

The implications of automobile dependency in Abu Dhabi city

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Abstract

Global trends indicate that automobile dependency is increasing at a tremendous pace especially in developing countries – much faster than the provision of roadway and transport infrastructure. Furthermore, research shows both car use and ownership tend to increase with economic development and growth. Abu Dhabi City is a typical example of a fast growing (economically, population and wealth) city, where car ownership is growing at an annual rate of 24% and most journeys are made by car. Transport policy makers in Abu Dhabi face an uphill challenge as they try on the one hand to develop a comprehensive multi-modal transport network that includes various elements of mass transit systems and on the other, to deal with an increasing car dependency. The externalities associated with a car dependent society is currently being felt in Abu Dhabi and the region in general, with the rise of congestion, health problems associated with lack of physical mobility, accidents and environment deterioration. This paper assesses the impacts of automobile dependency in Abu Dhabi city, and includes how Abu Dhabi compares with similar international cities, outlines key challenges facing Abu Dhabi while taking into account the unique characteristics of Abu Dhabi; and finally concludes with key recommendations that Abu Dhabi can employ to overcome automobile dependency, in order to realize the long-term aspirations of a world-class city with a well-integrated multi-modal transport system.

Keywords: automobile dependency, economic development, congestion, accidents, environmental deterioration, sustainability, noise, mass transit.



1 Introduction

Transportation is not only regarded as a means to an end, but also an end in its own merit. This pragmatic role of transport prompted one of the greatest innovations of all time – the automobile, and consequently a somewhat ‘love-affair’ between man and automobile ensued into epidemic automobile industry development. The need to travel has increased and, as such, automobiles continue to be very a dependable mode of transport both in terms of their convenience and flexibility, a yardstick of affluence, a symbol of security, a secondary need, and have also generally played a vital role in shaping many cities’ built infrastructure (Banister [4]). Notwithstanding their derived and perceived cardinal role, there is a continuous debate pitting their economic benefits at national and international level against their environmental impacts, specifically when viewed in terms of their direct contribution to greenhouse gas emissions and global warming, accidents and within the broad scope of sustainability.

This paper assesses the impacts of automobile dependency in Abu Dhabi city, and includes how Abu Dhabi compares with similar international cities, outlines key challenges facing Abu Dhabi while taking into account the unique characteristics of Abu Dhabi; and finally concludes with key recommendations that Abu Dhabi can employ to overcome automobile dependency, in order to realize the long-term aspirations of a world-class city with a well-integrated multi-modal transport system.

2 Literature review

Automobile dependency and associated impacts are not a new phenomenon; it continues to be a widely researched topic both in the field of transport and in social sciences. However, there is limited research conducted in the United Arab Emirates (UAE) and more specifically in Abu Dhabi, which is the focus of this case study. Accordingly most of the literature reviewed is internationally focused, but deals with the issues relevant to this topic.

2.1 Automobile and economic development

Current statistics indicate that the automotive industry has continued to grow worldwide (both in terms of production and ownership) at an average rate of about 16.5% annually over the past decade. Why the trend? The productivity of the automotive industry is intricately linked, to a large extent, to economic development and activity. In quantitative terms for example, in the UK, the automotive industry comprises over 3,300 businesses, directly contributes to about 5.9% of the manufacturing employment, 6.4% of gross value added and accounts for around 12% and 13% of manufactured exports and imports respectively (NAIGT [1]).

The automobile industry is the largest manufacturing industry in the USA and has been one of the most significant sectors of the USA economy when



measured in terms of its economic multiplier effect (CAR [2]). Its contribution is sufficiently large, that its growth or contraction is directly linked to changes in many developed nations' GDPs as has been evident in the most recent economic recession regime. Employment in automotive and automotive parts' manufacturing ranks among the top three manufacturing industries and is so much intertwined with the manufacturing sector, which directly generates so much retail business and also provides a critical bedrock of engineering technology innovation.

Automobile exports represent more than 20% of the manufacturing sector in Japan, Canada and Spain and account for more than 15% of total exports (OECD [3]). A high correlation is also found between car sales and private consumption as it is the main item of individual consumption after housing, which in turn accounts for a large part of total output. The relation appears to be particularly robust in the USA, the UK and Canada and in some smaller OECD countries.

