleets.

3. Environmental Impacts

Greenhouse Gases

Transport in Australia contributes some 12% of all greenhouse gas (GHG) emissions and 25% of emissions from total energy use [21]. Within land transport the following contributions apply:

- Passenger cars: 55%
- Commercial vehicles: 30%
- Buses: 2%

In Australia, during the last 30 years, there has been a 3% annual growth in passenger car movements and 4% in freight movements. In the next 20 years emissions from road freight vehicles are predicted to increase by 90% [21]. This forecast does not take into account demand impacts from e-business. Indeed we could not find sets of figures in this area which do account for e-business impacts. This is not really surprising since most figures are based on trends and also predate e-commerce, which is rising from revenues of almost nothing in 1996 to a conservatively estimated $US1.3 Trillion, worldwide in 2003 [22]. Figure 2 shows the Australian Bureau of Transport Economics [BTE] estimates of expected growth in the numbers of vehicles on the road, illustrating in particular the rise in light commercial vehicles (LCVs). These would be underestimates in view of e-commerce. While there is potential for some goods movement by non-motorised transport, most will still travel by LCV (Kosmo.com delivers candy bars and videos by bicycle, scooter or pedestrian in 11 cities across the USA [23]).

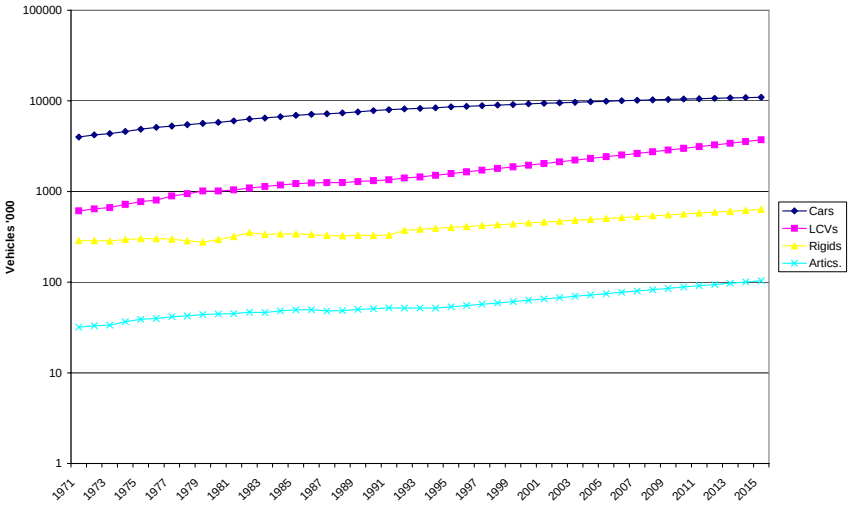

Figure 2: Increasing LCVs Numbers without E-commerce

Source: [24]. Note: Log scale to show cars, LCVs, rigid and articulated trucks.

While most attention has been centred on the GHG impacts of land transport, the contribution of air transport to GHG has also been growing rapidly. As noted previously, E-business is set to increase demand for air transport significantly for business travel, tourism and also possibly for high value or perishable freight. This is likely to adversely affect GHG emissions.

Health

Air Pollution: Current estimates of the health costs of vehicle emissions in Australia range from 0.01% to 1% of GDP, some $A5.3 billion a year [Brindle et al., 1999]. There are particular concerns internationally about impacts of particle exhaust emissions from diesel. The increases in freight deliveries stemming from e-commerce may be expected to increase the risk from diesel emissions unless there can be changes in the fuel use of such vehicles. The latest BTE estimates available, for 1998, show diesel makes up 22% of the fuel used by LCVs compared with 3% of fuel used by passenger cars [calculated from: [25]].

Safety

There has been particular concentration on ITS in Scandinavian countries where policies aiming for zero fatalities due to the road system are in place. In the Swedish study previously mentioned in section 4, considering information technology impacts on transport, around 70% of experts expected improvement

in safety for freight and distribution trips. 50% of the experts expected improved safety for passenger trips, commuting, business, and recreation and shopping [25]. Currently in Australia, despite increasing traffic, the road toll is dropping. Whereas in 1970 there were 30.4 fatalities per 100,000 of population, this rate has decreased to 9.7 in 1997 [26].

However, the current rate is not a cause for complacency. Road crashes are a major cause of death and injury in Australia, apart from the pain and suffering caused, both physical and psychological, road trauma is an anti-industry destroying wealth instead of creating it [27].

Figure 3 shows the breakdown of the current annual cost to the nation of $A15000M highlights the potential savings from ITS safety improvements.

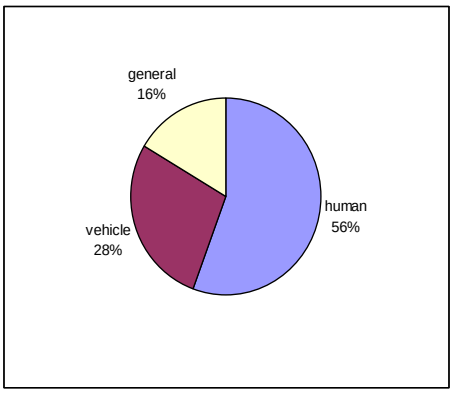

Figure 3: Breakdown of Road Crash Costs

4. Summary and Conclusions

Environmental Disadvantage/ Energy Costs

More LCVs Higher levels of demand for goods and services due to wider choices and lowering of business transaction/administration. Increases in travel by Light Commercial Vehicles [LCV] for local centre/home delivery: High impact on GHG and air quality given that LCVs have low standards for emissions.

More Trips: Increased pressure on logistics/distribution tasks from increased expectations/requirements of customers for greater flexibility and greater levels of reliability in the delivery of goods and services with subsequent increased numbers of services: Increased energy and GHG.

More Freight VKT : Increases in transport demand through increases in freight task due to wider choices of supplier/provider. Additional demand, mainly on road based transport, given its greater flexibility, level of service and ability for value adding services. Rail freight services will be disadvantaged what will be increasingly more demanding market segments.

Environmental Advantage /Energy Savings

More Accessible Depots: Location decisions by firms: consolidation trends into major centres; local distribution/collection centres using established 'bricks & mortar' (eg: seven-elevens; petrol stations; newsagents; etc.). Possibly small warehouses for freight will emerge.

More Efficient Logistics Routes: Logistics Operators increase productivity through better scheduling & routing software. This leads to cost reductions, less empty running and reduced emissions and GHG.

Less Traffic Delays: Links between ITS systems and B2B alliances: more data/information on entire supply chain available to all, including ITS components, leading to reductions in delays, accidents, vehicle operating costs and emissions.

Acknowledgement

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