2.2 Congestion

Congestion is manifested as a problem largely resulting from road traffic growing faster than road capacity. It has myriad impacts on individual travellers, the economy and society including delays, frustration, and pollution. It imposes costs to businesses in the form of potential effects on inventory costs, logistics reliability and just-in-time processing costs as well as reduced-scale economies associated with reduced access to diverse markets and suppliers (Banister [4]).

Considered in terms of its total and marginal costs, the average annual cost of congestion in the UK is £20 billion and is expected to hit the £30 billion mark in 2015 (Goodwin [5]). In the USA, congestion is equally being felt in over 439 urban areas and is estimated that in 2010, congestion caused urban Americans to travel 4.8 billion hours more and to purchase an extra 1.9 billion gallons of fuel (Schrank *et al.* [6]). In Chinese cities, the monthly economic cost of traffic congestion for one single resident reached 335.6 Yuan in Beijing, while it cost 265.9 Yuan and 253.6 Yuan per month respectively in Guangzhou and Shanghai (Horizon Research Consultancy Group [7]). Cities of developing nations alike have not been equally spared. A recent initiative by IBM ranks the emotional and economic toll of commuting in each city into a commuter pain index which estimates that the pain of the daily commute in cities centred on ten critical issues associated with automobile dependency. The 2011 global commuter pain survey indicated that drivers in cities around the world are much more unsettled and anxious and the trend is expected to continue (IBM [8]).

2.3 Greenhouse gas emission

Concerns of climate change and global warming have dramatically increased globally [9–11]. Automobiles generate environmental costs and air pollution, which is one of the critical challenges that policy makers have to deal with and already accounts for more than half of global liquid fossil fuel consumption and nearly a quarter of the world's energy related carbon dioxide (CO₂) emissions (Karekezi *et al.* [12]). The concentration of atmospheric CO₂ has increased from



a pre-industrial value of around 280ppm to 379ppm in 2005. Without immediate policy actions, the levels of CO₂ emissions is expected to rise to 550ppm by 2050 with increased associated risks of chronic diseases, high blood pressure and stress, retarded livability and overall contribution to ozone depletion and global warming (Banister and Hickman [13]). The corresponding picture of environmental impacts is somewhat depressing. Transport-related conventional emissions of CO, NO_x, SO₂, VOCs and PM₁ are expected to rise in urbanized areas of developing countries (WBCSD [14]).

2.4 Accidents

Road traffic accidents have now become the leading cause of death by injury and the tenth-leading cause of all deaths globally and make up a surprisingly significant portion of the worldwide burden of ill-health (Murray and Lopez [15]). An estimated 1.2 million people are killed and as many as 50 million are injured in road crashes annually. It is forecast that road traffic injuries will be the third-leading contributor to the global burden of disease and injury by 2020 when no action is taken, with developing countries bearing a large share of the burden, accounting for 85% of annual deaths and 90% of the disability-adjusted life years lost because of road traffic injuries (WHO and World Bank [16]).

2.5 Automobile and the urban form

Land-use and transport are linked in many aspects and cities around the world have been shaped by an automobile form of transport [17, 18]. Automobile dependence leads to urban sprawl and reduces accessibility and has given rise to unhealthy living habits and results in a socio-economic divide and captivating majority who cannot afford cars. This has given rise to social exclusion of the vulnerable communities and limits their access to basic amenities thereby reducing the cities' quality of life (Hickman *et al.* [19]). This offsets the productivity benefits of increased mobility. To the contrary, compact cities are impacted less by emissions and noise, provide adequate access, promote livability, reduce car and energy dependence and are more sustainable (Banister [4]).

2.6 Other externalities and rethinking sustainability

Automobile activity induces noise either from engine acceleration, tire/road contact, braking, etc. with varied impacts on hearing capabilities (Conley and McLaren [20]). Road network development to cater for automobile use consumes huge capital investment and maintenance costs – a burden to countries' expenditure, leads to farm land intrusion, displacement, natural habitat exploitation and its built environment consumes a valuable land-mass whose value can be converted into more economic viable activities (Litman [21]). Finally, disposal of vehicle and parts often results in environmental degradation with associated health and natural habitat impacts.



The growing interest in sustainability tenets has not left transportation behind. Sustainable transportation seeks to address the transportation needs of the present without causing undue impact of the future generations (Litman and Burwell [22]). The goal of sustainable transportation should therefore ensure that environmental, social and economic considerations are factored into decisions affecting transportation activity.

3 The case of Abu Dhabi city

Abu Dhabi is the capital city of the UAE and is considered one of the most highly motorized cities in the world. During the past decade, it has seen a tremendous increase in automobile growth, due to the significant investment from oil wealth and the urbanization of Emirati society. The annual average increase in the number of registered vehicles has stood at above 24% and is projected to double by the year 2030 (DoT [23]). The projected growth in traffic measured as vehicle kilometres travelled in Abu Dhabi between 2012 and 2030 is expected to increase by 56% for cars and 55% for light goods vehicles. The public transport system has not matured, with inadequate walking and cycling facilities limiting people's modal choices. Together with the urban sprawl and the cultural habits combined with climatic constraints in the region, the automobile remains the preferred choice of transport.

Automobile dependence has had considerable impacts both on positive and negative fronts; contributing significantly to economic development while at the same time contributing to insurmountable negative impacts. The automobile industry is a major contributor to Abu Dhabi's economy with 98% of goods being transported by road, and 88% of non-commercial journeys being undertaken by road, in comparison to only 10% by walking and 2% by cycling (DoT [24]). The transport industry generates 10% of Abu Dhabi wealth in terms of gross domestic product (GDP) and provides more than 500,000 jobs (DoT [24]).

Estimates of the concentrations of three main traffic related pollutants between 2007 and 2010 against the corresponding limit values recommended by the World Health Organization (WHO) showed that the average NO₂ concentrations of 40µg/m³ often exceeded the WHO's recommended hourly concentration (DoT [25]). The maximum concentrations of ozone is a potentially-growing problem which is likely to be affecting the health of Abu Dhabi's residents with maximum concentrations exceeding the limit value of 200µg/m³ and exceeding more than 10 times per year. However, the most serious real air quality problem facing Abu Dhabi is the high levels of small particulate matter with average concentrations of PM10s exceeding the WHO's recommended maximum daily value, although the quantity that is caused by traffic is not yet clear, initial estimates indicate traffic to be one of the highest contributors.

Road fatality rate in Abu Dhabi is one of the highest in the world. There was an increase in road accidents by 11% between 2009 and 2011 (HAAD [26]). Fatal road accidents rose by 1.4% between 2009 and 2011, while the number of



traffic injuries rose to 6,629 casualties in 2011. Road crashes accounted for 63% of all injury deaths in 2010 with more than half of all road fatalities from the 16–35 age groups [25]. Road accidents cost the UAE economy AED 14 billion in 2009, representing over 1% of GDP. It is estimated that the fatality rate per 100,000 population in Abu Dhabi stood at 24 in comparison with the best performing countries in the world such as the UK (5 fatalities per 100,000 population) [16].

Car dependence has cost Abu Dhabi a whopping 20 billion US dollars over the past 3 years just in transportation network investment in the form of road widening, bridges and interchanges so as to manage congestion [23]. The built environment consumed by the automobile infrastructure is massive as the road network to land mass ratio is significantly high in Abu Dhabi; estimated to be 20% per square kilometre. Since 2007, there has been a marked increase in travel time by 40% on main roads, reduced journey time reliability of over 30% and the out-of-pocket cost of congestion is estimated to have increased by 20% over the past 3 years [23].

4 Paradigm shift

There is no doubt that car dependency represents a serious problem in Abu Dhabi and the trend is highly unlikely to change in the future if no action is taken. Policy makers, experts and the general public do concur that a paradigm shift from car dependence heavily depends on breaking the inherent barriers (Allport [27]). While the barriers are well understood and mostly universal, Abu Dhabi has lagged behind inherently due to the following reasons [23]:

1. The fuel prices are one of the lowest in the world.
2. Cheaper cars due to zero tax policy and low interest rates on car loans.
3. The expansive city structure makes the automobile the best choice for many travel needs.
4. The culture is so inclusive and the car enhances the closeness and is regarded as more secure, flexible and faster than other modes of transport.
5. Many Emirati families and expatriates alike have affluent lifestyles and car ownership is seen as a status symbol.
6. The summer temperatures make other forms of transport such as walking and cycling extremely challenging.
7. There are hardly any multi-modal transport choices available, apart from limited bus services with no stringent demand management and taxation policies.

Many strategies have been employed elsewhere and have witnessed considerable achievements in many parts of the world in order to reduce car dependency of which Abu Dhabi can benchmark from. These strategies are fundamentally overarched to the following principles (Geels *et al.* [28]).

1. Land-use plan that encourages compact city structures and minimizes the total level of transportation activity.



2. Investment mass transit modes such as rail, metro, Bus Rapid Transit (BRT), tram, Light Rail Transit (LRT), bus and non-motorised modes (walking and cycling).
3. Adoption of travel demand management measures.
4. Investing in vehicle technologies that minimize the use of fossil fuel so as to potentially lower not only greenhouse gas emissions but also local pollutant emissions.

The success stories of these strategies are myriad and have been realized elsewhere. London, for example, with its investment in an integrated public transport system comprising of underground trains, trams, buses, taxis and cycle hire, coupled with travel demand management measures such as congestion charging, parking fees and comprehensive walking and cycling networks has been able to reduce car dependency thereby attaining an overall public transport share of 27% (LTA Academy [29]). Other cities that that have embarked on intensive and integrated mass transit options (rail, LRT, trams, BRT) have also gained much modal shift from car dependency. These include Tokyo 51%, Vienna 36%, Singapore, 44% with 22% walking, and 63% in Seoul, while its share is 62% in Paris. In Hong Kong, the share of mass transit is about 80% accounted for by rail, bus and tram whereas in Barcelona, it accounts for 26% of all journeys in Barcelona with walking having a share of 38% [29].

5 Conclusion and recommendations

While economic and other derived benefits of the automobile cannot be overemphasized, its dependency has now become a debatable sustainability issue pertaining to air pollution, global warming, road safety, degradation of natural landscapes, decreased accessibility and traffic noise (Banister [4]). While automobile dependency can be minimized, there are, however, technological, economic, policy barriers that must be overcome to realize the full potential of car dependency. Abu Dhabi government has begun to recognize the impacts of automobile dependency and is putting forward a number of actions to address this:

1. Mass transit options – Metro, LRT are at advanced stages of planning with exclusive bus lanes at the implementation stages.
2. The introduction of demand management measures – travel mobility management, parking charges and also earmarking road user charging.
3. Adopting low sulphur diesel and new vehicle emissions standards throughout Abu Dhabi.
4. A change in land-use and development code planning policies to ensure the integration of land-use and transport from the planning stage and to promote more transit oriented developments.
5. Increasing the price of fuels and subsidizing the cost of public transport (currently only buses) to encourage a modal shift.
6. Implementing a comprehensive walking and cycling master plan to facilitate and promote non-motorised transport in Abu Dhabi.



7. Development of long term strategic plans aimed at reducing car dependency and encouraging a mode shift to sustainable modes of transport.

It is also important that authorities and policy makers in Abu Dhabi pay particular attention to the social and behavioural motives in using the car, in order to develop effective policy measures to achieve behaviour change from car use to sustainable modes of transport. Some of the key instruments used to achieve behaviour change and therefore mode shift include, the provision of alternatives by offering alternative options – or taking away some of the options that result in negative impact; implementing regulation and enforcement to direct and force individuals' choices; by providing financial incentives, which could be designed to reward people monetarily for choosing travel behaviours that are considered sustainable; by providing information, education and awareness, this could involve providing various awareness campaigns aimed at heightening individuals' knowledge on the benefits of using public transport.

Furthermore, transport policy objectives must be adapted to discourage car use, especially in new development areas where planning policies that restrict parking provisions could be applied and even the extreme case of car-free development areas/zones, among others. The authorities should promote cars that use alternative fuels such as electric, hybrid or CNG. Additionally, in order to deal with the current congestion problems, there should be more emphasis on managing demand, since building more and more road space will only exacerbate the problem. It is vitally important that a holistic and collaborative approach is adopted when dealing with issues relating to car dependency and mode shift in order to understand the perception of people in Abu Dhabi on using public transport.

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